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# Invasive Plant Treatments

# Final Environmental Impact Statement

## Deschutes and Ochoco National Forests, Crooked River National Grassland

Deschutes, Jefferson, Klamath, Lake, Crook, Wheeler, Grant Counties, Oregon

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## Deschutes and Ochoco National Forests and Crooked River National Grassland

### Deschutes, Jefferson, Crook, Klamath, Wheeler, and Grant Counties, Oregon

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**Abstract:** This Final Environmental Impact Statement (FEIS) contains the Forest Service's proposal for treatment of Invasive Plants within the Deschutes and Ochoco National Forests and the Crooked River National Grassland. It also contains two alternatives to that proposal including a "No Action" alternative.

The overall purpose of and need for action is to reduce the extent of specific invasive plant infestations at identified sites, and to protect areas not yet infested from future introduction and spread of invasive plant species from these sites. As a connected action, there is sometimes a need to restore treatment sites with non-invasive vegetation to prevent the re-infestation of those sites. There is a need to provide a mechanism to allow quick detection and response to spreading invasive plant infestations.

The basis for accomplishing this project is contained in Federal Laws, Forest Service Policy Directives, The Deschutes National Forest Land and Resource Management Plan (1990), and the Ochoco National Forest and Crooked River National Grassland Land and Resource Management Plan (1989). Analysis will tier to the R6 Invasive Plant Program Final Environmental Impact Statement (USFS 2005a).

Three alternatives were analyzed in this FEIS:

1. A No-Action Alternative, which does not meet the purpose and need, but forms a basis for comparison with the action alternatives. No Action includes any invasive plant treatments approved in previous NEPA documents.

2. The Proposed Action, which was designed to address the Purpose and Need with the treatment of about 1,892 inventoried weed sites across the Forests and Grassland with integrated prescriptions that combine the use of herbicides with mechanical, manual, and cultural control methods. An early detection/rapid response strategy is also included.

3. An alternative designed to address the Purpose and Need in the same manner as the Proposed Action, with an emphasis on reducing the risk of herbicides entering the water.

The issues studied in this FEIS include: Concerns associated with chemical herbicides and their effects on human health, a desire to see the Forest Service utilize the methods necessary to implement effective treatment (i.e. more herbicides used where they are the most effective treatment, and to avoid delay), concerns for economics when choosing methods of treatment,

concerns with impacts to water quality and fish from applying herbicides and other treatment methods, concerns with impacts to non-target vegetation and wildlife from applying herbicides.

The preferred alternative, Alternative 2, is designed to meet the Purpose and Need in this way:

It allows for the effective treatment across 52,015 acres of Project Area Units, which accounts for 1,892 inventoried invasive plant sites totaling about 14,500 acres, plus the areas around and in between them having a high potential of being infested.

The treatments identified are expected to be effective in reaching the objectives (e.g. eradicate, control, suppress, contain) of the sites and will lead to a reduction in the use of herbicides over time.

It provides a framework for annual implementation planning, early detection/rapid response of new infestations, and monitoring.

# Reader's Guide

This Final Environmental Impact Statement (FEIS) contains information about project proposals that will address the problems posed by invasive plants that compromise our ability to manage native ecosystems, and will adopt new treatment strategies for invasive plants made available for use in Region 6 by the R6 Invasive Plant Program Final Environmental Impact Statement (USFS 2005a).

The information in this FEIS is organized to facilitate consideration of the environmental effects by the public, and by the Forest Supervisors of the Deschutes and Ochoco National Forests, who are responsible for deciding whether or not to implement the Proposed Action or alternatives to this proposal.

Understanding the structure of this document is important to an overall understanding of the information required in an EIS. The following provides an overview of the components of this document.

**Executive Summary:** The summary of the Final EIS provides a brief overview of the Purpose and Need for action, the Key Issues studied herein, and a comparison of the three alternatives.

**Table of Contents:** A table of contents is presented at the beginning of the document. Lists of tables, figures, and appendices is included.

**Chapter 1 – Purpose and Need:** Chapter 1 describes the Purpose and Need for the proposal, and the Proposed Action. It includes Management Direction for the project, and the Decision Framework. Public Involvement and the Issues generated by public comments are explained here.

**Chapter 2 – Alternatives:** Chapter 2 includes a description of the alternative development process, and discussions on alternatives and actions considered but eliminated from detailed analysis. The focus of this chapter is Alternatives Considered in Detail, including the No Action (Alternative 1), the Proposed Action (Alternative 2), developed by the Forest Service that drove analysis for this project, and one additional alternative developed by the Forest Service, Alternative 3, which responds to the issue of fish and water quality. The measures incorporated to reduce impacts (Project Design Features) are documented in this chapter. The final section of this chapter includes a summary of data and a comparison of alternatives considered in detail, in a table format.

**Chapter 3 – The Affected Environment and Environmental Consequences:** Chapter 3 describes current physical, biological, and social and economic environments within the area of influence of the Proposed Action (termed the Project Area Units). This information provides the baseline for assessing and comparing the potential impacts of the action alternatives. In addition, this chapter provides a comprehensive scientific and analytical comparison of the potential environmental impacts of Alternatives 2 and 3 relative to the No Action Alternative. In order to facilitate comparison of information provided, this chapter is organized and subdivided into resource areas/disciplines in a manner appropriate to the affected environment for this area.

**Chapter 4 – List of Preparers and Coordination:** Chapter 4 lists the individuals, Federal, State and local agencies and tribes that the Forest Service consulted during the development of this FEIS. It also discloses the distribution of the document including Federal Agencies, federally recognized tribes, State and local governments and organizations representing a wide range of views. The references, glossary, and index are in the last part of this chapter.

**Appendices:** The appendices provide more detailed information to support the analyses presented in the EIS.

Additional documentation, including more detailed analyses of project area resources, may be found in the project planning record located at Deschutes National Forest Headquarters in Bend, Oregon.

**Appendix A –** Table of Project Area Units with Species Present, Objectives, and Treatment

**Appendix B –** Treatment Options and Common Control Measures

**Appendix C –** Management Direction and Compliance with Forest Plan

**Appendix D –** Herbicide Information and PDF Crosswalk

**Appendix E –** Revegetation Planning and Implementation; Excerpts from 2003 Draft Guidelines for Revegetation

**Appendix F –** Annual Implementation Guide Including Mandatory and Optional Forms

**Appendix G –** Deschutes and Ochoco National Forests Invasive Plant Species Prevention Practices

**Appendix H –** Fisheries Analysis by Watershed and Tabular Data

**Appendix I –** Response to Public Comments on the Draft EIS

**Appendix J** – Watershed Information

**Appendix K** – Inventory and Monitoring Framework

## List of Frequently Used Acronyms

| | |
|---|---|
| AI | Active Ingredient |
| APHIS | Agricultural Plant Health and Insect Service |
| BCF | Bioconcentration Factor |
| BLM | Bureau of Land Management |
| CFR | Code of Federal Regulations |
| DEIS | Draft Environmental Impact Statement |
| EA | Environmental Assessment |
| EDRR | Early Detection / Rapid Response |
| EIS | Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| ESA | Endangered Species Act |
| FEIS | Final Environmental Impact Statement |
| HQ | Hazard Quotient |
| HUC | Hydrologic Unit Code |
| IDT | Interdisciplinary Team |
| INFISH | Inland Native Fish Strategy |
| IWM | Integrated Weed Management |
| NEPA | National Environmental Policy Act |
| NF | National Forest |
| NFMA | National Forest Management Act |
| NMFS | National Marine Fisheries Service |
| NHPA | National Historic Preservation Act |
| NOA | Notice of Availability |
| NOI | Notice of Intent |
| NOAA | National Oceanic and Atmospheric Administration |
| NPE | Nonylphenol Polyethoxylate |
| NRIS | Natural Resource Information Systems |
| NWFP | Northwest Forest Plan |
| ODA | Oregon Department of Agriculture |
| OHV | Off Highway Vehicle |
| OR | Oregon |
| PACFISH | Pacific Fish Strategy |
| PAU | Project Area Unit |
| PDF | Project Design Feature |
| PNW | Pacific Northwest |
| RHCA | Riparian Habitat Conservation Area |
| ROD | Record of Decision |
| RR | Riparian Reserve |
| SHPO | State Historic Preservation Office |
| TES | Threatened, Endangered, Sensitive |
| USDA | U.S. Department of Agriculture |
| USDI | U.S. Department of Interior |
| USFS | U.S. Forest Service |
| USFWS | U.S. Fish and Wildlife Service |
| WCM | Water Concentration Model |

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# Executive Summary

This section is a brief summary of the contents of the Final Environmental Impact Statement (per 40 CFR §1502.12). The FEIS begins with Chapter 1, page 7.

## Introduction

The Responsible Officials of this EIS propose to adopt new treatment strategies for invasive plants located on land within the nearly 2.5 million acres which make up the Deschutes and Ochoco National Forests (Forests) and the Crooked River National Grassland (Grassland). The Project Area Units are located in Deschutes, Jefferson, Crook, Klamath, Lake, Wheeler and Grant Counties in Oregon, and encompass approximately 52,015 acres of National Forest System lands. Approximately 14,547 acres of the Project Area Units are currently infested and targeted for treatment. However, the spread of invasive plants is unpredictable and actual locations of target species are likely to change over time.

The Proposed Action was developed to utilize the new tools and management techniques advanced in *Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants, Final EIS* (USFS 2005a), and Record of Decision (USFS 2005b).

## Background

Invasive plants are currently damaging the ecological integrity of lands within and outside these administrative units. The current situation of invasive plants on the Deschutes and Ochoco National Forests and Crooked River National Grassland is described in Chapter 3.3. Despite management direction introduced to all Land and Resource Management Plans in Region Six by the *Record of Decision (ROD) for Managing Competing and Unwanted Vegetation* (USFS 1988a), and the 1989 Mediated Agreement, invasive plants continue to increase and occupy previously uninfested areas, including Wilderness areas. Invasive plants spread at a rate of 8-12 percent annually (USFS 2005b) affecting all land ownerships, including National Forest System lands. The 1988 ROD specified and limited the tools available for the treatment of competing and unwanted vegetation, but did not provide administrative mechanisms for adapting new technologies. Herbicides approved for use by the Forest Service at that time were developed before 1980. Since then, new herbicides have been developed and registered for use that have advantages for controlling invasive plants, such as greater selectivity, greater efficacy, reduced application rates, and lower toxicity to animals and people. As noted above, the 2005 Record of Decision for the Pacific Northwest Region Invasive plant Program, Preventing and Managing Invasive Plants allows the use of new herbicides and imposes standards and guidelines that must be followed in the treatment and prevention of invasive plants on National Forest System lands.

## Desired Future Conditions

Healthy native plant communities remain diverse and resilient, and damaged ecosystems are being restored. High quality habitat is provided for native organisms throughout the Forests and Grassland. Invasive plants do not jeopardize the ability of the National Forests to provide goods and services communities expect. The need for invasive plant treatment is reduced due to the effectiveness and habitual nature of preventive actions, and the success of restoration efforts.[1] Forest Plan goals and objectives are listed in Chapter 1.5.1.

## Purpose and Need

There is a need to reduce the extent of specific invasive plant infestations at identified sites, and to protect uninfested areas from future introduction and spread of invasive plant species from these sites. This EIS is intended to address the problems posed by invasive plants across the three-million acre planning area of the Deschutes and Ochoco National Forests and Crooked River National Grassland ("Forests"). This document follows new management direction and proposes the use of new tools made available for use in Region 6 by the R6 Invasive Plant Program Final Environmental Impact Statement (USFS 2005a).

Invasive plants create a host of adverse environmental effects which are harmful to native ecosystem processes. Examples of these effects include: displacement of native plants; reduction in functionality of habitat and forage for wildlife, fish, and livestock; loss of threatened, endangered, and sensitive species habitat; increased soil erosion and reduced water quality; alteration of physical and biological properties of soil, including reduced soil productivity; changes to the intensity and frequency of wildfires; budget impacts that limit or reduce land management opportunities due to high costs or dollars spent for controlling invasive plants; and loss of recreational opportunities.

There is a need to provide a mechanism to allow quick detection and response to changing invasive plant infestations. Invasive plant infestations change in size and move; even the most complete inventories will never identify all infested areas. The Forest Service needs the flexibility to treat expanded and/or newly identified invasive plant sites in a timely manner. New infestations and new species are usually high priority for treatment. To facilitate this flexibility, there is a need to provide a mechanism to allow early detection and quick response to changing invasive plant infestations in a cost-effective manner that complies with environmental policy.

## Public Involvement

Ongoing public involvement occurred throughout this NEPA process. This project was included in the Schedule of Proposed Actions distributed by the Deschutes and Ochoco National Forests and Crooked River National Grassland since the Winter 2003 issue. On February 23, 2004 the original Notice of Intent (NOI) to prepare an Environmental Impact Statement to document and disclose the potential environmental effects of proposed invasive plant treatment activities on the Ochoco and Deschutes National Forests and CRNG appeared in the Federal Register (Volume 69, No. 35/February 23, 2004 on page 8174). Due to the extensive length of time between that publication in the Federal Register and the initiation of the analysis for this project, a Revised Notice of Intent was published Friday, October 21, 2005 in Volume 70, No. 203 on page 61244. Both NOIs called for public comment. Information on the proposal was posted on a project website - http://www.fs.fed.us/r6/invasiveplant-eis/site-specific/DES/.

On August 19, 2005 a scoping letter describing the project proposal was sent to over 700 individuals, organizations, tribes, and other agencies. It explained the February, 2004 scoping efforts and the reasons for again inviting public comment. It introduced the Proposed Action, summarized the Purpose of and Need for the proposal, and invited interested parties to submit written, facsimile, or electronic comments. A comment form was provided that could be filled out and mailed back to the Forests.

[1] This Desired Future Condition Statement became part of the Deschutes, Ochoco, and Crooked River National Grassland Land and Resource Management Plans with the Pacific Northwest Region Invasive Plant Program Record of Decision (USFS 2005b, page 2 and Appendix 1).

A public comment period on the Draft Environmental Impact Statement commenced on February 2, 2007. The Forest Service received comments from 17 individuals, organizations, and agencies. These comments were considered during completion of this FEIS. Responses to substantive comments are included in Appendix I. More information on the public involvement activities and consultation is available in Chapter 2 and Chapter 4.

# Issues

The following issues were identified through public scoping and internal evaluation and are studied in detail in this EIS and used to compare the alternatives. These issues are discussed in Chapter 1, Section 1.8.

*Water & Aquatic Species* - The public expressed concern about potential impacts to water quality and fish, primarily centered around risks of using herbicides in riparian areas. Alternative 3 was developed to compare the proposed action with an alternative that responds to this issue by imposing more restrictions on herbicide use near water.

*Treatment Effectiveness* - The public and other agencies and organizations expressed a strong desire to see the Forest Service utilize the methods necessary to make substantial progress in effective treatment of invasive species. This was mostly expressed as a desire to see more herbicides used where they are the most effective treatment, and to avoid delay which could allow further spread. These comments were often tied to the concept of prevention as well.

*Effects to Non-target Plants and Wildlife* - Native plant communities are at risk from the invasive plant species which can overtake and degrade habitat. Sensitive plant species and plants utilized for cultural purposes can be impacted by the treatments intended to control invasive species. On the whole, native plants are expected to benefit through reclaimed or protected habitat.

*Social/Economic Considerations* - The public wants to see economics considered when choosing methods of treatment. The different treatment methods vary in how much they cost to implement; and therefore, how much can be completed in any year. Labor-intensive methods such as hand pulling can be more expensive. Some members of the public would also like to see the Forest Service take the opportunity to provide jobs in rural areas by considering manual and mechanical methods of treatment.

*Human Health – Worker and Public Exposure to Herbicides* – The public expressed concerns about the use of herbicides and what kinds of effects they may have on human health, either through drinking water, through direct contact by forest workers, eating contaminated special forest products, or recreationists coming into contact with contaminated vegetation. There is concern about long-term and cumulative effects to humans from the use of herbicides. Some believe that the potential cost to human health is too high and other methods should be used to control invasive plants.

*Other Issues analyzed* – The EIS also analyzes effects of treatments on cultural resources, designated or special interest areas, soil, range resources, scenery and recreation values. These are discussed further in Chapter 3.

# Alternatives

In addition to the No Action Alternative (Alternative 1), the interdisciplinary team developed one additional action alternative to the Proposed Action (Alternative 2).

**Alternative 1: No Action –** This alternative is legally required and forms the basis for comparison against the action alternatives. Under this alternative, there would be no change in current management direction or in the level of ongoing management activities within the Project Area

Units. Only invasive plant sites already authorized for treatment under previous NEPA documents would continue to be treated. New sites would not be treated under this alternative. This alternative is described in Chapter 2.3.1.

**Alternative 2: Proposed Action –** This alternative was described in the Notice of Intent published in the Federal Register on October 21, 2005. It was created using the most current inventory of invasive plant sites. This alternative proposes to address problems posed by invasive plants that compromise our ability to manage native ecosystems on the Forests and Grassland. New management direction and tools made available for use in Region 6 will be utilized. Analysis will tier where appropriate to the *R6 Invasive Plant Program Final Environmental Impact Statement* (USFS 2005a). The following objectives are identified for each of the approximately 1,892 known invasive plant sites that span approximately 14,547 acres of the Forests and Grassland: Eradication, Control, Suppression, and Containment. This alternative is described in Chapter 2.3.2.

**Alternative 3 –** This alternative proposes to meet the same objectives as stated in the Proposed Action, but intends less risk of impact from herbicides in riparian areas near water. Certain herbicides would not be allowed for use, and treatment methods to apply herbicides would be limited. Mechanical treatment methods that may cause increased sediment would not be allowed in this alternative. This alternative is more fully described in Chapter 2.3.3.

## Decision Framework

The Forest Supervisors for the Deschutes National Forest and the Ochoco National Forest and Crooked River National Grassland are the responsible officials for this EIS. Based upon the effects of the alternatives, they will be making the following decisions: Will the Invasive Plant Project be implemented as proposed, as modified by an alternative, or not at all? What mitigation measures and monitoring will be required with implementation of the project?

The responsible officials will base their decisions on review of the environmental impact statement, and the following factors: 1) How well the alternative meets the need for action; 2) The potential for treatments to affect human health and the environment; and 3) The economic efficiency of the treatments.

# Chapter 1
## Purpose and Need

# Chapter 1 PURPOSE AND NEED FOR ACTION

**Changes Between Draft and Final:**

Minor editing occurred in Chapter 1.

## 1.1 Background

**Invasive Plants** are defined here as "non-native plants whose introduction does or is likely to cause economic or environmental harm or harm to human health." (Executive Order 13112). Invasive plants are distinguished from other non-native plants by their ability to spread (invade) into native ecosystems.

The Responsible Officials of this EIS propose to treat invasive plants located across land within the nearly 2.5 million acres which make up the Deschutes and Ochoco National Forests and the Crooked River National Grassland (Forests). The 289 Project Area Units are located in Deschutes, Jefferson, Crook, Klamath, Lake, Wheeler, and Grant Counties in Oregon, and encompass approximately 52,000 acres of National Forest System lands. Within these units are 1,892 known and mapped invasive plant sites on the Forests and Grassland covering about 14,500 acres. However, the spread of invasive plants is mostly unpredictable and actual locations of target species are likely to change over time.

Invasive plants are currently damaging the ecological integrity of lands within and outside these administrative units. Invasive plants are currently spreading at a rate of 8 – 12% annually (USFS 2005a) and are moving across and between National Forest System and other lands. The R6 2005 ROD (USFS 2005b) replaced management which was guided by the 1988 ROD and 1989 Mediated Agreement (USFS 1988a). The R6 2005 ROD standards are intended to increase treatment options and improve prevention across the Forests.

The 1988 ROD specified and limited the tools available for the treatment of competing and unwanted vegetation, but did not provide administrative mechanisms for adapting new technologies. Herbicides approved for use by the Forest Service at that time were developed before 1980. Since then new herbicides have been developed and registered for use that have advantages for controlling invasive plants, such as greater selectivity, less harm to desired vegetation, reduced application rates, and lower toxicity to animals and people.

The Proposed Action was developed to utilize the new tools and management techniques advanced in *Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants*, Final EIS (USFS 2005a), and Record of Decision (USFS 2005b) to address the many new sites that have been inventoried in the years since the last Forest-wide invasive plant control projects were completed in 1998.

> ***The Chief of the Forest Service has identified invasive species as one of the Four Threats to the Nation's Forests and Grasslands:***
>
> *"These are species that evolved in one place and wound up in another, where the ecological controls they evolved with are missing. They take advantage of their new surroundings to crowd out or kill off native species, destroying habitat for native wildlife. Where cheatgrass takes over, for example, the range loses forage value for deer and elk. We are losing our precious heritage—at a cost that is in the billions." Dale Bosworth, 2004.*
>
> **For more information on the Forest Service Invasive Species Program, see http://www.fs.fed.us/invasivespecies/index.shtml.**

As directed by the Forest Service Manual 2080, the Forests are applying the principles of Integrated Weed Management (IWM). IWM is an interdisciplinary pest management approach by which one selects and applies a combination of management techniques that, together, control a particular invasive plant species or infestation efficiently and effectively, with minimum adverse impacts to non-target organisms.

This EIS incorporates by reference (as per 40 CFR 1502.21) the project record, including specialist reports and other technical documentation used to support the analysis and conclusions of this EIS. Analysis was completed for botany, water quality, fisheries, soils, wildlife, cost effectiveness, human health, heritage resources, recreation, scenery, and range. Separate biological evaluations and/or biological assessments were completed for botanical species, aquatic species, and terrestrial wildlife species as part of the consultation process with the National Marine Fisheries Service and the US Fish & Wildlife Service. Biological Opinions will be issued for aquatic species prior to making a decision. The project record is located at the Deschutes National Forest headquarters in Bend, Oregon.

## 1.2 Desired Future Condition

By meeting the Purpose and Need for this project, the Forests and Grassland should be able to achieve the desired future condition integrated into the Deschutes and Ochoco Land and Resource Management Plans through implementation of the Pacific Northwest Region Invasive Plant Program ROD (USFS 2005b) or “R6 ROD.” The following is the desired future condition statement:

In National Forest lands across Region Six, healthy native plant communities remain diverse and resilient, and damaged ecosystems are being restored. High quality habitat is provided for native organisms throughout the region. Invasive plants do not jeopardize the ability of the National Forests to provide goods and services communities expect. The need for invasive plant treatment is reduced due to the effectiveness and habitual nature of preventative actions, and the success of restoration efforts.

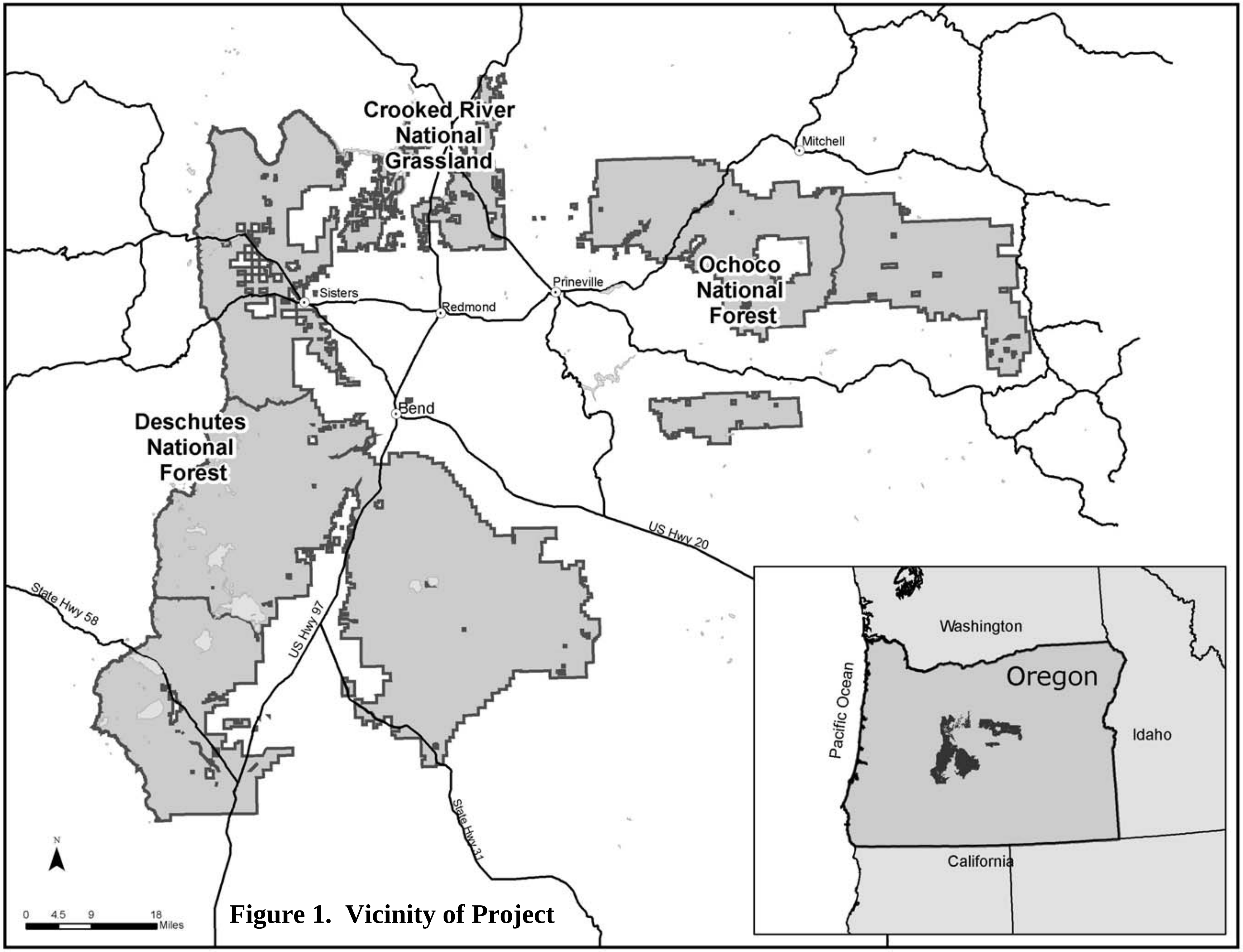


Figure 1. Vicinity of Project

## 1.3 Purpose and Need

The purpose of this project is to control invasive plants in a cost-effective manner that complies with environmental standards. The Forest Service is responding to the underlying need for timely suppression, containment, control, and/or eradication of invasive plants, including those that are currently known and those discovered in the future. The focus of this project-level EIS is on the part of the invasive plant program related to *treatment* of invasive plants.

This project will address the problems posed by invasive plants that compromise our ability to manage native ecosystems across the three-million acre planning area of the Deschutes and Ochoco National Forests and Crooked River National Grassland ("Forests"). This EIS tiers to analysis in the *R6 Invasive Plant Program Final Environmental Impact Statement* (USFS 2005a) and follows new management direction and tools made available for use in Region 6 with the Record of Decision (ROD). The R6 ROD provided an updated approach to invasive plant management, including standards for the use of new herbicides. This EIS will consider the new herbicides and methods of treatment allowed in the region. According to current inventories on the Forests, there are at least 1,892 individual locations of invasive, non-native plants.

The Forests are currently authorized to treat about 2% of known sites, and have gained experience with many of the invasive plant species now found in the planning area. Despite the local successes in the control of some sites (see, for example, page 94), invasive plants continue to increase and occupy new areas.

There is a need to eradicate, control, or contain the invasive plants at identified sites because these infestations displace native plants; harm fish and wildlife habitat; and degrade natural areas on the Forests. Invasive plant sites that occur along roads are readily spread into other areas by vehicles. Infestations occur in or near special areas such as Newberry National Volcanic Monument, along the banks of the Metolius River, and in the Black Canyon Wilderness. The native plant communities and function at these sites needs to be restored.

There is also a need for protection from future establishment and spread from these sites. Existing infestations have a high potential to expand onto neighboring lands, and further degrade forests and grassland because infested areas represent potential seed sources. Without action, invasive plant populations will continue to grow and spread, further compromising our ability to manage for healthy functioning ecosystems.

In addition, the Forest Service needs the flexibility to treat expanded and/or newly identified invasive plant sites in a timely manner. To facilitate this flexibility, there is a need to provide a mechanism to allow quick detection and rapid response to changing invasive plant infestations. Weed infestations change in density and location; even the most complete inventories will never identify all infested areas. New infestations and new species are usually high priority for treatment. Newly approved herbicides may become available that are better suited to an application other than those considered in this EIS. The Forest Service needs the ability to treat expanded and/or newly identified invasive plant sites in a cost-effective manner that complies with environmental policy.

## 1.4 Proposed Action

The Forest Service has a Proposed Action when the agency agrees to move forward with a proposal to authorize, recommend, or implement an action (CFR 1508.23). The Proposed Action is presented in detail in this FEIS Chapter 2.

The Proposed Action Alternative would implement invasive plant treatments across 1,892 weed sites on the Deschutes and Ochoco National Forests and Crooked River National Grassland. Currently the inventoried weed sites span about 14,547 acres. Treatments would span about the next 15 years. Invasive plant sites were grouped spatially into project area units. Each unit is expanded for potential spread or to account for uninventoried weeds. These project area units total 52,015 acres. Table 1 identifies the number of invasive plant sites and acres of project area units that are within each administrative unit of the Forests and Grassland.

**Table 1.** Project Area Unit Acres and Invasive Plant Sites by Administrative Unit. See Section 3.3 for a characterization of the invasive plant sites across the Forests.

| District | Number of Inventoried Invasive Plant Sites | Acres of Invasive Plant Sites* | Project Area Unit Acres |
|---|---|---|---|
| Bend/Fort Rock Ranger District | 350 | 1,604 | 12,469 |
| Crescent Ranger District | 49 | 1,080 | 1,892 |
| Sisters Ranger District | 272 | 4,320 | 10,579 |
| **Total Deschutes National Forest** | **671** | **7,004** | **24,940** |
| Crooked River National Grassland | 153 | 6,061 | 11,522 |
| Lookout Mountain Ranger District | 713 | 487 | 8,680 |
| Paulina Ranger District | 355 | 995 | 6,873 |
| **Total Ochoco National Forest** | **1,221** | **7,543** | **27,075** |
| **Combined Total** | **1,892 Weed sites** | **14,547 acres** | **52,015 acres** |

*Acres of invasive plant sites is greater than the actual area infested because the mapping takes in areas of sites that could be sparsely populated with invasive plants or patchy.

Under the Proposed Action, invasive plants on National Forest System lands would be treated with a combination of manual, mechanical, biological, and herbicide methods, and restoration. Treatments may include a combination of methods such as hand pulling, cutting, mowing, weed whacking, tilling, assorted biological controls, selective/hand herbicide applications, spot herbicide spraying, and broadcast herbicide spraying.

Site specific treatment prescriptions would be implemented to meet control objectives (suppress, contain, control, eradicate), the values at risk from invasive species, the biology of particular invasive plant species, proximity to water and other sensitive resources, and the size of the infestation. These factors may change over time. Appendix A displays the control objectives associated with mapped infestations. A variety of invasive plant species would be treated (See Table 9 for those currently inventoried).

Treatment of the approximately 14,547 acres of current infestations would span the next 1 to 15 years, approximately. Infested areas would be treated with an initial prescription, and retreated in subsequent years, depending on the results, until control objectives are met. Herbicide treatments are part of the initial prescription for most sites; however, use of herbicides would be expected to decline in subsequent entries.

The Proposed Action would also allow for treatment of infestations that are not currently inventoried through an early detection/rapid response (EDRR) strategy and annual implementation planning. Ongoing inventories would confirm the location of specific invasive plants and monitoring would evaluate the effectiveness of past treatments. Treatment prescriptions would be strict enough to ensure that adverse effects are minimized, and remain within the scope of effects analyzed in this

EIS, while flexible enough to adapt to changing conditions over time. Se pages 38-39 for more on EDRR.

A connected action of this Proposed Action is the restoration of treatment sites with desirable vegetation to prevent the re-infestation of those sites. The restoration objectives may be passive (allowing plants on site to fill in a treated area) or active restoration (including revegetation from existing vegetation, or any combination of seeding, planting, and mulching). The majority of sites on the Forests will not require active restoration, because invasive plants have not yet displaced native vegetation to the point that passive restoration cannot be accomplished. See pages 37-38 and Appendix E for more on restoration/revegetation.

This project does *not* include herbicide application directly to water, use of any pesticides other than herbicides, treatment of aquatic invasive plants (floating and submerged), or treatment of native vegetation.

## 1.5 Management Direction

The Federal Noxious Weed Act of 1974, as amended (7 U.S.C 2801 et seq.) requires cooperation with State, local, and other Federal agencies in the application and enforcement of all laws and regulations relating to management and control of noxious weeds (a summary of this act can be viewed at: http://ipl.unm.edu/cwl/fedbook/fedweed.html). This Act directs the Secretary of Agriculture to develop and coordinate a management program for control of undesirable plants which are noxious, harmful, injurious, poisonous, or toxic on Federal lands under the agency's jurisdiction, to establish and adequately fund the program, to complete and implement cooperative agreements and/or memorandums, and to establish Integrated Weed Management to control or contain species identified and targeted under cooperative agreements and/or memorandums.

U.S. Forest Service Manual 2080 directs the Forest Service to use an integrated weed management approach to control and contain the spread of noxious weeds on National Forest System (NFS) lands and from NFS lands to adjacent lands (USFS 1995a).

Integrated weed management is an interdisciplinary pest management approach by which one selects and applies a combination of management techniques that, together, control a particular invasive plant species or infestation efficiently and effectively, with minimum adverse impacts to non-target organisms. Integrated weed management is typically species- and site-specific, and includes education, preventive measures, early detection of infestations through inventory and mapping, and combinations of treatment methods as needed to effectively control the target species.

Executive Order 13112 (1999) directs federal agencies to reduce the spread of invasive plants. Invasive species have been identified by the current Chief of the Forest Service as one of the four threats to ecosystem health (see p. 7).

In 1998, the U.S. Forest Service developed a noxious weed strategy for noxious weeds and nonnative plants that provides short- and long-term emphasis and action items in five areas of Integrated Weed Management: prevention and education; control; inventory, mapping, and monitoring; research; and administration and planning (USFS 1998c).

The Forest Service Guide to Noxious Weed Prevention Practices provides management guidance in the form of goals along with prevention practices (USFS 2001a). Forest Service policy identifies prevention of the introduction and establishment of noxious weed infestations as an agency objective. This Guide provides a comprehensive directory of weed prevention practices for use in Forest Service planning and wildland resource management activities and operations. Based on this guide, the Forests prepared *Deschutes and Ochoco National Forests and Crooked River National Grassland Invasive Species Prevention Practices*, included here as Appendix G.

In October 2004, the Chief of the Forest Service released a National Strategy and Implementation Plan for Invasive Plant Species Management – part of the President's Healthy Forest Initiative. It focuses on four key elements: preventing invasive species before they arrive; finding new infestations before they spread and become established; containing and reducing existing infestations; and rehabilitating and restoring native habitats and ecosystems (see www.fs.fed.us/foresthealth/publications/Invasive_Species).

This EIS process and documentation has been completed according to direction contained in the National Forest Management Act (NFMA), the National Environmental Policy Act (NEPA), and the Council on Environmental Quality regulations, Clean Water Act, and the Endangered Species Act. The project is consistent with all applicable Federal, State and local laws. This EIS tiers to the Deschutes National Forest Land and Resource Management Plan Final Environmental Impact Statement and Record of Decision (1990) and incorporates by reference the accompanying Land and Resource Management Plan (LRMP, also called the Forest Plan) (1990), as amended by the Northwest Forest Plan (1994) where appropriate, and INFISH/PACFISH (1995) where appropriate; the Ochoco National Forest and Crooked River National Grassland Final Environmental Impact Statement and Record of Decision, (1989) and incorporates by reference the accompanying Land and Resource Management Plan (LRMP, also called the Forest Plan) (1989), as amended by INFISH (1995) and PACFISH (1995).

The Inland Native Fish Strategy (INFISH) was intended to be interim direction to protect habitat and populations of resident native fish and to provide for options for management. The INFISH delineated RHCAs where riparian-dependent resources receive primary emphasis. These RHCAs include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems.

PACFISH (Pacific Fish) was intended for the implementation of interim strategies for managing anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions of California.

### 1.5.1 Regional Policy and Forest Plan Direction

To build on the National Forest Service Strategy for Noxious Weed and Nonnative plants, the Pacific Northwest (PNW) Region issued a strategy for National Forests in Oregon and Washington that identifies priority actions for all organization levels (USFS 1999f).

In 2004, the Forest Service PNW Regional Office issued a Policy for Invasive Plant Prevention that directs National Forests and the National Scenic Area to complete environmental analysis for treating invasive plants (as funding allows), conduct timely treatment of priority infestations, develop invasive plant prevention practices, analyze the potential risks of ground-disturbing activities on the introduction and spread of invasive plants and design and incorporate prevention measures for these activities, and document this analysis in project files (USFS 2004c).

Invasive plant management direction contained in Land and Resource Management Plans of the Deschutes and Ochoco National Forests and Crooked River National Grassland has been amended by the recently published *Pacific Northwest Region Invasive Plant Program – Preventing and Managing Invasive Plants* Record of Decision (USFS 2005b). This site-specific FEIS follows new Standards and Guidelines as outlined in the regional document. The regional Record of Decision also releases the USDA Forest Service from direction provided by the 1988 Environmental Impact Statement and 1988 Record of Decision for Competing and Unwanted Vegetation, and the associated 1989 Mediated Agreement for invasive plant management.[2] The 2005 R6 ROD added

[2] *The Pacific Northwest Region Invasive Plant Program – Preventing and Managing Invasive Plants Record of Decision (2005)* applies to invasive plant management and prevention only, and does not affect other parts of the 1988 Record of Decision and 1989 Mediated Agreement that apply to unwanted native vegetation management.

goals, objectives, and standards for invasive plant management by amending the Deschutes and Ochoco National Forests' LRMPs.

These goals and objectives include:

**Goal 1 -** Protect ecosystems from the impacts of invasive plants through an integrated approach that emphasizes prevention, early detection, and early treatment. All employees and users of the National Forest recognize that they play an important role in preventing and detecting invasive plants.

| | |
|---|---|
| Objective 1.1 | Implement appropriate invasive plant prevention practices to help reduce the introduction, establishment and spread of invasive plants associated with management actions and land use activities. |
| Objective 1.2 | Educate the workforce and the public to help identify, report, and prevent invasive plants |
| Objective 1.3 | Detect new infestations of invasive plants promptly by creating and maintaining complete, up-to-date inventories of infested areas, and proactively identifying and inspecting susceptible areas not infested with invasive plants. |
| Objective 1.4 | Use an integrated approach to treating areas infested with invasive plants. Utilize a combination of available tools including manual, cultural, mechanical, herbicides, biological control. |
| Objective 1.5 | Control new invasive plant infestations promptly, suppress or contain expansion of infestations where control is not practical, conduct follow up inspection of treated sites to prevent reestablishment. |

**Goal 2 -** Minimize the creation of conditions that favor invasive plant introduction, establishment and spread during land management actions and land use activities. Continually review and adjust land management practices to help reduce the creation of conditions that favor invasive plant communities.

| | |
|---|---|
| Objective 2.1 | Reduce soil disturbance while achieving project objectives through timber harvest, fuel treatments, and other activities that potentially produce large amounts of bare ground |
| Objective 2.2 | Retain native vegetation consistent with site capability and integrated resource management objectives to suppress invasive plants and prevent their establishment and growth |
| Objective 2.3 | Reduce the introduction, establishment and spread of invasive plants during fire suppression and fire rehabilitation activities by minimizing the conditions that promote invasive plant germination and establishment. |
| Objective 2.4 | Incorporate invasive plant prevention as an important consideration in all recreational land use and access decisions. Use Forest-level Access and Travel Management planning to manage both on-highway and off-highway travel and travel routes to reduce the introduction, establishment and spread of invasive plants. |

<u>Objective 2.5</u> Place greater emphasis on managing previously "unmanaged recreation" (OHVs, dispersed recreation, etc.) to help reduce creation of soil conditions that favor invasive plants, and reduce transport of invasive plant seeds and propagules.

**Goal 3 -** Protect the health of people who work, visit, or live in or near National Forests, while effectively treating invasive plants. Identify, avoid, or mitigate potential human health effects from invasive plants and treatments.

<u>Objective 3.1</u> Avoid or minimize public exposure to herbicides, fertilizer, and smoke

<u>Objective 3.2</u> Reduce reliance on herbicide use over time in Region Six

**Goal 4** – Implement invasive plant treatment strategies that protect sensitive ecosystem components, and maintain biological diversity and function within ecosystems. Reduce loss or degradation of native habitat from invasive plants while minimizing adverse effects from treatment projects.

<u>Objective 4.1</u> Maintain water quality while implementing invasive plant treatments.

<u>Objective 4.2</u> Protect non-target plants and animals from negative effects of both invasive plants and applied herbicides. Where herbicide treatment of invasive plants is necessary within the riparian zone, select treatment methods and chemicals so that herbicide application is consistent with riparian management direction, contained in Pacfish, Infish, and the Aquatic Conservation Strategies of the Northwest Forest Plan.

<u>Objective 4.3</u> Protect threatened, endangered, and sensitive species habitat threatened by invasive plants. Design treatment projects to protect threatened, endangered, and sensitive species and maintain species viability.

Invasive Plant Treatment Standards and Guidelines added to the LRMPs from the R6 Invasive Plant Program ROD:

**#11** Prioritize infestations of invasive plants for treatment at the landscape, watershed or larger multiple forest/multiple owner scale.

**#12** Develop a long-term site strategy for restoring/revegetating invasive plant sites prior to treatment.

**#13** Native plant materials are the first choice in revegetation for restoration and rehabilitation where timely natural regeneration of the native plant community is not likely to occur. Non-native, non-invasive plant species may be used in any of the following situations: 1) when needed in emergency conditions to protect basic resource values (e.g., soil stability, water quality and to help prevent the establishment of invasive species), 2) as an interim, non-persistent measure designed to aid in the re-establishment of native plants, 3) if native plant materials are not available, or 4) in permanently altered plant communities. Under no circumstances will non-native invasive plant species be used for revegetation.

**#14** Use only APHIS and State-approved biological control agents. Agents demonstrated to have direct negative impacts on non-target organisms would not be released.

**#15** Application of any herbicides to treat invasive plants will be performed or directly supervised by a State or Federally licensed applicator.

All treatment projects that involve the use of herbicides will develop and implement herbicide transportation and handling safety plan.

**#16** Select from herbicide formulations containing one or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. Mixtures of herbicide formulations containing 3 or less of these active ingredients may be applied where the sum of all individual Hazard Quotients for the relevant application scenarios is less than 1.0.

All herbicide application methods are allowed including wicking, wiping, injection, spot, broadcast and aerial, as permitted by the product label. Chlorsulfuron, metsulfuron methyl, and sulfometuron methyl will not be applied aerially. The use of triclopyr is limited to selective application techniques only (e.g., spot spraying, wiping, basal bark, cut stump, injection).

Additional herbicides and herbicide mixtures may be added in the future at either the Forest Plan or project level through appropriate risk analysis and NEPA/ESA procedures.

**#18** Use only adjuvants (e.g. surfactants, dyes) and inert ingredients reviewed in Forest Service hazard and risk assessment documents such as SERA, 1997a, 1997b; Bakke, 2003.

**#19** To minimize or eliminate direct or indirect negative effects to non-target plants, terrestrial animals, water quality and aquatic biota (including amphibians) from the application of herbicide, use site-specific soil characteristics, proximity to surface water and local water table depth to determine herbicide formulation, size of buffers needed, if any, and application method and timing. Consider herbicides registered for aquatic use where herbicide is likely to be delivered to surface waters.

**#20** Design invasive plant treatments to minimize or eliminate adverse effects to species and critical habitats proposed and/or listed under the Endangered Species Act. This may involve surveying for listed or proposed plants prior to implementing actions within unsurveyed habitat if the action has a reasonable potential to adversely affect the plant species. Use site-specific project design (e.g. application rate and method, timing, wind speed and direction, nozzle type and size, buffers, etc.) to mitigate the potential for adverse disturbance and/or contaminant exposure.

**#21** Provide a minimum buffer of 300 feet for aerial application of herbicides near developed campgrounds, recreation residences and private land (unless otherwise authorized by adjacent private landowners).

**#22** Prohibit aerial application of herbicides within legally designated municipal watersheds.

**#23** Prior to implementation of herbicide treatment projects, National Forest system staff will ensure timely public notification. Treatment areas will be posted to inform the public and forest workers of herbicide application dates and herbicides used. If requested, individuals may be notified in advance of spray dates.

Additional Forest Plan Standards and Guidelines that apply to this project can be reviewed in Appendix C. This direction is contained in the Forest Plans:

- Deschutes National Forest Land and Resource Management Plan (1990)
- Ochoco National Forest & Crooked River National Grassland Land and Resource Management Plan (1989)
- Forest Plan Amendments from the Ochoco National Forest and Crooked River National Grassland Weed Environmental Assessment and Decision Notice (1995)

The Forest Plan Management Areas are listed in the following table.

**Table 2.** Management Areas of the Deschutes and Ochoco NF and Crooked River National Grassland where Mapped Invasive Plant Sites or Project Area Units occur.

| Deschutes National Forest | Ochoco National Forest |
|---|---|
| Deer Habitat | Deep Creek Recreation Area |
| Dispersed Recreation | Deschutes River Scenic Area |
| Bald Eagle | Developed Recreation |
| Experimental Forest | Eagle Roosting Area |
| Front Country Seen | Facilities |
| Front Country Unseen | General Forage |
| General Forest | General Forest |
| Intensive Recreation | General Forest Winter Range |
| Metolius Black Butte Scenic | Haystack Reservoir |
| Metolius Heritage | Metolius Winter Range - Deer |
| Metolius Old Growth | North Fork Crooked River Scenic Corridor |
| Metolius Special Forest | North Fork Crooked River Rec Corridor |
| Metolius Scenic View Retention Foreground | Old Growth |
| Metolius Scenic View Partial Retention | Old Growth Juniper |
| Metolius Wildlife/Primitive | Research Natural Area |
| Oregon Cascade Recreation Area | Rim Rock Springs Wildlife Area |
| Old Growth | Whychus Creek Management Area |
| Osprey Management Area | Summit Trail Preservation Corridor |
| Newberry National Volcanic Mon | Summit Trail Partial Visual |
| Moffit Butte Special Interest Area | Summit Trail Visual Retention Corridor |
| Lava River Cave Special Interest Area | U.S. Highway 26 Visual Corridors |
| Davis Lake Special Interest Area | Visual Management Corridors (Partial) |
| Wire Meadow Special Interest Area | Visual Management Corridors (Retention) |
| Scenic View Retention Foreground | Wilderness - Black Canyon |
| Scenic View Partial Retention Foreground | Wilderness – Bridge Creek |
| Scenic View Partial Retention | Wilderness – Mill Creek |
| Wilderness | Winter Range |
| Deschutes River – Scenic Segment | Winter Range - Antelope |
| Deschutes River – Rec. Segment | Lookout Mountain Rec. Area - Top |
| Metolius River – Scenic Segment | Bandit Springs Rec. Area |
| Metolius River – Rec. Segment | Steins Pillar Rec. Area |
| Whychus Creek – Scenic Segment | Hammer Creek Wildlife/Rec. Area |
| Crescent Creek – Rec. Segment | Rock Creek/Cottonwood Creek Roadless |
| Wake Butte Special Interest Area | |
| Winter Recreation | |
| Cultus River RNA | |
| Scenic View Retention Middleground | |

### Northwest Forest Plan

The Northwest Forest Plan is applicable west of the owl range line, on the Deschutes National Forest only.

Late Successional Reserves (LSRs) – Eleven LSRs were designated on the Deschutes National Forest by the Northwest Forest Plan. LSR Assessments considered the noxious weed conditions within each LSR and some included general recommendations for treatment. Applicable standards and guidelines are listed in Appendix C. Impacts to species that occur in LSRs from implementation of proposed invasive plant treatments are discussed in the wildlife section.

Watershed analysis (WA) is a component of the Aquatic Conservation Strategy (ACS) of the Northwest Forest Plan. Recommendations from WA documents were considered in project planning. The WA documents on the Deschutes National Forest note the presence of invasive plants and the recommendations were considered during design of this project. The ACS objectives are assessed in relation to the proposed activities in Chapter 3.6.

**Prevention Guidelines**

The Forests and Grassland have prepared a list of Invasive Plant Species Prevention Practices, included in this FEIS as Appendix G. Implementation of these prevention practices will minimize the introduction of invasive plants and facilitate the integration of invasive plant management practices into resource programs. These prevention practices will help the Forests and Grassland meet the Goals 1 and 2 of the Forest Plan, listed on page 14.

## 1.6 Decision Framework

The Forest Supervisors for the Deschutes National Forest, and the Ochoco National Forest and Crooked River National Grassland are the Responsible Officials for this EIS. They will be making the following decisions:

Will the Invasive Plant Project be implemented as proposed, as modified by an alternative, or not at all? What mitigation measures and monitoring will be required with implementation of the project?

The Responsible Officials will base their decisions on review of the environmental impact statement, and the following factors: 1) How well the alternative meets the need for action; 2) The potential for treatments to affect the environment; and 3) The economic efficiency of the treatments.

## 1.7 Public Involvement

Ongoing public involvement occurred throughout this NEPA process. This project has been included in the *Schedule of Projects for the Deschutes and Ochoco National Forests and the Prineville District of the BLM* since the Summer 2003 issue. On February 23, 2004 the original Notice of Intent (NOI) to prepare an Environmental Impact Statement to document and disclose the potential environmental effects of proposed invasive plant treatment activities on the Ochoco and Deschutes National Forests appeared in the Federal Register. The original Notice of Intent appeared in Federal Register Volume 69, No. 35/February 23, 2004 on page 8174. Due to the length of time between that publication in the Federal Register and the initiation of the analysis for this project, a Revised Notice of Intent was published Friday, October 21, 2005 in volume 70, No. 203 on page 61244. Both NOIs called for public comment. Information on the proposal was posted on a project website, which has since moved to the following address: http://www.fs.fed.us/r6/invasiveplant-eis/site-specific/DES/.

On August 19, 2005 a scoping letter describing the project proposal was sent to over 700 individuals, organizations, tribes, and other agencies. It explained the February, 2004 scoping efforts and the reasons for again inviting public comment. It introduced the Proposed Action, summarized the purpose of and need for the proposal, and invited interested parties to submit written, facsimile, or electronic comments. A comment form was provided that could be filled out and mailed back to the Forests.

The Forest Service received 28 responses. The largest number of comments addressed treatment effectiveness, urging that the project go forward in a timely manner. Prevention and monitoring were suggested for long-term site goals. A large number of comments expressed concern for social and economic factors, stating that inter-agency as well as partnerships with private groups with the same goals be explored for the sake of saving time and money. Effects on human health and non-target species from herbicides were other concerns realized through this process. Implementing herbicide application methods that reduce the threat to forest workers and those who use the forest, as well as the forest environment, including wildlife, soils, water, and aquatic biota were advised. Still others felt that herbicides should not be used at all. Issues generated from this public input facilitate project design development, alternative development, effects analysis of the alternatives, and selection of a preferred alternative.

Due to the complexity of the Proposed Action, the Forest Service has initiated additional public involvement activities during the analysis phase of this project: An update of the EIS process was sent to the mail list in February 2006 to describe the alternatives being considered; the interdisciplinary team arranged field trips and meetings with experts involved in noxious weed control and the application of herbicides (for example, from the Oregon Dept. of Agriculture and County Weed Departments); the interdisciplinary team met with representatives of the Sierra Club and Friends of the Metolius to discuss ribbongrass along the Metolius River; the Deschutes Provincial Advisory Committee was kept up to date by briefings on February 27, 2006 and June 7, 2006; The IDT met with the natural resource staff of the Confederated Tribes of the Warm Springs in May 2006; information and maps have been posted and updated on the Forests' internet site as well; the IDT leader met with representatives of the Crook County Natural Resources Committee in March 2007.

A 45-day public comment period began February 2, 2007. Results of the comment period are described in Appendix I. Consultation activities are described in Chapter 4.

## 1.8 Issues

The Forest Service compiled an initial list of issues based on comments from the public, organizations, agencies, tribes, and local state and federal governments. The following section summarizes issues identified through the scoping process and discusses how they are addressed in the EIS analysis. Most issues are resolved through project design features, adherence to standards and guidelines and the appropriate laws and regulations, and by consistency with decisions made in the *Pacific Northwest Regional Invasive Plant Program – Preventing and Managing Invasive Plants* Record of Decision (2005b). Some issues vary by alternative design.

The Council on Environmental Quality requires the USDA Forest Service to identify and eliminate from detailed study the issues that are not significant (40 CFR 1501.7). Issues may be eliminated from further analysis when the issue is outside the scope of the Proposed Action; is already decided by law, regulation, Forest Plan, or other higher level decision; is clearly not relevant to the decision to be made; or is conjectural and not supported by good scientific or factual evidence. Non-significant issues are part of the project record.

### Treatment Effectiveness

The public and other agencies and organizations expressed a strong desire to see the Forest Service utilize the methods necessary to make substantial progress in effective treatment of invasive species. This was mostly expressed as a desire to see more herbicides used where they are the most effective treatment, and to avoid delay which could allow further spread. The Proposed Action and Alternative 3 allow herbicide use across the project area. The alternatives vary in the formulations and application methods that are allowed in riparian areas, which may impact effectiveness.

The indicators used to measure this issue will be: the number of inventoried sites that can be effectively treated; the number of herbicide formulations available for use; the ability to respond quickly to new populations under each alternative; and a general assessment of effectiveness of invasive plant treatments.

### Effects to Native Vegetation and Non-Target Plants

Invasive plant treatments, especially herbicides, may harm non-target plants, including culturally significant, threatened, endangered and sensitive species or survey and manage species. Different herbicides have varying degrees of potency and selectivity (e.g., some herbicides affect certain plant families more readily than others), and application methods vary in the potential for off-site effects. As invasive plants decrease, native plants are expected to benefit through increased available habitat. The application of Project Design Features in each action alternative ensure this project is compliant with invasive plant treatment Standard #19, which directs the Forest Service to minimize or eliminate negative effects to non-target species. Indicators for this issue include the amount of risk to native plant communities from treatment and from invasive plants; and effects determinations will be made for Regional Forester's Sensitive plant species and Survey & Manage plant species.

### Social/Economic

The public wants to see economics considered when choosing methods of treatment. The different treatment methods vary in how much they cost to implement; and therefore, how much can be completed in any year. Some in the public want to see herbicides used because of cost. Manual and mechanical treatments, such as hand pulling will generally be more costly but at the same time would likely provide more jobs because of the labor involved. Some members of the public would also like to see the Forest Service take the opportunity to provide jobs in the rural areas by considering manual and mechanical methods of treatment. The indicators used to measure this issue will be: estimated cost of completing treatments; number of acres that can be treated under each alternative in a year, given a certain budget; and number of jobs that would be associated with each alternative in a year.

Invasive plants do not respect the boundaries between federal and privately-owned lands. Where invasive plants occur along boundary lines, there is the risk of them spreading to private property. The public does not want to see their efforts at control negated by spread from Forest Service lands. The action alternatives do not vary on this issue; both include treatment of existing sites along the Forest boundary.

### Water & Aquatic Species

The public expressed concern with impacts to water quality and fish. Some suggested that herbicide use in riparian areas should be avoided. Herbicides pose a risk of causing mortality or other effects to fish and aquatic species (such as algae, aquatic plants or aquatic insects that fish depend on for food and cover) if water is contaminated by herbicide drift, ground water recharge, washing into streams, or an accidental spill near fish habitat. Manual and mechanical treatments can impact water quality, fish, and other aquatic species by causing sediment, and disturbing riparian structure. Removal of vegetation along streams (such as reed canary grass) can increase erosion and sedimentation or reduce streambank stability, shade, and cover for fish.

This issue is addressed with project design features and by complying with standards and regulations. This project proposes no direct application of herbicides to water. Buffers and restrictions on the application method ensure that adverse effects to non-target species will be minimized or eliminated. Alternative 3 was developed to provide an even more cautious approach to invasive plant treatment within the riparian areas.

The indicators used to measure this issue will be: acres of treatment by treatment method within aquatic buffers; acres of treatment by treatment method within 100 feet of fish-bearing streams and 303(d) listed streams; amount and type of treatment near potable water sources; and effects determinations will be made for Regional Forester Sensitive and federally-listed fish species in the biological assessment process.

### Human Health – Public and Worker Exposure to Herbicides

The public expressed concerns about the use of herbicides and what kinds of effects they may have on human health, either through drinking water, through direct contact by forest workers, or contamination of drinking water or eating contaminated special forest products, or recreationists coming into contact with contaminated vegetation. There is concern about long-term and cumulative effects to humans from the use of herbicides. Some believe that the potential cost to human health is too high and other methods should be used to control invasive plants.

The indicators that will be used to measure this issue are: acres treated with herbicides; acres treated in areas where potable water is used; potential for exposure of forest workers. This issue is addressed with project design features and by complying with standards and guidelines. Alternatives do not vary on this issue. Both include precautions to avoid scenarios of concern.

### Effects to Wildlife

There is potential for disturbance to wildlife during implementation, and treatments may also disturb certain habitat components. Wildlife may contact herbicides or ingest invasive plants that have been treated with herbicide and become sick or die. This issue is generally addressed through adherence to invasive plant treatment standards and implementation of Project Design Features that are intended to further reduce the risk of adverse effects. Herbicide effects to the following are considered: threatened, endangered, and sensitive wildlife species (TES); survey and manage species; management indicator species (MIS), birds of conservation concern, and landbirds.

### Effects to Soil

Invasive plants provide ground cover that could be disturbed by treatments. Herbicide use may harm soil organisms or soil biology. The existence of invasive plants also can negatively affect soils. Effects are based on soil types and the properties of individual herbicides. This issue is addressed through adherence to Forest Plan invasive plant treatment standards. Project design features listed in Chapter 2 were adopted in order to minimize potential adverse effects.

**Other Items Considered, Including Required Disclosures:**

Range Resources
Scenic and Recreation Values
Congressionally Designated Areas and Other Areas of Special Interest
Civil Rights and Environmental Justice
Prime Lands
Cultural Resources
Wetlands
Short-term Uses/Long-term Productivity
Conflicts with other Policies, Plans, Jurisdictions
Irretrievable and Irreversible Commitment of Resources

# Chapter 2
## Alternatives

# Chapter 2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

**Chapter 2 Changes Between Draft and Final:**

- Improved reference map by adding more landmarks.
- The list of target invasive plant species has been updated.
- Activities common to both action alternatives clarified.
- Some Project Design Features (PDFs) edited or modified.

## 2.1 Introduction

Chapter 2 describes and compares alternatives considered for invasive plant treatment on the Deschutes and Ochoco National Forests and Crooked River National Grassland. Alternatives were developed by the Interdisciplinary Team to address the key issues. Three alternatives are analyzed in detail. Both action alternatives meet the purpose and need for action in varying degrees.

The descriptions of the alternatives in Chapter Two are derived from a detailed project database of existing invasive plant inventories. The project area was divided into treatment areas, called project area units (PAUs), that were classified by the type of site (e.g., roads, administrative sites, meadows) and assessed for the threat posed by existing invasive species and the potential for effective treatment. Treatment methods (herbicide and non-herbicide) and strategies were identified based on the location, extent and biology of the existing invasive plant species. Treatment priorities, methods and strategies are tiered to the 2005 R6 Invasive Plant FEIS. A primary outcome of the site-specific analysis is development of project design features so that invasive plant treatments minimize adverse effects to non-target plants and animals (treatment standards 19 & 20 – see page 16).

**Precision of Information and Adjustments**

Quantifiable measurements, such as acres and miles, and mapped unit boundaries used to describe the alternatives and effects are based on the best available information. Information used in designing the alternatives was generated from a mix of field reconnaissance, global positioning system (GPS) technology, the NRIS database[3], and the expertise of the invasive plant coordinators on the Forests and Grassland.

Adjustments have been made to the original proposal primarily based on additional site-specific information derived from ongoing field verification. Site-specific information is subject to change over time. Ongoing inventory will validate the location, extent, and species distribution of invasive plants.

[3] The National Resource Information System (NRIS) is a set of databases that contain resource information needed to support the business of managing national forests and grasslands. NRIS holds data on vegetation, soil and geology, air and water, animal life and social and economic data. Information on local invasive plant infestations is gathered and entered into NRIS by specialists on the Forests and Grassland, including site monitoring data.

## 2.2 Alternative Development

The interdisciplinary team used the issues described in Chapter 1 to refine the proposed action, an alternative to the proposed action, and to develop Project Design Features (PDFs) that minimize or eliminate potentially adverse effects. Aside from No Action, the alternatives do not drop any treatment areas from consideration; rather, they specify alternative means of controlling the invasive species, or require additional PDFs. Also see **Alternatives and Project Design Features Not Considered in Detail** at the end of this Chapter.

## 2.3 Alternatives Considered in Detail

### 2.3.1 Alternative 1 – No Action

This alternative is required by law and serves as a baseline for comparison of the effects of the alternatives. Under Alternative 1, there would be no change in the level of ongoing management activities within the project area. No Action means that additional herbicides permitted by the R6 2005 ROD would not be available for use.

Under the No Action alternative, the Forests and Grassland would continue to treat invasive plant species as authorized under existing NEPA documents, which is only about 6% of currently inventoried invasive plant sites. As approved by NEPA decisions, approximate acres treated on average over the last several years are shown in Table 3. Details on the areas treated each year are available from the Forests and Grassland Noxious Weed Program Manager.

Invasive plant treatments have been previously authorized under the following NEPA decisions:

- Ochoco National Forest and Crooked River National Grassland, Integrated Weed Management Environmental Assessment and Decision Notice (1995) allowed the Forest Service to treat 34 noxious weed sites with a mix of manual, biological, and herbicide treatments. It also amended the Ochoco/Grassland LRMP to include programmatic direction for Forest Plan desired future conditions, goals, objectives, and standards and guidelines for noxious weed management. Herbicides approved for use at that time under the (1988) Record of Decision for the Guide to Conducting Vegetation Management Project in the Pacific Northwest Region and selected for use on the Ochoco were dicamba, picloram, and glyphosate.
- Ochoco National Forest and Crooked River National Grassland, 1998 Integrated Noxious Weed Management Environmental Analysis and Decision Notice analyzed and authorized intensive weed management on 72 sites, with herbicide, manual, and/or biological control. Based on monitoring results from the weed sites treated under the 1995 EA, the 1998 expanded the area where herbicides could be used. Only dicamba, picloram, and glyphosate were proposed.
- Deschutes National Forest Noxious Weed Control Environmental Assessment and Decision Notice (USFS 1998a) authorized treatment at 98 noxious weed sites on 901 acres with manual treatment, 27 sites on 149 acres with biological agents, 1 site on 5 acres with prescribed burning, and 40 sites on 476 acres with herbicides. Only dicamba, picloram, glyphosate, and triclopyr were proposed.
- Turnpike Pit Medusahead Control, Environmental Assessment and Decision Notice (2005c) authorized herbicide treatment (glyphosate) of medusahead at the Turnpike Pit material source

(used for the extraction of rock and gravel) and require monitoring of the site (Paulina Ranger District, Ochoco NF).

On the Forests and Grassland, most of the herbicide treatments are accomplished through agreements with Crook, Deschutes, and Jefferson counties and the Oregon Department of Agriculture. The Ochoco National Forest also has agreements with Wheeler and Grant Counties for weed inventory and treatment.

The following table displays the annual average acres treated during the time period 2000 to 2004 for herbicides on the Deschutes; 2003 to 2005 for herbicides on the Ochoco and Grassland; and 2003 to 2005 for manual treatments on the Ochoco.

**Table 3.** Average acres treated annually by method under existing NEPA documents.

| | Deschutes NF | Ochoco NF | Crooked River NG | Total |
|---|---|---|---|---|
| Herbicide | 82 | 85 | 108 | 275 |
| Mechanical | 0 | 0 | 0 | 0 |
| Manual | 555 | 663 | 47 | 1,265 |
| Biocontrol | 15 | 35 | 5 | 55 |
| | | | Total | 1,595 |

Other invasive plant control activities occur on the Forests: The Oregon Department of Transportation applies herbicides along the right-of-way of State Highway 26 that passes through National Forest System land and the Grassland. BPA and TransCanada (formerly PGT) have treated their facilities on special use permit areas in the past.

Biocontrol[4] agents that have been released consist of the Canada thistle gall fly (*Urophora cardui*) and the Canada thistle stem boring weevil (*Ceutorhynchus litura*). The analyses for effects of such tools have already been completed under documents developed by Agricultural Plant Health and Insect Service (APHIS) for approval of entry of such organisms. The completed Environmental Impact Statements are available at: http://www.aphis.usda.gov/ppq/enviro_docs/index.html.

Under the No Action Alternative, the Forests would continue to implement prevention measures, and are required to comply with the standards for prevention practices included in the Invasive Plant ROD (USFS 2005b); the new treatment methods analyzed in the Invasive Plant FEIS would not be authorized for use in the project area. The Invasive Plant FEIS (USFS 2005a) predicts that the rate of spread of invasive plants would slow from implementing the prevention practices; however, prevention alone is insufficient to reach desired future conditions because of the extent of existing infestation. As a result, the infestations on the Forests and Grassland would continue to expand. Invasive plants not included in the earlier EAs would continue to expand; manual treatments cannot keep pace with the growth of the larger sites. No Forest Plan amendment is required to implement this alternative.

[4] Biological control is the deliberate use of natural enemies (parasites, predators, or pathogens) to reduce invasive plant densities. Insects released as biological controls generally feed on one portion of the plant; leaves, roots or seeds. Biological controls are therefore most effective when there is more than one insect control for each plant species.

## 2.3.2 Alternative 2 – Proposed Action

Alternative 2 would treat 1,892 inventoried weed sites across the Forests and Grassland with integrated prescriptions that generally combine the use of herbicides with mechanical, manual, and cultural control methods. The Proposed Action utilizes new tools made available through the Invasive Plant FEIS and ROD (2005), new herbicides in particular. An early detection/rapid response strategy is included for newly discovered infestations of invasive plants.

### Project Area Units

Invasive plant treatments are proposed for 1,892 individually mapped invasive plant sites. Mapped invasive plant sites[5] cover approximately 14,547 acres and are aggregated into 289 project area units. The project area units (PAUs) incorporate from one to ten weed sites and are delineated to include the weed sites, uninfested or uninventoried space in between sites, and allow for expected spread (along road systems, for example). They are delineated based on our current inventory, the site types (e.g. roads), and susceptibility for invasion. See Figure 2 and Maps 1-5. These PAUs total approximately 52,015 acres.

Because invasive species are mobile and will spread, the PAUs facilitate capture of resource concerns so that project design features can be applied if the existing weed sites are found to have spread or appear in a different part of the unit. Although each entire project area would be analyzed for effects, only the actual area containing invasive species would be treated in any given year.

The Project Area Unit is an important concept in this EIS because:

1. The Unit represents the local specialists' extrapolation of where the weeds may occur in uninventoried areas or where they are likely to spread in the near future, based on known sites.
2. Within the PAU the weeds may have already spread from the inventoried sites.
3. Effects analysis and project design features consider the resource conditions in the entire Unit, not just the area where an infestation has been mapped.

When weed sites are mapped, a boundary is drawn around an area of infestation, usually in the field with a hand-held Global Positioning Unit. The actual number, density, and distribution of the plants will vary. Some are patchy, some are dense, and some are single plants scattered widely in the site. Therefore, mapped weed sites incorporate more land than what is actually infested, and therefore more than what will actually be treated for invasive species. This is important because the estimate of effects in this EIS is based on the mapped weed site and thus can be considered the current maximum treatment scenario.

The treatments applied within each project area would be modified by Project Design Features (PDFs), which are intended to minimize or eliminate some of the potential adverse impacts (detailed in Section 2.4). PDFs define a set of conditions or requirements that an activity must meet to avoid or minimize potential effects on sensitive resources.

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[5] The invasive plant inventory is one component of the Natural Resource Information System (NRIS) that the Forest Service uses to maintain natural resource data. Further information about the inventory can be obtained by visiting http://www.fs.fed.us/emc/nris/ftp/invasives/Terrav12_overview.pdf. The terms "weed" and "weed site" if used in this document refer to invasive plants and invasive plant sites; these terms are sometimes used interchangeably. The term "noxious weed" has a legal definition, see Glossary.

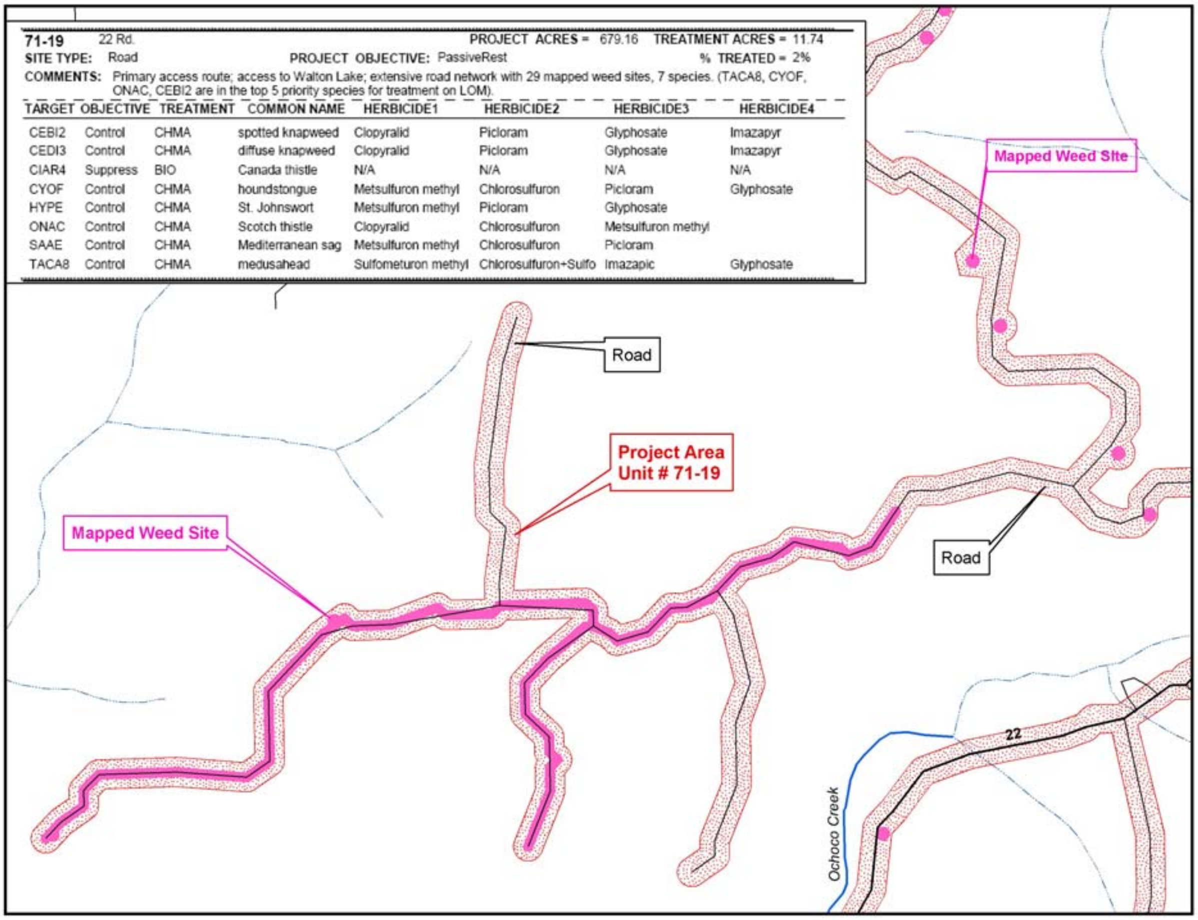


**Figure 2**. Representative Project Area Unit and Data from Project Area Summary Report, Appendix A of this EIS.

**Table 4.** Site Type Descriptions for Project Area Units (PAUs).

| Site Type | Project Area Unit Acres | % of Project Areas |
|---:|---:|---:|
| Rec. Site, Admin. Site, Summer Home | 70 | **< 1 %** |
| Forest | 8,850 | **17 %** |
| Wildfire Area | 1,296 | **2.5 %** |
| Meadow, Wetland, Floodplain, Lakeside or Streamside | 3,103 | **6 %** |
| Other (e.g. quarry, utility) | 890 | **1.7 %** |
| Roadside | 36,198 | **70 %** |
| Road along stream | 1,288 | **2.4 %** |
| Trail | 321 | **< 1 %** |
| | **52,015** | |

**Site Types**

Of the 289 PAUs mapped, the majority are along roads. The following site types are a summary of more specific categories applied to each PAU in the inventory database (See Appendix A).

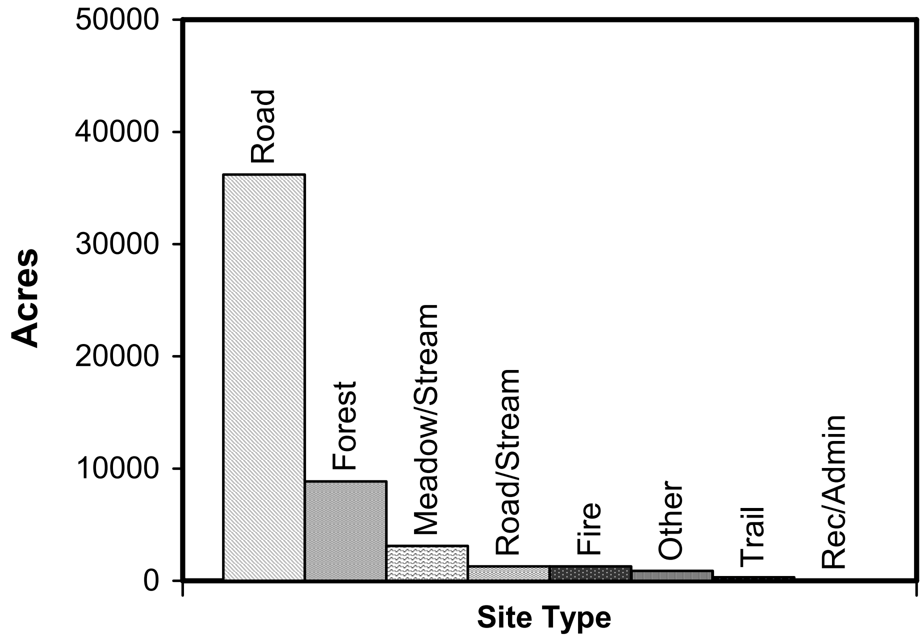


**Figure 3.** Acres of Project Area Units by Grouped Site Types. Disturbed areas, such as along roads, are the most common place to find invasive plants.

## Treatments

Various factors are considered when determining the appropriate treatment(s) for invasive plant species. These factors include:

- Target invasive plant species and its biology (e.g. mode of reproduction)
- Aggressiveness of the species and how quickly it may spread
- Population size and density
- Site type (e.g. riparian, upland, disturbed roadside)
- Site accessibility
- Desired plant species to maintain on the site

Appendix A includes the "Project Area Table" which lists all project area units, the invasive species present, and proposed control measures for each species. Refer to project area Maps 1-5 for locations of the units. Larger-scale maps are available at the Deschutes or Ochoco National Forest headquarters offices in Bend and Prineville, or on the internet at http://www.fs.fed.us/r6/invasiveplant-eis/site-specific/DES/.

Each project area may contain several species of invasive plants and will therefore involve more than one treatment. Treatments are a combination of methods, such as herbicide/manual or cultural/manual. The following table is intended to summarize the extensive amount of data in the Project Area Unit Table of Appendix A.

**Table 5.** Treatment methods applied within project area units, Alt. 2. This information summarizes the treatments that may be applied within project area units. This is a simplification of the prescription, as the order, timing, and application method will vary by site.

| Treatment Method | Mapped Weed Site Acres | Project Area Unit Acres |
|---|---|---|
| Herbicide only | 393 | 3,785 |
| Herbicide plus one or more of the following: manual, biological, cultural, mechanical, fire | 13,421 | 44,443 |
| Manual only | 706 | 3,635 |
| Manual plus biological | 0.5 | 19 |
| Biological only | 23 | 116 |
| Cultural only | 3 | 17 |
| Total | 14,546.5 | 52,015 |

The most common prescription is herbicide/manual (occurring within 154 Project Area Units), which means an initial application of herbicide would be followed up with either additional herbicide and manual treatments or just manual treatments. If pre-implementation site visit shows that the invasive plant site is small and can be efficiently and effectively hand-pulled, then the treatment would revert to manual.

Appendix B provides more detailed information on the strategies that are known to work best for the species inventoried on the Forests (such as timing of treatments, herbicide options).

**Table 6.** Summary of Treatment Methods Combinations that will occur across Project Area Units, Sorted by Site Type, Alt. 2

| Site Type | Treatment Method | Project Area Unit Acres* |
|---|---|---|
| **Rec. Site, Admin. Site, Summer Home** | Herbicide, Manual | 70 |
| **Forest** | Biological Only | 0.75 |
| | Herbicide Only | 346 |
| | Herbicide plus one or more of the following: manual, cultural, biological, mechanical | 8,028 |
| | Manual Only | 475 |
| **Wildfire Area** | Biological Only | 16 |
| | Herbicide, Manual | 1,280 |
| **Meadow, Wetland, Floodplain, Lakeside or Streamside** | Biological Only | 17.5 |
| | Herbicide plus one or more of the following: manual, mechanical, cultural | 3,004 |
| | Manual only | 81 |

| Site Type | Treatment Method | Project Area Unit Acres* |
|---|---|---|
| Other (e.g. quarry, utility) | Herbicide Only | 48 |
| | Herbicide, Manual | 842 |
| Roadside | Biological Only | 82 |
| | Herbicide Only | 3,292 |
| | Herbicide plus one or more of the following: manual, cultural, biological, mechanical | 29,802 |
| | Manual Only | 2,930 |
| | Manual plus biological | 19 |
| Road/Stream | Herbicide plus one or more of the following: manual, cultural, biological, mechanical, fire | 1,288 |
| Trail | Herbicide Only | 100 |
| | Herbicide plus manual | 72 |
| | Manual Only | 149 |

*Acres could occur in more than one category of site type which would account for the slight difference in total PAU acres shown in Table 5.

The amount of treatment within a unit is based on the occurrence of mapped invasive plant sites, which totals about 14,547 acres across the Forests and Grassland. The amount of invasive plant sites in a PAU can be considered the maximum amount of area that would be treated in a year; however, the actual amount would likely be less, and would be based on priorities and budget. See Chapter 3.10.2 for what a typical budget could accomplish given the costs per acre per treatment type.

## 2.3.3 Alternative 3

Alternative 3 was developed to respond to issues surrounding the effects to aquatic organisms. The areas proposed for invasive plant treatments are the same as Alternative 2, but differ in the prescriptions.

Buffers along streams are based on general riparian reserve and riparian habitat conservation areas (see Table 7). A 300-foot buffer will apply to all perennial streams, all fish bearing streams and all perennial lakes, ponds, and reservoirs. Within the buffers listed in Table 7, treatment methods are restricted as follows:

- The following herbicides would not be allowed within the aquatic buffers because they are considered high risk to fish: triclopyr, picloram, or sethoxydim.
- Broadcast spraying would not be allowed within these buffers or along road segments that are within 300 feet of perennial streams or lakes to reduce risk of drift into water.
- Machinery or equipment that could cause substantial sedimentation would not be allowed within the buffers or along roads where they are within 300 feet of a perennial stream or lake to limit risk of sedimentation.
- In addition, there would be no herbicide application allowed within the definable channel of intermittent streams when they are dry or within 10 ft of perennial or fish bearing streams,

rivers, lakes, ponds or reservoirs and intermittent streams when flowing. Ten feet is approximately three times the average spray width for spot spray applications so is sufficient to account for any overspray. (Under Alternative 2, invasive species that are below the high water mark could be treated with herbicides as water levels drop seasonally). This will impact treatment on approximately 230 acres on perennial streams, springs, or lakes and approximately 30 acres on intermittent streams.

**Table 7.** Width of Aquatic Buffers applied in Alternative 3. Restrictions on Treatment Methods within these buffers are listed on previous page.

| Classification | Aquatic Buffers for Alt. 3 |
|---|---|
| Class 1 | 300 |
| Class 2 | 300 |
| Class 3 | 300 |
| Class 4 | Bankfull |
| Wetlands>1 acre | 150 |
| Wetlands<1 acre | 150 |
| Lakes | 300 |
| Ponds | 300 |
| Reservoirs | 300 |
| Springs | 300 |

The following table displays how much of the National Forest System land falls within the buffers identified for Alternative 3 (Table 7) as well as how much of that is included in mapped invasive plant sites and Project Area Units (PAUs). A total of 8,671 acres of PAUs and 2,016 acres of mapped invasive plant sites are included in the aquatic buffers across the Forests and Grassland. These areas are subject to the restrictions listed on the previous page, and are therefore the areas where the two action alternatives differ.

**Table 8.** Project Area Units and Mapped Invasive Plant Sites within Alternative 3 Aquatic Buffers.

| Subbasin (4th field) | Subbasin Name | Subbasin Acres | Acres of Project Area Units within Aquatic Buffer* | Acres of Infestation within Aquatic Buffer |
|---|---|---|---|---|
| 17070201 | Upper John Day River | 1,370,836 | 458 | 17 |
| 17070204 | Lower John Day River | 2,020,149 | 453 | 64 |
| 17070301 | Upper Deschutes River | 1,378,957 | 3,080 | 1,091 |
| 17070302 | Little Deschutes River | 672,933 | 295 | 195 |
| 17070303 | S. Fork Crooked River | 980,618 | 943 | 280 |
| 17070304 | Upper Crooked River | 739,792 | 1,265 | 37 |
| 17070305 | Lower Crooked River | 1,204,246 | 1,454 | 98 |
| 17070306 | Lower Deschutes River | 1,468,564 | 424 | 223 |
| 17070307 | Trout Creek | 442,964 | 299 | 11 |
| | ***Total*** | *10,279,059* | *8,671* | *2,016* |

*See Table 7.

## 2.3.4 Elements Common to both Action Alternatives

There are 32 invasive plant species located across the project area. Some species have been inventoried across both Forests and the Grassland, such as spotted knapweed, while others are known only to one unit, such as ribbongrass. Table 9 shows the distribution of the known invasive species across the districts. As long as the treatment methods are similar to those described in this EIS, treatment will not be limited to these species.

**Table 9.** Invasive Plant Species inventoried and proposed for treatment on the Deschutes and Ochoco National Forests and Crooked River National Grassland. "X" indicates the location of inventoried site. *Acronyms are as follows*: BFR = Bend/Ft. Rock District; CRE = Crescent District; SIS = Sisters District; LOM = Lookout Mt. District; PAUL = Paulina District. CRNG = Crooked River National Grassland.

| Scientific Name | Common Name | Deschutes NF | | | Ochoco NF | | CRNG |
|---|---|---|---|---|---|---|---|
| | | BFR | CRE | SIS | LOM | PAUL | |
| *Acroptilon repens* | Russian knapweed | | | | X | X | X |
| *Arctium minus* | Lesser burdock | | | | X | | |
| *Cardaria draba* | Whitetop | | | | X | X | X |
| *Cardaria pubescens* | Hairy whitetop | | X | | | | |
| *Carduus nutans* | Musk thistle | | | | X | | |
| *Centaurea biebersteinii* | Spotted knapweed | X | X | X | X | X | X |
| *Centaurea debeauxii* ssp. *thuillieri* | Meadow knapweed | | | | X | | |
| *Centaurea diffusa* | Diffuse knapweed | X | X | X | X | X | X |
| *Centaurea solstitialis* | Yellow star-thistle | | X | | X | X | |
| *Cirsium arvense* | Canada thistle | X | X | X | X | X | X |
| *Cirsium vulgare* | Bull thistle | X | X | X | X | X | X |
| *Convolvulus arvensis* | Field bindweed | | X | | X | | X |
| *Cynoglossum officinale* | Houndstongue | | X | | X | X | |
| *Cytisus scoparius* | Scotch broom | X | X | X | X | X | |
| *Dipsacus fullonum* | Teasel | | | | X | X | X |
| *Elymus repens* | Quackgrass | X | | | | | |
| *Euphorbia esula* | Leafy spurge | X | X | | X | X | |
| *Hypericum perforatum* | St. Johnswort | X | X | X | X | X | X |
| *Iris pseudacorus* | Yellow flag iris | | | X | | | |
| *Kochia scoparia* | Kochia | | X | | | | X |
| *Linaria dalmatica* | Dalmatian toadflax | X | X | X | X | X | X |
| *Linaria vulgaris* | Butter and eggs | | X | | X | | |
| *Melilotus officianale* | Yellow Sweet Clover | | X | | | | |

| Scientific Name | Common Name | Deschutes NF | | | Ochoco NF | | CRNG |
|---|---|---|---|---|---|---|---|
| | | BFR | CRE | SIS | LOM | PAUL | |
| *Onopordum acanthium* | Scotch thistle | X | X | | X | X | X |
| *Phalaris arundinacea* | Reed canarygrass | X | X | X | | | |
| *Phalaris arundinacea var. picta* | Ribbongrass | | | X | | | |
| *Potentilla recta* | Sulphur cinquefoil | | | | X | X | |
| *Rubus discolor* | Himalayan blackberry | | | | | X | |
| *Salvia aethiopis* | Mediterranean sage | X | | | X | X | |
| *Salsola kali* | Russian thistle | X | X | X | | | |
| *Senecio jacobaea* | Tansy ragwort | | X | X | X | | |
| *Taeniatherum caput-medusae* | Medusahead | | | X | X | X | X |

## Invasive Plant Treatment Methods Considered in this EIS

The following table lists the various treatment methods that have been approved for use in the Region. These methods are employed in the action alternatives. In many cases, these methods are most effective when used in combination with one another, as well as in combination with prevention activities in accordance with Integrated Weed Management principles. The location and size of the infestation, environmental factors, management objectives, and treatments costs all factor into the choice of treatment method(s). Non-herbicide methods (e.g. hand pulling, digging) are preferred for treating sites that are small, accessible, and the species is effectively treated by non-herbicide methods.

**Table 10.** Invasive Plant Treatment Methods Approved for Use in the Region 6 Final Invasive Plant EIS and Considered in this EIS. These treatments are frequently used in combination as required by integrated invasive plant management (see Appendix B).

| Type Treatment | Description | Comments |
|---|---|---|
| Manual | A non-mechanized approach, such as hand pulling and digging with tools such as a shovel or hoe to remove plants or cut off seed heads. | Depending on the species & size of infestation, manual treatments can be labor intensive and must be repeated several times throughout the growing season for at least several years (until the seedbank is exhausted). For some species, such as spotted knapweed, this may be the preferred method when populations are small and easily accessible. |
| Mechanical | The use of any mechanized approach to control or eliminate invasive plants. Includes mowing, weed whacking, road brushing, or root tilling methods to reduce plant cover and root vigor. Also can reduce biomass so less herbicide is used. | Mechanical treatments are currently proposed for 4 species: reed canarygrass, Canada thistle, St. Johnswort, and leafy spurge. See Appendix A, Table A-2 for list of PAUs. |

| Type Treatment | Description | Comments |
|---|---|---|
| Biological | The release of insects or plant pathogens that are proven natural control agents of specific weed species. The insect or plant pathogen attack and weaken targeted weed species and reduce its competitive or reproductive capacity. Biological controls are used for reducing dense infestations of a weed species covering large areas. | This method also depends on the population distribution and type of site. In this project area, biocontrols are primarily used on knapweeds, Canada thistle, bull thistle, St. Johnswort, and toadflaxes. Redistribution of biological control agents would be expected to occur regardless of this decision (same as No Action alternative) and must comply with LRMP standards. Refer to Appendix B for more information. |
| Cultural | This category involves various methods (such as the use of grazing animals, addition of fertilizer/soil amendments, competitive planting, mulching, covering area with black plastic). For this project, the only cultural method being proposed is solarization, also called tarping. Will work best on small areas. | Covering infestations with black plastic may shade/kill rhizomes, but is not efficient for use on large areas. |
| Chemical (Herbicide) | Use of herbicides to kill plants and/or prevent seeds from germinating. Methods include spot spraying, wicking, boom broadcast, and stem injection.<br><br>Spot spraying – targets individual plants and is usually applied with a backpack sprayer. Sometimes also applies using a hose off a truck-mounted or ATV-mounted tank.<br><br>Directed hand application – (wicking, wiping, cut stump, basal bark, etc.) – involves precise application to stems or foliage of target plants. This is used in sensitive areas, such as near water, to minimize herbicide residues on the soil or in the water.<br><br>Stem injection –technique currently used on Japanese knotweed in western OR & WA.<br><br>Boom broadcast – involves using a hose and nozzle from a tank mounted on a truck or ATV. Herbicide is applied to cover an area of ground rather than individual plants. This method is used when the weed is dense | None of the alternatives propose aerial herbicide application.<br><br>Regional Final Invasive Plant EIS Standards 15-23 apply to herbicide treatments. Project Design Features further reduce potential impacts from herbicides.<br><br>Broadcast application of herbicide would be considered for situations warranted by the density (70-80 percent cover) and/or the distribution of invasive plants (for instance, continuous along a road), unless limited by PDFs and/or buffers.<br><br>Considering other restrictions, herbicide applications would be timed as best as practical to coincide with the best appropriate period of plant development to ensure maximum effectiveness, and herbicides would be applied at the lowest effective rate.<br><br>The latest technology used by applicators allows for precise application of the herbicides, even with boom spray equipment. |

| Type Treatment | Description | Comments |
|---|---|---|
| | enough that it is difficult to discern individual plants and the area to be treated makes spot spraying impractical. | |
| Prescribed Fire | Using fire to kill invasive plants, stimulate seed germination, or to remove dead plant material (thatch). | Extremely dense houndstongue patches on the Paulina Ranger District will be burnt to reduce cover and stimulate seed germination before spraying the area with herbicides. |

The following table displays the biological control agents that will be used on Canada thistle and St. Johnswort sites in the planning area. These agents may already be present on the Forests or Grassland.

Appendix B, Table B-3 displays the biological control agents currently released across the planning area. Additional releases of these agents would be expected to occur regardless of this decision and in compliance with Standard 14.

**Table 11.** Biological Agents for Species Proposed for Biological Control.

| Invasive Plant | Common Name Biocontrol Agent | Scientific Name Biocontrol Agent |
|---|---|---|
| **Canada thistle** (*Cirsium arvense*) | Canada thistle stem weevil | *Ceutorhynchus litura* |
| | Canada thistle stem gall fly | *Urophora cardui* |
| **St. Johnswort** (*Hypericum perforatum*) | St. Johnswort root borer | *Agrilus hyperici* |
| | St. Johnswort moth | *Aplocera plagiata* |
| | Klamath weed beetle | *Chrysolina hyperici* |
| | Klamath weed beetle | *Chrysolina quadrigemina* |
| | St. Johnswort gall midge | *Zeuxidiplosis giardi* |

## Herbicides

Table 12 displays the herbicide ingredients that may be used in both action alternatives as well as the lowest, typical, and highest application rates. The Project Design Features, Chapter 2.4 (PDFs) include some restrictions on the rate of herbicide use. The R6 2005 FEIS, and Appendix D of this FEIS list the commercial herbicide names and risks inherent to using these herbicides. Risk assessments for these herbicides are available online at http://www.fs.fed.us/foresthealth/pesticide/risk.shtml and some herbicide labels are available at http://www.fs.fed.us/foresthealth/pesticide/labels.shtml. There is evidence that herbicides are the most effective treatment for many of the invasive plants that will be treated under this EIS. See Chapter 3.2 and Appendix D for more information on herbicides.

**Table 12.** Approved Herbicides Highest and Lowest and Typical Application Rates. The "typical application rate" is the rate used in each of the Risk Assessments, and is usually based on an overall average of the amount of product used in all Forest Service applications in 2001. The "highest application rate" is the highest Forest Service application rate reported in 2001.

| Active Ingredient (a.i.) | Lowest Application Rate lb a.i./acre | Typical Application Rate lb a.i./acre | Highest Application Rate lb a.i./acre |
|---|---|---|---|
| Chlorsulfuron | 0.0059 | 0.056 | 0.25 |
| Clopyralid | 0.1 | 0.35 | 0.5 |
| Glyphosate | 0.5 | 2 | 7 |
| Imazapic | 0.031 | 0.13 | 0.19 |
| Imazapyr | 0.03 | 0.45 | 1.25 |
| Metsulfuron Methyl | 0.013 | 0.03 | 0.15 |
| Picloram | 0.1 | 0.35 | 1.0 |
| Sethoxydim | 0.094 | 0.3 | 0.38 |
| Sulfometuron Methyl | 0.03 | 0.045 | 0.38 |
| Triclopyr | 0.1 | 1.0 | 10 |

The surfactant known as nonylphenol polyethoxylate surfactant (NPE) was also analyzed at the following rates: low 0.167, typical 1.67, and high 6.68.

A goal of the Forests is to minimize the use of picloram across the planning area because of its persistency. Therefore, picloram will only be applied if there is no other effective herbicide available for the target species and where it is prescribed, its use falls under additional layers of precaution (e.g. PDF #12, 46, 48, 55, 66, Table 15).

Project Area Units listed in Appendix A may have more than one effective herbicide listed. The herbicides used would depend on the invasive plants present, the biology and ecology of particular species, site location, proximity to water, and size of infestations. These herbicides have restrictions based on known impacts and risks. These restrictions are detailed in Section 2.4 Project Design Features.

## Effective Treatment Methods by Target Species

The treatment methods described in the previous table can be applied effectively to certain target species. Appendix B provides current information on the methods that are effective in treating target species in the project area. No single management technique is perfect for all weed control situations; the Forest Service follows the integrated weed management approach to achieve effective and practical treatment at each site.

## Site Priority and Objectives

Invasive plant sites are prioritized for treatment based on the level of risk associated with the species and the type of site. Though all invasive plant sites are important to treat, the sheer number and distribution of sites results in the need to prioritize and focus our treatments. Prioritization will be a step in the annual implementation planning process (see page 39 and Appendix F), and is not included as a NEPA decision.

High priority sites include areas that have the potential to more rapidly spread seeds and propagules of invasive plant species, such as quarries, roads, and high use recreation sites, as well as current treatment sites. High priority sites are also determined by high priority species that have potential to spread quickly and change plant species composition to the extent that resources, such as sensitive plant populations, wildlife and livestock forage are at risk.

Medium priority sites include larger infestations with the goal to control or contain these sites to prevent further introduction and spread and environmental degradation. Some sites may be controlled over time given enough years of treatment. Other sites are so large and widespread that a more reasonable goal is to contain these sites by focusing treatment on the outside boundaries of the infestation to prevent further spread. Medium priority sites can contain high priority species, such as the knapweeds and houndstongue.

Low priority sites are either those infestations that are extremely difficult to eradicate or control, such as large, well-established infestations of reed canarygrass along lakeshore edges, or are low priority because the invasive plant species is less aggressive and there is less potential for significant ecological impacts (e.g., bull thistle).

**Table 13.** Treatment prioritization strategy used annually to implement invasive plant treatments on the Deschutes and Ochoco National Forests and Crooked River National Grassland.

| Priority | Description |
|---|---|
| **High** | Eradication, control or containment of aggressive new species with potential for significant ecological impact.<br>New infestations in high priority areas not yet infested.<br>Infested active gravel, fill, sand stockpiles, quarry, and borrow material sites.<br>Active restoration sites where invasive plant control is essential for successful restoration.<br>Sites that threaten or jeopardize Threatened, Endangered, and Sensitive plant and animal habitat.<br>Sites we have already been treating and need to continue this commitment.<br>Areas of high traffic (e.g., roads, high use recreation sites, trailheads, horse camps, fire camps, parking lots, etc.).<br>Unique plant habitats (e.g., wetlands, fens, bogs, botanical areas, Research Natural Areas). |
| **Medium** | Containment of existing large infestations of priority species with focus on boundaries of infestation. This is to prevent the spread of the invasive plant beyond the perimeter of patches or infestation areas mapped from current inventories.<br>Control of existing large infestations with a high potential for significant reduction and at least 15% of native plant component. Focus first on: 1) sites with the highest native plant cover available to colonize the site as the invasive plants are reduced; and 2) outside edges of population to prevent/contain further spread<br>Road systems that have less traffic but still function as seed dispersal vectors. |
| **Low** | Suppression of existing large infestations when eradication/control or containment is not possible.<br>Tolerate. Accept the continued presence of established infestations and the probable spread to ecological limits for certain species. Try to exclude new infestations through prevention practices. |

Target species within each project area unit are assigned a treatment strategy. These strategies vary depending on the potential negative impacts of a given invasive species and the value or sensitivity of the treatment site (or adjacent lands) (USFS 2005a, page 3-78). The Invasive Species section of Chapter 3 and Appendix A provide further information on the site-specific conditions within the project area units.

The following objectives are identified for the approximately 1,892 known invasive plant sites on the Forests and Grassland:

- **Eradication:** Attempt to totally eliminate an invasive plant species from a USDA Forest Service unit, recognizing that this may not actually be achieved in the short term since re-establishment/re-invasion may take place initially.
- **Control:** Reduce the infestation over time; some level of infestation may be acceptable.

- **Suppression:** Prevent seed production throughout the target patch and reduce the area coverage. Prevent the invasive species from dominating the vegetation of the area; low levels may be acceptable.
- **Containment:** Prevent the spread of the weed beyond the perimeter of patches or infestation areas mapped from current inventories.
- **Tolerate:** Accept the continued presence of established infestations and the probable spread to ecological limits for certain species. Try to exclude new infestations through prevention practices. This is for species where other levels of effort have not been successful.

## Site Restoration/Revegetation

Revegetation with carefully selected plant materials is a critical component of integrated weed management strategies. Commonly used control tactics, such as manual or herbicide treatments, may eliminate or suppress invasive species in the short term, but the resulting gaps in vegetation and bare soil create open niches that are susceptible to further invasion by the same or other undesirable plant species (Erickson et al. 2003).

Determining the need for active restoration/revegetation versus passive restoration (allowing plants on site to fill in a treated area) is the first step when addressing this need (USFS 2005a). Passive restoration depends on re-colonization from the existing seedbank and from plant propagules dispersed from surrounding sources, as well as native species from within the invasive plant site. Passive restoration may be appropriate where treated sites leave relatively little bare ground or along less-disturbed roadsides where adjacent native vegetation can provide adequate seed source to recolonize treated areas. Passive restoration will also occur on sites proposed for treatment with selective herbicides. For example, use of clopyralid on spotted knapweed within bitterbrush habitats would selectively treat the knapweed and would not harm the bitterbrush.

In some situations, native plant seeds in the soil seedbank can establish following invasive plant treatments on highly disturbed sites. After three years of treating spotted knapweed with a broadleaf selective herbicide on Highway 97 (high use transportation route), monitoring demonstrated the areas became dominated by sheep fescue (*Festuca ovina* var. *rydbergii*). We hypothesize that the seeds existed in the soil and were able to germinate with reduced competition from spotted knapweed.

Active revegetation is a long-term commitment that may best be focused on highest priority areas that are either ecologically unique, or to provide competition for highly aggressive invasive plant species. Active restoration is much like gardening – it requires long-term annual maintenance to control invasive plants in order to ensure successful revegetation. A three-year revegetation study of invasive plant sites on the Deschutes National Forest found that germination and establishment of native seeds was very slow and the small seedlings are slow-growing (Hurd 2005). This project found that native seeding in arid environments will require much more than three years of funding and time to monitor in order to see results. See Appendix E for more on revegetation planning.

Each Project Area Unit was evaluated for whether to allow for passive restoration from adjacent native plant communities or take an active role in revegetating the treated area. Many of our invasive plant sites are within or adjacent to native plant communities that will provide seeds and propagules to recolonize the invasive plant site following treatments. Nine Project Area Units have been selected for active revegetation (See Page 45 of Appendix A). Some areas were selected for their ecological importance and to out-compete aggressive invasive plant species (e.g., ribbongrass sites along the Metolius River and reed canarygrass sites in Big Marsh and Trout Creek Swamp); other areas were selected because revegetation is a critical step in rehabilitating degraded sites where the native plant component is lost and the invasive plant species is highly aggressive (e.g., medusahead and houndstongue sites on Paulina District).

In some cases, active restoration is not the preferred choice due to the nature of the site. Examples include continually disturbed areas, such as road shoulders that are frequently maintained, active gravel pits, and river banks that are prone to annual scouring; or areas that are not naturally vegetated, such as mid-channel gravel bars.

Revegetation will involve site preparation, such as raking to prepare a seed bed to promote seed germination, planting of seeds and/or propagules (depending on the species, this is done either in early spring or late fall to take advantage of available moisture), vigilant treatment of invasive plants as they germinate from the existing seedbank, and monitoring the results. In some cases, a follow-up seeding/planting may need to be done.

## Early Detection-Rapid Response Strategy

The Early Detection/Rapid Response (EDRR) strategy coupled with prevention guidelines and an annually-updated inventory, will allow us to maintain our invasive plant-free areas in an invasive plant-free condition. Under the EDRR approach, new or previously undiscovered infestations would be treated using the range of methods described in this EIS, and according to the Project Design Features listed later in this Chapter. The nature of invasive plant species makes this a necessary component of the Forests' treatment program:

- The precise location of individual target plants, including those mapped in the current inventory, is subject to rapid and/or unpredictable change;
- The NEPA process does not allow for rapid response; infestations may grow during the time it takes to prepare NEPA documentation.

The intent of the EDRR approach is to treat new infestations when they are small so that the likelihood of adverse effects from treatment is minimized, *and* the invasives plants will do less ecological damage. Recent work by Mehta et al (2007) finds that early detection and rapid response increases managers' chances to successfully restore invasive plant sites. We are assuming that new infestations will be similar to current infestations. For instance, the majority of weed sites occur along roads and that will probably be the case into the near future. We also expect that the impacts of similar treatments would be predictable. The precise location or timing of the treatment may be unpredictable; however, project design features – intended to minimize or eliminate adverse effects that could occur – keep effects within those disclosed for the current inventory.

The EDRR approach allows the Forest Service to treat anywhere on the Forest that the need exists, based on, but not limited to, the current inventory and anticipated rates of spread. The Implementation Planning process detailed below is intended to ensure that effects are within the scope of those disclosed in this EIS so that a new environmental assessment or environmental impact statement need not be prepared; new situations that may have different effects would be subject to further NEPA analysis. This strategy would follow the design of the alternative chosen.

The following steps went into developing the EDRR approach:

1. The invasive plant inventory for the Deschutes and Ochoco NF and Crooked River National Grassland was updated. Infested sites were aggregated into Project Area Units (Units) and entered into a database.
2. The Interdisciplinary Team considered the site conditions within the units and analyzed the potential effects of the preferred treatment methods for the areas.
3. Project Design Features were developed to minimize or eliminate adverse effects for situations where there was potential, resulting in low risk to people or the environment.

4. The **Implementation Planning** process is the means by which the selected alternative is properly implemented and serves as the framework for the EDRR approach. As treatments are applied to currently undetected invasive plants, project design features would be applied (to situations/conditions similar to those analyzed in the EIS) to eliminate or minimize adverse effects. Uncertainty is addressed through monitoring and adaptive management.

## Implementation Planning

This section outlines the process that would be used to ensure that the selected alternative is properly implemented. This process integrates the strategies outlined in this EIS and also satisfies pesticide use planning requirements in the Forest Service Handbook (FSH 2109.14). As prioritization takes place across the Forests and Grassland to make the best of the budget, high priority sites would be most likely to be effectively treated, but other infestations would continue to spread until they could be effectively treated. For the proposed action, assuming a constant budget of $250,000 per year, about 10% of the infested sites could be effectively treated each year. The cost of treating existing infestations would continue to increase.

An invasive plant assessment review team will be assembled to review the annual program, select appropriate PDFs, seek line officer approval, and implement required public notification. Appendix F goes in to more detail on the process outlined here:

1. **Characterize invasive plant infestations to be treated.** This step incorporates information from surveys and monitoring to update the invasive plant database, identify site conditions, and ensuring that nothing outside the scope of conditions described in this EIS exist.

2. **Develop site-specific prescription and plans.** The second step involves identifying a preferred method of treatment and determining if these methods are within the scope of the analysis in this EIS. Project Design Features are applied and consistency with Forest Plan standards is determined.

3. **Coordination and Notification.** Appropriate notification ensures that the adjacent landowners, partners, the general public, regulatory agencies and Tribes is aware of proposed invasive plant treatments.

4. **Accomplishment and Compliance Monitoring.** A monitoring framework is provided by the R6 2005 ROD, to help Forests determine if actions are taking place as described in the EIS, and if progress towards the desired future condition is occurring.

5. **Treatment and Post-Treatment Monitoring and Adaptive Management.** Effectiveness of treatment and effectiveness of project design features will be monitored. A protocol for monitoring effectiveness of measures intended to protect federally listed species is being developed by the Forest Service, Pacific Northwest Region.

## Forest Plan Amendments

The invasives treatment project is utilizing new tools made available to the Region with the R6 2005 ROD. In particular, the proposed action involves the use of several herbicides. Two standards and guidelines in the Ochoco National Forest and Crooked River National Grassland Land and Resource Management Plan (Forest Plan) discourage the use of herbicide treatments. The Forest Service proposes removing both of these standards to allow, where appropriate, careful and targeted herbicide use to treat invasive plants as part of an integrated weed management program and according to treatment standards provided in the *Invasive Plant Program Preventing and Managing Invasive Plants Record of Decision* (USFS 2005b). This change will reconcile our Forest Plan with the new direction provided in the regional ROD, which was developed with consideration of the scientific literature regarding invasive plant treatment and prevention.

**Table 14.** Proposed Amendment, Ochoco National Forest Land and Resource Management Plan.

<table>
<tr><th>Forest Plan</th><th>Scope</th><th>Current Standard and Guideline</th><th>Proposed Change</th></tr>
<tr><td>From Och/CRNG 1995 Weed EA/DN</td><td>Forest-wide Direction</td><td>Use chemical treatments only when other methods have proven ineffective or impractical. Adhere to EPA regulations and herbicide label restrictions.</td><td rowspan="2">Standards would be removed from the LRMP because they are not consistent with new LRMP standards and we would use herbicides to treat invasive plants according to the new standards provided by the Pacific Northwest Region: Preventing and Managing Invasive Plants Record of Decision (2005).</td></tr>
<tr><td>From Och/CRNG 1995 Weed EA/DN</td><td>Grassland-wide Direction</td><td>Use chemical treatments only when other methods would be ineffective or impractical.</td></tr>
</table>

## 2.4 Project Design Features Common to all Action Alternatives

Project design features (PDFs) were developed to reduce some of the potential adverse impacts the various treatments may cause. PDFs define a set of conditions or requirements that an activity must meet to avoid or minimize potential effects on sensitive resources. For PDFs involving herbicides, these are an added layer of caution to the already-regulated and approved use of these herbicides. All PDFs are required for both Action Alternatives. PDFs are not optional and are incorporated in the effects analysis.

These PDFs are based on site-specific resource conditions within the Project Area Units, including (but not limited to) the current invasive plant inventory, the presence of certain non-target or species of local interest and their habitats, proximity to water and potential for herbicide delivery to water, and the social environment.

For emphasis, some design features include herbicide label guidance and Forest Plan standards. Not all Forest Plan standards or label directions are repeated here; however, they will be followed.

| Concern | Project Design Feature | Source/Comments |
|---|---|---|
| **Pre-Project Planning** | | |
| 1. | The nature of invasive plant management requires ongoing project review and evaluation. The location of invasive plants in relation to various environmental components (i.e. plant species of local interest, special forest product gathering areas) is likely to change over the life of the project, thus animal species/habitats of concern, watershed and aquatic resources of concern (sensitive soils, streams, lakes, wetlands, high risk roadsides, municipal watersheds, domestic water sources), places where people gather, and range allotment conditions would be confirmed prior to treatment and appropriate design features would be applied. | This process based on similar projects nationwide.<br>Implementation Planning discussed in Appendix F. |

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| | Apply PDFs (including Terms and Conditions from consultation with regulatory agencies) depending on site conditions. | |
| **To Prevent Spread of Invasives from Treatment Activities or Re-Introduction on a Treated Site** | | |
| 2. | Vehicles and equipment (including personal protective clothing) used for invasive plant treatment activities would be cleaned prior to entering National Forest land. | Deschutes & Ochoco Forest Plan Standard (standard #2 from 2005 R6 ROD) |
| 3. | Where practical, thoroughly clean and inspect all equipment and clothing before moving off treatment areas. | This is a common measure used to prevent spread. |
| 4. | All invasive plants that are manually excavated after flower bud stage will be bagged and properly disposed of at an approved facility (e.g. landfill). | This is a common measure used to prevent spread. |
| 5. | When applying herbicides, protect non-target vegetation whenever practical in order to minimize the creation of exposed ground and the potential for re-infestation. | To reduce further invasive plant infestation at the treated site |
| **Coordination with other Landowners, Agencies** | | |
| 6. | The Forest Service would work with owners and managers of neighboring lands to respond to invasive plants that infest multiple ownerships. Treatments within 100 feet of Forest boundaries, including lands over which the Forest has right-of-way easements, would be coordinated with adjacent landowners | To increase effectiveness of treatments on multiple ownerships and ensure neighbors are fully informed of nearby herbicide use. |
| 7. | Herbicide use within 1000 feet (slope distance) of known domestic surface water intakes would be coordinated with known water user or manager. | 1000 feet selected to respond to public concern. Herbicide use as proposed will not contaminate drinking water supplies. |
| 8. | Municipal watershed agreements would be followed. Coordination with water boards and users would occur as required and herbicide use or application method may be excluded or limited in some areas. | See existing municipal agreements. |
| **To Ensure Effective, Safe, and Proper use of Herbicides and to Limit Potential Adverse Effects on People and the Environment** | | |
| ***Field Operations / Worker Safety*** | | |
| 9. | Herbicides would be used in accordance with label instructions, except where more restrictive measures are required as described below. Herbicide applications will only treat the minimum area necessary to meet site objectives. Herbicide formulations would be limited to those containing one or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. Herbicide application methods include wicking, wiping, injection, spot, and broadcast, as permitted by the product label and these Project Design Features. The use of triclopyr is limited to spot and hand/selective methods. Herbicide carriers (diluents) added by the applicator are limited to water and/or specifically-labeled vegetable oil. | Deschutes & Ochoco LRMP Standard (standard #16 of 2005 R6 ROD); Pesticide Use Handbook 2109.14<br>Limits potential for adverse effects on people and the environment. |
| 10. | Herbicide use would comply with standards in the *Pacific Northwest Regional Invasive Plant Program – Preventing and Managing Invasive Plants* ROD (2005), including standards on herbicide selection, restrictions on broadcast use of some herbicides, tank mixing, licensed applicators, and use of adjuvants, surfactants and other additives. | 2005 R6 ROD<br>Limits potential adverse effects on people and the environment. |
| 11. | Workers will use appropriate personal protective clothing and equipment at all times during application. Traffic control and signing during invasive plant-treatment operations will be used as necessary to ensure safety of | Label and MSDS requirements. Reduces potential for workers to be exposed. |

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| | workers and the public. | |
| 12. | Follow label advisory for effective rate. Lowest effective rates would be used. Additional limits on application rates are as follows:<br>**Spot** herbicide applications would not exceed application rates for the following herbicide:<br>• Sulfometuron methyl would not exceed 0.2 lb ai/ac.<br>**Broadcast** application would not exceed application rates for the following herbicides:<br>• Picloram at any rate higher than 0.5 lb. a.i./acre.<br>• Sulfometuron methyl at any rate higher than 0.12 lb a.i. /acre.<br>• NPE surfactant at any rate greater than 0.5 lb a.i./acre. | Limiting the application rate for these active ingredients will ensure their use stays below thresholds of concern for workers, the public, fish, and other aquatic organisms; these rates are based on results of the Risk Assessments. |
| 13. | Use selective spray techniques, or other targeted application techniques when practical and effective (cut stump, basal spray, etc.). | To further reduce the amount of herbicide applied per acre. |
| 14. | Favor salt/acid formulation of triclopyr over the ester formulation of triclopyr wherever equally or more effective. | Garlon 3A has less concern for human health |
| 15. | Herbicide applications would occur when wind velocity is between two and eight miles per hour. The less than 2 mph standard is to avoid spraying during inversions. During application, weather conditions would be monitored periodically by trained personnel. | Typical measure to reduce drift. |
| 16. | Use low nozzle pressure, apply as a coarse spray, and use nozzles designed for herbicide application that do not produce a fine droplet spray, e.g., use a nozzle diameter to produce a median droplet diameter of 200-800 microns, with an objective of >500 microns. | Label advisory. These are typical measures to reduce drift. |
| 17. | No spraying would occur if measurable precipitation is occurring or is predicted to occur within 24 hours within the given treatment area, or as label directs. Local conditions to be monitored by the licensed applicators. | Label instruction. Reduces potential for runoff and ensures effective treatment of target vegetation. |
| 18. | Choose transportation routes with fewer stream crossings, less traffic, and fewer blind curves. Use a guide vehicle when more than one vehicle is traveling to the site, or when large quantities or other circumstances dictate. | To reduce likelihood of spills. |
| 19. | A spill cleanup kit would be available whenever herbicides are transported or stored. | To contain any accidental spills. Source: FSH 2109. |

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| 20. | The lisenced applicator is responsible for the immediate cleanup of all spills. An Herbicide Transportation and Handling Safety/Spill Response Plan would be the responsibility of the herbicide applicator. *At a minimum the plan would:*<br>▪ Address spill prevention and containment.<br>▪ Estimate and limit the daily quantity of herbicides to be transported to treatment sites.<br>▪ Require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling.<br>▪ Require a spill cleanup kit be readily available for herbicide transportation, storage and application (minimum FOSS Spill Tote Universal or equivalent).<br>▪ Outline reporting procedures, including reporting spills to the appropriate regulatory agency.<br>▪ Ensure applicators are trained in safe handling and transportation procedures and spill cleanup.<br>▪ Require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition.<br>▪ Address transportation routes so that traffic, domestic water sources, and blind curves are avoided to the extent possible<br>▪ Specify conditions under which guide vehicles would be required.<br>▪ Specify mixing and loading locations away from water bodies so that accidental spills do not contaminate surface waters.<br>▪ Require that spray tanks be mixed or washed further than 300 feet of surface water.<br>▪ Ensure safe disposal of herbicide containers. | Source: FSH 2109.14<br>Reduce likelihood of spills and to contain any spills. Reduce potential for adverse effects from accidental spills. |
| 21. | Estimate and limit the daily quantity of herbicides to be transported to treatment sites. | To reduce potential for spills. |
| 22. | Spray equipment would be calibrated prior to seasonal start-up and periodically throughout the season to assure accuracy in applications. | To ensure proper application of herbicide. |
| 23. | Minimize traffic in riparian reserves/RHCAs where appropriate. | To minimize impact to riparian areas. |
| 24. | Exact fueling sites will be identified prior to implementation of the project, and would be at least 150 feet from lakes, wetlands, or stream channels. | To minimize risk of fuel entering water. |
| 25. | Some sites may only be reached by water or by crossing streams on foot. The following measures would be used to prevent a spill during water transport.<br>• Herbicide would be carried in 1 gallon or smaller plastic containers. The containers would be wrapped in plastic bags and then sealed in a dry-bag. The dry bag would be secured to the watercraft.<br>• Personnel applying herbicide by hand or with a backpack sprayer, or personnel manually pulling or grubbing invasive plants, would avoid, to the extent possible, standing or walking in wetted streams or other water bodies. | To reduce potential for spill in water. |

***Public Health / Public Notification***

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| 26. | The public would be notified about upcoming herbicide treatments via the local newspaper, Forest Service website, fliers, individual notification, or posting signs. | Standard #23, R6 2005 ROD.<br>To ensure no inadvertent public contact with herbicides. |

***Public Health / Municipal Watersheds***

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| 27. | Broadcast application of herbicides will not occur in municipal watersheds without consulting the water agency/association. Herbicide application will be to individual plants by spot spraying, stem injection, or dabbing.<br>Invasive species treatments other than manual (hand pulling) and biological (insects) will be coordinated with the municipal department in charge of the water system. | To ensure neighbors are informed; meet requirements of existing municipal agreements. |
| 28. | Herbicides will not be applied within 100 feet of the municipal water intake or within 100 feet of the stream for the first 600 feet above the intake. | To respond to public concern. Herbicide use as proposed for this project would not contaminate drinking water supplies. |

***Public Health / Other Drinking Water Sources***

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| 29. | No herbicide will be applied within 100 feet of a known domestic well or spring box. No broadcast application of herbicides will occur within 200 feet of a known domestic well or spring box. | To respond to public concern. Herbicide use as proposed for this project would not contaminate drinking water supplies. |
| 30. | The special use permit holder or agency department of record (e.g. recreation or facilities) responsible for the well or spring box will be notified prior to application of herbicides and will mark the diversion point so it can be avoided by the applicator and permittee can modify their use if so desired. | To ensure users are informed. |

***Public Health / Recreation or other High Use Sites***

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| 31. | High use areas, including administrative sites, developed campgrounds, visitor centers, and trailheads would be posted in advance of herbicide application or closed. Areas of potential conflict would be prominently marked on the ground or otherwise posted. Postings would indicate the date of treatments, the herbicide used, Forest Service contact information, and when the areas may be reentered. | Reduces conflicts and ensures no inadvertent public contact with herbicides. |
| 32. | When possible and treatment will still be effective, timing of treatments within high use recreation sites will avoid the normal high use period between June 15 and September 15, (peak use is in July and August). | To reduce conflicts with forest users. |
| 33. | For herbicide use within 100 feet of high-use recreation sites, selective application methods at typical or lower rates of application will be used. | To reduce drift in areas of high use. |
| 34. | Gathering areas, campgrounds, and administrative sites may be closed during and immediately after triclopyr application to eliminate accidental exposures. Extent of closure would be dependent on nature of herbicide used. | To reduce conflicts with forest users. |
| 35. | Minimize trampling and soil disturbance and visual impacts by limiting the number of people, machineries, the number of entries, and by using light-weight machinery within 100 feet of recreation sites. | To reduce impacts to recreation areas. |

***Public Health / Special Forest Products Including Cultural Use Plants***

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| 36. | Do not apply NPE surfactant at any rate greater than 0.5 lb a.i./acre in known areas of wild food collection. Favor other classes of surfactants wherever they are expected to be effective. | To protect public/worker health. Rate is below thresholds of concern for workers, the public, fish, and other aquatic organisms. |
| 37. | In areas of known special forest product or other wild foods collection application of triclopyr will be limited to direct application to target vegetation only; do not exceed FS typical rate (1.0 a.i./acre); favor salt/acid formulation of triclopyr over the ester formulation of triclopyr wherever it is expected to be effective. | To eliminate scenarios where people could be exposed to harmful doses of triclopyr. |

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| 38. | Popular berry and mushroom picking areas would be posted or otherwise marked where treatment with herbicides is occurring during harvest seasoon. | From Appendix Q of R6 2005 FEIS. Eliminates any scenario where people may be exposed to herbicide. |
| 39. | Special forest product gathering areas may be closed for a period of time to minimize inadvertent public contact with herbicide occurs. | To eliminate scenarios where people could be exposed. |
| 40. | Special forest product gatherers would be notified about current herbicide treatment areas when applying for their permits. Such information would be provided in multi-lingual formats depending on the known clientele for the forest. | To ensure no inadvertent public contact with herbicide. |
| 41. | Avoid using herbicides where cultural use plants are present during their season of collection, where possible (mostly spring and early summer for root plants and late summer to fall for berries). Fiber and medicinal plants may have different harvest seasons. This measure applies to known collecting areas.<br>Annually consult with American Indian tribes so members can be notified prior to gathering cultural plants. When plants are identified by tribes, buffer as for botanical special status species. | To ensure no inadvertent public contact with herbicide occurs and so that cultural use plants are fully protected. |
| **To Protect Soils, Water Quality, Fisheries and Aquatic Organisms** | | |
| 42. | Oregon Department of Fish and Wildlife (ODFW) Guidelines for Timing of In-Water Work Periods will be followed when feasible for portions of the project that fall below the ordinary high water mark (bankfull). This applies to all treatment methods. For treatments that fall below the high water mark and effective treatment of specific species cannot be met during the In-Water Work Period, the In-Water Work Period will be negotiated with ODFW during implementation planning. | To reduce potential for causing negative impacts to fish and fish habitat. |
| 43. | Use only aquatic formulations or low aquatic risk herbicides on soils with seasonally high water tables, where label restrictions allow. Land types in treatment areas identified as having a high water table during parts of or all of the year would be field-checked; treatment methods would be modified based on ground conditions. | Source: SERA Risk Assessments; R6 2005 FEIS and Fisheries Biological Assessment.<br>To ensure herbicide is not delivered to streams in concentrations that exceed levels of concern. |
| 44. | POEA and NPE surfactants would not be used in applications within 100 feet of surface water, wetlands or along roads with ditches that feed into streams. | Protects aquatic organisms. |
| 45. | Do not use clopyralid or metsulfuron methyl on high porosity soils (texture class 3 or 4) where there is a potential for contamination of surface or groundwater (such as where water table is high). | Label advisory.<br>To reduce potential for contamination of surface or groundwater. |
| 46. | No more than one application of picloram or sulfometuron methyl would occur on a given area in a calendar year, except to treat areas missed during the initial application. | To reduce potential for accumulation in soil. |
| 47. | Do not use chlorsulfuron on soils with high clay content (texture class 1). | Label advisory. To avoid excessive herbicide runoff. |
| 48. | Do not use picloram and/or sulfometuron methyl on soils with a high clay content (texture class 1); shallow and unproductive soils; or acidic soils unless other methods are not available or feasible. | Label advisory. To avoid excessive herbicide runoff; reduce potential for entering surface and/or ground water, or to accumulate in soil. |
| 49. | Ester formulation of triclopyr is not allowed within 150 feet of any water body or stream channel. | To protect aquatic organisms. Lower risk herbicides are preferred where effective; |

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| | | protections of terrestrial wildlife and human health. |
| 50. | Apply erosion control measures and native revegetation (*e.g*., mulching, native grass seeding, planting) where detrimental soil disturbance or de-vegetation may result in the delivery of measurable levels of sediment to federally listed fish species' critical habitat. | Minimize sedimentation. |
| 51. | Implement Mixture Analysis identified in Regional Fisheries Biological Assessment for tank mixtures proposed. The sum of Hazard Quotients (HQ) for tank mixtures shall not exceed 1. | R6 2005 ROD and Fisheries Biological Assessment |
| 52. | All herbicide storage, chemical mixing, refilling and post-application equipment cleaning is completed at least 300 feet from live water and in such a manner as to prevent the potential contamination of any riparian area, perennial or intermittent waterway, ephemeral waterway, or wetland. | To prevent water contamination. |
| 53. | Limit the number of workers and the number of entries in areas within 100 feet of streams. | To minimize trampling in riparian areas and fish habitat. |
| ***Alternative 2 Only*** | | |
| 54. | Use selected buffers and application methods from Table 15 below for application of herbicides. Buffers can be increased on a site specific basis if analysis determines that characteristics such as soils, slope, groundwater depth, etc indicate high potential for the contamination of groundwater or surface waters.<br><br>Forest Service personnel will identify any steps necessary to identify riparian areas prior to implementation of herbicide application. This may involve flagging, particularly in listed fish habitat. Forest Service specialists will work closely with herbicide applicators to ensure project design features are implemented. | Based on label advisories, SERA risk assessments. Demonstrate compliance with Standards #19 and 20.<br>To reduce likelihood that herbicides will enter surface waters in concentrations of concern. |
| ***Alternative 3 Only*** | | |
| 55. | Use selected buffers and application methods from Table 16 for application of herbicides. Buffers can be increased on a site specific basis if analysis determines that characteristics such as soils, slope, groundwater depth, etc suggest high potential for the contamination of groundwater or surface waters.<br><br>Forest Service personnel will identify any steps necessary to identify riparian areas prior to implementation of herbicide application. This may involve flagging, particularly in listed fish habitat. Forest Service specialists will work closely with herbicide applicators to ensure project design features are implemented. | Based on label advisories, SERA risk assessments. Demonstrate compliance with Standards #19 and 20.<br>To reduce likelihood that herbicides will enter surface waters in concentrations of concern. |
| 56. | Picloram, triclopyr, sethoxydim and herbicides with NPE or POEA surfactants will not be applied within 300 ft of streams, lakes, and wetlands. Aquatic approved glyphosate and aquatic approved imazapyr will be allowed in RR/RHCA areas. | Alt. 3 allows lower risk herbicides near water. |
| 57. | No application of any herbicides within the high water mark of intermittent streams, lakes, ponds, wetlands, or reservoirs. The high water mark is defined as bankfull or an area above the water surface where non aquatic vegetation is established. | Further protection of aquatic organisms by reducing potential for contamination in water. |
| 58. | No broadcast spraying within 300 feet of all perennial water sources or on road segments within 300 feet of perennial waterbodies. | This will minimize/eliminate any potential for herbicide drift or runoff entering water sources.<br>Source of 300 ft: NWFP |
| 59. | No application of any herbicides within 10 feet of the water's edge of | Further protection of aquatic |

| | | |
|---|---|---|
| | perennial sreams, rivers, lakes, ponds, wetlands, or reservoirs. | organisms by reducing potential for contamination in water. |
| 60. | No mechanical treatment within 300 feet of all water sources or on road segments that are within 300 feet of perennial waterbodies. | This will minimize/eliminate potential for additional fine sediments to enter waterbodies through soil disturbance and bare soil exposure.<br>Source of 300 feet: NWFP |

**To Ensure the Protection of Threatened, Endangered, Sensitive (TES) or Survey and Manage (S/M) Plant Species**

| | | |
|---|---|---|
| 61. | Surveys will be conducted for Threatened, Endangered, and Sensitive Plants and Survey & Manage (S/M) Plants prior to invasive plant treatments **if**: 1) the area has not already been surveyed for these species; **and** 2) if the area contains likely habitat for any of these species; **and** 3) if the proposed treatments are likely to have a negative impact to individual plants. Surveys will be conducted in the area within 100 ft. from where broadcast application of herbicides is planned and within 10 ft. for all other treatment types (herbicide spot spray, manual, etc.). If species of concern are located, then project design feature 62 will be applied. | Forest Service Manual 2670; Current Survey and Manage Species Direction.<br>To ensure sensitive species are protected and surveys are conducted when appropriate. |
| 62. | Within TES and S/M plant populations, prior to herbicide treatments where there are potential effects from the herbicide, a USDA Forest Service Botanist will identify the steps that need to be taken to protect the TES plants. This may involve avoiding TES and S/M plant populations or individuals (i.e., identify/map areas around sensitive plant populations that must be avoided, or flagging individual TES and S/M plants), and/or altering treatments (e.g., switching from herbicide to manual treatments within and adjacent to a TES plant population). USDA Forest Service Botanists will work closely with herbicide applicators to ensure project design features are implemented, will monitor and document the results, and use adaptive management to refine treatments as needed to adequately protect TES and S/M plant species. | To ensure appropriate steps are taken during implementation to protect sensitive or survey and manage plants. |
| 63. | For manual treatments within TES plant populations, a USDA Forest Service Botanist will instruct workers in the proper identification of plant species to be avoided and will monitor the manual treatments to ensure that individual TES plants are protected. | To ensure protection of TES and S/M plants. |
| 64. | If USDA Forest Service Botanists determine that buffers are needed to protect TES and Survey & Manage plant species from herbicide spraying, the buffer widths in PDF 65 will be employed. Treatments would be stipulated as for the given width. Determination of the need for buffers depends on the species to be protected, the invasive plant species to be treated, and the type of treatment that would be used. For example, if a selective herbicide is used, such as clopyralid (which only targets specific plant families), buffers may not be needed for sensitive plant protection. | To ensure protection of TES and S/M plants. |
| 65. | **Protection Buffer Widths for TES and S&M Plant Species.**<br>*Greater than 100 feet:* All treatments permitted. All herbicides are permitted.<br>*100 to 10 feet:* All treatments, except broadcast spraying permitted.<br>For herbicide treatment, use protective measures such as low-pressure spot-spray, directed spray applications, backpack applications, and/or protective barrier to prevent herbicide residues from impacting these species.<br>*Less than 10 feet:* No broadcast spraying permitted. Spot treatment (hand | Broadcast buffers based on Mt. Hood FEIS (USFS 2006b) |

| | | |
|---|---|---|
| | application of herbicides) is permitted. Precautions must be taken to avoid contact with individual TES/S&M plant species. Manual treatments permitted (apply PDF 64). | |
| 66. | The herbicides picloram and imazapyr would not be used in broadcast applications within 100 feet of any TES or S/M plant species, and would not be used in spot applications within 10 feet of any TES or S&M plant species. In order to protect sensitive plant species in saturated or wet soils at the time of application, do not use picloram or imazapyr due to their mobility. | Label advisories. |
| 67. | Design manual treatments (e.g., pulling, digging) to avoid trampling or other direct impacts to individual TES or S/M plant species. | To protect TES or S&M plants. |
| 68. | Do not use imazapic in areas previously treated with chlorsulfuron, metsulfuron methyl, sulfometuron methyl, or imazapyr. | To avoid damage to non-target plant species. |
| 69. | When using sulfonylurea herbicides (chlorsulfuron, metsulfuron methyl, and sulfometuron methyl), use lowest application rates that will still be effective and do not use within 50 feet of known Sensitive, S&M plant species and other unique plant species identified by Forest Service botanists for protection. | To protect non-target vegetation from drift effects including wind erosion. More conservative than Mars et al (1989). |
| **To Ensure Protection of Heritage Resources** | | |
| 70. | Avoid disking or plowing in eligible or unevaluated archaeological sites. Refer to implementation plan for avoidance measures in specific Project Area Units. | To protect cultural resources. |
| 71. | Avoid burning where unevaluated or known significant historic materials are present. | To protect cultural resources. |
| **To Ensure Protection of Range Resources** | | |
| 72. | Permittees will be made aware of annual treatment actions at the permittee annual operating plan meetings and/or if requested, notified in advance of spray dates. | The range label restrictions are included in herbicide info table (Appendix D to FEIS). |
| 73. | Protection Buffer Widths permanent water sources used for livestock watering, such as water troughs associated with spring developments, reservoirs, trick tanks, and other sources developed for range use and listed as a range improvement. Temporary watering developments such as watersets, will have no restrictions except when in use and as needed to follow label restrictions.<br>**Greater than 100 feet:** All treatments permitted.<br>**100 to 10 feet:** All treatments, except broadcast spraying permitted.<br>For herbicide treatment, use protective measures such as low-pressure spot-spray, directed spray applications, backpack applications, and/or protective barrier to prevent herbicide residues from impacting these species.<br>**Less than 10 feet:** No broadcast spraying permitted. | The measure will also protect wildlife that may use stock watering sources. |
| 74. | Some of the approved herbicides have use restrictions associated with domestic livestock that will be followed on public rangelands as listed in Grazing Restrictions Table, Appendix D | Label restrictions. |
| **To Protect Wildlife** | | |
| ***Northern Spotted Owl*** | | |
| 75. | Disturbing work activities (i.e. chainsaw, heavy equipment, etc) will not take place within 1/4 mile of the nest site or activity center of all known pairs or resident singles between March 1 and September 30. If activities occur within the nesting period, further consultation is required. The boundary of | To minimize disturbance. Source: Programmatic BA; decibel measurements of roadside sprayers |

the 1/4-mile area may be modified by the District Wildlife Biologist based on topographic breaks or other site-specific information (generally, a 125-acre area will be protected). This condition may be waived in a particular year if nesting or reproductive success surveys reveal that spotted owls are non-nesting or that no young are present that year. Waivers are valid only until March 1 of the following year.

There is no seasonal restriction on the use of roadside broadcast sprayers, as they fall within ambient noise levels.

Disturbance/disruption distances for Northern spotted owls during the breeding period (March 1 – September 30):

| Activity | Disturbance distance | Disruption Distances | |
|---|---|---|---|
| | **Breeding period** (March 1 – September 30) | **Spotted owl critical breeding period** (March 1 – July 15) | **Remainder of the spotted owl breeding period** (July 16 – September 30) |
| Use of Chainsaws | 440 yards (0.25 mile) | 65 yards | 0 yards |
| Use of heavy equipment | 440 yards (0.25 mile) | 35 yards | 0 yards |

***Northern Bald Eagle***

76. Invasive plant treatment activities that cause disturbance in excess of base levels that were occurring in 2001 will not take place within 1/4 mile non line-of-sight or 1/2 mile line-of-sight of known bald eagle nests between January 1 and August 31. This condition may be waived in a particular year if nesting or reproductive success surveys reveal that bald eagles are non-nesting or that no young are present that year. Waivers are valid only until January 1 of the following year.
To minimize disturbance. Source: Programmatic BA

77. Project activities that have potential to disturb bald eagle winter roosts, shall be restricted within 400 m of the roosting area from November 1 to April 30th.
To minimize disturbance. Source: Programmatic BA

***Greater Sage Grouse***

78. Do not use NPE-based surfactants in areas where sage grouse may forage (consult with District wildlife biologist).
To reduce risk of exposure

79. Human activities within 0.3 mile of leks will be prohibited from the period of one hour before sunrise until four hours after sunrise and one hour before sunset until one hour after sunset from February 15 – May 15.
To avoid disturbance

80. Do no conduct any vegetation treatments or improvement project in breeding habitats from February 15 – June 30.
To avoid disturbance

***Oregon and Columbia Spotted Frog***

81. Avoid broadcast spraying of NPE-based surfactants, in or within 100 feet of occupied spotted frog habitat or suitable wetland habitat. Coordinate treatment methods, timing, and location with local Biologist prior to implementation.

***American Peregrine Falcon***

82. All invasive plant treatments would be seasonally prohibited within 0.5 miles of peregrine nest sites (primary nest zone).

Invasive plant treatments involving motorized equipment and/or vehicles would be seasonally prohibited within 1.5 miles of known nest sites (secondary nest zones). This may include activities such as mulching, chainsaws, vehicles (with or without boom spray equipment) or other mechanically-based invasive plant treatment.

Non-mechanized or low disturbance invasive plant activities (such as spot spray, hand pull, etc.) may occur within the secondary nest zone, but would be coordinated with the wildlife biologist on a case-by-case basis to determine potential disturbance to nesting falcons and identify mitigating measures, if necessary.

83. Seasonal restrictions would be waived within primary and secondary nest zones if the site is unoccupied or if nesting efforts fail and monitoring indicates no further nesting behavior.

84. Season restrictions would apply during the periods listed below based on the following elevations:

| | |
|---|---|
| Low elevation sites (1000-2000 ft) | 01 Jan – 01 July |
| Medium elevation sites (2001 – 4000 ft) | 15 Jan – 31 July |
| Upper elevation sites (4001 + ft) | 01 Feb – 15 Aug |

Seasonal restrictions would be extended if monitoring indicates late season nesting, asynchronous hatching leading to late fledging, or recycle behavior which indicates that late nesting and fledging would occur.

85. Protection of nest sites shall be provided until at least two weeks after all young have fledged.

86. Clopyralid would not be used within 1.5 miles of peregrine nest more than once per year. Picloram would not be used more than once every two years (see PDC H8)

***Wetland Habitat (yellow rail, tricolored blackbird)***

87. Avoid broadcast or spot spraying of NPE-based surfactants in or adjacent to suitable breeding habitat

***Yellow Rail***

88. At known breeding sites, no disturbance between May 15 and September 15, unless local biologist evaluates sites to modify permitted disturbance dates.

89. Do not use NPE-based surfactants in known breeding or foraging areas.

***Pygmy Rabbit***

90. Activities in suitable burrowing habitat for pygmy rabbits will be restricted to one or two persons within suspected burrow areas, no heavy equipment, and manual or herbicide techniques only.

91. Do not use NPE-based surfactants in areas where pygmy rabbits may forage.

***Raptors and Great Blue Heron***

92. Active nest sites should be protected from disturbance above ambient levels during the dates specified. Local biologist will determine appropriate distances for planned operations prior to implementation.

- Golden eagle February 1 – August 15
- Osprey April 1 – August 31
- Red-tail hawk March 1 – August 31
- Northern goshawk March 1 – August 31
- Cooper’s hawk April 15 – August 31
- Sharp-shinned hawk April 15 – August 31
- Prairie falcon March 1 – August 1
- Great gray owl March 1 – June 30
- Great blue heron March 1 – August 31

## To Protect Air Quality

93. All prescribed burning operations would be coordinated with the Oregon State Department of Environmental Quality and the Oregon State Department

of Forestry through the State of Oregon smoke management program.

94. Burn areas adjacent to private land would be patrolled following ignition and daily thereafter until the prescribed fire manager determines there is no threat to private land.

95. Site-specific information (including fuels loads) about all prescribed burning units would be entered into the State of Oregon's regional smoke management database, along with observations of environmental conditions taken during burn implementation. This information would be used to determine the amount of emissions produced, and ensure compliance with Oregon smoke management guidelines and the annual limitation on emissions entered into with the other Oregon Blue Mountain Forests.

**Table 15.** Project Area Unit-Specific Project Design Features for Fisheries.

| Watershed Name and Number | Project Area Number | Species Affected | Project Design Feature |
|---|---|---|---|
| Willow Creek 1707030602 | 75-20 | Redband trout | Use clopyralid or aquatic glyphosate in place of picloram to treat Russian knapweed |
| Willow Creek 1707030602 | 75-24 | Non Native Fish | Use clopyralid or aquatic glyphosate in place of Picloram to treat Russian knapweed |
| Upper Trout Creek 1707030701 | All | Steelhead Redband Trout | Use of picloram restricted to treating sulphur cinquefoil weed populations. |
| Lower Whychus 1707030108 | 75-56 | Steelhead Bull Trout Redband Trout | Use of clopyralid, and sulfometuron to treat medusahead, and diffuse knapweed restricted to 10 acres per year in canyons where slopes exceed 10 % and within 300 ft of perennial water. |
| Odell Lake 1707030102 | 12-02 12-16 | Bull Trout Redband Trout | Use chlorsulfuron in place of picloram to treat butter and eggs or Dalmation toadflax |
| Bridge Creek 1707020403 | All | Steelhead Redband Trout | Use of picloram restricted to treating sulphur cinquefoil and field bindweed species. |
| Mountain Creek 1707020113 | All | Steelhead Redband Trout | Use of picloram restricted to treating sulphur cinquefoil and field bindweed species. |
| Rock Creek 1707020114 | All | Steelhead Redband Trout | Use of picloram restricted to treating sulphur cinquefoil and field bindweed species. |
| Upper Middle John Day 1707020113 | All | Steelhead Redband Trout | Use of picloram restricted to treating sulphur cinquefoil and field bindweed species. |
| Lower SF John Day 1707020113 | All | Steelhead Redband Trout | Use of picloram restricted to treating sulphur cinquefoil and field bindweed species. |
| Dry Paulina Creek 1707030309 | 72-15 72-37 | Redband Trout | No scarifying, burning or fire line construction within 50 feet of intermittent channels in areas selected for this treatment. |

**Table 16.** Minimum Buffers (ft) for Herbicide Applications used in Alternative 2.

| Herbicide | Perennial stream | | | Seasonal intermittent stream | | | Lake/Wetland | | |
|---|---|---|---|---|---|---|---|---|---|
| | Broadcast spray | Spot-spray | Hand | Broadcast spray | Spot-spray | Hand | Broadcast spray | Spot-spray | Hand |
| | | | | | | | | | |
| Clopyralid | 100 | 15 | bankfull | 50 | 15 | *bankfull | 100 | 15 | *bankfull |
| Chlorsulfuron | 100 | 50 | bankfull | 50 | 50 | bankfull | 100 | 50 | bankfull |
| Aquatic Glyphosate | 50 | 0 | 0 | 15* | 0 | 0 | *50 | 0 | 0 |
| Glyphosate | 300 | 100 | 50 | 100 | 50 | 50 | 300 | 100 | 50 |
| Imazapic | 100 | 15 | bankfull | 15 | 15 | *bankfull | 100 | 15 | *bankfull |
| Aquatic Imazapyr | 50 | 0 | 0 | 50* | 0 | 0 | *50 | 0 | 0 |
| Imazapyr | 100 | 50 | 15 | 100 | 50 | bankfull | 100 | 50 | bankfull |
| Metsulfuron Methyl | 100 | 15 | bankfull | 15 | *15 | *bankfull | 100 | 15 | *bankfull |
| Picloram | 300 | 100 | 50 | 100 | 50 | 50 | 300 | 100 | 50 |
| sethoxydim | 300 | 100 | 50 | 100 | 50 | 50 | 300 | 100 | 50 |
| Sulfometron Methyl | 100 | 15 | bankfull | 50 | 15 | bankfull | 100 | 50 | bankfull |
| Aquatic Triclopyr-TEA | X | 15+ | 0 | X | *15+ | 0 | X | *15+ | 0 |
| Triclopyr-BEE | X | 150 | 150 | X | 50 | 50 | X | 50 | 50 |
| Tank Mixtures | Use greatest buffer identified above. | | | | | | | | |

*If channel/wetland is dry there is no buffer.
+Follow up with EPA consultation.

**Table 17.** Minimum buffers (ft) for herbicide applications in Alternative 3 that can be used within 300 feet of water. No broadcast spraying would be allowed within buffers and no herbicide would be allowed within 10 feet of buffers.

| Herbicide | Perennial stream or river | | Seasonal intermittent stream | | Perennial Lake/Wetland | | Seasonal Lake/Pond/Wetland | |
|---|---|---|---|---|---|---|---|---|
| | Spot-spray | Hand | Spot-spray | Hand | Spot-spray | Hand | Spot-spray | Hand |
| Clopyralid | 15 | 10 | 15 | bankfull | 15 | 10 | 15 | bankfull |
| Chlorsulfuron | 50 | 10 | 50 | bankfull | 50 | 10 | 50 | bankfull |
| Aquatic Glyphosate | 10 | 10 | bankfull | bankfull | 10 | 10 | bankfull | bankfull |
| Imazapic | 15 | 10 | 15 | bankfull | 15 | 10 | 15 | bankfull |
| Aquatic Imazapyr | 10 | 10 | bankfull | bankfull | 10 | 10 | bankfull | bankfull |
| Imazapyr | 50 | 15 | 50 | bankfull | 50 | 10 | 50 | bankfull |
| Metsulfuron Methyl | 15 | 10 | 15 | bankfull | 15 | 10 | 15 | bankfull |
| Sulfometron Methyl | 15 | 10 | 15 | bankfull | 50 | 10 | 15 | bankfull |
| Aquatic Triclopyr-TEA | 15* | 10 | 15* | bankfull | 15* | 10 | 15* | bankfull |
| Tank Mixtures | Use greatest buffer identified above. | | | | | | | |

*Follow up with EPA consultation.

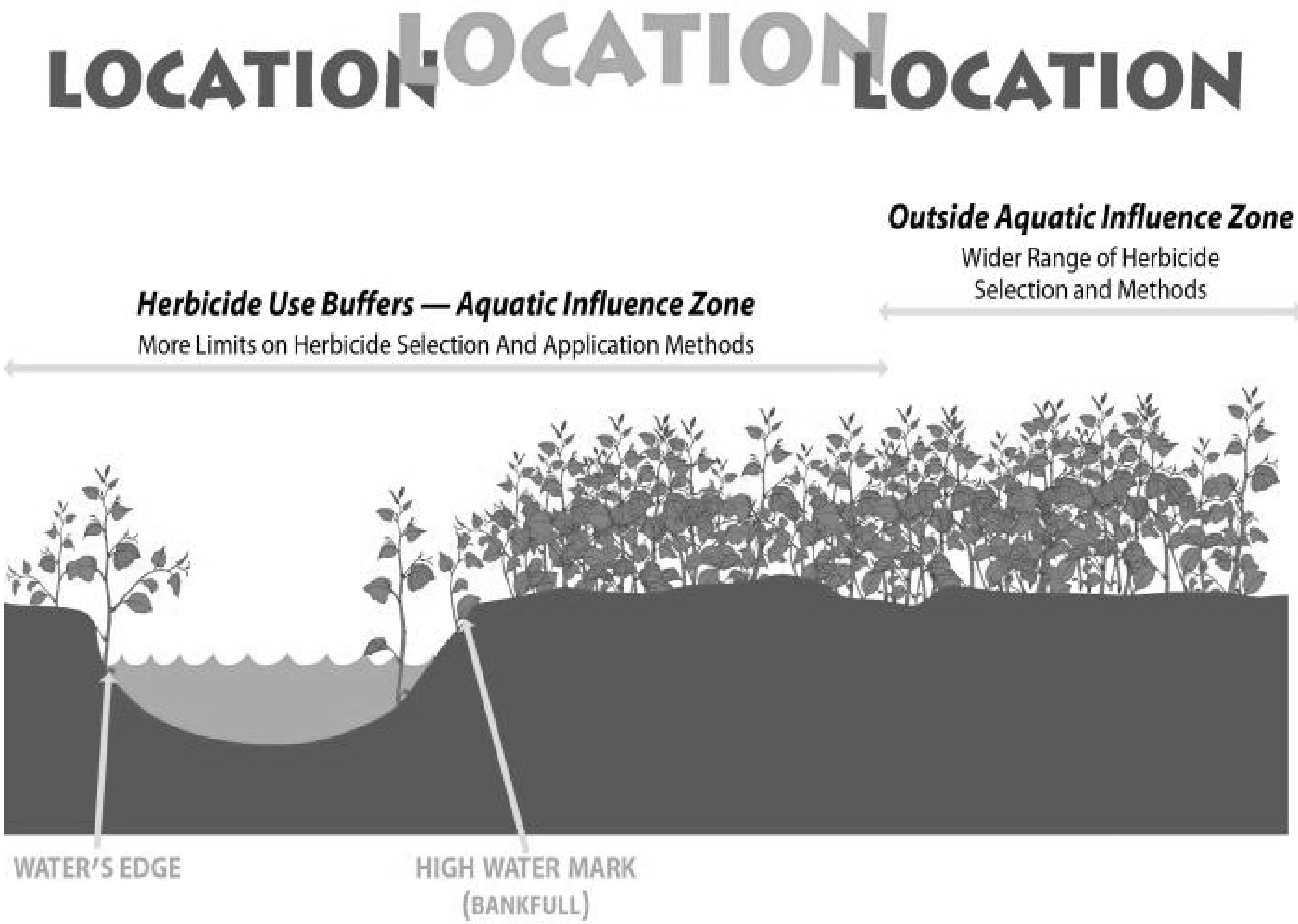


**Figure 4.** This picture shows how options for herbicide selection and application methods decrease in proximity to streams.

## 2.5 Alternatives Not Considered in Detail

### Use Methods Other Than Herbicides

Some public comments showed a concern over the use of herbicides and suggested that we utilize other methods instead. This approach would not meet the purpose and need for action (timely treatment of invasive plant sites to meet the associated strategies of eradicate, control, contain, or suppress), for the following reasons:

***Limits Effectiveness and Ability to Meet Purpose and Need***

Effectiveness of treatments depends on the tools available. Alternatives that limit the variety of tools also limit the effectiveness of treatments (R6 FEIS p. 4-15). The Regional Forester considered making available to the Forests a more limited list of herbicides (R6 Invasive Plant Program ROD) but concluded that, based on analysis in the Regional Invasive Plant Program FEIS, it would restrict treatment effectiveness and increase costs. The Regional Forester's decision to approve 10 herbicides is expected to reduce the extent and rate of spread of invasive species, as well as reduce the use of herbicides over time (FEIS p. 4-25, ROD p. 9 and Appendix 2-1). The approved herbicides also pose low risks to humans and non-target organisms. Our site-specific treatment plan for the Deschutes and Ochoco NF and Crooked River NG employs these herbicides as part of an integrated weed management approach where the local conditions, objectives, and concerns are assessed so that treatment is effective, adverse effects are minimized or eliminated, and the Forests and Grassland would realize a reduction in the use of herbicides over time. The purpose and need could not be met without the use of herbicides.

For some invasive plant sites, the size of the population and/or nature of the invasive species require the application of herbicides for effective treatment. For example, houndstongue is rapidly expanding and threatens much of the Ochoco National Forest. Manual treatment of houndstongue over the last several years has cost tens of thousands of dollars, but had not been enough to stem the continued threat, as smaller satellite infestations continue to appear.[6] Herbicides are necessary to control this invasive plant. For some invasive plants such as ribbongrass, manual and mechanical treatment is difficult and often ineffective regardless of the size of the population (see Chapter 3.3 for more information on effectiveness of treatments).

***Similar to No Action***

NEPA decisions have approved use of herbicides on 40 sites on the Deschutes National Forest (USFS 1998a), 72 sites on the Ochoco National Forest and Crooked River National Grassland (USFS 1998b), and one medusahead site on Paulina District, Ochoco National Forest (USFS 2005). These 113 sites represent only 6% of the total number of currently mapped sites (1,892). The No Action alternative would allow continued use of herbicides on these sites, but because these sites were approved for herbicide application 8 to 10 years ago, there have been ongoing treatments, and the amount of herbicide used at the sites has declined. The earlier NEPA documents also approved sites for manual or mechanical treatment. If No Action were selected, future manual and mechanical treatments that haven't already been approved would likely be categorically excluded from NEPA documentation. A

[6] Public comments suggested that volunteer labor is available to control the existing invasive plant populations. The work of manual weed pulling is extremely time-consuming, difficult, and uncomfortable work. Based on past experience, the Forest Service cannot depend entirely on the availability and willingness of the public to volunteer repeatedly and consistently to do the work required to control or eliminate many of the species/sites. Even large organized and advertised events, such as "Let's Pull Together," are primarily an educational tool that is meant to foster awareness amongst the populace, not an attempt to eradicate weed populations (Howard 2007, personal communication).

"No Herbicide" alternative is very similar to the No Action alternative based on the scale of the currently approved program, which is being considered in this EIS. Environmental consequences and effectiveness of manual or mechanical treatments are discussed in Chapter 3.

***Public Concern and Issue over Toxics Addressed in Project Design***

Public comments expressed concern about potential adverse effects to humans from releasing herbicides into the environment. This issue is addressed by following label instructions, following regional Forest Plan standards for herbicide use, and by using appropriate application methods. Public notification, buffers around water intakes, and other project design features minimize potential for exposure. Both action alternatives incorporate measures to protect the public above and beyond the label instructions.

## Restricted Herbicide use across Planning Area

Due to public comments and concerns surrounding the release of herbicides into the environment, the interdisciplinary team looked at two ways to restrict herbicide use across the project area: (1) Use herbicides as a tool of last resort, or (2) use herbicides only on highest priority sites.

The R6 2005 FEIS[7] analyzed an alternative that would focus more on prevention and make herbicides a tool of last resort (USFS 2005a). The analysis of that alternative need not be repeated in this EIS (40 CFR 1502.20). The Regional Forester decided in 2005 (USFS 2005b) to not select that alternative or a region-wide standard that would make herbicides a treatment of last resort. She explained that such a standard would deviate from integrated weed management principles that are part of Forest Service manual direction (FSM 2080.5).

As with the regional Record of Decision, the interdisciplinary team recommends that using herbicides as a tool of last resort in the project area would not be consistent with Integrated Weed Management (IWM) principles (see pages 8 and 12). That option, therefore, was not analyzed further in this EIS.

Also, only using herbicides at high priority sites would be difficult because priorities will likely change due to changed conditions, new sites, or new species. Although some sites/species may not be the highest priority on the landscape, they may be best treated with herbicides; this would lead to some weed sites not being effectively treated, potentially allowing them to spread and would not meet this project's purpose and need. This option was therefore not analyzed further in the EIS.

As noted above under "Use Methods Other Than Herbicides," in order to address concerns over human health and exposure to herbicides, the interdisciplinary team developed project design features (PDFs) and built them into the action alternatives. These PDFs are an added layer of caution to the already-regulated and approved use of these herbicides. Section 2.4 details these project-specific features. Some people expressed concern about the effects of herbicides on human health. Section 3.2 discusses the layers of caution integrated into herbicide use and 3.8 discloses the expected health effects of the alternatives. Workers and the public may be exposed to herbicides used to treat invasive plants under all alternatives in this project; however, no exposures exceeding a threshold of concern are predicted. This conclusion is based on facts about chemistry of the herbicides considered for use and the mechanisms by which exposure of concern might occur.

[7] The R6 2005 FEIS is available at http://www.fs.fed.us/r6/invasiveplant-eis/FEIS.htm

### No herbicide use within Riparian Reserves or Riparian Habitat Conservation Areas

Public comments included concerns about the use of herbicides in riparian areas and near water. Prohibiting the use of herbicides in RR/RHCAs would not meet the purpose and need for action. The issue has been addressed through PDFs, and the development of Alternative 3. Alternative 3 is designed to address concerns about the aquatic environment and is based on scientific evidence of how herbicides can reach water when applied nearby. For example, because broadcast application can increase the risk of herbicides drifting through the air and reaching water, Alternative 3 prohibits broadcast within 300 feet of perennial streams and lakes which will encompass riparian areas and beyond in most cases (see p. 221). Although the proposed action is not expected to have significant effects to the aquatic environment, Alternative 3 provides a comparison of a more restricted approach.

Certain invasive plant species are invasive in the riparian areas, such as ribbongrass, reed canarygrass, and yellow iris. These invasive plants are not likely to be controlled effectively with non-herbicide methods. As demonstrated in the analysis for Alternative 3, there is a reduction in the effectiveness with the restrictions in place. Based on what we know about the riparian species, eliminating herbicides altogether would render control of them infeasible. Some species that occur within Riparian Reserves/RHCAs can be in populations of such size or number that objectives could not be met with non-herbicide methods alone (e.g. houndstongue in the Dry Paulina subwatershed). Eliminating the herbicide treatment option would allow these invasives to persist throughout the forest. This is contrary to the purpose and need of controlling known sites and preventing them from spreading further.

Analysis in the Region 6 Invasive Plant Program FEIS (USFS 2005a) discloses the effects of non-herbicide methods on fish, wildlife, and plants (Appendix J). According to the FEIS these methods could have more impacts in riparian areas than herbicides. For example, pulling, digging, or grubbing invasive plants can cause soil disturbance, with the potential for soil to move through erosion. The R6 FEIS expected that manual and mechanical treatments would cover relatively small areas and that utilizing these methods in larger areas could lead to increased erosion and stream sedimentation. In the case of some weed sites in the project area, if herbicides were not allowed the manual treatments would take place over much larger areas.

The proposed action and Alternative 3 address the issue of aquatic concerns, while allowing careful and appropriate application of herbicides where it is required to meet site objectives of eradicate, control, contain, or suppress. Refer to sections 3.6 and 3.7 for expected impacts to the riparian areas and aquatic organisms.

### No Herbicide Use in Municipal Watersheds

An alternative was considered that would respond to the issues of human health and general toxicity of herbicides by not allowing any use of herbicides within municipal watersheds. There are three municipal watersheds in the planning area: Mitchell, Bend, and Sisters. There are also community water systems (such as Crescent) and other uses of water that originate on Forest Service land for personal consumption. There are currently very few known invasive plant sites within the municipal watersheds. This alternative was eliminated from detailed study because the following project design features were incorporated into the action alternatives in order to address the issue: coordination and agreement with departments managing municipal water systems, restriction on broadcast application, and buffers around water intakes.

### Prohibit Biological Control

Some members of the public expressed concern over the use of biological control agents in our invasive plant treatment project. The concerns centered on risks to non-target species. Other commenters felt that biocontrol should be a larger part of our program because of the benign nature of the treatment method.

An alternative that did not allow the use of biological control agents was eliminated from further study because biological control agents authorized by the State and approved for use in Region 6 have been extensively researched and screened prior to release in the United States. Additionally, the Forest Service will be conducting annual review of research and monitoring data regarding biocontrol, and providing current information to the Forests to incorporate in annual implementation planning (Bulkin, pers. comm. 2006).

Certain populations of some invasive plants necessitate the need for biological agents as a starting point to reduce invasive plant populations to a more manageable level, particularly in sensitive areas or where populations of a species are very large in size or the number of sites in an area. For example, Canada thistle sites on the Ochoco NF are so expansive that biocontrol is the only cost-effective method available at this time to get them to a more manageable size.

### Maximize Worker Jobs

Because it takes more people to remove weeds by hand than it does to treat them with herbicides, manual treatment prescriptions would theoretically provide more jobs. Some public comments suggested that the Forest Service take this approach in our invasive plant treatment project. This would not meet our purpose and need for action. As with the discussion under “Use Methods other than Herbicides” there is ample evidence that relying on non-herbicide methods alone will not be effective in meeting objectives at the hundreds of weed sites across the Forests and Grassland.

### Maximize Cost Efficiency

The converse to the “Maximize Worker Jobs” approach, public comments suggested that we could be most effective and efficient by utilizing herbicides as much as possible. One of the new Forest Plan goals provided by the R6 ROD states “Implement invasive plant treatment strategies that protect sensitive ecosystem components, and maintain biological diversity and function within ecosystems. Reduce loss or degradation of native habitat from invasive plants while minimizing adverse effects from treatment projects.” (USFS 2005b, p. Appendix 1-2). The proposed action described earlier in this chapter is consistent with the goals and is the most cost effective. The herbicides approved for use in the region have been selected for use across the Forests and Grassland according to where they would be most effective (refer to Appendix A and D). Sensitive ecosystems are protected and adverse effects are minimized by adhering to Forest Plan standards and locally-designed project design criteria.

### Focus on Education and Prevention

Focusing on prevention and education rather than treatment would not meet the purpose and need for action. The purpose and need includes timely treatment of invasive plant sites and early control of new sites. Prevention alone is outside the scope of this EIS. The R6 2005 FEIS analyzed an alternative that emphasizes prevention. It would have increased emphasis on reducing conditions related to land uses and activities on National Forest System lands that contribute to invasive plant introduction, establishment, and spread. Herbicide use was a “tool of last resort” in this alternative. The current project-level EIS does not need to repeat the analysis per 40 CFR 1502.20: Whenever a broad environmental impact statement has been prepared (such as a program or policy statement) and a subsequent statement or environmental assessment is then prepared on an action included within the entire program or policy (such as a site specific action) the subsequent statement or environmental assessment need only summarize the issues discussed in the broader statement and incorporate discussions from the broader statement by reference and shall concentrate on the issues specific to the subsequent action.

Prevention is an important component of invasive plant management and is an ongoing consideration in managing National Forests, regardless of the decision resulting from this EIS. Executive Order 13112 (1999) requires federal agencies to prevent the introduction of invasive species as well as promote education on invasive species. Newly adopted goals, objectives, and standards in the R6 2005 ROD (USFS 2005b) address both the prevention and treatment aspects of integrated weed management. This direction applies to all alternatives, including No Action. In 2004 the Regional Forester directed National Forests in the region to develop local invasive plant prevention practices. These are included in this FEIS as Appendix G. When assessing the effectiveness of the alternatives in this EIS, it is assumed that prevention standards and guidelines will be implemented. The Deschutes and Ochoco National Forests and Crooked River National Grassland also have an active education and outreach program.

In addition to requiring federal agencies to prevent the introduction and spread of invasives, the Executive Order also directs us to detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner. The need for this project is focused on treating currently known populations of invasive plants and responding quickly to newly detected sites. Scientific literature supports timely and appropriate treatment of invasive plants and restoration of native plant communities as important tools for effective integrated weed management (R6 FEIS, Ch. 3). Recent work by Mehta et al (2007) finds that early detection and rapid response increases managers' chances to successfully restore invasive plant sites. For these reasons the alternative of prevention alone was not considered in detail.

## 2.6 Alternative Comparison

This section provides tables that summarize and compare the alternatives by the activities proposed, how each responds to the purpose and need; and how each responds to the issues and the related effects on the issue indicators.

**Table 18.** Comparison of Alternative Components

| | Alt. 1 | Alt. 2 | Alt. 3 |
|---|---|---|---|
| Allows broadcast spraying of herbicides within 300 feet of perennial waterbodies | DES – Yes<br>OCH – No | Yes | No |
| Allows herbicide use within 10 feet of perennial waterbodies | DES – No<br>OCH – Yes | Yes | No |
| Allows triclopyr, sethoxydim, and picloram within 300 feet of perennial waterbodies | No | Yes | No |
| Allows Herbicide use in Intermittent Channels when Dry | Yes | Yes | No |
| Includes approved biological releases | Yes | Yes | Yes |
| Includes an Early Detection – Rapid Response Strategy | No | Yes | Yes |
| Includes Restoration and Adaptive Management through Monitoring | Limited testing | Yes | Yes |

**Table 19.** Comparison of the Alternatives Based on How Each Responds to the Issues. This is a summary of information presented in detail in Chapter 3.

<table>
<tr><th>Issue and Indicator<br>↓</th><th>Alternative 1</th><th>Alternative 2</th><th>Alternative 3</th></tr>
<tr><td colspan="4">Treatment Effectiveness</td></tr>
<tr><td>Acres Approved for Treatment</td><td>2,204</td><td>52,015 acres</td><td>52,015</td></tr>
<tr><td>Inventoried Invasive Plant Sites Treated</td><td>238 sites<br>2,204 acres</td><td>1,892 sites<br>14,547 acres</td><td>1,892 sites<br>14,547 acres</td></tr>
<tr><td>Estimated proportion of herbicide treatment</td><td>2% of inventoried sites approved for herbicides</td><td>95% first year of treatment on inventoried sites</td><td>95% first year of treatment on inventoried sites</td></tr>
<tr><td>Number of Herbicide Formulations Available</td><td>3 ONF, 4 DNF</td><td>10</td><td>10; 7 in riparian areas</td></tr>
<tr><td>Summary of Effectiveness</td><td>Least effective in controlling invasive plants: fewer acres treated and options most limited; No EDRR to limit spread of new sites</td><td>Most effective alternative in controlling invasive plants. 10 herbicides available for use; allows more broadcast; EDRR increases effectiveness</td><td>More effective than Alternative 1, but less than Alternative 2. 7 herbicides available near water; 10 everywhere else; EDRR increases effectiveness. No effective treatment of riparian species, will continue to have adverse impacts</td></tr>
<tr><td colspan="4">Social/Economic Aspects</td></tr>
<tr><td>Total cost for all sites' first year of treatment</td><td rowspan="2">Sites already covered by NEPA documentation have already had the first year of treatment</td><td>$2,205,290</td><td>$2,518,490</td></tr>
<tr><td>Acres treated in first year based on current budget</td><td>Broadcast herbicide: 996,500<br>Spot/hand herbicide: 968,750<br>Manual: 240,040</td><td>Broadcast herbicide: 790,400<br>Spot/hand herbicide: 1,472,750<br>Manual: 255,340</td></tr>
</table>

| Issue and Indicator ↓ | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| Jobs required based on acres treated by method in first year | | 88 | 112 |
| Average cost per acre | Manual $340<br>Herbicide $100 - $250 | Manual $340<br>Herbicide $100 - $250 | Manual $340<br>Herbicide $100 - $250 |
| **Water and Aquatic Species** | | | |
| Herbicide Treatments near Perennial Waterbodies | Deschutes NF – not allowed within 100 feet.<br>Ochoco NF - some sites remaining from 1,045 acres of Treatment Areas in '98 EA | 1,518 invasive plant site acres proposed for herbicides within 300 feet.<br>724 acres proposed within 100 feet.<br>230 acres within 10 feet | 1,288 invasive plant site acres proposed for herbicides within 300 feet. Broadcast spraying not allowed within 300 feet.<br>494 acres proposed within 100 feet.<br>0 acres within 10 feet |
| Effects for Federally Listed and Region 6 Sensitive Fish Species | No direct impacts to fisheries or aquatic invertebrates from continuing treatments.<br>Potential for indirect effects where riparian areas not treated. Invasives prohibit native vegetation which provides shade from becoming established. | Major impacts prevented with PDFs.<br>Potential risk for effects to bull trout and redband trout from herbicide treatments near water.<br>No measurable effects from manual, mechanical and cultural methods except in Metolius River where cover would be reduced. | Major impacts prevented with PDFs.<br>Reduced risk of herbicide residue washing into streams. Reduced risk of direct overspray to water.<br>Effective control of ribbongrass not possible. Invasives would continue to degrade habitat.<br>No measurable effects from manual mechanical and cultural methods except in Metolius River where cover would be reduced. |
| **Human Health and Public Notification** | | | |
| Worker Safety | No Significant Impact (FONSI) from ongoing | Project design features eliminate plausible harmful exposure scenarios. | Same as Alt. 2 |

| Issue and Indicator ↓ | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| | treatments (previous NEPA determination) | | |
| Drinking Water | No Significant Impact (FONSI) from ongoing treatments (previous NEPA determination) | Project design features eliminate plausible harmful exposure scenarios. | Same as Alt. 2 |
| Public Health | No Significant Impact (FONSI) from ongoing treatments (previous NEPA determination) | Project design features eliminate plausible harmful exposure scenarios. | Same as Alt. 2 |
| **Native Plant Communities** | | | |
| Effects to Federally Listed Plant Species | No Effect | No Effect | No Effect |
| Effects to Sensitive Plant Species | Invasive plant sites would continue to expand causing further degradation of native plant habitats and potential loss of additional rare plants.<br>Less risk of non-target effects from herbicide.<br>Highest risk to Sensitive plants from loss of habitat. | PDFs will minimize or eliminate any short-term effects to native vegetation.<br>Some individual plants may be impacted by treatments in short term (1-5 years), but there will be beneficial effects to native plant habitats.<br>Treatments will not lead to a trend toward federal listing.<br>More herbicide options help plan treatments that minimize non-target effects. | PDFs will minimize or eliminate any short-term effects to native vegetation.<br>Some individual plants may be affected in short term (1-5 years) but there will be beneficial effects to native plant habitats.<br>Treatments will not lead to a trend toward federal listing.<br>Restrictions on broadcast spraying (within riparian reserves) will further minimize potential short-term impacts to non-target veg.<br>Riparian native plants will continue to be impacted by rhizomatous invasive plant species that are difficult to control |

| Issue and Indicator ↓ | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| | | | without the use of herbicides. |
| Effects to Survey & Manage Plants | Low potential risk to individual plants from non-target effects of herbicide.<br>Highest risk to survey and manage plant species from loss of habitat. | Individual plants could be harmed in short-term.<br>Low risk that herbicide treatments would impact individual S&M plant species.<br>In long term, S&M plant species will benefit from treatment effectiveness. | Individual plants could be harmed in short-term.<br>Low risk that herbicide treatments would impact S&M plant species.<br>Broadcast restrictions may reduce potential impacts to non-vascular plants in riparian zone.<br>In long term, S&M plant species will benefit from treatment effectiveness. |
| Summary Effects to Native Vegetation | Native vegetation will continue to be impacted by invasive plants.<br>Less risk of damage to individual native plants from herbicides.<br>Long-term risk to native vegetation from spread of invasive plants. | PDFs minimize or eliminate short-term effects to native vegetation from herbicide treatments.<br>Native plant habitats will benefit from invasive plant treatments. | PDFs minimize or eliminate short-term effects to native vegetation from herbicide treatments.<br>Native plant habitats will benefit from invasive plant treatments.<br>Riparian native plants may continue to be impacted by rhizomatous invasive plant species. |
| **Wildlife** | | | |
| Threatened/Endangered Species: Spotted Owl and Bald Eagle | No direct adverse effects from ongoing treatment. | Potential for disturbance from noise, but minimized with PDF; no impact to habitat. No plausible effects from herbicide. | Potential for disturbance from noise, but minimized with PDF; no impact to habitat. No plausible effect from herbicide. |
| Sensitive Species: Pygmy rabbits, sage grouse, harlequin duck, yellow rail, | No direct adverse effects from ongoing treatments. | Some potential harm to individuals; no risk to populations. | Some potential harm to individuals; no risk to populations. |

| Issue and Indicator ↓ | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| spotted frogs and Crater Lake tightcoil snail. | | | |
| Sensitive Species: California wolverine, Pacific fisher, grebes, bufflehead, upland sandpiper, American peregrine falcon, gray flycatcher, tricolored blackbird | No direct adverse effects from ongoing treatment. | No Impacts | No Impacts |
| Management Indicator Species | No adverse effects from disturbance or herbicide exposure | Effects from disturbance are avoided with seasonal restrictions<br>No adverse effects from disturbance or herbicide exposure | Effects from disturbance are avoided with seasonal restrictions<br>No adverse effects from disturbance or herbicide exposure |
| Wildlife Habitat | Highest risk of habitat loss. | Lowest risk of habitat loss. | The risk of habitat loss is lower than Alternative 1 and higher in riparian areas than Alternative 2. |

# INDEX MAP

# MAP 1

# INSERT Project Area Unit Map #2

# INSERT Project Area Unit Map #3

# INSERT PROJECT AREA UNIT MAP #4

# Chapter 3

## Affected Environment and Environmental Consequences

# Chapter 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

### Chapter 3 Changes Between Draft and Final

- Effects determinations for sensitive plant species updated in Native Vegetation section.
- An updated 303(d) list became available; the water quality section has been updated to reflect the new list.
- Subwatersheds listed for each basin, moved to new Appendix J.
- The Bald Eagle is no longer listed as Threatened under the Endangered Species Act, and is discussed under Regional Forester's Sensitive Species.
- Fish and Wildlife analyses have been improved. Fisheries analysis by watershed moved to Appendix H.
- Information on smoke management has been added to the end of this chapter.
- Minor edits throughout chapter to clarify and/or fix errors.

## 3.1 Introduction

Chapter 3 of this EIS summarizes the physical, biological, social, and economic environments of the affected project area (existing conditions) and the potential changes to those environments due to implementation of the alternatives discussed in Chapter 2 (environmental consequences). It also presents the scientific and analytical basis for the comparison of alternatives presented. For ease in presentation and comparison, the analysis discussions are separated into individual resources areas.

Biological Evaluations (BE) have been prepared in compliance with the requirements of Forest Service Manual (FSM) 2670, 2671, FSM W.O. Amendments 2600-95-7, and the Endangered Species Act (ESA of 1973, as amended. A Biological Assessment (BA) will be prepared in compliance with the requirements of Forest Service Manual (FSM) 2630.3, FSM 2672.4 and the Endangered Species Act of 1973 (Subpart B: 402.12, Section 7 Consultation, as amended) on actions and programs authorized, funded, or carried out by the Forest Service to assess their potential for effect on threatened and endangered species and species proposed for federal listing (FSM 2670.1).

The effects of treatment are assessed for the entire unit. The amount of treatment within a unit is based on the occurrence of mapped weed sites, which totals about 14,547 acres across the Forests and Grassland. The amount of weed sites in a unit can be considered the maximum amount of area that would be treated in a year; however, the actual amount would likely be less, and would be based on priorities and limited by budget.

### 3.1.1 The Planning Area

The entire planning area involves nearly 3 million acres of National Forest and Grassland in Central Oregon, and lies within 55 fifth-field watersheds (see Table 36). Land in these watersheds is divided amongst the National Forest system, Confederated Tribes of the Warm Springs Reservation, Bureau of Land Management, State of Oregon, private timberlands and agricultural lands, and other private holdings.

The Inventory of invasive plant sites on the Deschutes and Ochoco National Forests and Crooked River National Grassland (Forests) amount to approximately 0.5 % of the National Forest System lands in Central Oregon.

## 3.1.2 Treatment Assumptions & Scenarios

The analysis in this chapter of the EIS is based on the assumption that none of the treatments would be considered 100 percent effective immediately after the initial entry. While initial entries in year one are estimated to eliminate 80 – 95% percent of the invasive plants at a site, maintenance entries would be required in either year one or in subsequent years.

The following assumptions were made about treatment scenarios.

- 80% effectiveness is assumed at each treatment area after each year. For example, if 1000 acres are treated in year 1 and the treatment is 80% effective, 200 acres would need to be treated in year 2. If 200 acres are treated in year 2 and the treatment is 80% effective, 40 acres would need to be treated in year 3.
- Herbicide methods would precede non-herbicide methods in most cases, because non-herbicide treatments will be most effective when populations have been substantially reduced through herbicide treatment. In some cases, manual, mechanical, and prescribed fire methods precede herbicide treatment.
- The treatments are required to recur for at least five years. Even though a site may be cleared of invasive plants before five years, the scenario used for analysis assumes a worse-case.
- Table A.1 of Appendix A lists the herbicides that would be effective on a particular site from first choice to fourth choice. It is assumed that the first choice herbicide would be used unless resource conditions warrant moving to the next choice (annual implementation plan will list these situations). Herbicides would generally be applied at or below typical application rate, and in no instance exceed rates allowed by label requirements or Project Design Features (Table 12). In project area units (PAUs) that list several species present, the infestations are most often distinct and application of more than one herbicide is not likely to occur on the same place at the same time.

This project would be implemented over the next 15 years approximately, as funding allows, until no more treatments were needed, or until conditions have changed sufficiently to warrant this EIS outdated. Site-specific conditions are expected to change within the life of the project: treated infestations would be reduced in size, untreated infestations would continue to spread, and/or new invasive plants could become established within the project area.

In most cases, herbicide treatment would precede manual or non-herbicide because the non-herbicide treatments will be most effective when populations have been substantially reduced through the use of herbicides. In some cases, manual and mechanical treatments would occur in advance of herbicide treatments. The most ambitious treatment scenario for analysis purposes would be for all sites to have an initial treatment in the first year. In reality, the amount to be treated in any year is estimated to be approximately 10% of the inventoried sites. The benefits and adverse impacts of treatment are likely to be less than predicted for the most ambitious scenario because funding and other constraints would limit the amount treated in any one year.

**Year 1, Most Ambitious Scenario**

- Total Acres Treated: 14,547[8]
- # of Sites Treated: 1,892
- Acres Treated with Herbicide: 13,424
- Acres Treated with Non-Herbicide: 760
- Percentage of Treatments that are Non-Herbicide: 5%
- Active Restoration- roughly 263 acres

**Relationship to Early Detection-Rapid Response Strategy**

All action alternatives include the ability for Forest Service land managers to approve treatments on currently unknown invasive plant sites while incorporating Project Design Features (see Appendix F). The premise of early detection-rapid response analysis approach is that treatments of new infestations in accordance with methods and design features defined in this project-level EIS will have similar effects to treatments of known sites.

If treatments are begun at an ambitious pace, early detection/rapid response would tend be a smaller part of the program in the future. If initial treatments are not ambitious, over time, early detection-rapid response could be expected to become a larger part of the annual program.

Even if the acreage treated in one year were to exceed the most ambitious treatment scenario, the effects analysis would still be valid, because the Project Design Features (PDFs) and Implementation Planning process described in Chapter 2 and Appendix F ensure that the plausible adverse effects of treating currently unknown infestations would be within the scope of those disclosed here. Section 3.8 provides further reasoning about how PDFs minimize or eliminate adverse effects to all non-target organisms.

## 3.1.3 Basis for Cumulative Effects Analysis

The Council on Environmental Quality (CEQ) regulations for the implementation of NEPA define cumulative effects as the "impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions…" 40 CFR 1508.7. Cumulative effects are discussed where there is an effect to the environment which results from the incremental effect of the action when added to other past, present, or reasonably foreseeable future actions (40 CFR 1508.7).

The cumulative effects considered in this EIS are related to the risks to the human environment associated with herbicide exposure or other invasive plant treatments. The risk of adverse effects of invasive plant treatments have been minimized by the Project Design Features (PDFs) described in Chapter 2.4, and therefore the potential for cumulative effects is minimal. Refer to Appendix D for information on how specific risks are addressed through PDFs. The Invasive Plant FEIS (USFS 2005a) serves as the basis for the site-specific effects analysis discussed in this EIS.

The effects of herbicide use are mainly limited to the site of application, and governed by the extent of the target species to be treated. Herbicide is only applied where needed. Drift from broadcast treatments is unlikely to harm non-target vegetation more than 20 feet away from treated areas (see

[8] The amount of acres is calculated from the inventoried invasive plant site coverage in GIS. This figure does not account for the variation in density or patchiness of the sites, so is an overestimation of the actual area covered by invasive plants and therefore the area actually treated with herbicides or other methods.

discussion page 124). Spot and hand treatments are far less likely to move off site. Herbicide potential to be delivered to streams is also managed through buffers and PDFs. Only land and roads within the National Forest System will be treated in the action alternatives. The proposed use of herbicides on and off National Forest system lands could result in additive doses of herbicides to workers, the general public, non-target plant species, and/or wildlife; however, risk of adverse effects of the use of the proposed herbicides has been minimized by the Project Design Features, Section 2.4, and although workers, the public, and fish/wildlife may be exposed, multiple exposures do not necessarily result in cumulative adverse effects. The herbicides proposed are water-soluble, are rapidly eliminated from humans and do not concentrate in fatty tissues and do not significantly bioaccumulate (USFS 2005a). Where more than one herbicide may be used in a PAU, the potential for synergistic effects is very low. The Invasive Plant FEIS (USFS 2005a) states "Combinations of herbicides in low doses (less than one tenth of the RfD) have rarely demonstrated synergistic effects."

The mobility and persistence of herbicides was considered in the development of Project Design Features, which also serve to limit the mechanisms by which additive doses of concern to people, wildlife, or fish could occur. All acute or chronic exposures identified in the R6 2005 FEIS as potentially exceeding thresholds of concern would be avoided. Thus, the effects of the use of herbicides within the scope of this project are unlikely to exceed thresholds of concern. This assumes our neighbors' use of herbicide complies with all applicable regulations and laws.

**Invasive Plant Treatment across the Watersheds**

There is no requirement for landowners to report invasive plant treatment information, so an accurate accounting of all acres of invasive plant treatment in the watersheds is not available. Beginning in 2007, the State of Oregon will require Pesticide Use Reporting to a centralized database (http://www.oregon.gov/ODA/PEST/purs_index.shtml). Reporting requirements will apply to those who use pesticides in the course of business or any other for-profit enterprise, to government entities, and for use in locations intended for public access.

The Invasive Plant FEIS (USFS 2005a) estimated that invasive plant control occurs on over 1.25 million acres in Oregon and Washington, with over 90 percent of the control through the use of herbicides. Even the highest estimates of herbicide use on the National Forests would account for less than three percent of the total land treated with herbicides in Oregon and Washington (USFS 2005a, p. 4-1).

Invasive plant management in the watersheds being analyzed for water quality (Section 3.6) is accomplished by the counties, private individuals, and federal agencies. The Prineville District of the Bureau of Land Management (BLM) uses herbicide to treat invasive plants under NEPA documents that were completed in 1996. They treated 1,200 acres in 2004. Counties are responsible for controlling noxious weeds along county roads and other county property outside of and within National Forest System lands. They also work with conservation districts and watershed councils to control noxious weeds on private property.

The Confederated Tribes of the Warm Springs and Bureau of Indian Affairs released a Vegetation Management Noxious Weed Control Plan and Assessment in 2005 that proposed manual, mechanical, biological, prescribed burning, as well as herbicide treatments. The plan is designed to treat and control invasive plants on the Reservation over the next five years. The amount of herbicide to be used on tribal lands is not available.

Land management activities tend to be more intensive on state and private lands than on adjacent National Forest System (NFS) lands. The NFS lands are generally in the upper portions of the affected watersheds. The largest use of herbicides in the planning area is on agricultural lands below the Forest boundary. Nonpoint sources of herbicides in streams and groundwater result from the agricultural use (USGS 2006). More information on agricultural herbicide use in contained in the analysis file.

Past and ongoing treatment of invasive plants on the Deschutes and Ochoco National Forests and Crooked River National Grassland are authorized under the decisions described in Chapter 2 (No Action Alternative). Additionally, recent wildfires have prompted invasive plant control through Burned Area Emergency Rehabilitation (BAER). Monitoring and/or hand pulling of invasive plants has been recommended by BAER teams for the recent fires including Eyerly (2002), Davis (2003), B&B (2003), Black Crater (2006), Lake George (2006), and Maxwell (2006).

The use of herbicides for treating unwanted vegetation (other than invasive plants) has been analyzed on the Deschutes National Forests under the following recent project: 18 Fire Competing Vegetation Project (20 units treated with spot application of granular hexazinone, beginning 2007, decision signed).

The actions proposed in these projects to do not overlap the invasive plant sites intended for treatment in this EIS. The effects analysis for this project indicated that the expected effects of the hexazinone applications will not extend beyond the immediate treatment areas. Hexazinone has a low risk of lateral transport of residues and application rates are applied to minimize the amount of herbicide residue left on the target plants. Additionally, the treatment of unwanted vegetation would not overlap in time with the proposed invasive plant treatments.

## 3.2 Herbicides, Adjuvants, Surfactants and Inert Ingredients

### Herbicide Risk Assessments

The effects from the use of any herbicide depends on the toxic properties (hazards) of that herbicide, the level of exposure to that herbicide at any given time, and the duration of that exposure. The R6 2005 FEIS used the herbicide risk assessments displayed in Table 20 to evaluate the potential for harm to non-target plants, wildlife, human health, soils and aquatic organisms from the herbicides considered for use on the Deschutes and Ochoco National Forests and Crooked River National Grassland.

Risk assessments were done by Syracuse Environmental Research Associates, Inc (SERA) using peer-reviewed articles from the open scientific literature and current Environmental Protection Agency (EPA) documents, including Confidential Business Information to which SERA had clearance. Information from laboratory and field studies of herbicide toxicity, exposure, and environmental fate was used to characterize the risk of adverse effects to non-target organisms.

The risk assessments considered worst-case scenarios including accidental exposures and application at maximum label rates. The R6 2005 FEIS added a margin of safety to the SERA Risk Assessments by making the thresholds of concern substantially lower than normally used for such assessments. Although the risk assessments have limitations (see R6 2005 FEIS pages 3-95 through 3-97), they represent the best science available.

Table 20 displays the risk assessments that may be accessed via the Pacific Northwest Region website at http://www.fs.fed.us/r6/invasiveplant-eis/Risk-Assessments/Herbicides-Analyzed-InvPlant-EIS.htm.

**Table 20.** Risk Assessments for Herbicides and Surfactants Considered in this EIS

| Herbicide | Date Final | Risk Assessment Reference |
|---|---|---|
| Chlorsulfuron | November 21, 2004 | SERA TR 04-43-18-01c |
| Clopyralid | December 5, 2004 | SERA TR 04 43-17-03c |
| Glyphosate | March 1, 2003 | SERA TR 02-43-09-04a |
| Imazapic | December 23, 2004 | SERA TR 04-43-17-04b |
| Imazapyr | December 18, 2004 | SERA TR 04-43-17-05b |
| Metsulfuron methyl | December 9, 2004 | SERA TR 04-43-17-01b |
| Picloram | June 30, 2003 | SERA TR 03-43-16-01b |
| Sethoxydim | October 31, 2001 | SERA TR 01-43-01-01c |
| Sulfometuron methyl | December 14, 2004 | SERA TR 03-43-17-02c |
| Triclopyr | March 15, 2003 | SERA TR 02-43-13-03b |
| NPE and Other Surfactants | May 2003 | USDA Forest Service, R-5 (Bakke 2003) |

In addition to the analysis of potential hazards to human health from every herbicide active ingredient, Bakke (2002, 2003) and SERA Risk Assessments evaluated available scientific studies of potential hazards of other substances associated with herbicide applications: impurities, metabolites, inert ingredients, and adjuvants. There is usually less toxicity data available for these substances (compared to the herbicide active ingredient) because they are not subject to the extensive testing that is required for the herbicide active ingredients under FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act).

Information on adjuvants and surfactants is tiered to the R6 2005 FEIS, which incorporated the *Analysis of Issues Surrounding the Use of Spray Adjuvants with Herbicides* (Bakke 2007) and the *Human and Ecological Risk Assessment of Nonylphenol Polyethoxylate-based (NPE) Surfactants in Forest Service Herbicide Applications* (Bakke 2003, Bakke 2007).

The Forest Service maintains a Pesticide management and Coordination website that contains human health and ecological risk assessments; pesticide use policy information; pesticide labels; material safety data sheets; and reports on pesticide use across National Forest System lands: http://www.fs.fed.us/foresthealth/pesticide.

**Nonylphenol Polyethoxylate (NPE)**

The primary ingredient in many of the non-ionic surfactants used by the USDA Forest Service when applying herbicides is a compound known as nonylphenol polyoxylate (NPE). A separate risk assessment (Bakke 2003b) for NPE surfactants was completed because concerns have been expressed about toxicity of the chemical components and breakdown products of NPE surfactants. NPE surfactants are appropriate for some applications where the herbicide label requires the addition of a surfactant. NPE surfactants may also improve efficacy in other herbicide applications where addition of a surfactant is optional. In some, but not all of these situations, there are alternative surfactants that would be effective that do not contain NPE (USFS 2005a). The typical application rate of NPE for USDA Forest Service, Pacific Northwest Region is 1.67 pounds per acre (USFS 2005a).

**Incomplete or Unavailable Information**

Risk assessments have a high degree of uncertainty in interpretation and extrapolation of data. Uncertainty may result from a study design, questions asked (and questions avoided), data collection, data interpretation, and extreme variability associated with aggregate effects of natural and synthesized chemicals on organisms, including humans, and with ecological relationships. Due to data gaps, assessments rely heavily on extrapolation from laboratory animal tests (USFS 2005a).

Regardless of disadvantages and limitations of ecological and human health risk assessments, risk assessments can determine (given a particular set of assumptions) whether there is a basis for asserting that a particular adverse effect is possible. The bottom line for all risk analyses is that absolute safety can never be proven and the absence of risk can never be guaranteed (SERA 2007). Further, a risk assessment has only been completed on one surfactant type (NPE) (Bakke 2003, 2007). Limited information on other surfactants, adjuvants, and inert ingredients is available in Bakke (2003, 2007) and various risk assessments. Since risk assessments have not been completed for most surfactants, adjuvants and inert ingredients, information regarding the toxicity and effects of these chemicals is largely unavailable.

For risk assessments considering adjuvants, surfactants and inert ingredients in herbicide mixtures, the information within the risk assessment may not be complete. SERA (2007) discusses how the risk assessments apply generally accepted scientific and regulatory methodologies to encompass these uncertainties in predictions of risk. SERA risk assessments identify and evaluate incomplete and unavailable information that is potentially relevant to human health and ecological risks. Each risk assessment identifies and evaluates missing information for that particular herbicide and its relevance to risk estimate. Such missing information may involve any of the three elements needed for risk assessments: hazard, exposure, or dose-response relationships. A peer-review panel of subject matter experts reviewed the assumptions, methodologies and analysis of significance of any such missing information. SERA addresses and incorporates the findings of this peer review in its final herbicide risk assessment.

### Herbicide Toxicology Terminology

The following terminology is used throughout this chapter to describe relative toxicity of herbicides proposed for use in the alternatives.

**Aquatic Label:** Some herbicides are labeled by EPA for direct application in water. While no direct application would occur in any alternative for this project, treatment of emergent invasives in standing water or dry stream beds may involve use of such formulations to meet label requirements. Aquatic labeled herbicides are not necessarily less hazardous to aquatic organisms than other herbicides, but have been more extensively tested (however, aquatic labeled herbicides are less hazardous to aquatic organisms than their terrestrial formulations). Aquatic labeled herbicides would not be favored over effective non-aquatic labeled herbicides that pose lower risk to aquatic organisms, assuming compliance with label advisories.

**Bioaccumulation:** The increase in concentration of a substance in living organisms as they take in contaminated air, water, or food because the substance is very slowly metabolized or excreted (often concentrating in the body fat).

**Exposure Scenario:** The mechanism (for example, by skin or ingestion) by which an organism (person, animal, fish) may be exposed to herbicides active ingredients or additives. The application rate and method influences the amount of herbicide to which an organism may be exposed.

**Threshold of Concern:** A level of exposure below which there is a low potential for observable adverse effects to an organism. The No-observed-adverse-effect level (NOAEL) is the exposure level at which there are no statistically or biologically significant differences in the frequency or severity of any adverse effect in the exposed or control populations.[9] When a hazard quotient is less than 1, risk

[9] The laboratory test include organ/tissue examination/dissection, lethal and non-lethal effects (i.e. behavior changes and weight loss).

is extremely low for any observable adverse effects due to the particular exposure scenario, and it is considered below the threshold of concern. Exposure scenarios are very conservative and therefore the risk characterization or threshold of concern is sufficiently protective. This level was further reduced in the R6 2005 FEIS to add a margin of safety to the risk assessment process for Threatened and Endangered species.

**Hazard Quotient (HQ)**: The Hazard Quotient (HQ) is the amount of herbicide or additives to which an organism may be exposed (dose) divided by the exposure threshold of concern (No Observable Adverse Effect Level – NOAEL). An HQ less than or equal to 1 indicates an extremely low level of risk. A HQ below 1 indicates a level below a threshold of concern.

**Lowest Observed Adverse Effect Level (LOAEL):** The lowest dose of a chemical in a study, or group of studies, that produces statistically or biologically significant increases in frequency or severity of adverse effects between the exposed and control populations.

**No Observable Adverse Effect Level (NOAEL):** Exposure level at which there are no statistically or biologically significant differences in the frequency or severity of any adverse effect in the exposed or control populations.

**No Observed Effect Concentration (NOEC):** Synonymous with NOEL.

**No Observed Effect Level (NOEL):** Exposure level at which there are no statistically or biologically significant differences in the frequency or severity of any effect in the exposed or control populations.

**Reference Dose (RfD):** The RfD is a numerical estimate of a daily exposure to the human population, including sensitive subgroups such as children, that is not likely to cause harmful effects during a lifetime. RfDs are generally used for health effects that are thought to have a threshold or minimum dose for producing effects.

## Risk Reduction Framework

Alternatives 2 and 3 incorporate a risk reduction framework to ensure the safe and effective use of herbicides. Figure 4 displays the layers of caution that are integrated into risk reduction framework for herbicide use in the United State Department of Agriculture (USDA) Forest Service, Pacific Northwest Region. First, label requirements, federal and state laws, and the EPA approval process provide an initial level of caution regarding herbicide use. Next, the SERA Risk Assessments (2001, 2003a, 2003b, 2003c, 2004a, 2004b, 2004c, 2004d, 2004e, 2004f) disclosed hazards associated with worst-case herbicide conditions (maximum exposure allowed by the label).

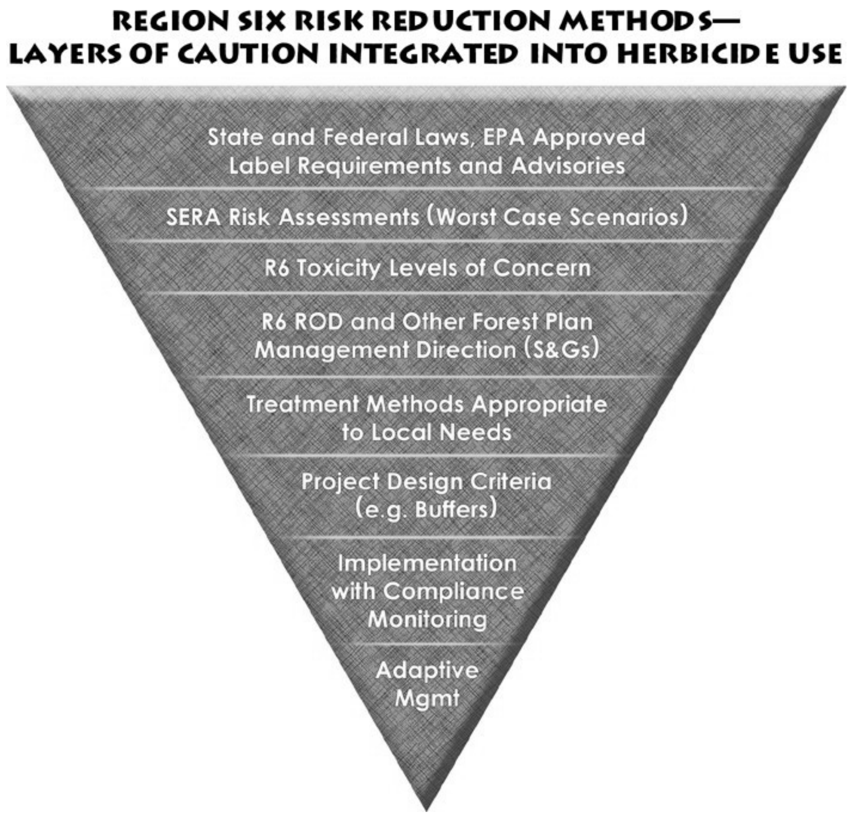


**Figure 5. Layers of Caution Integrated Into Herbicide Use**

The R6 2005 FEIS included an additional margin of safety by reducing the level of herbicide exposure considered to be of concern to Threatened and Endangered fish and wildlife. The R6 2005 ROD adopted standards to minimize or eliminate risks to people and the environment. This National Forest Site-Specific Invasive Plant Treatment Project is designed to comply with the R6 2005 ROD standards. Finally, the Project Design Features (PDF) further reduce the risks associated with herbicide treatments by eliminating or minimizing as much as possible the impacts to the environment (FEIS, Chapter 2.4).

Figure 4 also depicts how the site-specific situation on the Deschutes and Ochoco National Forests allows for additional layers of caution to be integrated into herbicide use locally:

1. Treatment methods have been limited to those necessary to eradicate, control or contain invasive plants on the Forests or Grassland; higher risk projects such as aerial application and/or broadcast application near wet streams were eliminated from consideration because they are not necessary to meet local invasive plant treatment needs.

2. Project Design Features ensure herbicide exposures under the Proposed Action will not exceed conservative levels of concern for people and botanical, wildlife, and aquatic species of local interest. The analysis throughout Chapter 3 demonstrates that herbicide use even under the most ambitious scenario under the Proposed Action is unlikely to result in exposures of concern. This is true for known infestations as well as those found in the future, because the Project Design Features (PDFs) serve to limit the rate, type, and method of herbicide application sufficiently to eliminate exposure scenarios that would cause concern, based on the site conditions at the time of treatment. Further analysis would be required if a new infestation would not be treated effectively according to the PDFs (for instance, the herbicides available for use near streams were not effective for a new infestation).

3. The implementation planning and monitoring and adaptive management processes described in Chapter 2 and Appendix F ensure that effective treatments are completed according to PDFs, and undesired effects are indeed minimized.

# 3.3 Invasive Species and Treatment Effectiveness

## 3.3.1 Affected Environment

The public, other agencies, and organizations expressed a strong desire to see the Forest Service utilize the methods necessary to make substantial progress in effective treatment of the invasive species. This was mostly expressed as a desire to see more herbicides used where they are the most effective treatment, and to avoid delay which could allow further spread. Comments were often tied to the concept of prevention. Restrictions on herbicide use tend to reduce treatment effectiveness and increase cost. Many invasive plants do not respond effectively to manual and mechanical treatments without herbicides.

### Invasive Plants

An invasive plant is a non-native plant whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112). Invasive plants are distinguished from other non-native plants in their ability to spread (invade) into native ecosystems. Some species of invasive plants are listed by the Secretary of Agriculture or by the responsible State official as “noxious weeds. This analysis includes all State-listed noxious weeds plus other invasive species that are of concern because of their impacts to ecosystem health. The term “invasive plants” more broadly encompasses all invasive, aggressive, or harmful non-indigenous plant species, whether designated noxious or not.

The consequences of invasive plant infestations can include alteration of the structure, organization, or function of ecological systems (Olson 1999). Invasive plants can increase soil erosion, leading to a disproportionate loss of biologically active organic matter and nitrogen. Invasive plants have the ability to deplete nutrients and water in the soil to levels lower than native plant species can tolerate, allowing invasive plants to out-compete native vegetation. Many invasive plants are early successional species, meaning they colonize areas that have been recently disturbed. Since invasive plants have the ability to deplete available resources to lower levels than native vegetation can tolerate, they can quickly dominate disturbed sites. When invasive plants dominate native plant communities, native plant species diversity is decreased. Invasive plants can out-compete native species because they produce abundant seed, have fast growth rates, have no natural enemies, and are often avoided by large herbivores. Some invasive plants also produce secondary compounds, which can be toxic to native plant species or animals. Weed infestation can therefore lead to a decrease in native plant species, which can alter the ability of wildlife to find suitable edible forage.

Invasive plants create a host of adverse environmental effects that are harmful to native ecosystem processes. Examples of these effects include: displacement of native plants; reduction in habitat and forage for wildlife and livestock; loss of threatened, endangered, and sensitive species; increased soil erosion and reduced water quality; reduced soil productivity; and changes in the intensity and frequency of fires. Invasive plants spread between National Forest system lands to neighboring areas, affecting all land ownerships. The problem is so great that the Chief of the Forest Service has included invasive species as one of the “Four Threats to the Nation’s Forests and Grasslands (http://www.fs.fed.us/projects/four-threats/).

Roads are conduits for the spread of invasive plants, providing for their transport and dispersal (e.g., seeds and vegetative reproductive parts attached to vehicles) and providing disturbed ground for easy colonization and establishment. Roads serve to introduce and establish invasive plants in areas where they were previously unknown, jeopardizing the ecological integrity of native plant communities.

## Scope of Problem

Thirty-two invasive plant species are inventoried, mapped and proposed for treatment on the Deschutes and Ochoco National Forests and Crooked River National Grassland (Table 9, page 32). In the past 10 years, nearly 2,000 invasive plant sites have been mapped covering 14,547 gross acres[10] (approximately 0.5% of the 2.3 million acres managed by the Forests and Grassland). Inventory is conducted during project planning, Burned Area Emergency Response, and as field going personnel, the public, or other agencies provide information on the location of invasive plants.

Additional invasive plant sites likely exist but have not yet been detected by annual inventory and mapping efforts. Some species, such as cheatgrass (*Bromus tectorum*), North Africa grass (*Ventenata dubia*) and Russian thistle (*Salsola kali*) occur in such abundance that many sites have not been mapped. Table 9 summarizes the 32 species that are proposed for treatment in this analysis.

Sites range in size from one plant to numerous plants scattered over large acreages (Table 21). The majority of inventoried sites (1,440 sites; 76% of known sites) are smaller than one acre; 215 sites (11% of known sites) are between 1 and 5 acres in size; 57 sites (3%) are between 5 and 10 acres in size; and 180 sites (10%) are equal to or larger than 10 acres. Table 22 summarizes the mapped number of sites of invasive plant infestations currently inventoried on the Ranger Districts and the Grassland.

The two Forests and Grassland share many of the same invasive plant species, such as spotted and diffuse knapweeds, Canada and bull thistles, St. Johnswort, and Dalmatian toadflax. Yet, there are differences between the units as to which species are especially problematic. Table 23 summarizes, by species, the number of sites and mapped gross acres currently proposed for treatment on each District and the Grassland. Medusahead, for example, is most abundant on the Crooked River National Grassland, while it occurs in very low numbers (if at all) on the other units. Though Dalmatian toadflax is established on Bend/Ft. Rock District, it is a new invader on the Grassland and, therefore, a high priority for treatment. Paulina District (Ochoco NF) contains the majority of houndstongue, and treating this species will be complex and require a long-term commitment. Paulina District has little medusahead; therefore, this species is a high priority for treatment before it encroaches onto other sites. Yellow star thistle is a high priority species for treatment on Lookout Mt. District; their one known site has been reduced from 5 acres to < ¼ acre through herbicide and manual treatments that were approved in a 1998 Environmental Assessment (USFS 1998b). Diligent annual monitoring and treatment will be necessary to ensure this site is eradicated and does not spread. Spotted knapweed is well established in the city of Bend, Oregon and road corridors continue to spread this species further onto adjacent Bend/Ft. Rock District (Deschutes NF) lands. Though spotted knapweed is abundant on Sisters District, diffuse knapweed is more abundant on this district compared to other districts in this project area. Crescent District does not have the scale of invasive plant problems like the other units, yet it plays a vital role in early detection and rapid response of new invader species entering our area via major highways (e.g., Highways 97 and 58). In the past few years, individual plants of yellow starthistle, kochia, and hairy whitetop have been found along Highway 97 and 58 and hand-pulled before flowering and setting seed.

[10] Gross acres: the area delineated by the outer perimeter of the weed infestation. The gross area may contain areas of land that are not currently occupied by weeds.

**Table 21.** Range of Invasive Plant Site Sizes.

| Size of Infestation | # of Invasive Plant Sites | % of Known Sites |
|---|---|---|
| < 1 acre | 1,440 | 76 |
| 1 to < 5 acres | 215 | 11 |
| 5 to < 10 acres | 57 | 3 |
| = or > 10 acres | 180 | 10 |
| **Total** | 1,892 | 100% |

**Table 22.** Number of invasive plant sites currently mapped and proposed for treatment within PAUs on the Deschutes and Ochoco National Forests and Crooked River National Grassland.

| Forest/Grassland | District | # Sites |
|---|---|---|
| **Deschutes National Forest** | | |
| | Bend/Fort Rock | 350 |
| | Crescent | 49 |
| | Sisters | 272 |
| | ***Forest Total*** | ***671*** |
| **Ochoco National Forest** | | |
| | Lookout Mountain | 713 |
| | Paulina | 355 |
| | ***Forest Total*** | ***1,068*** |
| | | |
| **Crooked River National Grassland** | | ***153*** |
| ***TOTAL FOR PROJECT AREA*** | | ***1,892*** |

**Table 23.** Number of sites and mapped acreages of invasive plants proposed for treatment on the Deschutes and Ochoco National Forests and Crooked River National Grassland. ***Deschutes National Forest: BFR*** *= Bend/Ft. Rock District;* ***CRE*** *= Crescent District;* ***SIS*** *= Sisters District.* ***Ochoco National Forest*****:** ***LOM*** *= Lookout Mountain District;* ***PAUL*** *= Paulina District.* ***CRNG*** *= Crooked River National Grassland.* ***Note:*** A site may contain multiple species; therefore sites and acreages are not cumulative.

| Species | Common Name | District | GIS polygon Acres | # Sites |
|---|---|---|---|---|
| *Acroptilon repens* | Russian knapweed | LOM | 0.2 | 2 |
| | | PAUL | 0.8 | 2 |
| | | CRNG | 36.6 | 3 |
| | | | | |
| *Arctium minus* | Lesser burdock | LOM | 0.1 | 2 |
| | | | | |
| *Cardaria draba* | Whitetop | LOM | 1.6 | 20 |
| | | PAUL | 10.8 | 43 |
| | | CRNG | 1.9 | 12 |
| | | | | |
| *Cardaria pubescens* | Hairy whitetop | CRE | 23.0 | 2 |
| | | | | |
| *Carduus nutans* | Musk thistle | LOM | 0.6 | 1 |
| | | | | |
| *Centaurea biebersteinii* | Spotted knapweed | BFR | 1,281 | 214 |
| | | CRE | 1,813 | 22 |

| Species | Common Name | District | GIS polygon Acres | # Sites |
|---|---|---|---|---|
| | | SIS | 2,836 | 101 |
| | | LOM | 19 | 122 |
| | | PAUL | 112 | 29 |
| | | CRNG | 484 | 43 |
| | | | | |
| *Centaurea debeauxii* ssp. *thuillieri* | Meadow knapweed | LOM | < 0.1 | 1 |
| | | | | |
| *Centaurea diffusa* | Diffuse knapweed | BFR | 538 | 7 |
| | | CRE | 1,437 | 9 |
| | | SIS | 2,363 | 45 |
| | | LOM | 12 | 64 |
| | | PAUL | 8 | 15 |
| | | CRNG | 831 | 39 |
| | | | | |
| *Centaurea solstitialis* | Yellow star-thistle | CRE | < 0.1 | 1 |
| | | LOM | 0.1 | 1 |
| | | PAUL | 1.1 | 1 |
| | | CRNG | < 0.1 | 1 |
| | | | | |
| *Cirsium arvense* | Canada thistle | BFR | 182 | 27 |
| | | CRE | 928 | 20 |
| | | SIS | 85 | 20 |
| | | LOM | 61 | 293 |
| | | PAUL | 13 | 96 |
| | | CRNG | 0.2 | 2 |
| | | | | |
| *Cirsium vulgare* | Bull thistle | BFR | 346 | 69 |
| | | CRE | 1,159 | 25 |
| | | SIS | 195 | 12 |
| | | LOM | 0.5 | 8 |
| | | PAUL | 0.8 | 8 |
| | | CRNG | 16 | 19 |
| | | | | |
| *Convolvulus arvensis* | Field bindweed | CRE | 28 | 3 |
| | | LOM | 0.8 | 9 |
| | | CRNG | 1.3 | 14 |
| | | | | |
| *Cynoglossum officinale* | Houndstongue | CRE | 88 | 2 |
| | | LOM | 263 | 83 |
| | | PAUL | 783 | 101 |
| | | | | |
| *Cytisus scoparius* | Scotch broom | BFR | 0.09 | 2 |
| | | CRE | 607 | 4 |
| | | SIS | 401 | 15 |
| | | LOM | 0.4 | 5 |
| | | PAUL | 0.1 | 1 |
| | | | | |
| *Dipsacus fullonum* | Teasel | LOM | 1.2 | 17 |
| | | PAUL | 2.8 | 6 |
| | | | | |

| Species | Common Name | District | GIS polygon Acres | # Sites |
|---|---|---|---|---|
| *Elymus repens* | Quackgrass | BFR | 38 | 2 |
| | | | | |
| *Euphorbia esula* | Leafy spurge | BFR | 1 | 1 |
| | | CRE | 1.3 | 1 |
| | | LOM | 0.1 | 1 |
| | | PAUL | 0.08 | 1 |
| | | | | |
| *Hypericum perforatum* | St. Johnswort | BFR | 28 | 12 |
| | | CRE | 1,108 | 21 |
| | | SIS | 1,755 | 78 |
| | | LOM | 4 | 26 |
| | | PAUL | 5 | 9 |
| | | CRNG | 0.2 | 3 |
| | | | | |
| *Iris pseudacorus** | Yellow flag iris | SIS | - | - |
| | | | | |
| *Kochia scoparia* | Kochia | CRE | 0.20 | 2 |
| | | CRNG | 0.1 | 1 |
| | | | | |
| *Linaria dalmatica* | Dalmatian toadflax | BFR | 132 | 68 |
| | | CRE | 230 | 9 |
| | | SIS | 111 | 7 |
| | | LOM | 0.1 | 1 |
| | | PAUL | 1.2 | 4 |
| | | CRNG | 0.1 | 1 |
| | | | | |
| *Linaria vulgaris* | Butter & eggs | BFR | < 0.1 | 1 |
| | | CRE | 439 | 8 |
| | | LOM | 0.3 | 4 |
| | | | | |
| *Melilotus officinale* | Yellow sweet clover | CRE | .01 | 2 |
| | | | | |
| *Onopordum acanthium* | Scotch thistle | BFR | 1 | 2 |
| | | CRE | 243 | 3 |
| | | SIS | - | - |
| | | LOM | 0.8 | 8 |
| | | PAUL | 11 | 3 |
| | | CRNG | 39 | 3 |
| | | | | |
| *Phalaris arundinacea* | Reed canarygrass | BFR | 110 | 14 |
| | | CRE | 2,188 | 7 |
| | | SIS | see ribbongrass | - |
| *Phalaris arundinacea* var. *picta* | Ribbongrass | SIS | 1 | 236 patches |
| | | | | |
| *Potentilla recta* | Sulphur cinquefoil | LOM | 3 | 26 |
| | | PAUL | 5 | 20 |
| | | | | |
| *Rubus discolor* | Himalayan blackberry | PAUL | 0.8 | 1 |
| | | | | |

| Species | Common Name | District | GIS polygon Acres | # Sites |
|---|---|---|---|---|
| *Salvia aethiopis* | Mediterranean sage | LOM | 16 | 5 |
| | | PAUL | 5 | 2 |
| | | | | |
| *Salsola kali* | Russian thistle | BFR | 267 | 9 |
| | | CRE | 132 | 2 |
| | | SIS | 9.3 | 2 |
| | | | | |
| *Senecio jacobaea* | Tansy ragwort | CRE | 88 | 9 |
| | | LOM | < 0.1 | 1 |
| | | SIS | 126 | 11 |
| | | | | |
| *Taeniatherum caput-medusae* | Medusahead | SIS | 6 | 1 |
| | | LOM | 14 | 33 |
| | | PAUL | 6.7 | 13 |
| | | CRNG | 4,756 | 25 |

* Yellow flag iris has been located on the Sisters Ranger District, but has not yet been mapped.

Invasive plant species may be established on one Ranger District of a National Forest yet be a new invader on a different District. For example, Dalmatian toadflax is established on the Deschutes National Forest yet is a new invader of Crooked River National Grassland. Two species that are new to our area but not yet established on the Forests and Grassland are slender false brome (*Brachypodium sylvaticum*) and orange hawkweed (*Hiereacium aurantiacum*).

## Mechanisms of Invasion and Spread

Invasive plant populations increase in acreage at an estimated rate of 8 to 12 percent per year on National Forest System lands in the United States (USFS 1999a). Existing populations of invasive plants could continue to spread at this rate on National Forest System lands as well as on adjacent land under other ownership and management. On National Forest System lands, the LRMP prevention standards and prevention guidelines will reduce this rate (USFS 2005b, Appendix 2-1). Invasive plant infestations tend to occur in disturbed areas. Although the presence of invasive plants is not a new phenomenon, the geographic scope, frequency, and the number of species involved have grown enormously as a direct consequence of expanding transport and commerce, especially in the past 200 years. Invasion occurs when invasive plant species are transported to new, often distant places where they proliferate, spread, and persist. The rapid rate of human expansion accounts for a majority of the long-distance dispersal of newly invading species (USFS 2005a).

Invasive plants have been introduced purposefully and accidentally. Most invasive plants have been introduced for horticultural uses by nurseries, botanical gardens, and individuals (Reichard and White 2001). Introductions through contaminated livestock feed, ornamental landscaping, road stabilization, and erosion control have occurred throughout National Forest System lands and adjacent lands in Oregon and Washington. Commercial landscape nurseries in Oregon and Washington sell, or once sold, exotic species for domestic landscaping that later were found to be invasive (such as English ivy and purple loosestrife). For instance, we believe that ribbongrass was introduced in the 1930s or 40s by a homeowner on the Metolius River for ornamental purposes. It is still sold today at nurseries and in garden centers of major home improvement stores. And for another example, on June 16, 2005, ODA confiscated 157 one-gallon containers of orange hawkweed being sold at a nursery in Deschutes County, Oregon. This species is quarantined in the State of Oregon and across the United States because it grows very aggressively. It is likely that plants were sold before the confiscation and have been planted in the area. Invasive plant species have been used in seed mixes on National Forest System lands for erosion control, bank stabilization, and burned area rehabilitation (USFS 2005a).

The mechanisms of spread for invasive plants include natural vectors such as birds, insects, or wildlife, and natural forces, such as water and wind. Wind and water in particular are major natural dispersal agents. Disturbance-based vectors are also mechanisms of spread for invasive plants. Invasion and dominance by invasive plants is highly correlated with soil disturbance, but are not limited to disturbed areas (Cox 1999). Invasive plants can readily invade, occupy, and dominate conifer plantations, road prisms, trails and trailheads, mined sites, gravel pits, river corridors, wildlife wallows and bedding areas, and rangelands. Many invasive species could also establish in naturally-occurring small openings. Natural and human induced small-scale and large-scale disturbance creates “safe sites” for invasive plant establishment, and in areas where desirable species are not available to occupy these sites, invasive species could dominate (USFS 2005a). Section 3.1 of the R6 Invasive Plant FEIS describes the many vectors for invasive plant spread, including timber and other vegetation management activities, roads management, livestock grazing, fire and fuels management, recreation and recreation management, and minerals and mining.

Invasive plant inventories indicate most infestations on the Forests and Grassland begin on disturbed areas, such as road shoulders and log landings. The road system throughout the Forests are a primary means of spreading invasive plants, providing vectors for dispersal (e.g., seeds and vegetative reproductive parts of plants attached to vehicles) and disturbed ground for invasive plant colonization and establishment. Seventy-two percent of the PAUs are located along roads. Timber harvest, livestock grazing, road building, and other ground disturbing management activities all contribute to the establishment and spread of invasive plants.

Wildfires also contribute to introduction and spread of invasive plants.[11] Fires often create disturbances that are conducive to invasive plant spread, particularly where competing vegetation is destroyed and soil is exposed. Large fires in Central Oregon involve firefighting resources from across Oregon and other states. Many of the vehicles involved have invasive plant seeds attached to undercarriages and wheels that spread plants along travel routes, in staging areas, within burns, and at incident command posts. Prevention practices now in place are helping to reduce the incidence of fire suppression vehicles spreading weeds (for example, a weed wash station was implemented at Cache Mountain Fire, USFS 2004d).

Often, Burned Area Emergency Response (BAER) teams are used to minimize threats to public safety, property, soil productivity, and water quality caused by large wildland fires. Invasive plants are an environmental threat that BAER teams must address. Monitoring of past fire events indicate that one to two years after fire events, noxious weeds spread about 60 percent in areas where they had already been established (USFS 2003a).

**Priority Species**

Table 24 lists the highest priority species for treatment on each District and the Grassland. Some species are a priority because they are established on the District and rapidly expanding and invading into native plant and wildlife habitats, while other species are a priority because they are new invaders and need to be controlled before they become established and control becomes more difficult, expensive, and time consuming. Though the species listed in Table 24 are

[11] From 1995 to 2004 the Ochoco NF saw 45,342 acres and the Deschutes NF saw 151,342 acres burned in wildfires.

currently the highest priority for treatment, this list can change any time that a new invasive plant species is discovered.

**Table 24.** Top 5 priority Invasive plant species for each district of the Deschutes and Ochoco National Forests and on the Crooked River National Grassland (*as of August 2005*).

| Forest/Grassland | District | 1st | 2nd | 3rd | 4th | 5th |
|---|---|---|---|---|---|---|
| **Deschutes NF** | **Bend/Ft. Rock** | Spotted knapweed | Dalmatian toadflax | Canada thistle | St. Johnswort | Reed canarygrass |
| | **Crescent** | Spotted knapweed | Leafy spurge | Dalmatian toadflax | Canada thistle | Reed canarygrass |
| | **Sisters** | Diffuse knapweed | Spotted knapweed | St. Johnswort | Scotch broom | Canada thistle |
| **Ochoco NF** | **Lookout Mt.** | Medusahead | Yellow star-thistle | Houndstongue | Scotch thistle | Spotted knapweed |
| | **Paulina** | Medusahead | Houndstongue | Spotted knapweed | Scotch thistle | Whitetop |
| **Crooked River National Grassland** | | Medusahead | Russian knapweed | Dalmatian toadflax | Scotch thistle | Spotted knapweed |

## Background Information

### Deschutes National Forest

In 1994, the Deschutes National Forest conducted public scoping and prepared a Categorical Exclusion environmental document to allow manual and biological control of 44 noxious weed sites[12] (the total number of known sites on the Forest at that time) on 1,657 acres (USFS 1994a).

The effectiveness of hand-pulling noxious weed sites varied, depending on the population size, and the ability to consistently and repeatedly treat sites (which depended on access, funding, and available labor). Though manual treatments were effective at some sites, District Weed Coordinators, who manage noxious weed sites on their districts, were unable to keep up with the overall rapid increase and spread of noxious weeds. By 1998, the Deschutes National Forest had 235 known noxious weed sites. In 1998, the Deschutes National Forest analyzed treatments on the highest priority sites and the Decision Notice/Environmental Assessment approved manual treatments on 98 sites covering 901 acres; biological control on 27 sites covering 149 acres, herbicide treatments on 40 sites covering 476 acres; and prescribed burning on one five acre site (USFS 1998a).

### Ochoco National Forest/Crooked River National Grassland

In 1995, the Ochoco NF and Crooked River National Grassland completed an Integrated Weed Management Environmental Assessment which approved treatments on 34 treatment areas, mostly along roads (USFS 1995f). Each Treatment Area contained several individual sites and species, for a total of about 304 individual sites on 285 acres. The Forest and Grassland saw a 90% reduction in the number of invasive plants on sites where herbicides were used; however, invasive plants continued to spread into new areas that were not approved for treatments.

Therefore, in 1998, the Ochoco NF and Grassland completed an Environmental Assessment (EA) that approved treatments on 72 sites covering 673 acres (USFS 1998b). Most of these sites occurred along roads, within managed right-of-ways, including road shoulders, pullouts, cut and

[12] The tern "noxious weeds" was used by the Forest Service in the past. We now use the term "invasive plant" to refer to all of the species we control, whether they are designated noxious or not.

fill areas, ditch lines, and associated maintenance areas such as gravel dump sites and rock pits. Herbicides were approved for use on sites that had 11+ individual plants. Sites that contain less than 10 weed plants are hand-pulled.

## Objectives of Treatment Methods Proposed in EIS

***Biological Control*** **--** Within the analysis area, biological control is proposed where sites are either too large to be sprayed with herbicides, the invasive plant species is so abundant that other methods would not be practical, or the biological control agent is effective on the target plant species and we can reduce or eliminate the need to use herbicides. Canada thistle is so abundant on Lookout Mt. District on the Ochoco National Forest that the most efficient treatment method at this time would be biological control. The toadflax stem weevil, *Mecinus janthinus*, is working very well on reducing Dalmatian toadflax infestations without the non-target plant effects that picloram can have (Langland, pers. comm 2006); therefore, biological control will be considered for use on Dalmatian toadflax populations throughout this analysis area. Biological control will comply with Regional Standard 14 (R6 2005 ROD) – we would not use any biological control agents that have been found to have adverse effects to native plant species.

***Cultural Treatments*** **--** Cultural treatments proposed in this EIS mainly focus on solarization techniques, such as using black plastic to cover reed canarygrass and ribbongrass in order to shade out and kill pieces of roots (i.e., rhizomes). Solarization coverings may have negative effects on soil microorganisms and do not selectively allow other plants to grow as would a selective hand application of an herbicide. However, in areas such as Big Marsh, solarization of small reed canarygrass sites is proposed only on ditches filled in with material from dikes constructed when ditches were dug in the 1940s. Reed canarygrass is well-established and occurs throughout the marsh.

***Manual Treatments*** – Manual treatments proposed in this EIS are mostly on small, easily accessible populations of annual (e.g., yellow starthistle) and perennial tap-rooted (e.g., spotted and diffuse knapweeds) species. The objective of manual treatments is to prevent seed production of invasive plants, which means that each population must be visited several times during the growing season to catch late-germinating plants, and these sites must be treated for many years (depending on the species) to prevent new plants from getting established from the soil seedbank. Houndstongue plants growing within 50 feet of the sensitive Peck's mariposa lily would be hand-pulled. Digging isolated plants or small patches of rhizomatous species can be effective if either all rhizomes are removed or resprouts are consistently and continually removed during the growing season. An example where this might be used would be patches of ribbongrass along edges of the Metolius River (in the water) where the roots are growing on top of cobbles.

***Mechanical Treatments*** **--** Mechanical treatments proposed in this EIS are in combination with other treatment methods to increase overall treatment effectiveness. Objectives are to reduce biomass so that less herbicide is used, and/or to stimulate new growth to make herbicides more effective, or to prepare a site for revegetation. For example, successful treatment of reed canarygrass has been to weed-whack plants down to about 4" tall, let the stems grow back for 1-2 months to about 10-12" tall, then do a fall application of aquatic labeled glyphosate (Tu 2005). This treatment should be repeated the next year and then follow-up planting of intermittent plugs of desirable species. The majority of proposed mechanical treatments involve using a weed-whacker, yet harrowing is proposed at two dense houndstongue sites that would first be burned and treated with herbicide, then harrowed to prepare the sites for revegetation.

***Prescribed Fire –*** In this EIS, prescribed fire is one of several integrated treatments proposed for two highly-disturbed PAUs on Paulina District. The treatment objectives are to prescribe burn houndstongue, which will reduce vegetative cover and stimulate houndstongue germination, then treat with herbicide, then disk the site to prepare for revegetation.

***Herbicide Treatments --*** The objectives of herbicide treatments are to more efficiently reduce the size of moderate to large infestations of invasive plants to a point at which they can be hand-pulled, to more efficiently treat large expansive areas where invasive plants are continually showing up due to the nature of the site or because manual treatments pose a safety issue, such as along major highways (e.g. Highways 97 and 26); and to effectively control invasive plant species that do not respond to non-herbicide methods. Different herbicides vary in effectiveness and length of control on different invasive plants, and herbicide techniques can vary in effectiveness, environmental effects, and costs. Oregon Department of Agriculture and Crook County weed control specialists provided a list of the preferred herbicides for each of the invasive plant species that currently exist within Invasive Plant PAUs and ranked these according to effectiveness (EIS, Appendix B). For example, clopyralid (the Transline formulation) would be the 1st choice herbicide for spotted and diffuse knapweeds, with picloram, glyphosate, and imazapyr 2nd, 3rd, and 4th choices. Their ratings also considered non-target vegetation effects. Glyphosate was ranked as 3rd or 4th choice for most herbicides (i.e., not the preferred option) because it is non-selective and will kill any plant that comes into contact with the herbicide, and has the potential to leave bare ground. Selective herbicides are more desirable for maintaining as much native vegetation on site as possible.

***Combination Treatments*** – The majority of time a combination of treatment methods is used to treat invasive plant sites. For example, as large invasive plant infestations are reduced in size, the preferred treatment would change from herbicide to manual. In large infestations, such as the Fly Creek area on Sisters, the center of the knapweed population would be treated biologically with insects and a combination of herbicides and manual treatments would be used along the periphery of the population to keep it from spreading further.

The proportion of infested acres that would be treated using herbicides varies between alternatives. Alternatives 2 and 3 differ in herbicide methods that can be used within aquatic buffer zones.

## 3.3.2 Environmental Consequences, Treatment Effectiveness

This section focuses on the relative likelihood that the treatment methods approved in each alternative would be effective in reducing invasive plant populations and, therefore, reducing threats to non-target vegetation from invasive plants. Treatment effectiveness increases with the number of treatment options available and the percentage of infested lands that may be treated. Rapid response to newly discovered infestations also increases treatment effectiveness.

**Summary of Findings for Treatment Effectiveness**

**Alternative 1 (No Action)** – This alternative is the least effective in controlling invasive plants. Fewer acres would be treated and treatment options are most limited. There would be no Early Detection/Rapid Response Strategy. Newly discovered invasive plant sites could not be treated until a new environmental analysis is completed, which can take years to accomplish, during which time invasive plants spread.

**Alternative 2 (Proposed Action)** – This is the most effective alternative for treating invasive plants. Ten herbicides are available for use, providing more options than Alternative 1 for effective treatment of invasive plants. Alternative 2 would allow broadcast spraying of invasive plants on more acres than Alternative 3. The Early Detection/Rapid Response Strategy would increase treatment effectiveness through quick response to newly discovered invasive plant populations, controlling them before they spread further.

**Alternative 3** – As with Alternative 2, ten herbicides are available for use, providing more options for more efficient and effective treatment of invasive plants than Alternative 1. The Early Detection/Rapid Response Strategy would increase treatment effectiveness through quick response to newly discovered invasive plant populations, controlling them before they spread further. The differences between Alternatives 2 and 3 are relatively small, currently affecting only about 230 of our mapped acres of invasive plants (Table 63). However, overall treatment effectiveness would be less than Alternative 2 because: 1) herbicides cannot be used within 10 ft. of perennial water, making it difficult to treat riparian rhizomatous invasive species, such as ribbongrass and reed canarygrass, that are difficult to manually treat, likely allowing increased spread into riparian areas; and 2) herbicides cannot be broadcast sprayed within 300 ft. of perennial streams and rivers, seasonal intermittent streams, perennial lakes and wetlands, and seasonal lakes, ponds, and wetlands; this would reduce treatment efficiency and effectiveness and likely result in fewer acres treated each year.

The effectiveness of an alternative to treat the diverse group of invasive plants depends on the variety of tools available (R6 2005 FEIS 4-15). Thus, alternatives that limit the variety of tools also limit the effectiveness of treatments. In many cases, treatment methods are most effective when used in combination with one another, as well as in combination with prevention activities in accordance with Integrated Weed Management principles. A study by Brown et al. (2001) showed that a combination of manual or mechanical and herbicide treatments was more effective than herbicides alone when dealing with a persistent species such as spotted knapweed.

Small infestations of some invasive plants could be treated effectively by manual or mechanical methods (Mazzu 2005). The key to effective hand pulling is to remove as much of the root as possible while minimizing soil disturbance (Tu et al. 2001). Generally, species that are annuals or biennials can be effectively treated manually if the populations are small and/or if there are not too many sites. Moderate to large infestations of annual and biennial invasive plant species may be difficult to treat manually, however, because treatments need to be repeated over many years and dormant seeds remain viable in the soil for many years. Rhizomatous invasive plant species are also very difficult to treat manually because there is a high likelihood of plants reproducing from vegetative parts (i.e., root or stolon fragments that break off and remain in the soil can revegetate, creating new plants). Brown et al. (2001) found that hand pulling spotted knapweed for two consecutive years was the most expensive treatment and provided less than 60% control of spotted knapweed after two seasons of pulling. They concluded that hand pulling is not an economically viable option on dense and/or large knapweed infestations.

Treating moderate to large infestations requires labor-intensive efforts of large workforces. Mazzu (2005) notes that non-herbicide methods can be more effective for some species if a consistent and large labor force is available, such as through volunteers. On the Bend/Ft. Rock District, a large infestation of spotted knapweed near the Besson Day Use Area has been hand-pulled for five years, yet the population has not been reduced (Powers 2006, pers. comm.).

The biology of the target invasive plant species must also be considered. Rhizomatous plant species, such as reed canarygrass and ribbongrass, can be especially problematic. Reed canarygrass is difficult to control due to its persistent rhizome system and its ability to reproduce vegetatively (Tu 2004). Herbicide treatment is often recommended for perennial species with rhizomes and/or creeping root systems, such as Canada thistle, leafy spurge, and reed canarygrass. Appendix A of the Botany Report summarizes life cycle, habitat, and mode of reproduction for invasive plant species documented on the Forests and Grassland.

The location and size of the infestation, species biology, environmental factors, management objectives, and treatment costs all factor into the choice treatment method(s) (USFS 2005a). Mazzu (2005) compiled information about treatment options for invasive plant species in the Forest Service's Pacific Northwest Region (Region 6). Mazzu's information was incorporated into Appendix B, which summarizes and discusses treatment options for those invasive species currently documented on the Forests and Grassland. Additional information about effectiveness of various treatment methods can be found in the Regional Invasive Plant FEIS (USFS 2005a, 3-80 to 3-92).

## Treatment Effectiveness Common to All Alternatives

All alternatives strive towards integrated treatments, such as using manual treatment as a follow-up to get plants missed by herbicide spraying, or using a mechanical method, such as weed whacking, on tall stems to reduce biomass and reduce the amount of herbicide used. Herbicide treatment is often followed up by manual or herbicide treatment later in the season to get plants that were missed by the initial herbicide application for several years later when invasive plant populations are reduced to the point at which they can be hand-pulled.

Invasive plant treatments that occur on parcels neighboring National Forest System lands contribute to project effectiveness. Invasive plants move between land ownerships and administrative units. Treatments should occur across land ownerships to optimize the effectiveness of these alternatives. Invasive plants are currently being treated on county and state lands and on some private lands and this work would continue regardless of the alternative that is selected. On-going partnerships will continue, such as the "Central Oregon Weed Gang", a consortium of state, county, federal, and private partners who have joined together to increase effectiveness of treating invasive plants across different land ownerships. Efforts such as the recent Central Oregon Weed Summit (January 31-February 2, 2006) will continue for all alternatives. The objective of the Weed Summit was to work together to promote healthy ecosystems by reducing invasive plants, acknowledging and furthering the economic and community benefits that healthy ecosystems provide.

The R6 2005 ROD amended all Pacific Northwest Region (Region 6) National Forests Land Management Plans to require they comply with a suite of invasive plant prevention, treatment and restoration standards (R6 2005 ROD, USFS 2005b). In addition to these required standards, the Deschutes and Ochoco National Forests and Crooked River National Grassland have developed Prevention Guidelines to be considered in planning and implementing projects. All three alternatives in this EIS will comply with the LRMP Standards and utilize the Forests and Grassland Prevention Guidelines. If appropriate prevention, treatment and restoration standards are implemented, it is reasonable to assume that the combined action of these measures will eventually reduce the overall size of invasive plant infestations in Region Six (USFS 2005a, 4-26). This would be the same for the action alternatives.

In all alternatives, the threat to native plant habitats from invasive plants is considered greater than any effects that would occur from treatments. Due to concerns about rare plant habitat loss from invasive plant species, sensitive plant populations immediately threatened by invasive plants are a high priority for treatment. All alternatives, including the No Action, approve a range of non-herbicide methods, including biological, manual and mechanical treatments. The variation between alternatives is mostly related to the use of herbicides and where they would be applied.

## ALTERNATIVE 1 – NO ACTION

### Direct and Indirect Effects

Under the No Action Alternative, invasive plant treatments would be limited to areas authorized under existing NEPA documents that were completed in 1998. Since 1998, many additional invasive plant sites have been mapped and, if left untreated, will continue to expand. Under Alternative 1, only 238 invasive plant sites would be treated of the 1,892 that are currently mapped (about 13% of mapped invasive plant sites). Therefore, the majority of invasive plant sites would not be treated under this alternative. It is highly likely that the majority of invasive plant populations within the Forests and Grassland would continue to expand, spread, and become increasingly more difficult and costly to control in the future and continue to further degrade native plant habitats. Invasive plants would continue to displace native plant species, thereby decreasing vegetative diversity. Untreated infestations would continue to spread and expand, serving as seed sources for new infestations both on and off federal lands.

**Table 25.** Summary comparison of the alternatives.

| Measuring Factors | Alt. 1 | Alt. 2 | Alt. 3 |
|---|---|---|---|
| # Herbicide formulations available for use | 4 | 10 | 10 (fewer in riparian areas) |
| # of invasive plant sites that could be treated | 238 | 1,892 | 1,892 |
| # of invasive plant sites that could be treated with herbicides, either alone or in combination with other techniques. | 113 | 1,892 | 1,892* |
| EDRR | No | Yes | Yes |
| Treatment Effectiveness | Low | Highest | High |

*Except those portions of sites within 10 feet of water.

Treatments approved in 1998 have been effective in reducing the size of some invasive plant populations. Effectiveness has depended on treatment type, population size, site conditions (e.g. compacted soil can reduce the effectiveness of manual treatments), funding and availability of labor. Monitoring has shown that herbicides have been effective at reducing invasive plant populations to a point at which they can be hand pulled. For example, a 5+ acre patch of yellow starthistle was reduced to 1/10$^{th}$ of an acre in four years (1999-2002) of spraying the site with picloram (Lesko 2006). This small site is now annually monitored and individual plants are hand-pulled. Herbicide treatments along Highway 97, a major thoroughfare and vector for spread of invasive plants, have resulted in a reduction of spotted knapweed; 77.7 acres were treated in year 2000; in 2005, only 7.6 acres needed treatment (Langland 2005a). Monitoring has shown a decrease in the number of knapweed plants within four plots on the Deschutes National Forest following a combination of herbicide and manual treatments (Table 26). (Grenier 2002). Monitoring has also shown that herbicide use on the Deschutes National Forest at approved sites has declined since year 2000. Though annual fluctuations in invasive plant populations might require more herbicide use in some years, the overall amount of herbicide use has declined as invasive plant populations have been controlled (Table 27). On the Deschutes National Forest, there were 195.1 acres treated with herbicide in year 2000; in 2005, only 29.18 acres were treated. Table 28 reports the decrease in herbicide use at selected sites on the Deschutes (ODOT 2005).

**Table 26.** Number of knapweed plants at four plots following a combination of herbicide and manual treatments, Deschutes National Forest.

| Year | Hwy 97 | Lava Butte | Skyliner Road | Bend Pine Nursery |
|---|---|---|---|---|
| 1999 (data collected prior to herbicide treatment) | 3000+ | Not treated; plants not counted | Not treated; plants not counted | Not treated; plants not counted |
| 2000 (data at 3 plots collected prior to herbicide treatment) | Data not collected | 3,447 | 1,195 | 2,651 |
| 2001 | < 200 | 20 | 215 | 63 |

**Table 27.** Herbicide acres and total herbicide usage on the Deschutes National Forest, 2000-2005 (Oregon Department of Agriculture 2005).

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|
| Total Acres Treated | 195.1 | 105.5 | 54.34 | 21.53 | 34.40 | 29.18 |
| Total Picloram Usage (gal.) | .5 | .25 | .24 | .09 | .15 | .10 |
| Total Glyphosate Usage (gal.) | 1.6 | 1.0 | .95 | .25 | .15 | .23 |
| Total Dicamba Usage (gal.) | 47.0 | 24.8 | 13.0 gal. | 5.38 | 8.39 | 6.97 |

**Table 28.** Percent reduction in the amount of herbicide used at selected sites, 2000-2004, Deschutes National Forest. Data from Oregon Department of Agriculture (2005).

| Invasive Plant Site | % Reduction in Herbicide Use in 2004 since treatment began in 2000 |
|---|---|
| Highway 97 | 92 |
| China Hat Road | 90 |
| Cascade Lakes Highway | 86 |
| Road 16, Sisters District | 100 |

Manual treatment has been effective at some invasive plant sites and will continue to be the preferred treatment (e.g., tansy ragwort sites on Crescent District in the Moore Creek timber sale units, PAU 12-01). However, manual treatments have not been effective at other sites, such as Besson Day Use Area on Bend/Ft. Rock District. This area has been pulled for five years and has not reduced the spotted knapweed population, largely due to the population size and compacted soil (Powers 2006, *personal communication*). On Paulina District (Ochoco National Forest), houndstongue is aggressively spreading despite manually treating it since 2000. The combination of expense and length of time for manual treatments results in fewer acres being treated than could be done with herbicides (Mafera 2006, *personal communication*). In smaller populations, manual treatment of houndstongue can be very effective, but there are large sites that are too dense to be practical for manual treatments. Untreated houndstongue sites continue to produce seeds and spread up and down drainages as seeds are transported into new areas by animals and/or winter/spring stream flows.

Alternative 1 would have a heavy reliance on manual treatment because only 113 sites are approved for herbicide use (6% of the total number of currently mapped 1,892 sites). Alternative 1 is limited in scope, with fewer sites treated and fewer tools available. NEPA decisions have approved use of herbicides on 40 sites on the Deschutes National Forest (USFS 1998a), 72 sites on the Ochoco National Forest and Crooked River National Grassland (USFS 1998b), and one medusahead site on Paulina District, Ochoco National Forest (USFS 2005c). Along Highway 20 on Sisters District of the Deschutes National Forest, spotted knapweed has expanded beyond the area approved for treatment in the 1998 Environmental Assessment and these expansion areas would not be treated under the No Action alternative. Recent large wildfires on Sisters District have also resulted in the rapid expansion of spotted knapweed and St. Johnswort. Left unchecked, invasive plant species will continue to expand and infest new areas, reducing the diversity and health of native plant communities.

A limited number of herbicides are available under the No Action Alternative. Only three herbicides are available for use on the Ochoco National Forest and Crooked River National Grassland (dicamba, glyphosate, and picloram). These three herbicides plus triclopyr are available for use on the Deschutes National Forest. The herbicides available under the No Action Alternative do not always provide the best options for the variety of invasive plant species and situations that are present within the Forests and Grassland because they are not as selective or effective on some species as the suite of herbicides proposed for use in Alternatives 2 and 3. Some of the newer herbicides that would be approved under Alternatives 2 and 3 are much more selective and would have fewer adverse effects on non-target species.

Of the four herbicides available for use on the Deschutes National Forest, dicamba has been the preferred choice for use on spotted and diffuse knapweeds. Since the Forests and Grassland Environmental Assessments were completed in 1998, new Forest Service risk assessments have determined that dicamba is in a higher risk category for humans, large mammals and birds (USFS 2005b, page 7). In fact, the R6 2005 FEIS dropped dicamba for use on National Forests; however, the No Action alternative would continue treatment of invasive plants as approved in the 1998 Environmental Assessment, which includes the use of dicamba.

Under No Action, the values at risk from invasive plants would continue to be great. There is likelihood that populations may be lost of sensitive plant species currently threatened by invasive plants. Sixty-one of the 289 Project Area Units (PAUs) have documented populations of Sensitive plants and, in many of these units, the invasive plant populations exist very close to Sensitive plant populations. Because Alternative 1 is limited in scope, treating the fewest invasive plant sites with the fewest tools available, it will be more difficult to ensure protection to all Sensitive plant populations as compared to Alternatives 2 and 3. Most of the newly discovered invasive plant sites (since the 1998 environmental assessments were completed) would not be treated. Therefore, it is likely that invasive plants will continue to increase and spread, jeopardizing Sensitive plants.

Meadow, riparian, and forest habitats would continue to be at risk. Roads would continue to act as vectors of invasive plant spread between National Forest and other lands. Only 113 sites would be treated, leaving some of the highest priority sites unchecked. As discussed earlier in this report, invasive plants can create a host of adverse environmental effects which are harmful to native ecosystems. Invasive plants displace native plants, reducing forage for wildlife and livestock, increase soil erosion and reduce water quality. When invasive plants dominate native plant communities, native plant species diversity is decreased. This reduction in biodiversity can indirectly affect insects and birds.

Alternative 1 does not incorporate an Early Detection/Rapid Response strategy to treat un-inventoried infestations of invasive plants that were not identified or specified in existing NEPA documents. The absence of this type of strategy would greatly increase the potential for new invasive plant infestations to establish and spread, further degrading native plant communities, altering ecosystem structure and functions (e.g., plant-pollinator relationships, mycorrhizal associations, species diversity and richness, etc.).

Invasive plant prevention, treatment and restoration standards adopted under the Regional Invasive Plant FEIS (USFS 2005a and 2005b) are expected to reduce the rate of spread of invasive plants across the Pacific Northwest Region. Though the rate of spread may be slowed by incorporating these prevention measures, existing untreated infestations will continue to impact native plants and plant communities. New invasive plant sites mapped since 1998 would not be treated under the No Action Alternative.

Invasive plant treatments that occur on parcels neighboring the National Forest system lands would contribute to project effectiveness where the Forest Service is able to treat infestations on its lands. Invasive plant movement between land ownerships and administrative units, and treatments should occur across land ownerships to optimize treatment effectiveness. However, as invasive plants continue to spread and the ability to treat them is limited with the No Action Alternative, overall treatment effectiveness with neighboring lands would be reduced.

Due to the limited ability to treat infestations that have been mapped since 1998, there would be no treatment of invasive species that have recently been identified as problematic. Ribbongrass, a variety of reed canarygrass (*Phalaris arundinacea* var. *picta*) has become a growing concern as recent surveys indicate this species has spread along the Metolius River. Friends of the Metolius, a group of concerned citizens who care about the beauty and biodiversity of the Metolius River, have approached Sisters District (Deschutes National Forest) requesting that action be taken to control this species. Alternative 1 would not allow treatment of the ribbongrass.

### Summary of Botany Treatment Effects for Alternative 1

In summary, Alternative 1 differs from the other alternatives in:

- ***Alternative 1 is limited in scope with fewer sites treated and fewer tools available.*** Only 238 sites would be treated compared to the known 1,892 sites. The majority of currently infested acres would not be treated leading to continued displacement of native plant species, including Sensitive and Survey & Manage plant species.
- ***Herbicide use would be limited -- fewer acres could be treated with herbicides and the number of available herbicides is limited.*** Herbicides are an effective tool for treating some invasive plant species in certain situations. Alternative 1 would treat about six percent of the current infested acres with herbicides. Limited use of herbicides may result in limited treatment effectiveness, resulting in further loss of native plants and habitats. Under Alternative 1, only three herbicides are available for use on the Ochoco National Forest and Crooked River National Grassland (dicamba, glyphosate, and picloram). These 3 herbicides plus triclopyr are available for use on the Deschutes National Forest.
- ***Increased spread of invasive plants could have long-term negative effects on native plant habitats.*** This, in turn, can have negative effects on many other resources, such as decreased wildlife forage, increased soil erosion, etc.
- ***No Early Detection/Rapid Response Strategy***. Alternative 1 does not provide a mechanism for quick response to newly discovered invasive plant populations before they become established. Once established, they are more difficult to control and fewer methods are effective.
- ***There would be no effects to Sensitive plants from invasive plant treatments at sites approved for treatment, yet increased spread of invasive plants (due to the limited scope of Alternative 1) may affect the future viability of sensitive plants.*** Earlier NEPA analysis and decisions concluded that the range of invasive plant treatments approved in 1998 Environmental Assessments would have no effect on sensitive plant species. However, our limited ability to effectively and efficiently treat invasive plants under Alternative 1 may result in loss of sensitive plants and eventually loss of some populations.

## ALTERNATIVE 2 – PROPOSED ACTION

Alternative 2 proposes to treat inventoried invasive plant populations within 289 Project Area Units. Treatment prescriptions and long-term site objectives have been developed to apply integrated pest management methods, such as combining manual and mechanical methods with the use of herbicides for more effective treatment. Ten herbicides analyzed in the Region 6 Invasive Plant EIS (USFS 2005a) would be available to more effectively control invasive plant infestations. The Proposed Action includes an Early Detection/Rapid Response strategy to treat new or expanding invasive plant infestations where the site conditions and preferred treatment fall within the scope of the proposed action.

Alternative 2 is not as restrictive as Alternative 1 in the use of herbicides, allowing the following in accordance with herbicide label restrictions:

- Herbicide use within 10 feet of perennial streams, lakes/wetlands, and seasonal intermittent streams (limited to application methods as shown in Table 16);
- The use of triclopyr, sethoxydim, and picloram within 300 feet of perennial streams, lakes/wetlands, and seasonal intermittent streams;
- Herbicide use in intermittent channels when they are dry;
- Broadcast spraying of some herbicides closer to perennial streams, lakes/wetlands, and seasonal intermittent streams than allowed under Alternative 3. For example, under Alternative 2, clopyralid could be broadcast sprayed up to 100 feet from perennial streams and lakes/wetlands and up to 50 feet of seasonal intermittent streams.

### Direct and Indirect Effects

Of the 3 alternatives, Alternative 2 provides the most options for what, how and where herbicides can be used. We expect that this would increase treatment effectiveness by providing more options to gain control over current infestations, therefore reducing further spread. Our current situation of largely relying on manual treatment has resulted in an increase in invasive plants at sites where manual treatments have not been effective. Invasive plant sites that are not eradicated continue to produce and disseminate seeds. In addition to providing more treatment options, Alternative 2 would result in treatment of significantly more acres than Alternative 1, and this would also to help reduce the rate of spread of invasives (Table 25).

About 230 acres of invasive plant sites could be treated with herbicides within riparian areas. Overall treatment effectiveness would be greater under Alternative 2 because: 1) herbicides could be used within 10 ft. of perennial water, allowing us to use herbicides to treat riparian rhizomatous invasive species (ribbongrass and reed canarygrass) that are difficult to manually treat; and 2) herbicides could be broadcast sprayed within 300 ft. of perennial streams and rivers, seasonal intermittent streams, perennial lakes and wetlands, and seasonal lakes, ponds and wetlands, increasing our ability to treat more acres more efficiently.

Treatment effectiveness is increased when the most effective treatment method can be used in the most efficient way. Alternative 2 provides the most options for what, how and where herbicides could be used. Some of the most abundant invasive plant species on the Forests and Grassland are spotted and diffuse knapweeds, with hundreds of sites (700+) spread across 1,000s of acres. Of the ten herbicides approved in the R6 2005 FEIS, clopyralid would be the most effective herbicide for spraying knapweeds with the fewest non-target vegetation effects. The selectivity of clopyralid is what reduces the potential effects to non-target vegetation. As discussed previously, clopyralid targets plant species in four plant families: sunflower, pea, nightshade, and buckwheat families. Spotted and diffuse knapweeds occur along roads and in adjacent forest lands, often occurring within 300 feet of perennial streams, lakes/wetlands, and seasonal intermittent channels. Because clopyralid is selective, it can be broadcast sprayed over many common shrubs and plants that would be unaffected by the herbicide, allowing more efficient and effective treatment. Under Alternative 2, clopyralid could be broadcast sprayed up to 100 feet from perennial streams and lakes/wetlands and up to 50 feet of seasonal intermittent streams. Broadcast spraying is actually done in a very selective manner, switching easily and quickly between using a hand application technique to a "selective patch broadcast" method (Langland 2005b, per. comm.; Alexanian 2006, pers. comm.), so that patches of vegetation are only treated if they are occupied by invasive plants. This method allows for selective broadcast spraying only where needed, minimizing herbicide use and non-target plant damage, yet increasing treatment efficiency. Increased efficiency will increase treatment effectiveness in the long run. Under Alternative 3, clopyralid could not be broadcast sprayed within 300 feet of these water bodies. Clopyralid could not be used at all under Alternative 1.

Similarly, houndstongue has become a serious problem on the Ochoco National Forest, particularly on Paulina District, where it inhabits both upland and riparian areas, as well as the transition zones in between. Numerous streams and intermittent channels dissect the Ochoco National Forest. Of the three alternatives, Alternative 2 provides increased ability to treat houndstongue because it would allow broadcast spray of metsulfuron methyl on houndstongue up to 100 ft. of perennial streams, lakes and wetlands, and up to 15 feet of seasonal intermittent streams, therefore allowing more efficient treatment of more acres than would be allowed under Alternative 3. Current information suggests that this herbicide would be the most effective option for treating houndstongue (Alexanian 2006, pers. comm.). Alternative 1 does not allow the use of metsulfuron methyl. Alternative 3 would not allow broadcast spray of houndstongue within 300 ft. of any water bodies, including seasonal intermittent streams, which would result in more acres of manual treatment for houndstongue control. Houndstongue can be effectively treated manually; however, as discussed under Alternative 1, the combination of expense and length of time for manual treatments of houndstongue results in fewer acres being treated and increased opportunity for it to spread. Treatment of this species would be most effective under Alternative 2.

Increased treatment effectiveness would provide more long-term habitat protection to Sensitive plant species. Spotted knapweed grows intermingled with bitterbrush within Peck's penstemon populations. As with bitterbrush; clopyralid could be broadcast sprayed over Peck's penstemon without harming it. Peck's penstemon is in the figwort family which is not targeted by clopyralid. Clopyralid is considerably more selective than the herbicides allowed under the No Action Alternative and would afford more protection to native plant species, including rare plants, while increasing treatment effectiveness.

Under Alternative 2, there are no buffers required for spot or hand applications of the aquatic formulation of glyphosate. This would allow more effective treatment of riparian rhizomatous invasive plant species, such as ribbongrass, which grows along the edges of and on islands within the Metolius River, and reed canarygrass, which grows along the edges of lakes, rivers, streams, and in wetlands. Herbicides have proven to be effective on reed canarygrass (Tu 2005, pers. comm.). Alternative 2 also allows treatment of invasive species that are below the high water mark as water levels drop seasonally. Treatment effectiveness of riparian invasive plant species would be greater under Alternative 2 than under Alternatives 1 and 3.

In some cases, use of herbicides will be important in achieving successful revegetation of invasive plant sites. A study of Russian knapweed in riparian areas along the Missouri River in eastern Montana found that herbicides are a key component in achieving revegetation success (Henry 2004). Without herbicide treatments before seeding, the researchers had very poor native species establishment. Alternative 2 proposes revegetation of Rimrock Springs Dam in Project Area Unit 75-20 after herbicide treatment of Russian and spotted knapweeds and Canada thistle.

Treatment and restoration of this very disturbed site would likely be most effective under Alternative 2 due to our ability to use herbicides prior to revegetating the site.

The adoption of an Early Detection/Rapid Response strategy would allow for quick treatment of newly found invasive plant populations, thereby preventing their spread, reducing ecosystem impacts, and greatly increase treatment effectiveness.

Under both Alternatives 2 and 3, the amount of herbicide used would decrease over time at specific sites as invasive plants are controlled. Monitoring (discussed earlier under Alternative 1) has shown that many sites treated with herbicides and/or a combination of herbicides plus manual treatments have reduced invasive plant populations and, therefore, the use of less herbicide at specific sites due to treatment effectiveness. Though invasive plant populations can fluctuate yearly and herbicide use can vary from year to year, overall, the amount of herbicide used has decreased over five years of treatment (Table 27).

### Summary of Botany Treatment Effectiveness for Alternative 2

In summary, Alternative 2 is expected to have the highest treatment effectiveness of the three alternatives:

- ***All ten herbicides would be available for use.*** Treatment effectiveness would be increased with the ability to select the appropriate and preferred herbicide. On many sites, more selective herbicides will result in effective treatments with fewer effects to non-target plant species.
- ***Allows treatment of all currently mapped invasive plant sites.***
- ***Allows broadcast spraying of herbicides within 300 ft. of perennial water.*** More acres could be treated more efficiently, therefore increasing overall treatment effectiveness where it is necessitated by size and density of the invasive plant population.
- ***Allows use of herbicides close to water to treat riparian invasive plant species.***
- ***Early Detection/Rapid Response Strategy.*** Treatment effectiveness would be increased through quick response to newly discovered invasive plant populations, controlling them before they spread even further.
- ***Increased treatment effectiveness would provide more long-term protection to native plants and native plant habitats, including rare plant species.***

## ALTERNATIVE 3

Alternative 3 was developed to respond to issues surrounding the effects to aquatic organisms. The areas proposed for invasive plant treatments are the same as Alternative 2, but differ in the prescriptions. Under Alternative 3, a 300-foot buffer will apply to all perennial streams, all fish bearing streams and all perennial lakes, ponds, and reservoirs. Within the buffers, treatment methods are restricted as described in Chapter 2.

### Direct and Indirect Effects

Alternatives 2 and 3 differ as far as treatment efficiency. Both alternatives include the use of the ten herbicides that were approved in the R6 2005 FEIS. However, a primary difference between the two alternatives is the herbicide methods that can be applied within 300 ft. of water and the use of herbicides close to water (within 10 ft.).

Alternative 3 restricts broadcast spraying within 300 feet of water bodies because of concerns about potential delivery to streams from drift. Most herbicides can still be applied in Alternative 3, but must be spot sprayed or hand applied. These techniques would be effective in controlling target invasive plants, yet, at many sites, would not be as efficient as broadcast spraying, likely resulting in annual treatment of fewer acres than Alternative 2. About 230 acres of mapped invasive plant sites could not be treated with herbicides at all because of riparian restrictions under Alternative 3. If fewer acres are treated and it takes longer to reach target goals of controlling invasive plant populations, then treatment effectiveness would be lessened and existing invasive plant populations left untreated would continue to expand. Spotted and diffuse knapweeds are some of the most prevalent invasive plant species in central Oregon, and both occur within 300 feet of perennial water bodies and intermittent stream channels. Under Alternative 3, knapweed populations within 300 feet of perennial water bodies could not be broadcast sprayed. Spot spraying of these populations would be an effective treatment, but efficiency would be reduced, requiring more labor-intensive treatments likely resulting in fewer sites treated.

In some situations, treatment effectiveness would be reduced under Alternative 3 because triclopyr, picloram and sethoxydim cannot be used within the 300 ft. buffer. The only mapped site of Himalayan blackberry occurs along Cottonwood Creek on Paulina District, growing approximately 50 feet or less from this perennial creek. This site is expanding and, if left unchecked, has the potential to become a very large infestation. Triclopyr is the preferred herbicide for treating Himalayan blackberry (Appendix B). Triclopyr is a selective systemic herbicide for woody and broadleaf species, especially root- or stem-sprouting species (Appendix D). Within the 300 ft. buffer, another herbicide option would be glyphosate, which is a broad spectrum, non-selective herbicide that can kill any plant it touches. Triclopyr would be the more selective option (applied using a cut stump method). The canes of Himalayan blackberry can grow up to lengths of 7 meters in a single season (Mazzu 2005). Once first year canes have arched over and hit ground, daughter plants can develop where cane apices have rooted. This aggressive species is a high priority for treatment with the objective of eradicating it before it spreads further.

On Paulina District, houndstongue infestations run up drainages between the creek and adjacent scablands. Rarely are these infestations greater than 300 feet wide on each side of the creek. Alternative 3 restricts broadcast spraying within 300 feet of perennial water bodies, resulting in less efficient treatment of these populations than under Alternative 2.

Alternative 3 does not allow herbicides to be used within 10 feet of perennial or fish bearing streams, rivers, lakes, ponds or reservoirs; therefore, reducing our ability to effectively treat ribbongrass, a rhizomatous invasive plant species that occurs adjacent to the Metolius River. Manual treatment of ribbongrass would be difficult – about 250 clumps of ribbongrass are scattered along ten miles of the Metolius River and many sites are difficult to access, especially those clumps occurring on islands within the river. It would be difficult to consistently and repeatedly hand-pull sprouting stems throughout the growing season. Likewise, reed canarygrass is a rhizomatous riparian species that occurs along the edges of streams and lakes that can be difficult to hand-pull. With both species, root fragments left behind have the potential to resprout. Soil solarization could be an option, placing a cover, usually black or clear plastic, over the soil surface to trap solar radiation and cause an increase in soil temperatures to levels that kill plants, seeds, plant pathogens, and insects (Tu et al. 2001). Soil solarization, however, can cause significant biological, physical, and chemical changes in the soil that can last up to two years, and deter the growth of desirable native species (Tu et al. 2001). Soil solarization techniques are being considered for small selective populations of reed canarygrass in Big Marsh on Crescent District, Deschutes National Forest, where herbicides are not desirable due to the presence of rare wildlife and plant species. If a solarization technique were to be used in Big Marsh, it would be limited to disturbed areas created by hydrologists as part of a long-term marsh restoration process; these areas would be revegetated with genetically-local native plant species. At most other reed canarygrass and ribbongrass sites, soil solarization may not be practical due to the expanse of the target invasive populations.

Treatment effectiveness within the 10 ft. no-herbicide riparian zone can also be reduced for tap-rooted species, such as spotted knapweed. Manual pulling of spotted knapweed in riparian areas can be very difficult (Powers 2006, pers. comm.). In some riparian sites, the soil is compacted from heavy recreation use. Some sites are difficult to pull due to the multitude of intertwined roots from other plant species in more densely vegetated riparian areas. The ten foot no-herbicide buffer under Alternative 3 may result in less effective treatment of those riparian sites where these conditions occur.

As described under Alternative 2, the amount of herbicide used will decrease over time at specific sites as invasive plants are controlled. This would be the same for both Alternatives 2 and 3. Invasive plant populations fluctuate annually due to weather and other variables and more herbicide might be used in one year than in a previous year; however, monitoring has shown that in the long-term (4+ years), herbicide use at treated sites would decrease as invasive plants are controlled.

### Summary of Botany Treatment Effectiveness for Alternative 3

Alternative 3 is expected to have higher treatment effectiveness than Alternative 1, but lower treatment effectiveness than Alternative 2. In summary, under Alternative 3:

Alternative 3 is expected to have higher treatment effectiveness than Alternative 1, but lower treatment effectiveness than Alternative 2. In summary, under Alternative 3:

- ***Ten herbicides would be available for use but three cannot be used within 300 ft. of water.*** As with Alternative 2, treatment effectiveness would be increased more than Alternative 1 with the ability to select the appropriate and preferred herbicide. On many sites, more selective herbicides will result in effective treatments with fewer effects to non-target plant species.
- ***Restrictions on broadcast spraying would reduce treatment efficiency, lowering treatment effectiveness.*** Populations of high priority invasive plants (e.g., spotted and diffuse knapweeds and houndstongue) within 300 ft. of perennial water bodies could not be broadcast sprayed, which may be the most effective treatment (depending on the species and situation). Spot or hand herbicide application methods could still be effective, but would be slower to apply, possibly resulting in treating fewer acres annually (depending on budgets).
- ***Restricts herbicide use within 10 ft. of water.*** This would reduce treatment effectiveness of invasive plants that are difficult to treat with other methods, such as reed canarygrass, ribbongrass, and yellow iris.
- ***Early Detection/Rapid Response Strategy.*** Treatment effectiveness would be increased through quick response to newly discovered invasive plant populations, controlling them before they spread even further.

### Cumulative Effects for Treatment Effectiveness for All Alternatives

Land Management Plans for all Pacific Northwest Region (Region 6) National Forests were amended in 2005 to include Regional Invasive Plant Standards for prevention, treatment and restoration. All three alternatives in this EIS would comply with these standards, which are intended to reduce the spread of invasive plants and protect and restore healthy ecosystems.

Cumulatively, these standards will increase treatment effectiveness by reducing invasive plant spread and the number of new infestations that need to be treated. The Forests and Grassland began implementing these Standards in March 2006. For example, Invasive Plant Coordinators have been working with engineers and other resources specialists to inspect material source sites in compliance with Regional Standard #7. All three alternatives would incorporate the Forest and Grassland Prevention Guidelines that were developed to reduce the spread of invasive plants (Appendix G).

All Forest and Grassland projects consider invasive plants during project planning. For each project, an invasive plant risk assessment is developed to assess if the project has a high, moderate or low risk of introducing and spreading invasive plants. Mitigations are developed for each project to reduce identified risks. Invasive plant risk assessments would be completed for other activities regardless of the alternative selected from this EIS. There would be a beneficial cumulative effect over time as we assess and prevent the risk of invasive plant spread through project modifications. However, the long-term success of prevention measures is influenced by how many invasive plants are present on the landscape. Currently, we have many more invasive plant sites than in 1998, making it more difficult to gain effective control.

Even with the implementation of Regional Standards and local Forest planning efforts, invasive plants would continue to increase and spread at an estimated annual rate of 8-10% during the next 10+ years under the No Action Alternative. Limited invasive plant treatments would result in existing populations continuing to spread, with an overall increase in invasive plants throughout the Forests and onto adjacent land ownerships. Over the same time period, Alternatives 2 and 3 are expected to more effectively and efficiently treat invasive plants than Alternative 1, resulting in beneficial cumulative affects.

Common to all three alternatives is the cumulative effect of increased disturbance and recreation over time within the Forest and Grassland, driven by increasing human population growth and pressure. Ground- and habitat-disturbing forest management activities, over time (10, 20, 30+ years hence), would continue to create opportunities for invasive plants to establish and spread. Management activities include timber harvest, increased visitor and recreational use, road building, road decommissioning, rock excavation at quarries, maintenance and improvement of existing facilities, construction of new facilities, grazing, fuel reduction treatments, and fire suppression. Demands on the Forest and Grassland are likely to continue to increase over the course of time as a result of steady human population growth in central Oregon. Spread of invasive plants from adjacent private lands onto the Forest and Grassland can be expected. Without effective and rapid treatment, invasive plant populations are highly likely to increase within the Forest and Grassland over time, altering and degrading increasingly more native plant communities and thereby negatively affecting many ecosystems services and values, such as wildlife and plant diversity, forest and soil health, recreational opportunities, and scenic (viewshed) quality. These cumulative effects are expected to be greater under Alternative 1.

National Forest System lands closest to cities within central Oregon will continue to be vulnerable to invasive plants. Numerous large infestations of invasive plants, such as spotted knapweed within the Bend city limits, will continue to spread from these areas along major highways (which serve as seed dispersal vectors) onto National Forest System lands. Recreational forest users coming from these cities are apt to unknowingly carry seeds on cars, off-highway vehicles, mountain bikes, horses, etc. On-going partnerships with State, County and private groups, such as the Sunriver Owner's Association, may help reduce the spread in the long-term, but, current existing infestations will continue to provide seed sources. Treatment effectiveness is highest under Alternative 2 and this would help to reduce the cumulative effects of persistent and continuing invasive plant spread. The Early Detection/Rapid Response Strategy in Alternatives 2 and 3 would allow efficient and effective treatment of new invasive plant populations along major highways, preventing spread onto adjacent National Forest System lands.

Wildfires will continue to occur in the future. Many invasive plant species germinate readily after wildfire and, being as they are adapted to colonize disturbed sites, they move rapidly into and across large areas opened up by fire. Early Detection/Rapid Response Strategies built into Alternatives 2 and 3 would increase treatment effectiveness and this would have a cumulative positive effect in reducing spread of invasive plants.

Alternatives 2 and 3 both include an Early Detection/Rapid Response Strategy which would allow relatively rapid treatment of newly discovered invasive plant populations as long as the sites have the same characteristics as sites analyzed in this EIS. Rapid treatment of invasive plant populations would cumulatively reduce invasive plant spread throughout the Forests and Grassland and also have beneficial effects to adjacent private lands.

There would be beneficial cumulative effects when invasive plants that cross land ownerships are treated by the land owners, such as private landowners and state, county, and federal agencies. There are also beneficial cumulative effects when treatments occur at sites that have a high potential to spread seeds, such as quarries and fire camps. For example, on the Ochoco National Forest, the Turnpike Pit Medusahead Control Environmental Assessment approved treatment of medusahead within a rock pit, which will prevent further spread of this aggressive species by transport and use of materials from this area (USFS 2005b).

# 3.4 Native Vegetation and Botanical Species of Local Interest

This section addresses effects of invasive plants and herbicides on non-target native plants, including Sensitive and Survey and Manage (S&M) plant species.

The effects of non-herbicide methods are analyzed in Appendix J of the R6 2005 FEIS. Non-herbicidal methods include manual, mechanical, fire, cultural, restoration/revegetation, and biological control. While some native vegetation may be impacted by manual and mechanical methods, such as unintentional removal or trampling of flowers, fruits or root systems, these effects are unlikely to be significant with properly trained crews. Most of the concerns about adverse effects of treatment are related to herbicide use, either from direct spray and/or the potential for drift, leaching or runoff to affect non-target vegetation.

## 3.4.1 Affected Environment

The Deschutes and Ochoco National Forests and Crooked River National Grassland contain a wide variety of plant species and communities due to varying elevation and precipitation zones that occur within Central Oregon. The project area ranges from high elevation alpine habitats in the Cascade Mountains that receive 120 inches of annual precipitation to desert habitats that receive about 8-10 inches of annual precipitation.

Invasive plants pose threats to biological diversity of native plant communities, altering ecosystem processes. Invasive plants contribute to the decline in frequency of native plant species that depend on similar habitats, cause a decline in overall species numbers, are highly adept at capturing available moisture and nutrients, and are often able to quickly spread. Displacement of native vegetation, decreased species diversity, and changing habitat structure and composition result from invasions by invasive species (Olson 1999).

In general, grasslands, riparian areas, and relatively dry, open forests are more susceptible to invasion than are dense moist forests and high montane areas (USFS 2005a, 3-40; Interior Columbia Basin Ecosystem Management Project 2000). The former have frequent gaps in plant cover, which favor invasive plant establishment, whereas the latter have relatively closed plant cover or have extreme climate or soils, which are tolerated by fewer invasive plant species. Invasive plants tend to colonize disturbed ground along roads, highways, utility (power line and gasoline) corridors, recreational residences, and along trails and in campgrounds and quarries. Once established, invasive plants begin to spread, displacing native vegetation. Eastside forests are more susceptible to invasive plants for the above reasons.

Plant communities can be classified by a variety of factors such as vegetation structure, site moisture, overstory and understory. The Pacific Northwest Region Invasive Plant FEIS (USFS 2005a) used broad Potential Vegetation Groups (PVGs) to rate the susceptibility of vegetation. The susceptibility of plant communities to invasion can be influenced by many factors, including disturbance levels, community structure, and the biological traits of the invader species. Overall, the majority of plant community types found on the Deschutes and Ochoco National Forests and Crooked River National Grassland are highly susceptible to invasion (see Table 8 of the Botany Report for a summary of plant community types in the planning area).

## Threatened, Endangered and Sensitive Plant Species

The Forest Service is directed to manage habitats for all existing native and desired non-native plants, fish, and wildlife species in order to maintain at least viable populations of such species. This direction comes from the Forest Service Manual section 2600 (USFS 1995, WO Amendment 2600-95-7) and stems from direction provided by the Endangered Species Act. Forest Service Manual (FSM) 2670.5 defines sensitive species as those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers, density, or habitat capability that would reduce a species existing distribution. In FSM 2670.22, management direction for sensitive species is, in part, to ensure that species do not become threatened or endangered because of Forest Service actions, and to maintain viable populations of all native species. A viable population consists of a number of individuals adequately distributed throughout their range necessary to perpetuate the existence of the species in natural, genetically stable, self-sustaining populations.

There are no federally listed threatened or endangered plant species, or species proposed for listing, present on the Deschutes and Ochoco National Forests and Crooked River National Grassland. Table 29 summarizes the fifty sensitive plant species that are either documented or suspected to occur on the Forests and Grassland**.**

A biological evaluation is conducted to review Forest Service programs and activities for possible effects on endangered, threatened, proposed, or sensitive species, as required in Forest Service Manual 2672.4 (USFS 1995b). The biological evaluation process consists of a prefield review of available information to identify known or potentially occurring threatened, endangered, and sensitive (TES) plant species, a field reconnaissance of the proposed project, and an evaluation of potential effects to TES plant species from the proposed project. If there would be potential adverse effects or conflicts, then the project is evaluated to see if it can be revised so that adverse effects do not occur.

### Pre-Field Review

A review of available information was completed in order to identify Sensitive plant species known or potentially occurring in the project area.

The following sources were consulted for the pre-field review:

- Regional Forester's Sensitive Species List (USFS 2004b).
- Oregon Natural Heritage Information Center's (formerly the Oregon Natural Heritage Program) Rare, Threatened and Endangered Species List (Oregon Natural Heritage Information Center 2004).
- U.S. Forest Service sensitive plant survey GIS layer and associated databases.
- USFS personnel (District Botanists and Ecologists).
- Literature.
- Survey and Manage database and known site GIS layer.

**There are no known occurrences of federally listed endangered or threatened plants within the Deschutes and Ochoco National Forests and Crooked River National Grassland.** There is no habitat recognized as essential for listed or proposed plant species recovery under the Endangered Species Act. Because there are no Threatened or Endangered plant species on the Deschutes and Ochoco National Forests and Crooked River National Grassland, this assessment will refer only to "Sensitive" species, rather than "TES" species.

The Region 6 Regional Forester has listed 50 sensitive plant species that are either documented or suspected to occur on the Deschutes and Ochoco National Forests and Crooked River National Grassland (Table 29). Habitat descriptions for the species are contained in the Botany Specialist Report.

**Table 29.** Sensitive plant species documented (D) or suspected (S) to occur on the Deschutes and Ochoco National Forests and Crooked River National Grassland.

| Scientific Name and Code | Common Name | DES | OCH & CRNG |
|---|---|---|---|
| **Vascular Plants** | | | |
| *Achnatherum hendersonii* | Henderson's needlegrass; Indian ricegrass | | D |
| *Achnatherum wallowaensis* | Wallowa needlegrass; Indian ricegrass | | D |
| *Agoseris elata* | tall agoseris | D | |
| *Arabis suffrutescens var. horizontalis* | horizontal woody rockcress | S | |
| *Arnica viscosa* | Mt. Shasta arnica | D | |
| *Artemisia ludoviciana* ssp. *estesii* | Estes' artemisia; white sagebrush | D | S |
| *Aster gormanii* | Gorman's aster | S | |
| *Astragalus diaphanus var. diurnus* | transparent milkvetch | | S |
| *Astragalus peckii* | Peck's milk-vetch | D | S |
| *Astragalus tegetarioides* | bastard milkvetch | | D |
| *Botrychium ascendens* | trianglelobe moonwort | | D |
| *Botrychium crenulatum* | scalloped moonwort | | D |
| *Botrychium minganense* | Mingan moonwort | | D |
| *Botrychium montanum* | mountain moonwort | | D |
| *Botrychium paradoxum* | peculiar moonwort | | D |
| *Botrychium pinnatum* | northern moonwort | | D |
| *Botrychium pumicola* | pumice grape-fern | D | |
| *Calamagrostis breweri* | Brewer's reedgrass | S | |
| *Calochortus longebarbatus* var*. longebarbatus* | long-bearded mariposa-lily | S | S |
| *Calochortus longebarbatus* var*. peckii* | longbeard mariposa lily | | D |
| *Camissonia pygmaea* | dwarf suncap | | S |
| *Carex backii* | | | S |
| *Carex hystericina* | bottlebrush sedge | S | D |
| *Carex interior* | inland sedge | | D |
| *Carex livida* | livid sedge | S | |
| *Carex stenophylla* *(Carex eleocharis; Carex duriuscula*) | needleleaf sedge | | S |
| *Castilleja chlorotica* | green-tinged paintbrush | D | |
| *Cicuta bulbifera* | bulblet-bearing waterhemlock | S | |
| *Collomia mazama* | Mt. Mazama collomia | S | |
| *Cypripedium parviflorum* | lesser yellow lady's slipper | | S |
| *Gentiana newberryi* var. *newberryi* | Newberry's gentian; alpine gentian | D | |
| *Lobelia dortmanna* | Dortmann's cardinalflower | D | |
| *Lomatium ochocense* | | | D |
| *Lycopodiella inundata* | inundated clubmoss | D | |
| *Lycopodium complanatum* | ground cedar | S | |

| Scientific Name and Code | Common Name | DES | OCH & CRNG |
|---|---|---|---|
| *Mimulus evanescens* | Disappearing monkeyflower | | S |
| *Ophioglossum pusillum* | northern adderstongue | S | |
| *Penstemon peckii* | Peck's penstemon | D | D |
| *Pilularia americana* | American pillwort | S | |
| *Rorippa columbiae* | Columbia yellowcress | D | S |
| *Scheuchzeria palustris* ssp. *americana* | rannoch-rush | D | |
| *Scirpus subterminalis* | swaying bulrush | D | |
| *Thelypodium eucosmum* | world thelypody | | S |
| *Thelypodium howellii* | Howell's thelypody | S | S |
| ***Bryophytes*** | | | |
| *Rhizomnium nudum* | rhizomnium moss | D | |
| *Schistostega pennata* | luminous moss | D | |
| *Scouleria marginata* | marginate splashzone moss | S | S |
| ***Lichens*** | | | |
| *Dermatocarpon luridum* | silverskin lichen | S | S |
| *Leptogium cyanescens* | skin lichen | S | |
| ***Fungi*** | | | |
| *Ramaria amyloidea* | | D | |

Of the 50 plant species in the above list, 16 sensitive plant species occur within Invasive Plant PAUs. Of the 289 PAUs, 61 have at least one documented sensitive plant site (30 PAUs on the Deschutes National Forest; 30 on the Ochoco NF, and one on the Crooked River NG).

**Table 30.** Sensitive plant species that occur within Invasive Plant PAUs.

| Unit | Scientific Name | Common Name | # Project Area Units Occurs in |
|---|---|---|---|
| **Deschutes National Forest** | *Agoseris elata* | tall agoseris | 8 |
| | *Artemisia ludoviciana* | Estes' Artemisia | 1 |
| | *Botrychium pumicola* | pumice grape fern | 2 |
| | *Castilleja chlorotica* | green-tinged paintbrush | 5 |
| | *Gentiana newberryi* | Newberry's gentian | 2 |
| | *Penstemon peckii* | Peck's penstemon | 18 |
| | *Rorippa columbiae* | Columbia yellowcress | 1 |
| | *Scirpus subterminalis* | swaying bulrush | 1 |
| **Ochoco National Forest** | *Achnatherum hendersonii* | Henderson's needlegrass | 1 |
| | *Astragalus tegetarioides* | bastard milkvetch | 1 |
| | *Botrychium crenulatum* | scalloped moonwort | 1 |
| | *Botrychium minganense* | Mingan moonwort | 1 |
| | *Botrychium montanum* | peculiar moonwort | 1 |
| | *Botrychium pinnatum* | northern moonwort | 1 |
| | *Calochortus longebarbatus* var. *peckii* | Peck's mariposa lily | 25 |
| | *Carex hystericina* | bottlebrush sedge | 1 |
| **Crooked River National Grassland** | *Penstemon peckii* | Peck's penstemon | 1 |

Table 31 summarizes what PAUs have known sensitive plant sites, the type of site encompassed by the PAU, and which invasive plant species is closest to known sensitive plant populations.

**Table 31.** Invasive plant threats to Sensitive plant species within PAUs.

| Project Area Unit (PAU) | Unit | Location | Site Type | Sensitive Plant Species | Invasive Plant within TES | Distance from closest Infestation (ft.) | Invasive Plant Threats |
|---|---|---|---|---|---|---|---|
| 11-02 | Bend/Ft. Rock | Rd. 18 | Road | Pumice grape fern (*Botrychium pumicola*) Green-tinged paintbrush (*Castilleja chlorotica*) | N | > 3,000 | Spotted knapweed is the closest invasive plant. |
| 11-04 | Bend/Ft. Rock | Pine Mountain | Road | Green-tinged paintbrush (*Castilleja chlorotica*) | Y | 0 | Spotted & diffuse knapweeds and Canada thistle occur near or within green-tinged paintbrush population. |
| 11-05 | Bend/Ft. Rock | Hwy 31 | Road | Pumice grape fern (*Botrychium pumicola*) | Y | 0 | Spotted knapweed within pumice grape fern site. Overall, very few invasive plant sites in this Project Area Unit (Powers 2006, *personal communication*). |
| 11-09 | Bend/Ft. Rock | Rd. 40 | Road | Green-tinged paintbrush (*Castilleja chlorotica*) | N | 100 | Spotted knapweed is the closest invasive. |
| 11-12 | Bend/Ft. Rock | Rd. 45 | Road | Green-tinged paintbrush (*Castilleja chlorotica*) | N | 26,000 | Spotted knapweed is far from green-tinged paintbrush and not yet high risk. |
| 11-17 | Bend/Ft. Rock | Tumalo Creek | Meadow/ Wetland/ Floodplain | Newberry's gentian (*Gentiana newberryi*) | N | 280 | Spotted knapweed is closest invasive plant. |
| 11-37 | Bend/Ft. Rock | Rd. 25 | Road | Green-tinged paintbrush (*Castilleja chlorotica*) | Y | 0 | Spotted knapweed within TES plant site. |
| 11-62 | Bend/Ft. Rock | Meadow Camp | Road | Estes' artemisia (*Artemisia ludoviciana* ssp. *estesii*) | Y | 0 | Canada thistle close to Estes' artemisia. |
| 12-02 | Crescent | Hwy 58, west | Road | Columbia yellowcress (*Rorippa columbiae*) | N | < 100 | Tumble mustard (*Sisymbrium altissimum*) is across the Hwy from Rorippa. |
| 12-05 | Crescent | Big Marsh | Meadow/ Wetland/ Floodplain | Swaying bulrush (*Scirpus subterminalis*) | N | Within 100 | Reed canarygrass occurs throughout the marsh and does threaten swaying bulrush. |
| 15-01 | Sisters | Little Montana, 800 Rd | Forest | Tall agoseris (*Agoseris elata*); Peck's penstemon (*Penstemon peckii*) | Y | 0 | Spotted & diffuse knapweeds and Canada thistle occur near TES plants. |

| Project Area Unit (PAU) | Unit | Location | Site Type | Sensitive Plant Species | Invasive Plant within TES | Distance from closest Infestation (ft.) | Invasive Plant Threats |
|---|---|---|---|---|---|---|---|
| 15-02 | Sisters | Abbot Butte | Road | Tall agoseris (*Agoseris elata*) | N | 130 | Spotted knapweed is closest invasive. |
| 15-03 | Sisters | Rd. 16 | Road | Newberry's gentian (*Gentiana newberryi*); Peck's penstemon (*Penstemon peckii*) | Y | > 3,000 and 0 | Newberry's gentian is at the far south end of the Project Area in wet meadows and not close to any invasive plant populations. Peck's penstemon occurs with spotted & diffuse knapweeds. |
| 15-04 | Sisters | Indian Ford, N Sisters Gravel Pit | Road | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Spotted & diffuse knapweeds occur by Peck's penstemon. |
| 15-05 | Sisters | Hwy 20 road corridor | Road | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Spotted & diffuse knapweeds and St. Johnswort occur near Peck's penstemon. |
| 15-06 | Sisters | Hwy 242, Reed's Ranch | Road | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Spotted & diffuse knapweeds occur near Peck's penstemon. |
| 15-07 | Sisters | Cache Fire Area | Road | Peck's penstemon (*Penstemon peckii*) | Y | 0 | St. Johnswort occurs near Peck's penstemon. |
| 15-10 | Sisters | Rd 1230 | Road | Tall agoseris (*Agoseris elata*); Peck's penstemon (*Penstemon peckii*) | Y | 0 | Spotted & diffuse knapweeds and St. Johnswort near TES plant sites. |
| 15-11 | Sisters | Black Butte | Road | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Spotted & diffuse knapweeds and St. Johnswort near TES plant sites. |
| 15-12 | Sisters | Fly Creek | Road | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Spotted & diffuse knapweeds occur near Peck's penstemon. |
| 15-13 | Sisters | 1260 Rd | Forest | Tall agoseris (*Agoseris elata*); Peck's penstemon (*Penstemon peckii*) | Y | 0 | Spotted & diffuse knapweeds and Canada thistle occur near TES plants. |
| 15-14 | Sisters | Eyerly/Four Corners | Road | Peck's penstemon (*Penstemon peckii*) | Y | 0/290 | St. Johnswort occurs within Peck's penstemon population. Spotted knapweed is ~ 290 ft. away. |
| 15-16 | Sisters | Rd. 1220 | Forest | Peck's penstemon (*Penstemon peckii*) | N | ~100 | St. Johnswort near Peck's penstemon. |
| 15-18 | Sisters | Rd. 1419/1420 | Road | Tall agoseris (*Agoseris elata*); Peck's penstemon (*Penstemon peckii*) | Y | 0 | Spotted & diffuse knapweeds and Canada thistle occur near TES plants. |

| Project Area Unit (PAU) | Unit | Location | Site Type | Sensitive Plant Species | Invasive Plant within TES | Distance from closest Infestation (ft.) | Invasive Plant Threats |
|---|---|---|---|---|---|---|---|
| 15-19 | Sisters | Rd. 14 | Road | Tall agoseris (*Agoseris elata*); Peck's penstemon (*Penstemon peckii*) | Y | 0 | Spotted & diffuse knapweeds and Canada thistle occur near TES plants. |
| 15-20 | Sisters | Rd. 1216, 1217 | Road | Tall agoseris (*Agoseris elata*); Peck's penstemon (*Penstemon peckii*) | Y | 0 | Spotted & diffuse knapweeds and St. Johnswort near TES plant sites. |
| 15-21 | Sisters | Rd. 12 | Road | Tall agoseris (*Agoseris elata*); Peck's penstemon (*Penstemon peckii*) | Y | 0 | Spotted & diffuse knapweeds and St. Johnswort near TES plants. |
| 15-27 | Sisters | Glaze Meadow | Meadow/ Wetland/ Floodplain | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Dalmatian toadflax near Peck's penstemon. |
| 15-31 | Sisters | NW 1290 and vicinity | Road | Tall agoseris (*Agoseris elata*) | Y | 0 | Spotted knapweed is closest invasive plant. |
| 15-32 | Sisters | Metolius River | Meadow/ Wetland/ Floodplain | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Spotted & diffuse knapweeds and St. Johnswort near Peck's penstemon. |
| 71-02 | Lookout Mt. | Hwy 26 | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 4,480 | Spotted knapweed, the closest invasive plant; is still far away and not yet threatening Peck's mariposa lily. |
| 71-08 | Lookout Mt. | Rd. 42, s. portion of Rd. 30 + 42-320 | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 3,260 | Scotch thistle, the closest invasive plant, is still quite far away. |
| 71-17 | Lookout Mt. | 2610 Rd. and Coyle Material Source | Quarry | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Russian knapweed near TES plants. |
| 71-19 | Lookout Mt. | 22 Rd. | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 675 | Houndstongue near Peck's mariposa lily. |
| 71-25 | Lookout Mt. | 4240 Rd System | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 2,380 | Houndstongue quite far down the road from Peck's mariposa lily. |
| 71-31 | Lookout Mt. | 2600-450 | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 2,000 | Houndstongue down the road from Peck's mariposa lily. |

| Project Area Unit (PAU) | Unit | Location | Site Type | Sensitive Plant Species | Invasive Plant within TES | Distance from closest Infestation (ft.) | Invasive Plant Threats |
|---|---|---|---|---|---|---|---|
| 71-45 | Lookout Mt. | 2620-150, 020, Hamilton Pit | Quarry | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 17,000 | No invasive plants close by Peck's mariposa lily. |
| 71-50 | Lookout Mt. | 2730, 2735 Rd System | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 5,780 | No invasive plants close by Peck's mariposa lily. |
| 71-51 | Lookout Mt. | FS 16, 17, 1680 Rd. System | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 800 | Canada thistle near Peck's mariposa lily. |
| 71-59 | Lookout Mt. | 27 and 3320 Rd. System | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 600 | Canada thistle near Peck's mariposa lily. |
| 72-01 | Paulina | 58, 5870, 58-800 roads | Road | Bastard milkvetch (*Astragalus tegetarioides*) | N | 1,800 | Whitetop is relatively far from Peck's mariposa lily. |
| 72-03 | Paulina | 42 Road | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Spotted knapweed, Canada thistle, and St. Johnswort near Peck's mariposa lily; |
| 72-04 | Paulina | 4250 road to 4256 jct. and the 4250-100 road | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Spotted knapweed and Dalmatian toadflax near Peck's mariposa lily. |
| 72-05 | Paulina | 30 Road and 30-750 | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 1,000 | Closest infestation is Canada thistle. |
| 72-06 | Paulina | 2630 Rd and 12 Rd to Forest Boundary | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 85 | Canada thistle population is close to Peck's mariposa lily. |
| 72-07 | Paulina | 38 Road, 3820 rd, 38-120 road | Road | Northern moonwort (*Botrychium pinnatum*) Scalloped moonwort (*Botrychium crenulatum*) | N | 12 | Canada thistle close to TES plants. |
| 72-12 | Paulina | `Parts of the 12, 4250 and 4274 roads | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Canada thistle near Peck's mariposa lily. |

| Project Area Unit (PAU) | Unit | Location | Site Type | Sensitive Plant Species | Invasive Plant within TES | Distance from closest Infestation (ft.) | Invasive Plant Threats |
|---|---|---|---|---|---|---|---|
| 72-13 | Paulina | 4270 road, part of 4274 road and 4254 road | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Diffuse knapweed, Canada thistle and houndstongue near TES plants. |
| 72-14 | Paulina | 4260 Road | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Houndstongue near Peck's mariposa lily. |
| 72-15 | Paulina | 4280 road, 4280-060 and 4280-061 | Road/ Stream | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Houndstongue near Peck's mariposa lily. |
| 72-16 | Paulina | 4260-570 | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 35 | Medusahead near Peck's mariposa lily. |
| 72-17 | Paulina | 4260-560 system | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Houndstongue and medusahead threaten Peck's mariposa lily. |
| 72-18 | Paulina | 4260-650 road | Stream | Silverskin lichen (*Dermatocarpon luridum*) | N | 0 | Houndstongue occurs in area. Not within TES plant population because lichen occurs in water. |
| 72-19 | Paulina | 4260-500 and 4260-501 Roads | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Houndstongue near Peck's mariposa lily. |
| 72-20 | Paulina | 4260-400, 4260-300 and 4260-360 roads | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Houndstongue near Peck's mariposa lily. |
| 72-25 | Paulina | 4280-067 road | Road | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Houndstongue near Peck's mariposa lily. |
| 72-32 | Paulina | 3810-500 Rd. system | Road | Mingan moonwort *(Botrychium minganense)* Peculiar moonwort (*Botrychium montanum*) | N | 135 | Whitetop close to Botrychium species. |
| 72-42 | Paulina | Roba Ck., south of 42560-500 | Stream | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Houndstongue near Peck's mariposa lily. |

| Project Area Unit (PAU) | Unit | Location | Site Type | Sensitive Plant Species | Invasive Plant within TES | Distance from closest Infestation (ft.) | Invasive Plant Threats |
|---|---|---|---|---|---|---|---|
| 72-50 | Paulina | Burnt Corral Creek south of 4260-300 to Burnt Corral Spring | Stream | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Houndstongue near Peck's mariposa lily. |
| 72-52 | Paulina | Black Canyon Wilderness | Trail | Bottlebrush sedge (*Carex hystericina*) | Y | 0 | Canada thistle near Carex plants. |
| 72-59 | Paulina | 5820-011 road (closed) area | Forest | Henderson's needlegrass (*Achnatherum hendersonii*) | Y | 0 | Three medusahead plants were pulled in 2003 & not seen since. |
| 75-43 | Crooked River NG | Squaw Flat part 1 | Other | Peck's penstemon (*Penstemon peckii*) | N | 150 | Medusahead abundant on CRNG and high risk to Peck's penstemon. |

### Field Surveys

Proposed projects that would involve any type of ground-disturbance on the Forests and Grassland are evaluated to determine if there are known sites and potential habitat for Sensitive plant species through a prefield review process. Depending on the project and if potential habitat exists, areas are then surveyed using one or more survey techniques (i.e., Limited Focus, Intuitive Control, and/or Complete survey methods). The focus of the surveys is to identify where potential sensitive plant habitat exists and, in those areas, do a more intensive search. Records containing information on survey routes, surveyor, and results are on file at District offices. When a sensitive plant is found, a plant inventory form is completed and sites are mapped using GPS technology. Sites are entered into a GIS layer (Geographical Information System) and database. Spatial layers in GIS and associated databases were used to evaluate the Project Area Units for known occurrences of Sensitive and Survey & Manage plants.

Each of the 289 Invasive Plant PAUs were evaluated to determine if these areas had been adequately surveyed for vascular plants, lichens, bryophytes and fungi on the Forests and Grassland Sensitive Plant List. Each of the 289 areas was classified into one of five conditions:

1. PAU needs sensitive plant surveys (or at least evaluated for potential habitat and the need to survey) prior to implementing invasive plant treatments.
2. Entire PAU is adequately surveyed and does not need further surveys prior to implementing invasive plant treatments.
3. Current invasive plant sites do not need surveys, but surveys may be needed if new invasive plant sites are found in other portions of the PAU.
4. PAU needs surveys if treating outside of road prism (i.e., existing invasive plant populations have spread beyond the roadside).
5. PAU needs surveys if treatments planned for riparian areas.

Through this process, it was determined that twenty seven (9%) of the 289 PAUs needed sensitive plant surveys prior to implementing treatments within currently mapped invasive plant sites. Surveys in these 27 PAUs were conducted during field season of 2006. The majority of Invasive Plant PAUs are along roads or within other disturbed habitats that are generally not good habitat for Sensitive plants.

## Survey & Manage Plant Species (Deschutes National Forest Only)

In addition to sensitive species, National Forests and Bureau of Land Management lands in western Oregon, western Washington, and northwestern California have responsibility to survey and manage a specific set of species due to requirements in the Northwest Forest Plan (NWFP). The NWFP, adopted in 1994, amended Forest Plans within the range of the northern spotted owl; i.e., western Oregon, Washington, and parts of northern California (USDA Forest Service and USDI Bureau of Land Management 1994). The Survey and Manage Standard and Guideline of the NWFP provides mitigation for late-successional and old-growth associated species whose persistence might not be assured by other components of the Northwest Forest Plan. Western portions of the Deschutes National Forest are within the NWFP; however, the Ochoco National Forest and Crooked River National Grassland do not have lands within the NWFP. Therefore, Survey & Manage species are only applicable to the NWFP area of the Deschutes National Forest.

The Survey and Manage Standard and Guidelines were revised in 2001, adopting new standards and guidelines for Survey & Manage (USDA Forest Service and USDI Bureau of Land Management 2001). This amendment was designed to add clarity, remove duplication, increase or decrease levels of management for specific species based on new information affecting the level of concern for their persistence, and establish a process for making changes to management for individual species in the future originally intended in the Northwest Forest Plan.

The 2001 Survey and Manage Record of Decisions (ROD) categorized species into six categories based on rarity (rare or uncommon), practicality of conducting pre-disturbance surveys, and if the status of the species was largely undetermined. The ROD also established timelines for the completion of Strategic Surveys for Category B species (rare species for which pre-disturbance surveys are not practical). The objective of strategic surveys is to find additional new sites and to characterize the habitat, improving our knowledge and ability to manage and conserve the species. For the non-fungi Category B species, the deadline for completion of Regional Strategic Surveys was the beginning of fiscal year 2006. Because this timeline was not met for all species, projects proposed in old growth forests may now require pre-project, “Equivalent Effort” surveys for certain Category B species (USDA Forest Service and USDI Bureau of Land Management 2006).

Throughout the NWFP area in California, Oregon and Washington, strategic surveys were not completed for six non-vascular plant species (two lichens and four bryophytes). Therefore, Equivalent Effort Surveys for these species must now be conducted within lands managed under the Northwest Forest Plan for projects that: 1) have the potential to cause a significant negative effect on the species habitat or the persistence of the species at the site; and 2) the project occurs in old-growth forest habitat and has a signed decision in fiscal year 2006 or later.

## Pre-Field Review

As with Threatened, Endangered and Sensitive plants, Deschutes National Forest lands within the NWFP were evaluated to determine if there are known sites and potential habitat for Survey & Manage plant species. The following sources were consulted for the pre-field review of Survey & Manage plant species:

- Direction provided in the January 2001 Record of Decision (USDA Forest Service and USDI Bureau of Land Management 2001) for survey and protection of Survey & Manage plant species.
- Deschutes National Forest list of Survey & Manage plant species that have potential to occur on the Forest and for which pre-project disturbance surveys are required. “GeoBob” (Geographical Biotic Observations), a rare/uncommon species database maintained by the Bureau of Land Management.
- Direction provided from an internal memo about Equivalent Effort Surveys (USDA Forest Service and USDI Bureau of Land Management 2006).
- USFS personnel (District Botanists and Ecologists).
- Literature, including survey protocols for various species.

Table 12 of the Botany Specialist Report summarizes information for the five Survey & Manage plant species that occur or may occur on the Deschutes National Forest and for which pre-project surveys are required.

There are several Survey & Manage plant species suspected to occur on the Deschutes National Forest that are now on the Deschutes National Forest Sensitive Plant List. Two of these species (*Leptogium cyanescens* and *Schistostega pennata*) are now on both the Survey & Manage and Sensitive Plant Lists for the Deschutes National Forest. Three other Survey & Manage plant species were moved to our Sensitive plant list and are surveyed for prior to ground-disturbing projects because they are considered sensitive species, not because of Survey & Manage requirements. Our Survey & Manage responsibility for these three species is to manage all known sites: *Dermatocarpon luridum* (S&M Category E), *Ramaria amyloidea* (S&M Category B), and *Rhizomnium nudum* (S&M Category B).

### Field Surveys

Proposed projects on Deschutes National Forest lands within the Northwest Forest Plan area are evaluated to determine if there are known sites and potential habitat for Survey & Manage plant species through the prefield review process. Depending on the project and if potential habitat exists, areas are surveyed. The focus of the surveys is to identify where potential Survey & Manage plant habitat exists and, in those areas, do a more intensive search. Records containing information on survey routes, surveyor, and results are on file at District offices. When a Survey & Manage plant site is located, information is also recorded and sites are mapped using GPS. Spatial layers in GIS and associated databases were used to evaluate the Project Area Units for occurrences of Survey & Manage plants.

Sixty four Project Area Units occur (or portions occur) within the Northwest Forest Plan area. As with Sensitive plants, each of the 64 units was evaluated to determine if these areas had been adequately surveyed for five Survey & Manage species for which pre-disturbance surveys are required (*Cypripedium montanum, Leptogium cyanescens, Marsupella emarginata* var. *aquatica, Schistostega pennata, and Tritomaria exsectiformis).* Twelve (19%) of the 64 Project Area Units needed Survey & Manage plant surveys prior to implementing treatments within currently mapped invasive plant sites. Surveys were conducted during field season of 2006. See the Botany Specialist Report for more information on these species and surveys. Seven of the 64 Project Area Units have documented Survey & Manage plant species (Table 32).

**Table 32.** Survey & Manage Known Sites within Invasive Plant Project Area Units, Deschutes National Forest. S&M Category Codes: B = Rare species, manage all known sites; C = Uncommon species, manage high-priority sites; EE = equivalent effort surveys are needed.

| Project Area Unit (PAU) | Location | Species | Life-form | S&M Category | Pre-Project Surveys Required? | Manage Known Sites? | Notes |
|---|---|---|---|---|---|---|---|
| 11-07 | Rd. 46 (Century Drive) | *Hydnotrya inordinata* | Fungus | B | N | Y | The invasive plant sites do not occur near the fungus. |
| 11-17 | Tumalo Creek | *Tritomaria exsectiformis* | Liver-wort | EE | Y | Y | One *Tritomaria exsectiformis* site occurred downstream from a spotted knapweed site near the intake facility, but is believed to be extant; the other TREX3 site is at a seep near Skyliner Lodge. Spotted knapweed occurs along Tumalo Creek. |
| 15-01 | Little Montana | *Hygrophorus caeruleus* | Fungus | B | N | Y | Within mapped spotted knapweed site. |
| 15-05 | Hwy 20 | *Choiromyces alveolatus* | Fungus | B | N | Y | Spotted knapweed occurs along Hwy 20; St. Johnswort has expanded in areas along Hwy 20 due to recent wildfires. |
| 15-10 | Rd. 1230; west B&B | *Hygrophorus caeruleus* | Fungus | B | N | Y | Fungus site on edge of Project Area Unit, in vicinity of 1232/320 Rds junction. |
| 15-14 | Eyerly/Four Corners; Gunsight Pass | *Cypripedium montanum* | Vascular plant | C | Y | Y | Five sites. Diffuse knapweed occurs in the road very near Cypripedium montanum in the Gunsight Pass area. Cirsium vulgare and Bromus tectorum occur along the same road. Medusahead was found (and pulled) in the upper part of a timber sale unit immediately below the road. Our responsibility is to manage high priority sites. |
| 15-17 | Rd. 1499 | *Cypripedium montanum* | Vascular plant | C | Y | Y | One site reported but follow-up field visits have not relocated this site. Our responsibility is to manage high priority sites. |

## 3.4.2 Environmental Consequences

This section addresses effects of invasive plants and herbicides on non-target native plants, including Sensitive and Survey and Manage (S&M) plant species.

The effects of non-herbicide methods are analyzed in Appendix J of the R6 2005 FEIS. Non-herbicidal methods include manual, mechanical, fire, cultural, restoration/revegetation, and biological control. While some native vegetation may be impacted by manual and mechanical methods, such as unintentional removal or trampling of flowers, fruits or root systems, these effects are unlikely to be significant with properly trained crews. Most of the concerns about adverse effects of treatment are related to herbicide use, either from direct spray and/or the potential for drift, leaching or runoff to affect non-target vegetation.

**Summary of Findings for Native Vegetation**

**Alternative 1:** This alternative has the highest risk to the long-term health of native plant communities due to increased spread of invasive plants. Though there would be less risk of herbicide contact and potential damage to native vegetation, it is highly likely that native vegetation will continue to be impacted by invasive plants because the No Action alternative would not treat the numerous infestations that have been mapped since 1998. These infestations would continue to spread. On sites where herbicides could not be used, the reliance on labor-intensive manual treatments is unlikely to keep up with the spread of invasive plants. The lack of an Early Detection/Rapid Response Strategy would inhibit our ability to treat newly discovered invasive plant infestations, resulting in increased spread and potential long-term impacts to native plant communities.

**Alternative 2:** This alternative would afford the most protection to native plants due to the increased ability to treat invasive plants. Effects to non-target native vegetation from herbicide treatments are expected to be minimal because of the small portion of land that would be treated (~ 2% of the Forests and Grassland), utilization of selective spray techniques, application of PDFs, and the ability to use more selective herbicides than available in the past or under the No Action Alternative. An Early Detection/Rapid Response Strategy would increase our ability to control invasive plants, reducing impacts to native plant habitats.

**Alternative 3:** This alternative would protect native plants more than Alternative 1 due to increased ability to treat invasive plants. However, compared to Alternative 2, riparian native vegetation may still be at risk from rhizomatous invasive species (such as ribbongrass and reed canarygrass) that could not be treated with herbicides near the water's edge. Effects to non-target native vegetation from herbicide treatments are expected to be minimal because of the small portion of land that would be treated (~ 2% of the Forests and Grassland), utilization of selective spray techniques, application of PDFs, and the ability to use more selective herbicides than available in the past or under the No Action Alternative. An Early Detection/Rapid Response Strategy would increase our ability to control invasive plants, reducing impacts to native plant habitats.

**Summary of Findings for Threatened, Endangered, Sensitive, and Survey and Manage Plants**

**ALL ALTERNATIVES:** ***There are No Effects on Threatened or Endangered plant species or habitat from invasive plant treatments for any of the alternatives.*** There are no federally listed Threatened or Endangered plant species or habitats documented or suspected to occur in the Planning Area. Therefore, activities proposed in the alternatives will have no effect on federally listed plant species. ***Invasive plant treatments would not cause a trend toward Federal listing for any Sensitive plant species.***

**Alternative 1 (No Action)** –Alternative 1 is the least effective in treating invasive plants and, therefore, poses the highest risk to Sensitive and Survey & Manage plant species from loss of habitat. Alternative 1 provides the least protection to Sensitive plant habitat because many currently inventoried sites of invasive plants would either not be approved for treatment, or, sites approved for treatment would be limited in available treatment methods and options. On sites where herbicides could not be used, the reliance on labor-intensive manual treatments is unlikely to keep up with the spread of invasive plants; where invasive plants occur with sensitive plants, there will be increased risk to sensitive plants and habitat. The lack of an Early Detection/Rapid Response Strategy would inhibit our ability to treat newly discovered invasive plant infestations, resulting in increased spread and potential long-term impacts to sensitive plants and their habitat.

**Alternative 2 (Proposed Action) –** Alternative 2 provides the most options for effective and efficient treatment of invasive plants and, therefore, would provide us the ability to treat invasive plants that threaten sensitive plant populations and their habitat. Invasive plant treatments implemented with all appropriate Project Design Features would minimize or eliminate effects from treatments to Sensitive and Survey & Manage plant species. Also, increased herbicide options provide increased ability to select an herbicide that has a lower risk to Sensitive plants.

**Alternative 3** – The effects are similar to Alternative 2. However, compared to Alternative 2, riparian Sensitive and Survey & Manage plant species may still be at risk from invasive plants that could not be treated with herbicides near the water's edge due to their rhizomatous nature or compacted soil conditions that make manual treatments difficult. Invasive plant treatments implemented with all appropriate Project Design Features will minimize or eliminate effects from treatments to Sensitive and Survey & Manage plant species. Increased herbicide options provide increased ability to select an herbicide that has a lower risk to sensitive plants.

## Effects of Invasive Plants on Native Vegetation

The public has expressed concerns that there is and will continue to be a loss of vegetation diversity within local native plant communities from invasive plants. Management direction for protecting native plant species and habitats is found in Forest Service Manual 2620 that directs us to manage habitats for all existing native and desired non-native plants, fish and wildlife species in order to maintain at least viable populations of such species.

In the long-term, the threat from invasive plants to native plants and native plant habitats is greater than effects from invasive plant treatments. Invasive plants have the ability to deplete nutrients and water in the soil to levels lower than native plant species can tolerate, allowing invasive plants to out-compete native vegetation (Olson 1999). Many invasive plants are early successional species, meaning they colonize areas that have been recently disturbed. Since invasive plants have the ability to deplete available resources to lower levels than native vegetation can tolerate, they can quickly dominate disturbed sites and displace native vegetation. When invasive plants dominate native plant communities, native plant species diversity is decreased. Invasive plants can out-compete native species because they produce abundant seed, have fast growth rates, have no natural enemies, and are often avoided by large herbivores. For example, medusahead is able to compete effectively with desirable forage species partly because it is a winter annual that has rapid fall germination and root growth throughout the winter when other species are dormant (University of California 2006). Some invasive plants also produce secondary compounds, which can be toxic to native plant species or animals. Results from experiments on diffuse knapweed suggest that this invader produces chemicals that long-term and familiar Eurasian plants have adapted to, but that relatively new North American plants have not (Hierro and Callaway 2003). Weed infestation can therefore lead to a decrease in native plant species, which can alter the ability of wildlife to find suitable edible forage.

The Interior Columbia Basin Project's Science Integration Team did an extensive analysis of conditions in this region and note that exotic plants (invasive plants) are a significant threat to rangelands (http://www.icbemp.gov/). As part of this analysis, Croft et al. (1997) did an analysis of vascular plants in the Interior Columbia River Basin and noted that exotic plant invasion is one of the major threats to native plant species. Of the 20 threats summarized in their report (ranging from agricultural conversion to fire to livestock grazing to road maintenance and construction, etc.), there were more rare plants affected by exotic plant species than any of the other 19 listed threats.

On the Forests and Grassland, invasive plants are considered to be a major threat to Sensitive plants. Dewey (2005) determined that invasive plants pose a significant threat to Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*). Teasel (*Dipsacus sylvestris*) appears to have displaced at least one documented site of Peck's mariposa lily along Marks Creek on the Ochoco National Forest (Helliwell 1993). Pajutee (2006) determined the spread of invasive plants has accelerated across the range of Peck's penstemon (*Penstemon peckii*) in the past decade. The Peck's penstemon Draft Species Conservation Strategy (Pajutee 2006a) identifies all populations as either "protected" or "managed." Protected populations are key to the species viability and receive the highest level of protection. The Strategy recommends that no permanent habitat loss occur in protected sites. Invasive plants alter native plant habitats and treating invasive plants would provide protection to Peck's penstemon habitat. Invasive plants have also been identified as a threat to rare moonworts (*Botrychium* spp.) in the Columbia Basin (Zika et al. 1995). By simplifying complex plant communities, invasive plants reduce biological diversity and threaten rare plant habitats.

Belnap et al. (2001) discuss how invasive plants affect biological soil crusts by reducing the diversity of native vascular plants. The vertical and horizontal vascular plant structure of many arid and semi-arid vegetation communities optimizes growth of biological soil crusts (Belnap et al. 2001). Vascular plants create windbreaks and shade, influencing how much moisture and light reach the soil surface. They also trap leaf litter, keeping the interspaces free of substantial or persistent litter cover. Invasive exotic plants generally decrease the structural diversity of native vascular plant communities by creating monocultures of densely spaced plants and by homogenizing litter distribution. They also lead to decreased biological crust cover and species richness in most ecosystems.

## Effects of Herbicides to Native Vegetation

Some members of the public have expressed concern that that the application of herbicides has the potential to adversely affect non-target plant species. All invasive plant treatments are designed to kill or slow the growth and spread of target plants, and some damage to non-target plant species is likely in all alternatives, despite careful planning and implementation.

Herbicides have the potential to shift species composition of native plant communities, as less herbicide-tolerant species are replaced by more herbicide-tolerant species. For example, the repeated use of triclopyr, a broadleaf selective herbicide, might shift the species composition resulting in a reduction of woody vegetation and an increase in the herbaceous and grass component. Clopyralid, a selective herbicide that targets broadleaf plants in four plant families, might reduce native lupines that occur within invasive plant sites, though other plant species (e.g., bitterbrush and Idaho fescue) would not be affected. An 8-year field experiment at two grassland and two early seral forest sites in western Montana in which spotted knapweed was treated with picloram, clopyralid, or clopyralid + 2,4-D, observed a shift in the plant communities back to a grass-dominated structure (Rice et al. 1993, 1997). However, they found that depressions in plant community diversity were small and transitory; in the 3rd year after the initial applications, there were no significant differences among treatments and some herbicide-treated plots had begun to surpass the untreated plots in community biodiversity measures.

Native plants in the sunflower (*Asteraceae*), mustard (*Brassicaceae*) and legume (*Fabaceae*) families are generally more sensitive to herbicides because many broadleaved invasives are from these families and herbicides are designed to target the invasives (Mazzu 2004). Monocots, in general, tend to be more tolerant since many herbicides are designed for broadleaf dicot plants. This is especially true with grasses which tend to be more tolerant, expect for herbicides specifically developed to control grasses.

The type of herbicide and the application method may also affect pollinators. A reduction or shift in pollinator species could also lead to changes in plant species composition or diversity (USFS 2005a, 4-27). However, invasive plants, left untreated, also shift species composition and affect pollinated plants by disrupting the structure and function of ecosystems (North American Pollinator Protection Campaign 2006). Native pollinators have co-evolved with the plants they visit, such that their physiology is matched to most efficiently exploit the nectar and pollen resources of the flowers upon which they specialize. Studies in natural area grasslands have found significant reductions in species diversity as dense roadside colonies of spotted knapweed invaded into adjacent native grasslands (Rice et al. 1997). It is highly likely that reduced species diversity from invasive plants has indirect effects on pollinators.

Herbicides can move off-site in water, soil, and wind, thereby affecting non-target vegetation. This can result from spray drift (from broadcast and spot treatments), runoff, leaching, or through groundwater movement. Herbicides can vary dramatically in their potential for movement. For example, picloram is highly soluble in water, is mobile under both laboratory and field conditions, is resistant to degradation, and has a high potential to leach into groundwater in most soils. In contrast, glyphosate strongly binds to soil particles, which prevents it from excessive leaching or from being taken up from the soil by non-target plants, and has a low potential for leaching into groundwater systems, and degrades quickly (USFS 2005a, 4-32).

Translocation of herbicide between rhizomatous same-species individuals, or from plant-fungi, rootlet mycorrhizal interactions can also result in herbicide movement. The result may include mortality and reduced productivity (e.g., physiological, structural, and abnormal growth). Effects, such as mortality, brown spots, and lack of chlorophyll may not be immediate, and may become apparent months later.

The risk of adverse effects is dependent on the type of herbicide used and the application method chosen. Herbicides have different characteristics, degrees of selectivity, and modes of action. Potency of the herbicide and persistence also are factors, as is duration of the treatment. The Herbicide Information Summary (Appendix D) provides information about the ten herbicides proposed for use, including their characteristics, mode of action, and potential hazards and risks. For example, glyphosate is generally non-selective (i.e., kills most plants that come into contact with it), yet does not persist for long in the environment, while picloram, which targets broadleaf and woody plants, is a persistent herbicide that can remain active for several growing seasons post application. Clopyralid mimics auxins, plant growth hormones, and stimulates abnormal growth. Metsulfuron methyl works by inhibiting the activity of an enzyme called acetolactate synthase, an enzyme necessary for plant growth.

Selectivity of an herbicide refers to it being selective for particular kinds of plants, whereas the ability to damage a broad spectrum of plant species makes an herbicide non-selective. The herbicides proposed for use in treating invasive plants vary in their selectivity ranging from non-selective glyphosate to clopyralid which is selective for plant species in four plant families. Commonly, on the Deschutes National Forest, the invasive spotted knapweed (sunflower family) grows underneath and between bitterbrush (rose family); clopyralid would target the spotted knapweed without harming the bitterbrush. Some herbicides, such as sethoxydim, are selective for grasses and not other broadleaf plants. Picloram, one of the more persistent herbicides, could move readily to non-target native plants through root translocation (movement of an herbicide from one plant to another across root surfaces) or surface runoff.

The risk to non-target vegetation also varies with the herbicide application method. Spot and hand application methods may substantially reduce the potential for loss of non-target vegetation because there is little potential for drift as the herbicide is more directly applied to the target vegetation. Drift is mostly associated with broadcast treatments and can be mitigated to some extent by the applicator. Drift can be minimized by equipment (use nozzles designed for herbicide application that do not produce a find droplet spray), application methods (use low nozzle pressure), and applying during certain weather conditions (e.g., apply herbicide when wind velocity is between two and eight miles per hour, and do not spray if precipitation is predicted to occur within 24 hours).

Droplet size in herbicide application is a key factor in minimizing drift as larger droplets are heavier and, therefore, less affected by wind and evaporation. The largest particles, being the heaviest, will fall to the ground quickly upon exciting the sprayer. Medium size particles can be carried beyond the sprayer swath (the fan shape spray under a nozzle), but virtually all of the particles fall within a short distance of the release point. The smallest, and therefore the lightest particles have the potential to travel the farthest, for this reason if the droplet size forced out of the nozzle can be limited to larger particle sizes, the potential for herbicide to drift beyond the target vegetation can be controlled. Figure 5 demonstrates the relationship between droplet size and buffer distance. As droplet size increases (VMD microns), the distance herbicide may travel in concentrations sufficient to harm plants decreases. VMD is the “Volume Median Diameter” and is used to measure droplet size in microns. Factors affecting droplet size are nozzle type, orifice size and spray angle, as well as spray pressure, and the physical properties of the spray mixture. By simply changing the type of nozzle (diameter of pore size) used during broadcast treatments, the drift potential of herbicide can be effectively and significantly decreased as the droplet size forced out the nozzle is increased in size (USFS 2006c). Vegetation on the ground, including the target invasive species themselves, acts as a substantial barrier to herbicide droplet drift as well.

Spray nozzle diameter, pressure, the amount of carrier-applied with the herbicide, and herbicide release height are important controllable determinants of drift potential by virtue of their effect on the spectrum of droplet sizes emitted from the nozzles. Meteorological conditions such as wind speed and direction, air mass stability, temperature and humidity and herbicide volatility also affect drift.

Commercial drift reduction agents are available that are designed to reduce drift beyond the capabilities of the determinants previously described. These products create larger and more cohesive droplets that are less apt to break into small particles as they fall through the air. They reduce the percentage of smaller, lighter particles that are the size most apt to drift.

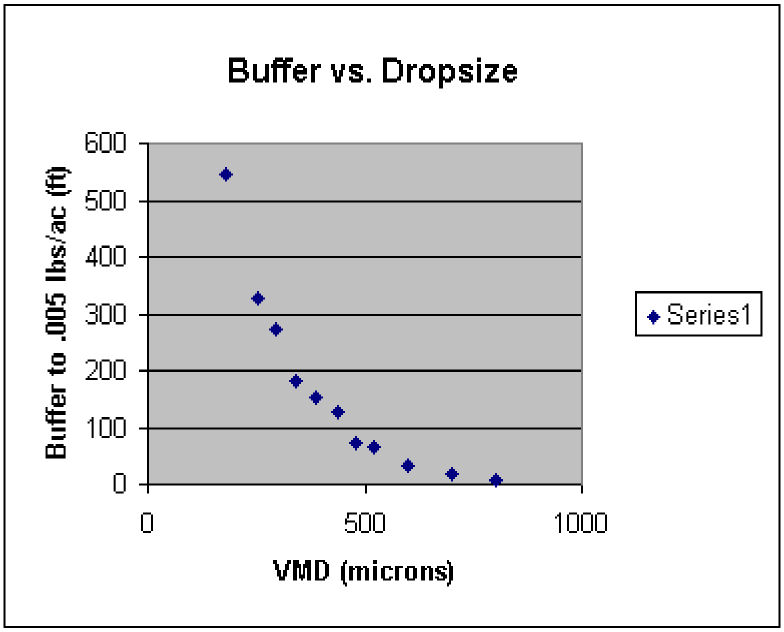


**Figure 6.** Illustration of how herbicide droplet size can reduce the distance that the herbicide can drift (USFS 2006c).

Marrs et al. (1989) in the study, "Assessment of the Effects of Herbicide Spray Drift on a Range of Plant Species of Conservation Interest," examined the distances in which drift affected non-target vascular plants using broadcast treatment methods. The five herbicides that they tested included sulfonylurea herbicides (chlorsulfuron plus metsulfuron methyl) and glyphosate. Their observations are consistent with drift-deposition models in which the fallout of herbicide droplets has been measured. Most of the severe impacts (death of the plants and severe growth suppression) were confined to a very short distance (about 2 meters, 6 meters maximum). Symptoms of plant damage and flower suppression were found at slightly greater distances, but most damage occurred near the sprayer. The maximum safe distance at which no lethal effects were found was 20 feet, but for most of the herbicides tested, the distance was 7 feet. In most cases, there was rapid recovery by the end of the growing season. They concluded: "In summary, the effects of severe damage by herbicide-droplet drift from simulation experiments set up to cover a range of high-risk herbicides under realistic application conditions, with standard hydraulic sprayers, suggest that buffer zones surrounding nature reserves and other sensitive vegetation could be quite narrow, in the order of *c*. 5-10 m" (~16-33 feet).

## Lichen, Bryophytes, and Fungi

In 2004, 80 fungi and non-vascular (lichens and bryophytes) plants were added to the regional sensitive species lists. Of these, 3 bryophytes (*Rhizomnium nudum*, *Schistostega pennata*, and *Scouleria marginata*), two lichens (*Dermatocarpon luridum* and *Leptogium cyanescens*) and one fungus (*Ramalaria amyloidea*) are suspected or documented to occur on the Deschutes and/or Ochoco National Forests and the Grassland. The Region 6 Invasive Plant FEIS (USFS 2005a, 4-130) concluded that some fungi and non-vascular plants could be negatively affected by at least two active ingredients (triclopyr and glyphosate). The FEIS also stated that fungi could be negatively affected by herbicides known to affect soil mycorrhizae (sulfometuron methyl, picloram, glyphosate, triclopyr) but studies are laboratory based and results difficult to extrapolate to field situations (USFS 2005a, 4-130). There is a lack of information regarding the effects of herbicides on fungi (Pilz 2006, pers. comm*)*. However, these species are often associated with late successional forest ecosystems, which are not usually of high susceptibility to invasion; whereas the vast majority of our invasive plant sites occur along roads, in quarries, and other disturbed sites. The Sensitive and Survey & Manage fungi species that are documented or suspected to occur on our Forests are associated with late successional forest ecosystems, which are not usually of high susceptibility to invasion (by weeds).

Pilz and Molina (2001) do not know of any studies investigating the relations between pesticide applications and edible forest mushroom production or consumption. Herbicides are sometimes used to release newly planted conifers from competition by broadleaf trees and shrubs, but commercially harvested ectomycorrhizal mushrooms usually begin fruiting 5-15 years later as the conifer stand develops, so that only persistent compounds or recent drift from nearby areas are potential hazards. Estok et al. (1989) studied the effects of four herbicides on the growth of three species of ectomycorrhizal fungi. Mycorrhizal fungi provide host plants with benefits, such as increased nutrient uptake and improved resistance to stress, and are necessary for the proper growth and development of most vascular plants. Busse et al. (2003) studied ectomycorrhizal formation on ponderosa pine seedlings treated with a single application of sulfometuron methyl, triclopyr, or imazapyr under greenhouse and growth chamber conditions. They found that mycorrhizae formation was uninhibited by the three herbicides, and their results support "previous findings that commonly-used forest herbicides are not detrimental to soil organisms."

As with fungi, little information is available on how herbicides may affect bryophytes and lichens. Newmaster et al. (1999) analyzed the relationship between herbicide application rates and changes in bryophyte and lichen abundance and species numbers after herbicide treatments. They divided bryophytes and lichens into three ecologically-defined response groups: herbicide-tolerant colonizers, semi-tolerant long-term stayers from dry open forest, and sensitive forest mesophytes. They tested two herbicides used in Canada in silviculture treatments to control competing vegetation: triclopyr and glyphosate. Their research showed that bryophyte and lichen abundance and species diversity decreased after herbicide treatments. It is difficult to extrapolate from this study to our invasive plant treatments because the majority of our invasive plant sites are in highly disturbed areas (roads, quarries, etc.), with far fewer sites in upland undisturbed forests. Also, glyphosate and triclopyr use would be relatively minimal. Newmaster et al. (1999) cite references that state that physiological research has shown that some bryophyte and lichen species are extremely sensitive to herbicides, yet they also cite references showing that field trials and observations suggest that bryophyte and lichen diversity may be enhanced by silvicultural herbicide treatments.

Lichens and bryophytes lack roots and instead obtain moisture and nutrients directly from the atmosphere; therefore, they are particularly sensitive and vulnerable to aerosols and contaminants in the atmosphere such as herbicide mist. Lichens would be especially sensitive to herbicides because they lack a waxy cuticle and so would easily absorb them (Geiser 2006, pers. comm.).

Biological soil crusts are a complex mosaic of cyanobacteria, green algae, lichens, mosses, microfungi, and other bacteria. In rangelands, they function as living mulch by retaining soil moisture and discouraging annual weed growth (Belnap et al. 2001). Invasion of exotic annual plants into perennial plant communities can pose a long-term threat to biological soil crusts, as the crust-dominated interspace between perennial plants is often heavily invaded. Because biological crusts stabilize soils, germination of seeds of exotic species can be inhibited in sites with well-developed crusts and low plant litter, as was recently demonstrated for the annual exotic grass, cheatgrass (*Bromus tectorum*) (Belnap 2001). Kaltnecker et al. (1999) found that areas with intact biological soil crust cover maintain low cheatgrass densities despite abundant seed sources nearby. In contrast, native species that have evolved with biological soil crusts may have mechanisms, such as a geniculate awn that drills the seed into the soil. A study by Youtie et al. (1999) addressed herbicide effects on intact biological soil crusts. Direct application of two glyphosate herbicides (Roundup and Accord) on moss-dominated biological soil crusts had no short-term (within one year) negative impact on bryophyte cover. In fact, bryophyte cover decreased significantly in control plots due to litter buildup from exotic annual grasses that had invaded the site, while cover stayed the same or increased slightly in treated plots. There is little information on the effects of repeated herbicide application or long-term effects of glyphosate and other herbicides. Youtie et al. (1999) recommend selective spot spraying medusahead as early in the spring as possible, when the medusahead rye is most susceptible and native plants are dormant.

## Effects Common to All Alternatives

All invasive plant treatments are designed to kill or slow the growth of target plants, and some damage to non-target plant species is likely in all alternatives, despite careful planning and implementation. Though the use of herbicides does have inherent risks of impacting non-target individual native plants, any time that herbicides are used, they will be used selectively and prudently. All herbicide laws and regulations will be followed. State and County herbicide applicators have specialized equipment that allows them to readily switch between hand application techniques (i.e., spot spraying individual plants) to a selective patch broadcast spray technique (Langland 2006, pers. comm). Our intent, when applying herbicides, is always to minimize non-target plant species damage and to protect known populations of Sensitive and Survey & Manage plants – this is the same for all alternatives. In all alternatives, District Botanists will carefully plan invasive plant treatments to minimize any effects to rare plant species.

All the alternatives are required to meet the new Regional Invasive Plant Standards (USFS 2005b). Several of these standards specifically address minimizing or eliminating direct or indirect negative effects to non-target plants, including rare plant species (ROD, Standards 19 and 20).

All alternatives strive towards integrated treatments, such as using manual treatment as a follow-up to get plants missed by herbicide spraying, or using a mechanical method, such as weed whacking, on tall stems to reduce biomass and reduce the amount of herbicide used. Herbicide treatment is often followed up by manual treatment later in the season to get plants that were missed by the herbicide or several years later when invasive plant populations are reduced to the point at which they can be hand-pulled.

In all alternatives, the threat to native plant habitats from invasive plants is considered greater than effects from invasive plant treatments. Due to concerns about rare plant habitat loss from invasive plant species, Sensitive plant populations immediately threatened by invasive plants are a high priority for treatment. Short-term adverse effects from invasive plant treatments are expected to be offset by the long-term benefits of habitat protection. Under all three alternatives, known Sensitive and Survey & Manage plant sites will be identified by Forest Service Botanists, who will also be involved in planning invasive plant treatments that occur within or near Sensitive and Survey & Manage plant sites. Currently, Forest Service Botanists work with herbicide applicators and manual treatment crews to ensure that these species are protected as best we can. Regardless of the selected alternative, Forest Service Botanists will continue to oversee invasive plant treatments to ensure protection of Sensitive and Survey & Manage plant species.

All alternatives approve a range of non-herbicide methods, including biological, manual and mechanical treatments. The variation between alternatives is mostly related to the use of herbicides.

# ALTERNATIVE 1 – NO ACTION

## Direct and Indirect Effects

### Native Vegetation

The numbers of sites that can be treated under Alternative 1 comprise only 13% of the currently inventoried sites on the Forests and Grassland (238 of the currently mapped 1,892 sites). It is highly likely that the majority of invasive plant populations within the Forests and Grassland would continue to expand and spread, causing further degradation of native plant habitats. This in turn affects other resources, such as wildlife forage and habitat, native pollinator diversity, soils, etc. The majority of plant community types found on the Forests and Grassland are highly susceptible to invasion and treatment of existing infestations is imperative in order to reduce this risk.

Herbicide use is limited in Alternative 1. As discussed above (see *Treatment Effectiveness*), there would be a heavy reliance on manual treatments at the majority of sites covered under this alternative. Manual treatments are expensive and labor-intensive, which has resulted in fewer sites being treated each year (Mafera 2006, pers. comm.). On Paulina District, this is leading to rapid expansion of houndstongue in several areas, which, in turn, because of the nature of spread, is also resulting in satellite populations further up drainages.

Manual treatments would pose less risk than herbicides to non-target vegetation. However, moderate to large invasive plant infestations will likely continue to expand, posing high risk to the health and stability of native plant habitats. Monitoring has shown that herbicides have been effective at reducing invasive plant populations. On the Deschutes National Forest, herbicide treatments in 1999-2001 reduced knapweed populations 83%, 94%, 95%, and 98% at four plots (Grenier 2002). Brown et al (2001) tested the efficacy of various management techniques alone and in combination on spotted knapweed control. They found that herbicides alone provide the most effective spotted knapweed control for the lowest cost. Hand-pulling twice for two consecutive years was the most expensive treatment and provided less than 60% control of spotted knapweed after two seasons. Because Alternative 1 limits the number of sites that could be treated with herbicides, the long-term effects to native plants and plant communities from invasive plants are expected to be greater than with Alternatives 2 and 3.

A limited number of herbicides are available under Alternative 1. Only three herbicides are available for use on the Ochoco National Forest and Crooked River National Grassland (dicamba, glyphosate, and picloram). These 3 herbicides plus triclopyr are available for use on the Deschutes National Forest. The herbicides available under Alternative 1 do not provide the best options for the variety of invasive plant species and situations that are present within the Forests and Grassland. The combination of glyphosate, picloram, dicamba, and triclopyr does not provide as wide a range of tools as Alternatives 2 and 3. This combination is relatively non-selective (R6 2005 FEIS, 4-36). On sites approved for herbicide treatments, Alternative 1 would have a heavy reliance on picloram to treat houndstongue due to the limited availability of herbicides (Alexanian 2006, pers. comm.). Picloram is considered a higher risk herbicide to the environment because it is very mobile and persistent, and because of the levels of hexachlorobenzene (also called HCB) that it contains (Bautista 2005, pers. comm.). Picloram is one of the more persistent herbicides; it can readily move to non-target native plants through root translocation or runoff (USFS 2005a). The threat of off-site damage to native plants and plant communities is expected to be higher under Alternative 1 than Alternatives 2 and 3, which provide more selective herbicide options.

Of the four herbicides available for use on the Deschutes, dicamba has been the preferred choice for use on spotted and diffuse knapweeds and would continue to be used under Alternative 1. The R6 2005 FEIS considered dicamba to be a high risk herbicide and dropped it from consideration in their action alternatives. Under Alternatives 2 and 3, clopyralid would be available for use on knapweeds, and is considerably more selective and would afford more protection to native plant species. Herbicide choices are limited under Alternative 1 and, therefore, limit treatment effectiveness compared to Alternatives 2 and 3.

Limited herbicide use would reduce the potential for herbicide damage to biological soil crusts. However, invasive plants reduce vascular plant diversity which, in turn, can decrease biological crust cover (Belnap et al. 2001). It is highly likely that invasive plants would continue to spread under Alternative 1, negatively affecting native plant communities and indirectly affecting biological soil crusts.

### Sensitive Plants

Because many invasive plant sites would not be treated under Alternative 1, the risks to Sensitive plants are higher as invasive plant sites continue to expand and spread. It is likely that additional populations of Peck's mariposa lily will be adversely impacted by houndstongue as it continues to spread. St. Johnswort has expanded on Sisters District and continues to be the emerging weed threat within the Metolius Basin (Burtelow and Suna 2004), which is an important area for Peck's penstemon. Canada thistle will likely continue to spread along the Deschutes River, further impacting Estes' artemisia. Spotted and diffuse knapweeds would continue to spread, increasing long-term degradation to habitats occupied by Peck's penstemon and green-tinged paintbrush. Houndstongue would continue to spread on the Ochoco National Forest, increasing negative effects to Peck's mariposa lily populations and habitat.

In the three Conservation Strategies that are completed for sensitive plants (Pajutee 2006; Powers 2006b; Dewey 2007), invasive plants are identified as a threat. Alternative 1 would not allow treatment of many invasive plant sites that currently threaten these Sensitive plant species and, therefore, does not meet management guidelines for protecting these species.

The No Action Alternative does not provide as many herbicide options as Alternatives 2 and 3. These limited options reduce our ability to use a more selective herbicide when near sensitive plants. Alternative 1 does use the least amount of herbicide so there is less risk of herbicide to contact and damage individual Sensitive plants. However, our ability to protect Sensitive plant habitat in the long-term is reduced under Alternative 1.

### Survey & Manage Plants (NWFP area of Deschutes National Forest Only)

The effects to Survey & Manage plant species would be similar to effects to Sensitive plant species. The limited use of herbicides under Alternative 1 would result in less potential risk to individual plants; however, limited ability to effectively treat invasive plants will result in their continued spread, resulting in further loss of native plant habitats and greater threats to native plant biological diversity. The composition and structure of native plant communities would continue to be altered and, as we lose native plant biodiversity, substrates for nonvascular plants (bryophytes and lichens) would be reduced, as well as hosts that benefit mycorrhizal fungi.

## Summary of Herbicide Effects to Native Vegetation, Alternative 1

- ***Long-term risk to native vegetation from invasive plants.*** The majority of invasive plant sites would not be treated, resulting in the continued displacement of native plant species. Limited treatment methods and options will hamper treatment effectiveness, resulting in continued loss of native plant biodiversity and higher risks to native plants than Alternatives 2 and 3.
- ***Effects to other resources from loss of native plant habitats.*** When the quality and integrity of native plant communities are degraded, other resources are impacted, such as wildlife forage and habitat, soil quality, native pollinator diversity, etc.
- ***Less risk of herbicide damage to individual native plants due to less herbicide use***. There would be less herbicide use and, therefore, less risk of damage to individual non-target native plants in the short-term.
- ***Alternative 1 is the least effective in treating invasive plants and, therefore, poses the highest risk to Sensitive and Survey & Manage plant species from loss of habitat.*** Invasive plants will continue to impact rare plant habitat throughout much of the Forests and Grassland. Increased spread of invasive plants would alter native plant habitats and potentially risk long-term viability of rare plant species.

## Alternatives 2 and 3

### Botany Project Design Features for Action Alternatives

Project Design Features (PDFs) were developed to minimize effects from invasive plant treatments to non-target native plants. Some PDFs are specific to Sensitive and Survey & Manage plants; others apply to all non-target vegetation but would also provide protection to Sensitive and Survey & Manage plant species.

The Herbicide Information Summary (Appendix D) identifies potential risks to non-target vegetation for each of the proposed ten herbicides. Information such as herbicide characteristics (e.g., selectivity of the herbicide), basic hazard identification, and risk characterization was used to design PDFs to minimize potential risks to non-target native plants. PDFs developed for other resources (e.g., riparian buffers) also provide protection to non-target vegetation, including Sensitive and Survey & Manage plant species.

PDFs are mandatory and apply to both action alternatives (Alternatives 2 and 3). They would not be required in the No Action alternative (Alternative 1). PDFs are taken into consideration when comparing the alternatives. Some PDFs were designed to reduce off-site movement of herbicides by wind or water; others require that surveys be conducted for Sensitive plants and appropriate buffers applied. Refer to Chapter 2.4 for a list of project-specific PDFs.

A 50 foot buffer from Sensitive and Survey & Manage plants and other identified unique plant species for sulfonylurea herbicides is based on research done by Marrs et al. (1989) that is discussed earlier (see *Effects of Herbicide to Native Plants and Plant Communities* section). This research suggested that buffer zones surrounding nature reserves should be in the order of 16-33 feet for ground sprayers to minimize the risk of herbicide impacts on these habitats. The 50 ft. buffer required in this EIS (unless otherwise protected by covering such as with plastic) is more conservative and is intended to further ensure that rare plant species will not be impacted by these herbicides.

The analysis is based on the assumption that all protection measures are followed: Project Design Features, Regional standards (R6 2005 FEIS and ROD), and herbicide label requirements.

## ALTERNATIVE 2 – PROPOSED ACTION

Alternative 2 proposes to treat inventoried invasive plant populations within 289 Project Area Units. Treatment prescriptions and long-term site objectives have been developed that strive to combine manual and mechanical methods with the use of herbicides for more effective treatment. Ten herbicides analyzed in the Region 6 Invasive Plant EIS (R6 2005 FEIS) would be available to more effectively control invasive plant infestations. The Proposed Action includes an Early Detection/Rapid Response strategy to treat new or expanding invasive plant infestations.

The analysis of effects to sensitive plant species considers the known locations of the plants as well as suitable habitat. The number of individual plants in a population is not readily known and not a critical factor in determining the effect of invasive plant treatments. PDFs would be applied to avoid any adverse effects to sensitive plants; therefore, the determination that individuals could be harmed is based on the assumption that where non-selective herbicides are needed to treat an invasive, there is potential for overspray or drift – but that is limited to individuals within the immediate vicinity of the invasives being treated.

## Direct and Indirect Effects

### Native Vegetation

Alternative 2 allows the use of several new herbicides (chlorsulfuron, metsulfuron methyl, sulfometuron methyl, imazapic, and imazapyr) that are associated with hazards to non-target vegetation (R6 2005 FEIS, 4-27 to 4-33). However, the risk to non-target vegetation is reduced by careful implementation of Project Design Features (PDFs), and by following herbicide label restrictions, and Regional standards. The selection of herbicides allowed under Alternatives 2 and 3 (compared to Alternative 1) allows us to choose an herbicide that would pose low risk to non-target plant species and be effective at controlling the target invasive species.

PDFs are expected to minimize or eliminate effects to non-target plants, including Sensitive and Survey & Manage species. In addition, several Regional Standards will reduce the severity and extent of impacts associated with herbicide runoff and drift. For example, Standard 16 restricts triclopyr to selective applications, which would reduce direct effects to non-target woody species, culturally important species, and ectomycorrhizal fungi. Regional Standard #19 requires that site-specific characteristics (soil characteristics, proximity to surface water and local water table depth to determine herbicide formulation, size of buffers needed, etc.) be used to design invasive plant treatments.

Sulfonylurea herbicides pose a higher risk to non-target plants. We can control drift during application by using methods discussed above (see *Effects of Herbicides to Native Vegetation*), but there are inherent risks with these herbicides due to wind erosion. There is a possibility that wind can pick up herbicide molecules and move them. Wind erosion can be reduced by using spot or hand application techniques (instead of broadcast spray method) in areas with a lot of bare ground and very dry and light soils that are more likely to be carried by wind. Presence of vegetation and/or heavier soils would help reduce the potential for wind erosion and many of the invasive plant sites proposed for treatment with sulfonylurea herbicides have vegetation present to help reduce wind erosion. For example, wind erosion should be minimal if dense houndstongue patches on Paulina District were boom sprayed with metsulfuron methyl because there would be a lot of foliar interception and absorption by the plants, resulting in less soil contacted directly by the herbicide (Bautista 2006, pers. comm.). Sulfometuron methyl is proposed for use on medusahead, with the majority of sites on the Grassland. Historically (in the late 1930s), the Grassland experienced considerable wind erosion and deposition, yet there is currently little evidence of wind scour even on the most depauperate sites (Gibson 2006, pers. comm.). PDFs are intended to minimize movement of herbicide molecules by wind.

Repeated use of herbicides could potentially shift species composition, as less herbicide-tolerant species are replaced by more herbicide-tolerant species. For example, the repeated use of triclopyr, a broadleaf selective herbicide, might shift the species composition resulting in a reduction of woody vegetation and an increase in the herbaceous and grass component. However, invasive plants also shift species composition and alter habitats. Any shift due to herbicide spraying would be minimal for the following reasons: 1) Alternative 2, which has the most herbicide options, would treat a relatively small portion of the Forests and Grassland (~ 2% of 2,340,567 acres); and 2) the majority of invasive plant sites are along roads (72%) and within other disturbed sites in which native plant species composition is already altered. It is unlikely that there would be a significant shift in native plant species composition across the landscape.

Rice et al. (1993) determined: "Concerns that recommended herbicide applications for spotted knapweed control will have negative effects on natural plant community diversity are not warranted." They found that plant community diversity is maintained and may increase in the years after spraying heavily infested sites.

The presence or potential of biological soil crusts within proposed treatment areas is most likely in soils within a 9 to 14" precipitation zone that define juniper/sagebrush steppes (Ochoco soil map unit B4) and higher elevation scablands (Ochoco soil map unit P5) on the Ochoco National Forest, as well as juniper and/or sagebrush range sites on the Crooked River Grassland (Ochoco soil map units E and F) or Deschutes National Forest (Deschutes soil map units 48 and 91). Although there is a possibility of herbicide application on biological crusts in these areas, crusts are less likely to be present in areas of existing invasive plant populations due to their susceptibility to the physical disturbance that encouraged the invasive plant populations to prosper. However, if present, the effects of herbicide treatments on these crusts is not well documented but would likely be similar to those described for soil organisms in Table 36 of the EIS (Sussmann 2006, pers. comm. and author of Soil Resource Report for this EIS). PDFs are expected to minimize effects of herbicides on the soil where herbicide and soil characteristics would combine to create a known hazard of toxicity to microbes, measurable losses to productivity, or convey herbicide residues to surface or ground water resources at levels potentially toxic to aquatic species.

The Early Detection/Rapid Response Strategy under Alternative 2 would reduce the risk of invasive plant spread and provide better protection to native vegetation than currently allowed under Alternative 1.

In summary, effects to non-target native vegetation from herbicide treatments under Alternative 2 are expected to be minimal because of the small portion of land that would be treated (~ 2% of the Forests and Grassland), utilization of selective spray techniques, application of PDFs, and the ability to use more selective herbicides than available in the past or under Alternative 1.

### Sensitive Plants

The effects to sensitive plants are the same for Alternatives 2 and 3: Invasive plant treatments may impact individual plants but will not contribute to a trend towards federal listing or loss of viability to any Sensitive plant populations or species. PDFs were developed to minimize or eliminate herbicide treatment effects to Sensitive plants and to comply with Regional Invasive Plant Standards. For example, PDF 69 requires the lowest effective application rate be used when applying sulfonylurea herbicides (chlorsulfuron, metsulfuron methyl, and sulfometuron methyl) and these herbicides cannot be used within 50 feet of a known Sensitive (or Survey & Manage) plant unless the rare plants are protected by covering. In the long-term, native plant habitats will benefit from invasive plant treatments and this will benefit Sensitive plants.

Regional standards that require restoration of disturbed ground (including passive restoration where there is a good supply of native plants to colonize sites), retention of native vegetation and development of a long term strategy for infested areas, will ensure that Sensitive plants are given consideration during project planning and that healthy habitat will be promoted. Regional Standard 20 requires that we design treatments to reduce or eliminate adverse effects to species and critical habitats proposed and/or listed under the Endangered Species Act. Though there are no proposed or listed Threatened or Endangered plant species on the Forest and Grassland, we will be using site-specific project design (e.g., application rate and method, timing, wind speed and direction, nozzle type and size, buffers, etc.) in applying herbicide treatments near Sensitive plants.

Even with PDFs and all the layers of caution integrated into herbicide treatments (*see* Figure 3), there is always the chance – though a minimal chance – that an individual Sensitive plant(s) might be damaged in some way by herbicide contact. However, this would be a short-term effect and it is expected that Sensitive plant populations would not be jeopardized in the long-term. Monitoring of *Botrychium gallicomontanum* in a native Minnesota prairie showed although damage occurred to plants when sprayed with glyphosate, plants underground, either as juvenile sporophytes or as dormant adult sporophytes at the time of herbicide application were not affected by the herbicide (Ahlenslager 2006, pers. comm., referring to Johnson-Groh unpublished data). Thirteen days after the herbicide had been applied, newly discovered moonworts were yellowed and deformed, revealing obvious signs of damage. Two permanent plots were established in 1997 and have been monitored annually for the long-term effects of the herbicide. In 1998, there were 36 new plants that had not been present in 1997 when the plots were sprayed. Plants underground, either as juvenile sporophytes, which have not yet emerged, or, as dormant adult sporophytes at the time of herbicide application, probably were not affected by the herbicide. These new recruits are typical of moonwort populations and will likely sustain the populations despite one year of herbicide application. Invasive plant treatments would benefit Sensitive plant species in the long-term by reducing impacts from invasive plants. Without the availability of herbicides as a treatment option, invasive plants have the potential to overrun and displace rare plants. As discussed previously, invasive plants are a serious threat to the long-term viability of sensitive plants. On the Forests and Grassland, Conservation Strategies for Peck’s mariposa lily (Dewey 2005), Peck’s penstemon (Pajutee 2006a), and pumice grape-fern (Powers 2006b) all identify invasive plants as a threat.

The majority of invasive plant sites proposed for treatment are along roads and in other disturbed sites (e.g., quarries, utility sites, trails, etc.). The majority of Sensitive plant populations are not centered along roads, quarries, or other highly disturbed sites that tend to be occupied by invasive plants, though the perimeter of Sensitive plant populations may intersect with roads.

There are Sensitive plants that are adapted to open, disturbed habitats. Any species along roadsides or where activities occur that disturb native plant communities will be threatened by not only invasive plants, but by invasive plant treatments (R6 2005 FEIS, 4-130). Some Sensitive plants actually do well in disturbed areas because the natural processes which created openings or gaps have been eliminated. For example, tall agoseris (*Agoseris elata*) on Sisters District occurs in road ditches and along the edges of trails, which can be prime habitats for invasive plants such as spotted knapweed. Both tall agoseris and Peck’s penstemon are fire-adapted and need bare mineral soil to germinate; spotted and diffuse knapweed competes for the same habitat. Those Sensitive plant populations that occur in habitats occupied by invasive plants are at higher risk of being affected by invasive plant treatments. PDF 62 requires Forest Service Botanists to identify steps that need to be taken to protect Sensitive plants. This may involve avoiding and/or altering treatments so that Sensitive plants are protected. Though tall agoseris and Peck’s penstemon occur in early seral habitats, it is important to note that these habitats are dominated by native vegetation and might be considered low or moderately disturbed.

When invasive plants occur within Sensitive plant populations, the preferred herbicide option may be one that could affect the Sensitive plant if it were inadvertently contacted by the herbicide. For example, metsulfuron methyl is the preferred herbicide for treating aggressive houndstongue, which can, and in some areas does, occur near Peck's mariposa lily. Use of clopyralid on spotted knapweed or Canada thistle (both in the sunflower family) could harm individual plants of tall agoseris or Estes' artemisia (both also in the sunflower family). If metsulfuron methyl is used to control St. Johnswort, it is possible for individual plants of Peck's penstemon to be harmed. PDFs would be implemented to reduce the risk to Sensitive plants in these situations.

For example, in Project Area Unit 72-59, the use of sulfometuron methyl on medusahead could affect Henderson's needlegrass (*Achnatherum hendersonii*) plants if the herbicide inadvertently came into contact with the Henderson's needlegrass. At this site, in 2003, a Paulina District Botanist found and pulled three medusahead plants; in 2006, less than 12 plants were pulled. This early detection and rapid response was very effective in preventing rapid spread of the medusahead. Herbicides are proposed for this area if medusahead spreads beyond the point at which manual treatment is an effective option. If that were to happen, herbicide would be very selectively sprayed near Henderson's needlegrass plants using either a backpack spray or a dripless wick. PDF 62 would be applied by a Forest Service Botanist who would work with herbicide applicators to determine the best methods to protect this rare grass. Options might include using a cone to cover the needlegrass during herbicide treatment to alleviate drift. In Sensitive plant sites, the suite of available herbicides would be evaluated and the best one selected to protect the Sensitive plant but still allow effective treatment. Sulfometuron methyl was identified as an herbicide that would be effective on medusahead (Appendix B, Table B-4); being a sulfonylurea herbicide, there is a potential for wind erosion. At this particular needlegrass site, there is not much risk of soil and/or wind erosion due to the amount of gravel and red clay soils (Mafera 2006 and Bautista 2006, pers. comm.). If a site evaluation suggested that wind erosion potential was high, other herbicides, such as glyphosate, might be considered. Both Alternatives 2 and 3 allow more herbicide options, allowing us more flexibility to select herbicides for particular situations to reduce/minimize non-target vegetation effects.

The ten proposed herbicides were evaluated for potential effects on each of the documented Sensitive plant species. Some herbicides are low risk to Sensitive plant species because the herbicide does not target that plant family. For example, the herbicide sethoxydim is selective for annual and perennial grasses, whereas broadleaf plants and sedges tolerate this herbicide (*see* Appendix D). Clopyralid targets plants within the sunflower, legume, nightshade, and buckwheat families. Clopyralid treatment of spotted knapweed would not harm nearby plants of Peck's penstemon, which is in the figwort plant family. Conversely, tall agoseris is in the sunflower family, and could be affected by clopyralid. In some situations, some herbicides would not cause negative effects to a Sensitive plant because the herbicide would not be proposed for use in the same habitat that a Sensitive plant occurs in. For example, triclopyr is the preferred herbicide for use on Scotch broom and Himalayan blackberry and these two invasive plant species would not occur in habitats occupied by rare needlegrass species (*Achnatherum* spp.). Similarly, Sensitive plant species that grow in aquatic environments would not likely be impacted by those herbicides that are not approved for aquatic use due to aquatic protection buffers.

The results of this evaluation are summarized in Appendix C of the Botany Specialist Report. That information was then used to make the determinations listed in Table 33. Forest Service Manual requires botanists to evaluate each proposed project to determine if it would affect Sensitive plants, and to develop recommendations for removing, avoiding, or compensating for any adverse effects (USFS 1995b). We are required to determine if a project will either have No Impact (NI), or May Impact Individuals or Habitat but will not likely contribute to a trend towards federal listing (MIIH), or Will Impact Individuals or Habitat (WIIH) with a consequence that the action may contribute to a trend towards Federal listing or cause a loss of viability to the population or species. In this project, there are no situations that warranted a “WIIH” determination because: 1) invasive plant treatments will benefit native plant habitats and therefore benefit Sensitive plants; and 2) PDFs would provide protection to Sensitive plants from invasive plant treatments. Due to the high level of threat to Sensitive plants from invasive plants, any changes to native plant habitats that might occur from herbicide use or other invasive plant treatments would be relatively short-term (several years at most). Invasive plant treatments may take several years to control or eradicate the population; however herbicide use would be reduced each year as the invasive plant population is reduced. Invasive plant treatments are critical for protecting Sensitive plant habitats in the long-term.

If an herbicide has the potential to impact a Sensitive plant, Appendix C of the Botany Specialist Report directs which PDFs would be required to be applied in order to minimize or eliminate potential effects. An effects determination of May Impact Individuals or Habitat (Table 33) is due to remaining uncertainty because the herbicide could cause some damage if it were to unintentionally come into contact with an individual plant. We are doing everything we can to avoid impacts to non-target vegetation and are, therefore, meeting Regional Standard 19, but we cannot say with 100% certainty that all individual Sensitive plants would be not harmed in any way by herbicide treatments. However, careful and selective use of herbicides is the highest priority when using this type of treatment method.

If additional populations of the Sensitive plant species listed in Appendix C of the Botany Specialist Report are located in the future within Project Area Units, or through the early detection/rapid response strategy this table provides guidance on which PDFs should be applied to protect the Sensitive plant and this information would become part of the annual implementation planning process. For new Sensitive species not already listed, the same analysis process used in this EIS would be applied: each herbicide would be evaluated for its potential to affect the Sensitive plant and the appropriate PDFs identified to ensure that any risks are minimized or eliminated.

The Early Detection/Rapid Response Strategy under Alternative 2 would reduce the risk of invasive plant spread and provide better protection to Sensitive plants than currently allowed (under Alternative 1). PDFs would be applied to newly found invasive plant sites that occur within Sensitive plant populations.

Alternative 2 is consistent with management direction in the Species Conservation Strategy for Peck’s penstemon (Pajutee 2006), the Draft Conservation Strategy for pumice grape fern (Powers 2006b), and the Conservation Strategy for Peck’s mariposa lily (Dewey 2007). All three Conservation Strategies identify invasive plants as threats to these Sensitive plant species; treating invasive plants is important for protecting these species.

**Table 33.** Evaluation of potential effects of proposed herbicides on currently known sensitive plant populations within Invasive Plant Project Area Units for Alternatives 2 and 3. Effects codes: NI = No Impact; MIIH = May Impact Individuals or Habitat, But Will Not Likely Contribute To A Trend Towards Federal Listing or Loss of Viability to The Population or Species. See Appendix C of the Botany report for applicable PDFs for each species. Note: PDFs would minimize or eliminate effects to Sensitive plants; an effects determination of MIIH is due to remaining uncertainty because the herbicide could cause some damage if it were to unintentionally come into contact with an individual plant.

| Project Area | Sensitive Plant Species | Invasive Plant within TES | Distance from closest Infestation (ft.) | Notes about proposed herbicide treatments for closest infestations and PDFs | Effects Conclusion after applying PDFs |
|---|---|---|---|---|---|
| 11-02 | Pumice grape fern (*Botrychium pumicola*) Green-tinged paintbrush (*Castilleja chlorotica*) | N | > 3,000 | No herbicides planned close to TES populations. Spotted knapweed is the closest invasive plant and clopyralid, which is proposed for use, would not affect either sensitive plant. | NI |
| 11-04 | Green-tinged paintbrush (*Castilleja chlorotica*) | Y | 0 | Clopyralid is proposed for use on spotted & diffuse knapweeds and Canada thistle. Green-tinged paintbrush is in the figwort family and would not be affected by clopyralid. | NI |
| 11-05 | Pumice grape fern (*Botrychium pumicola*) | Y | 0 | Clopyralid is proposed for use on spotted knapweed. Pumice grape fern is in the Adder's tongue family and would not be affected by clopyralid. Very few invasive plant sites (Powers 2006, *personal communication*). | NI |
| 11-09 | Green-tinged paintbrush (*Castilleja chlorotica*) | N | 100 | Clopyralid is proposed for use on spotted knapweed. Green-tinged paintbrush is in the Scrophulariaceae family which would not be affected by clopyralid. | NI |
| 11-12 | Green-tinged paintbrush (*Castilleja chlorotica*) | N | 26,000 | No herbicides planned near TES populations. Spotted knapweed is the closest invasive plant and clopyralid, proposed for use, does not target Scrophulariaceae family. | NI |
| 11-17 | Newberry's gentian (*Gentiana newberryi*) | N | 280 | Spotted knapweed is closest invasive plant and clopyralid, proposed for use, would not affect Newberry's gentian. | NI |
| 11-37 | Green-tinged paintbrush (*Castilleja chlorotica*) | Y | 0 | Invasive plants would be treated manually so there would be no effects from herbicides. | NI |
| 11-62 | Estes' artemisia (*Artemisia ludoviciana* ssp. *estesii*) | Y | 0 | Clopyralid is proposed for use on Canada thistle, which is in the sunflower family. Being as Estes' artemisia is also in the sunflower family, there is a potential risk. | MIIH |
| 12-02 | Columbia yellowcress (*Rorippa columbiae*) | N | < 100 | Sisymbrium altissimum is across the Hwy from Rorippa, but this species is not proposed for treatment. Rorippa occurs in a highly disturbed habitat and at high risk from invasive plants more than proposed treatments. Due to the variety of invasive plants that can occur along Highway 58, various herbicides might be used. | MIIH |

| Project Area | Sensitive Plant Species | Invasive Plant within TES | Distance from closest Infestation (ft.) | Notes about proposed herbicide treatments for closest infestations and PDFs | Effects Conclusion after applying PDFs |
|---|---|---|---|---|---|
| 12-05 | Swaying bulrush (*Scirpus subterminalis*) | N | Within 100 | Reed canarygrass occurs throughout the marsh, but swaying bulrush does not occur within areas proposed for treatment. Solarization techniques are the primary treatment with possibly some spot herbicide treatments. Swaying bulrush would be flagged prior to treatment and avoided. | NI |
| 15-01 | Tall agoseris (*Agoseris elata*) Peck's penstemon (*Penstemon peckii*) | Y | 0 | Clopyralid is proposed for use on spotted & diffuse knapweeds and Canada thistle. Peck's penstemon is in figwort family and would not be affected by clopyralid; however, tall agoseris is in the same plant family as the knapweeds and thistle (sunflower family); therefore potential effects. Peck's penstemon population is designated as Protected in the Draft Species Conservation Strategy (Pajutee 2006a) | MIIH |
| 15-02 | Tall agoseris (*Agoseris elata*) | N | 130 | Spotted knapweed is closest invasive plant; clopyralid, proposed for use, could affect tall agoseris. | MIIH |
| 15-03 | Newberry's gentian (*Gentiana newberryi*) Peck's penstemon (*Penstemon peckii*) | N | > 3,000 | Invasive plants would be treated manually so there would be no effects from herbicides. Newberry's gentian is at the far south end of the Project Area in wet meadows and not close to any invasive plant populations. Peck's penstemon does occur with spotted & diffuse knapweeds; clopyralid (proposed for use on knapweeds which are in the sunflower family) would not affect Peck's penstemon (which is in the figwort family). Peck's penstemon is designated as Protected in the Draft Species Conservation Strategy (Pajutee 2006a). | NI |
| 15-04 | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Clopyralid is proposed for use on spotted & diffuse knapweeds (sunflower family) and would not affect Peck's penstemon (figwort family). Peck's penstemon is designated as Protected in the Draft Species Conservation Strategy (Pajutee 2006a). | NI |
| 15-05 | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Peck's penstemon would not be affected by the use of Clopyralid, on spotted & diffuse knapweeds, but could be affected by the use of metsulfuron methyl, proposed for use on St. Johnswort. This population is designated as a Managed population in the Draft Species Conservation Strategy (Pajutee 2006a). | MIIH |
| 15-06 | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Clopyralid is proposed for use on spotted & diffuse knapweeds (sunflower family) and would not affect Peck's penstemon (figwort family). Peck's penstemon is designated as Protected in the Draft Species Conservation Strategy (Pajutee 2006a). | NI |

| Project Area | Sensitive Plant Species | Invasive Plant within TES | Distance from closest Infestation (ft.) | Notes about proposed herbicide treatments for closest infestations and PDFs | Effects Conclusion after applying PDFs |
|---|---|---|---|---|---|
| 15-07 | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Metsulfuron methyl is proposed for use on St. Johnswort and could affect Peck's penstemon. Peck's penstemon is designated as Protected in the Draft Species Conservation Strategy (Pajutee 2006a). | MIIH |
| 15-10 | Tall agoseris (*Agoseris elata*) Peck's penstemon (*Penstemon peckii*) | Y | 0 | Peck's penstemon would not be affected by the use of Clopyralid, on spotted & diffuse knapweeds, but could be affected by the use of metsulfuron methyl, proposed for use on St. Johnswort. Tall agoseris could be affected by both herbicides. Peck's penstemon is designated as Protected in the Draft Species Conservation Strategy (Pajutee 2006a). | MIIH |
| 15-11 | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Invasive plants would be treated manually so there would be no effects from herbicides. Peck's penstemon is designated as Protected in the Draft Species Conservation Strategy (Pajutee 2006a). | NI |
| 15-12 | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Clopyralid is proposed for use on spotted & diffuse knapweeds (sunflower family) and would not affect Peck's penstemon (figwort family). Designated as Managed in the Draft Species Conservation Strategy (Pajutee 2006a). | NI |
| 15-13 | Tall agoseris (*Agoseris elata*) Peck's penstemon (*Penstemon peckii*) | Y | 0 | Clopyralid is proposed for use on spotted & diffuse knapweeds and Canada thistle. Peck's penstemon is in figwort family and would not be affected by clopyralid; however, tall agoseris is in the same plant family as the knapweeds and thistle (sunflower family); therefore potential effects. This population is designated as a Managed population in the Draft Species Conservation Strategy (Pajutee 2006a). | MIIH |
| 15-14 | Peck's penstemon (*Penstemon peckii*) | Y | 0 and 291 | St. Johnswort occurs within Peck's penstemon population; metsulfuron methyl, proposed for use on St. Johnswort, could affect Peck's penstemon. Spotted knapweed is ~ 290 ft. away; Peck's penstemon would not be affected by clopyralid. See Appendix C for applicable PDFs. This population is designated as a Managed population in the Draft Species Conservation Strategy (Pajutee 2006a). | MIIH |
| 15-16 | Peck's penstemon (*Penstemon peckii*) | N | ~100 | Metsulfuron methyl, proposed for use on St. Johnswort, could affect Peck's penstemon. See Appendix C for applicable PDFs. This population is designated as a Managed population in the Draft Species Conservation Strategy (Pajutee 2006a). | MIIH |
| 15-18 | Tall agoseris (*Agoseris elata*) Peck's penstemon (*Penstemon peckii*) | Y | 0 | Invasive plants would be treated manually so there would be no effects from herbicides. Peck's penstemon is designated as Protected in the Draft Species Conservation Strategy (Pajutee 2006a). | NI |

| Project Area | Sensitive Plant Species | Invasive Plant within TES | Distance from closest Infestation (ft.) | Notes about proposed herbicide treatments for closest infestations and PDFs | Effects Conclusion after applying PDFs |
|---|---|---|---|---|---|
| 15-19 | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Clopyralid is proposed for use on spotted & diffuse knapweeds and Canada thistle. Peck's penstemon is in figwort family and would not be affected by clopyralid. Picloram, proposed for use on Dalmatian toadflax, could affect Peck's penstemon. Peck's penstemon is designated as Protected in the Draft Species Conservation Strategy (Pajutee 2006a). | MIIH |
| 15-20 | Tall agoseris (*Agoseris elata*) Peck's penstemon (*Penstemon peckii*) | Y | 0 | Peck's penstemon would not be affected by the use of Clopyralid proposed for use on spotted & diffuse knapweeds, but could be affected by the use of metsulfuron methyl, proposed for use on St. Johnswort. Tall agoseris could be affected by both herbicides. Peck's penstemon is designated as Protected in the Draft Species Conservation Strategy (Pajutee 2006a). | MIIH |
| 15-21 | Tall agoseris (*Agoseris elata*) Peck's penstemon (*Penstemon peckii*) | Y | 0 | Invasive plants would be treated manually except for Canada thistle. Peck's penstemon would not be affected by the use of clopyralid, which would be the preferred herbicide for Canada thistle. Tall agoseris could be affected by Clopyralid. Peck's penstemon is designated as Protected in the Draft Species Conservation Strategy (Pajutee 2006a). | MIIH |
| 15-27 | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Bull thistle would be treated manually and there would be no effects to Peck's penstemon from herbicides. Peck's penstemon is designated as Protected in the Draft Species Conservation Strategy (Pajutee 2006a). | NI |
| 15-31 | Tall agoseris (*Agoseris elata*) | Y | 0 | Spotted knapweed is closest invasive plant; clopyralid, proposed for use, could affect tall agoseris. | MIIH |
| 15-32 | Peck's penstemon (*Penstemon peckii*) | Y | 0 | Ribbongrass treatments would be extremely site- and species-specific and there would not be impacts to Peck's penstemon, which does not occur in the same habitat as the ribbongrass. Peck's penstemon is designated as Protected in the Draft Species Conservation Strategy (Pajutee 2006a). | NI |
| 71-02 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 4,480 | No herbicides planned close to Peck's mariposa lily populations. Spotted knapweed is the closest invasive plant; clopyralid, proposed for use, would not affect Peck's mariposa lily. | NI |
| 71-08 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 3,260 | No herbicides planned close to Peck's mariposa lily populations. Scotch thistle is the closest invasive plant; clopyralid, proposed for use, would not affect Peck's mariposa lily. | NI |

| Project Area | Sensitive Plant Species | Invasive Plant within TES | Distance from closest Infestation (ft.) | Notes about proposed herbicide treatments for closest infestations and PDFs | Effects Conclusion after applying PDFs |
|---|---|---|---|---|---|
| 71-17 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Peck's mariposa lily (lily family) would not be affected by clopyralid, proposed for use on diffuse knapweed. Picloram, proposed for use on Russian knapweed, is not expected to affect CALOP because of monitoring results of using high application rates of picloram within a *Calochortus macrocarpus* population (Mark Lesko 2006, personal communication). | NI |
| 71-19 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 675 | Metsulfuron methyl, proposed for use on houndstongue, could be injurious to Peck's mariposa lily, so MIIH. However, currently houndstongue far enough from lily. | MIIH |
| 71-25 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 2,380 | No herbicides planned close to Peck's mariposa lily populations. Houndstongue quite far down the road from Peck's mariposa lily. | NI |
| 71-31 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 2,000 | Houndstongue quite far from Peck's mariposa lily. | NI |
| 71-45 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 17,000 | No herbicides planned close to Peck's mariposa lily populations. Spotted knapweed is currently quite far from Peck's mariposa lily. | NI |
| 71-50 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 5,780 | No herbicides planned close to Peck's mariposa lily populations. | NI |
| 71-51 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 800 | No herbicides planned close to Peck's mariposa lily populations. Clopyralid is proposed for treating the nearest Canada thistle (sunflower plant family) site (~ 800 ft. from Peck's mariposa lily) would not affect members of the lily family. | NI |
| 71-59 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 600 | Peck's mariposa lily (lily family) would not be affected – Canada thistle will only be treated with biocontrol. No herbicide effects expected. | NI |
| 72-01 | Bastard milkvetch (*Astragalus tegetarioides*) | N | 1,800 | No herbicides planned close to bastard milkvetch populations. Chlorsulfuron is proposed for use on whitetop, but whitetop is relatively far away. See Appendix C for applicable PDFs. | NI |
| 72-03 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Peck's mariposa lily would not be affected by clopyralid, proposed for use on spotted knapweed and Canada thistle, but could be affected by metsulfuron methyl, proposed for use on St. Johnswort. | MIIH |

| Project Area | Sensitive Plant Species | Invasive Plant within TES | Distance from closest Infestation (ft.) | Notes about proposed herbicide treatments for closest infestations and PDFs | Effects Conclusion after applying PDFs |
|---|---|---|---|---|---|
| 72-04 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Peck's mariposa lily would not be affected by clopyralid, proposed for use on spotted knapweed, but could be affected by picloram, proposed for use on Dalmatian toadflax and sulphur cinquefoil. | MIIH |
| 72-05 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 1,000 | No herbicides planned close to bastard milkvetch populations. Closest infestation is Canada thistle; Peck's mariposa lily (lily family) would not be affected by clopyralid which is proposed for use on Canada thistle (sunflower family). | NI |
| 72-06 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 85 | Canada thistle population is relatively close to Peck's mariposa lily; however, clopyralid does not target the lily family. | NI |
| 72-07 | Northern moonwort (*Botrychium pinnatum*) Scalloped moonwort (*Botrychium crenulatum*) | N | 12 | Botrychium species (in the Adder's tongue family) are not in a plant family that is targeted by clopyralid (which is proposed for use on Canada thistle). | NI |
| 72-12 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Peck's mariposa lily (lily family) would not be affected by clopyralid, proposed for use on Canada thistle (sunflower family). | NI |
| 72-13 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Peck's mariposa lily would not be affected by clopyralid, proposed for use on diffuse knapweed and Canada thistle, but could be affected by metsulfuron methyl, proposed for use on houndstongue. | MIIH |
| 72-14 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Peck's mariposa lily could be affected by metsulfuron methyl, proposed for use on houndstongue. | MIIH |
| 72-15 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Peck's mariposa lily could be affected by metsulfuron methyl, proposed for use on houndstongue. | MIIH |
| 72-16 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | N | 35 | Peck's mariposa lily could be affected by sulfometuron methyl, proposed for use on medusahead. | MIIH |
| 72-17 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Peck's mariposa lily could be affected by metsulfuron methyl (proposed for use on houndstongue) and sulfometuron methyl (proposed for use on medusahead). | MIIH |

| Project Area | Sensitive Plant Species | Invasive Plant within TES | Distance from closest Infestation (ft.) | Notes about proposed herbicide treatments for closest infestations and PDFs | Effects Conclusion after applying PDFs |
|---|---|---|---|---|---|
| 72-18 | Silverskin lichen *Dermatocarpon luridum* | N | Not sure – may be plants in riparian area next to Roba Creek, near lichen | Silverskin lichen occurs in the water, usually submerged or inundated for most of the year. This analysis assumes that all herbicides would affect lichens, but PDFs would keep herbicides out of the water. Houndstongue is the closest invasive plant and metsulfuron methyl is proposed for use on it; this is not an aquatic herbicide and aquatic buffers and water-related PDFs would apply. | NI |
| 72-19 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Peck's mariposa lily could be affected by metsulfuron methyl, proposed for use on houndstongue. | MIIH |
| 72-20 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Peck's mariposa lily could be affected by metsulfuron methyl, proposed for use on houndstongue. | MIIH |
| 72-25 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Peck's mariposa lily could be affected by metsulfuron methyl, proposed for use on houndstongue. | MIIH |
| 72-32 | Mingan moonwort *(Botrychium minganense)* Peculiar moonwort (*Botrychium montanum*) | N | 135 | Chlorsulfuron, proposed for use on whitetop, could affect the Botrychium species. | MIIH |
| 72-42 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Peck's mariposa lily could be affected by metsulfuron methyl, proposed for use on houndstongue. | MIIH |
| 72-50 | Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*) | Y | 0 | Peck's mariposa lily could be affected by metsulfuron methyl, proposed for use on houndstongue. | MIIH |
| 72-52 | Bottlebrush sedge (*Carex hystericina*) | Y | 0 | Invasive plants would be treated manually and there would be no effects from herbicides on the sedge. | NI |

| Project Area | Sensitive Plant Species | Invasive Plant within TES | Distance from closest Infestation (ft.) | Notes about proposed herbicide treatments for closest infestations and PDFs | Effects Conclusion after applying PDFs |
|---|---|---|---|---|---|
| 72-59 | Henderson's needlegrass (*Achnatherum hendersonii*) | Y | 0 | Currently, medusahead very limited due to rapid response (hand pulled 3 plants found in 2003 & < 12 plants in 2006). However, if medusahead does come back and rapidly expands beyond that which can be hand-pulled, or a large medusahead population is discovered nearby, herbicide would be considered. Sulfometuron methyl is proposed for use on medusahead, using a combination of techniques to avoid needlegrass. Glyphosate may be considered adjacent to needlegrass. | Currently = NI; if future rapid expansion of medusahead were to occur, then would be MIIH |
| 75-43 | Peck's penstemon (*Penstemon peckii*) | N | 150 | Sulfometuron methyl, proposed for use on medusahead, could affect Peck's penstemon. | MIIH |

## Survey and Manage Plants (NWFP area of Deschutes National Forest Only)

Survey and Manage plant sites within Project Area Units on the Deschutes National Forest were identified. Seven Invasive Plant Project Area Units contain known sites of Survey & Manage plant species (Table 34).

As discussed above (see Effects of Herbicides to Native Vegetation, Lichens, Bryophytes and Fungi), nonvascular plants may be more sensitive to herbicides than vascular plants due to their physical structure and characteristics. However, most invasive plant sites are in highly disturbed areas, such as roads and quarries, and are not high quality habitat for the typically old-growth dependent Survey & Manage plant species. Of the five Survey & Manage plant species which require pre-project surveys on the Deschutes National Forest, mountain lady's slipper (*Cypripedium montanum*) is probably the most threatened by invasive plants and by invasive plant treatments because it occurs along roads where there are mapped invasive plants. The other species do not occur in habitats where invasive plants tend to occur. Skin lichen (*Leptogium cyanescens*) occurs in riparian habitats and there is a low probability that it would occur on the Deschutes National Forest (Dewey 2006b). *Tritomaria exsectiformis* and *Marsupella emarginata* var. *aquatica* (both liverworts) occur in very wet habitats (the latter attached to submerged rocks in fast moving perennial water). Riparian invasive plant species, such as reed canarygrass and ribbongrass, could pose a threat to populations of these liverworts, but there are currently no known invasive plant threats to these sites (Dewey 2006a, pers. comm.). *Schistostega pennata* requires humid, heavily shaded microsites and there is a low probability of this species occurring in open disturbed habitats typically occupied by invasive plants (Dewey 2006b).

Though individual plants or fungal mycelium could be harmed by herbicides, the long-term benefits of protecting native plant habitat from invasive species would outweigh short-term impacts of herbicides on individual Survey & Manage plant species.

The following Botany PDFs are intended to protect Survey & Manage plants from invasive plant treatments: PDFs 4, 5, 61, 62, 64, 65, 66, 67, 68 and 69. Other PDFs would help protect non-target vegetation, including Survey & Manage plants: herbicide application rates (PDF 12), herbicide selective spray techniques (PDF 13), wind and precipitation restrictions when applying herbicides (PDFs 15 & 17), and using equipment to reduce herbicide drift (PDF 16). However, even with these protection measures, if fungi are not visible during herbicide treatments, we cannot be certain that we are avoiding impacts to these species from treatments.

After evaluating PDFs and uncertainties, an effects determination was made for each of the seven Project Area Units with Survey & Manage plants (Table 34). As with Sensitive plants, invasive plants would pose a higher risk in the long-term to Survey & Manage plants than the proposed invasive plant treatments. PDFs, Regional Invasive Plant Standards and other layers of caution would be incorporated into planning and implementing invasive plant treatments. Potential impacts to Survey & Manage plants are expected to be minimal or eliminated.

The Early Detection/Rapid Response Strategy under Alternative 2 would increase our ability to more quickly treat invasive plant sites, providing more protection in the long-term to the native plant habitats occupied by Survey & Manage plants.

**Table 34.** Evaluation of potential effects of proposed herbicides on known Survey & Manage plant populations within Invasive Plant Project Area Units for both Alternatives 2 and 3. Effects codes: NI = No Impact; MIIH = May Impact Individuals or Habitat, But Will Not Likely Contribute To A Trend Towards Federal Listing or Loss of Viability to The Population or Species.

| Project Area | Species | Life-form | Invasive Plant within population | Distance from closest infestation (ft.) | Notes about proposed herbicide treatments for closest infestations and PDFs | Effects Conclusion after applying PDFs |
|---|---|---|---|---|---|---|
| 11-07 | *Hydnotrya inordinata* | Fungus | N | 8,000 | No invasive plant sites nearby. | NI |
| 11-17 | *Tritomaria exsectiformis* | Liver-wort | N | 850+ | One *Tritomaria exsectiformis* site occurred downstream from a spotted knapweed site near the intake facility, but is believed to be extirpated; the other TREX3 site is at a seep near Skyliner Lodge and at least 850 feet away from spotted knapweed & bull thistle sites along Tumalo Creek. Clopyralid, proposed for use on those 2 invasives, but TREX3 is far away and effects are not expected. | NI |
| 15-01 | *Hygrophorus caeruleus* | Fungus | Y | 0 | Within mapped spotted knapweed site. All applicable PDFs would be applied. | MIIH |
| 15-05 | *Choiromyces alveolatus* | Fungus | Y | 0 | Spotted knapweed occurs along Hwy 20; St. Johnswort has expanded in areas along Hwy 20 due to recent wildfires. The preferred herbicides to target these invasives would be Clopyralid for use on spotted knapweed and metsulfuron methyl on St. Johnswort. All applicable PDFs would be applied. | MII |
| 15-10 | *Hygrophorus caeruleus* | Fungus | Y | 0 | Fungus site on edge of Project Area Unit, in vicinity of 1232/320 Rds junction. Diffuse knapweed and St. Johnswort in area. All applicable PDFs would be applied. | MIIH |
| 15-14 | *Cypripedium montanum* | Vascular plant | Y | 0 | Five sites occur. Diffuse knapweed occurs in the road very near *Cypripedium montanum* in the Gunsight Pass area. Bull thistle and cheatgrass do occur along the same road. Medusahead was found (and pulled) in the upper part of a timber sale unit immediately below the road. All applicable PDFs would be applied. | MIIH |
| 15-17 | Cypripedium montanum | Vascular plant | Y | Unknown | One site reported but not relocated yet. Spotted and diffuse knapweeds, St. Johnswort, and Scotch broom are mapped along Rd. 1499. Cypripedium would not be affected by clopyralid (used on knapweeds), but could be affected by metsulfuron methyl for St. Johnswort, and possibly by triclopyr used on Scotch broom. PDF 61 (surveys) and 62 (botanist identify steps to protect) at a minimum would be needed to protect Cypripedium. All applicable PDFs would be applied. | MIIH |

### Summary of Herbicide Effects to Native Vegetation for Alternative 2

- ***Protection measures will minimize or eliminate any short-term effects to native vegetation from herbicide treatments.*** The combination of PDFs, Regional Standards, and herbicide laws and regulations provide protection to non-target plant species. Selective application methods, timing of treatments, and use of more selective herbicides that are less harmful to desired, non-target plants will result in minimal, if any, effects. There is a low risk to native vegetation from herbicide treatments.
- ***Native vegetation will benefit in the long-term from invasive plant treatments.*** Even if individual plants were affected by herbicide treatments, these effects would be short-term. In the long-term, native plant habitats will benefit from invasive plant treatments.
- ***Increased herbicide options will help plan treatments to minimize non-target effect to Sensitive plants***. More herbicide options (10 herbicides) are available under Alternatives 2 and 3, and allow us options to select a lower risk herbicide when sensitive plants are in the vicinity.
- ***Sensitive and Survey & Manage plant species will benefit from the treatment effectiveness of Alternative 2***. Rare plant populations threatened by invasive plants will be a high priority for treatment. The more quickly invasive plants can be controlled in these sites, the better the chances for long-term survival and viability of Sensitive and Survey & Manage plant species.
- ***Invasive plant treatments will not lead to a trend toward Federal listing.*** Even if individual Sensitive plants were inadvertently affected by herbicide treatments, the long-term benefits of protecting native plant habitats from

## ALTERNATIVE 3

### Direct and Indirect Effects

#### Native Vegetation

Alternative 3 is similar to Alternative 2 in that the ten herbicides analyzed in the Regional Invasive Plant FEIS would be available for use, providing more options for more efficient and effective treatment of invasive plants than Alternative 1. The same PDFs and other protection measures described above for Alternative 2 also apply to Alternative 3. The combination of PDFs, Regional Standards, and herbicide laws and regulations would provide protection to non-target plant species. Selective application methods, timing of treatments, and use of more selective herbicides that are less harmful to desired, non-target plants will result in minimal, if any, effects. There is a low risk to native vegetation from herbicide treatments. The Early Detection/Rapid Response Strategy would increase treatment effectiveness through quick response to newly discovered invasive plant populations, controlling them before they spread further and providing increased protection to native vegetation.

The primary difference between the two alternatives is that Alternative 3 limits the herbicide methods and the selection of herbicides that can be applied within 300 ft. of water and the use of herbicides close to water (within 10 ft.). This currently affects only about 230 our mapped acres of invasive plants, but – for the reasons described below – does affect our current and future ability to protect riparian areas from invasive plants.

Restrictions on broadcast spraying under Alternative 3 would result in more selective herbicide application methods (i.e., spot spray, wicking) within 300 ft. of water, which is expected to minimize impacts to non-target native vegetation from herbicide treatments. However, more selective herbicide application may result in fewer acres being treated and more years of spraying. Therefore, short-term benefits to individual native plants from more selective herbicide techniques may be outweighed by the longer time needed to gain control over invasive plant populations.

Under Alternative 3, herbicides cannot be used within 10 feet of water. Controlling rhizomatous species, such as reed canarygrass, ribbongrass and Canada thistle, would be more difficult than under Alternative 2, which allows the use of some herbicides up to the water's edge. Large infestations of these rhizomatous species are difficult to control manually. To be successful with manual treatments, it would require persistent, frequent hand-pulling of all sprouting stems throughout the growing season. For example, more than 250 clumps of ribbongrass occur along the edge and on islands within the Metolius River, scattered along 10 miles of river. Due to the rhizomatous growth of ribbongrass and accessibility issues along the river, repeated and frequent manual treatments would be difficult. A demonstration project on private land being conducted by the Friends of the Metolius (with the Forest Service assisting in monitoring and data collection as a partner) is testing herbicide, manual, and solarization methods for treating ribbongrass. Initial treatments showed that hand-pulling ribbongrass clumps that occur on cobbles in the water were easier than on the streambank where it proved to be difficult and nearly impossible to avoid pulling the native grasses and sedges that are intermixed with ribbongrass. Pulling ribbongrass on the streambank leaves more bare soil that can add additional fine sediments to the river. Under Alternative 3, ribbongrass is likely to continue spreading. The same applies to reed canarygrass and Canada thistle. Riparian invasive species can impact riparian plant species that occupy the narrow wet margins of rivers and streams, such as clustered field sedge (*Carex praegracilis*). If ribbongrass continues to displace native vegetation, forming monocultures along the Metolius River, there could also be indirect effects to pollinators, aquatic insects, and wildlife that depend on the diversity of native plants. Within the 10-foot no herbicide buffer, soil solarization is another method that could be utilized; however, soil solarization can deter the growth of desirable native plant species (Tu et al. 2001).

Manual pulling of tap-rooted species, such as spotted knapweed, in riparian areas can also be very difficult (Powers 2006, pers. comm.). In some riparian sites, the soil is compacted from heavy riparian use; some sites are difficult to pull due to the multitude of intertwined roots from other species that can occur in riparian areas, which are often more densely-vegetated than the surrounding uplands. The ten foot no-herbicide buffer under Alternative 3 may result in less effective treatment of those riparian sites where these conditions occur.

In some riparian areas, manual treatment of invasive plants in the 10 ft. buffer would be feasible if populations are small and easily accessible, the soil is not compacted, and roots can easily be pulled. These sites will require more effort and time to eradicate the invasive plants because manual treatments are more labor intensive and time consuming. Depending on the size of the infestation and the number of people required to hand-pull plants, there can be trampling effects to native plants from the manual treatments. Given historical Forest Service budgets, it is likely that fewer acres of invasive plants would be treated annually and effects to native plant communities may be longer-term in these situations.

Alternative 3 does not allow the use of triclopyr within 300 ft. of riparian areas. Triclopyr is proposed for use on Himalayan blackberry, which occurs along Cottonwood Creek on Paulina District, growing approximately 50 feet or less from this perennial creek. Himalayan blackberry is an aggressive species that can grow up to lengths of 7 meters in a single season (Mazzu 2005). Once first year canes have arched over and hit the ground, daughter plants can develop where cane apices have rooted. Paulina District's site is expanding and, if left unchecked, has the potential to become a very large infestation. This aggressive species is a high priority for treatment with the objective of eradicating it before it spreads further, impacting additional native plant habitat. The Paulina District's Himalayan blackberry site went from one stem in year 2000, to 30 ft. diameter in 2002, and eight "daughter" plants formed in 2004 (Mafera 2006, *personal communication*). This site, which occurs along an anadromous fish stream, is not easily accessible -- it takes about 1.25 hours drive and a three mile hike to reach the site. For manual treatment to be effective it would require repeated treatments throughout several growing seasons; the distance involved in getting to this site reduces our ability to effectively treat it manually. Triclopyr is the preferred herbicide for treating Himalayan blackberry (Appendix B). Triclopyr is a selective systemic herbicide for woody and broadleaf species, especially root- or stem-sprouting species. Picloram and glyphosate can be effective for treating Himalayan blackberry, but picloram cannot be used within 300 ft. of water bodies and glyphosate is a broad spectrum, non-selective herbicide that can kill most plants it touches.

Effects to riparian native vegetation may be greater under Alternative 3 than Alternative 2 if it takes longer to control invasive plant sites within riparian areas. Because herbicides cannot be broadcast sprayed within 300 feet of water bodies, it is likely that fewer acres of invasive plants would be treated, and less effective treatment options, such as manual treatment of rhizomatous invasive species in riparian zones, will be more difficult and take more time to reach management objectives.

As with Alternative 2, repeated use of herbicides could potentially shift species composition. However, any shift would be minimal for the same reasons discussed above. It is unlikely that there would be a significant shift in native plant species composition across the landscape.

The potential effects for biological soil crusts are the same as Alternative 2. The direct effects of herbicide applications proposed in this project on soil microbes are expected to be negligible due to evidence from research and practicable application rates (from Soil Resource Report).

### Sensitive Plants

The effects determination to sensitive plants from invasive plant treatments is the same for Alternatives 2 and 3: Invasive plant treatments may impact individual plants but will not contribute to a trend towards federal listing or loss of viability to Sensitive plant populations or species. The same PDFs apply to both Alternatives 2 and 3 and intend to minimize or eliminate herbicide treatment effects to Sensitive plants and comply with Regional Invasive Plant Standards (R6 2005 ROD). The ten proposed herbicides were evaluated for potential effects on each of the documented Sensitive plant species and the appropriate PDFs identified (Appendix C of the Botany specialist report). Table 18 also applies to Alternative 3. As with Alternative 2, even with the PDFs and all the layers of caution integrated into herbicide treatments, there is always the chance – though a minimal chance – that an individual Sensitive plant might be damaged by inadvertent herbicide contact. However, this would be a short-term effect and invasive plant treatments would benefit Sensitive plant species in the long-term. There is greater concern that uncontrolled invasive plants will negatively impact Sensitive plants and their habitats.

Under Alternative 3, herbicides cannot be broadcast sprayed within 300 feet of water. More selective application methods, such as spot spraying or wiping, would be effective yet would likely take longer to accomplish. In some situations, restrictions on broadcast spraying may result in fewer acres being treated and a longer time to gain control over invasive plants; this may affect some Sensitive plant populations. For example, the Sensitive Peck's penstemon does occur within 300 ft. of many creeks; broadcast spraying clopyralid could be done with minimal, if any, effects to Peck's penstemon and many native plants, and allow more efficient treatment of more acres. In this scenario, Alternative 2 would provide more options to gain control over spotted knapweed than Alternative 3.

However, in some situations, more selective herbicide methods (than broadcast spraying) would need to be used to protect Sensitive plants and this would be the same for both Alternatives 2 and 3. For example, treating spotted knapweed plants with clopyralid within a tall agoseris site would require more selective herbicide application methods (e.g., spot spraying) to protect the tall agoseris because this member of the sunflower family would be affected by this herbicide. Likewise, Peck's mariposa lily could be affected by use of metsulfuron methyl on houndstongue, requiring more selective herbicide methods instead of broadcast spraying.

The primary difference between Alternatives 2 and 3 on sensitive plants is a reduced ability to control rhizomatous invasive species that occur within 10 feet of water that are difficult to control manually, without the use of herbicides. Estes' artemisia, a central Oregon endemic plant species (only occurs in this area), is found along the Deschutes River, usually within 10 ft. of the river. Canada thistle, a rhizomatous species, occurs in the same habitat, close to the River. At Meadow Camp Picnic Area (Project Area Unit 11-62) on the Deschutes River, Canada thistle grows about 10 feet from Estes' artemisia. Canada thistle is difficult to treat manually. Alternative 3 limits the option to use herbicide on this Canada thistle population. Likewise, Canada thistle occurs with the sensitive bottlebrush sedge (*Carex hystericina*) in Black Canyon Wilderness on Paulina District (Project Area Unit 72-52). Our ability to treat Canada thistle is limited under Alternative 3.

Peck's penstemon occurs in wet swales and along intermittent creeks on Sisters District and is primarily threatened by spotted and diffuse knapweeds. Depending on accessibility, small populations of spotted knapweed could be hand-pulled within the 10 ft. no-herbicide buffer; this tap-rooted species is easier to hand-pull than rhizomatous species. It would be more time consuming, difficult, and less effective, to hand-pull large populations of spotted knapweed. Project Area Unit 15-01 (called "little Montana") is a large spotted knapweed site that occurs within a population of Peck's penstemon that has been designated as "protected" (Pajutee 2006a). Protected populations are carefully selected to represent the existing array of geographic and morphological variation that occurs within this species. These protected populations are chosen to be geographically distributed to promote pollinator outcrossing and maintain natural modes of seed dispersal. Protected populations aim to achieve long-term species viability by maintaining existing genetic variance and promoting reproductive success. Within the Little Montana site, intermittent channels dissect the area. At this site, Alternative 2 would allow quicker and more effective control of spotted knapweed than Alternative 3.

Alternative 3 is consistent with management direction in the Species Conservation Strategy for Peck's penstemon (Pajutee 2006), the Draft Conservation Strategy for pumice grape fern (Powers 2006b), and the Conservation Strategy for Peck's mariposa lily (Dewey 2007; draft that will soon be finalized). All three Conservation Strategies identify invasive plants as threats to these Sensitive plant species; treating invasive plants is important for protecting these species.

### Survey & Manage Plants

As with Alternative 2, there is a low risk that the proposed herbicide treatments would impact Survey & Manage plant species, which do not typically occur in habitats occupied by invasive plants. Survey & Manage plants are usually closely associated with late-successional or old-growth, undisturbed forests; the majority of our invasive plant sites are in highly disturbed, open areas.

However, if herbicides were to be used near non-vascular plants, they may be quite susceptible to herbicides, more than vascular plants (see previous discussions). Some of the known sites are fungi (Table 32). The fruiting bodies of fungi do not regularly appear from year to year; a species might be present but not visible when treating invasive plants. Therefore, it is difficult to ensure that herbicide spraying will not impact them. Table 34 evaluates potential effects of proposed herbicides on Survey & Manage plants. PDFs, Regional Invasive Plant Standards, and other layers of caution would be incorporated into planning and implementing invasive plant treatments, and every effort would be made to minimize or eliminate, as best we can, impacts to Survey & Manage plants.

Alternative 3's broadcast spray restrictions within 300 ft. of water may reduce potential impacts to those Survey & Manage plant species that occur in this zone. Selective herbicide spraying, especially with herbicides that are not highly mobile, is likely to afford more protection to non-vascular plants, including Survey & Manage, than broadcast spray methods. Overall effects to non-vascular plant species from herbicide treatments are likely to be less under Alternative 3 then under Alternative 2 due to the use of more selective herbicide methods within some invasive plant sites.

As with sensitive plants, invasive plants themselves pose a higher risk to Survey & Manage plants than the proposed treatments. Controlling invasive plants and preventing their spread will provide long-term benefits to Survey & Manage plants by protecting their habitats.

Currently, there are no riparian invasive plant species, such as reed canarygrass or ribbongrass, threatening known Survey & Manage plant sites. Our inability to treat these invasive species with the 10-foot no-herbicide buffer restriction under Alternative 3 would not affect currently known Survey & Manage sites. However, it could affect potential Survey & Manage habitat. Reed canarygrass and ribbongrass could be potential threats to *Tritomaria exsectiformis* in the future, but is not currently a problem.

## Summary of Effects to Native Vegetation for Alternative 3

- ***Restricted broadcast spraying will likely minimize short-term impacts to non-target plants but may result in treating fewer acres.*** Restrictions on broadcast spraying under Alternative 3 would result in more selective herbicide methods (i.e., spot spray, hand application), which will likely minimize impacts to non-target native vegetation from the herbicide treatments. However, **more** selective herbicide application may result in fewer acres being treated and more years of spraying. Therefore, short-term benefits to individual native plants from more selective herbicide techniques may be outweighed by the longer time needed to gain control over invasive plant populations.
- ***Protection measures will minimize or eliminate any short-term effects to native vegetation from herbicide treatments.*** The combination of PDFs, Regional Standards, and herbicide laws and regulations provide protection to non-target plant species. Selective application methods, timing of treatments, and use of more selective herbicides that are less harmful to desired, non-target plants will result in minimal, if any, effects. There is a low risk to native vegetation from herbicide treatments.
- ***Even with Project Design Features, there could be some individual plants (including Sensitive plants) affected by herbicide spraying but treating invasive plants would have long-term benefits.*** Individual plants may be affected by treatments, but these effects would be short-term (1-5 years, depending on how long it takes to control the invasive plant population). In the long-term, rare plants and native plant habitats will benefit from invasive plant treatments.
- ***Increased herbicide options will help plan treatments to minimize non-target effect to Sensitive plants***. More herbicide options (10 herbicides) are available under Alternatives 2 and 3, and allow us options to select a lower risk herbicide when sensitive plants are in the vicinity.
- ***Sensitive and Survey & Manage plant species will benefit from the treatment effectiveness of Alternative 2***. Rare plant populations threatened by invasive plants will be a high priority for treatment. The more quickly invasive plants can be controlled in these sites, the better the chances for long-term survival and viability of Sensitive and Survey & Manage plant species.
- ***Invasive plant treatments will not lead to a trend toward Federal listing.*** Some herbicides, if they were to come into contact with a Sensitive plant, have the potential to weaken, damage or kill individual Sensitive plants. PDFs are intended to minimize or reduce these impacts. Overall, invasive plant treatments are intended to protect Sensitive plant habitats and these treatments would not lead to a trend toward Federal listing.

- ***Riparian native plants may continue to be impacted by rhizomatous invasive plant species***. Riparian rhizomatous plant species, such as reed canarygrass and ribbongrass, that are difficult to control without the use of herbicides, would continue to impact native riparian plant species that grow near the water's edge.

### Cumulative Effects on Native Vegetation for All Alternatives

In the reasonably foreseeable future, there will continue to be projects and activities on the Forests and Grassland that cause ground disturbance, and disturbed areas will be susceptible to invasive plants. These actions include road maintenance, timber harvesting, fire suppression, fuel reduction, recreation, stream restoration projects, grazing, etc. Roads will continue to be a major conduit for invasive plants. Recreation use of National Forests will likely continue to increase, contributing to the spread of invasive plants. There will also continue to be projects and activities on adjacent state, county, private and other federal lands. Cumulatively, these actions will contribute to the introduction, spread and establishment of invasive plants on National Forest System lands. However, Regional Standards and Forest/Grassland Prevention Guidelines will help reduce the extent or intensity of land uses that spread invasive plants resulting in a cumulatively beneficial impact (R6 2005 FEIS, 4-39). These Regional Standards are intended to help us protect ecosystems from the impacts of invasive plants, and minimize the creation of conditions that favor invasive plant introduction, establishment and spread during land management actions and land use activities.

Natural disturbances, such as wildfire, will occur in the future. Many invasive plant species germinate readily after wildfire and, being as they are adapted to colonize disturbed sites, they move rapidly into and across large areas opened up by fire and this would have negative cumulative impacts on native plant habitats. Early Detection/Rapid Response Strategies built into Alternatives 2 and 3 would reduce these impacts by allowing us to more quickly treat invasive plant populations, reducing their spread.

There will not be significant cumulative effects to native plant communities from the proposed invasive plant treatments. Rather, the proposed actions are intended and expected to restore native plant communities when they are being adversely affected by invasive plants. PDFs common to the action alternatives (Alternatives 2 and 3) will reduce risk of adverse effects from invasive plant treatments to non-target native vegetation, including Sensitive and Survey & Manage plant species. Proposed treatments, implemented according to PDFs, have a low likelihood of contributing to cumulative effects from other projects on and off the Forests and Grassland. Invasive plant treatments are expected to have an overall beneficial impact to native vegetation.

There would likely be significant cumulative negative effects on native vegetation if invasive plants are not treated. This risk is highest under the No Action Alternative because many existing invasive plant sites would not be approved for treatment and would continue to spread.

There could be additive cumulative effects to susceptible non-target plant species if herbicide use is repeated over time on the same site. This cumulative effect would be most likely under the No Action Alternative where limited herbicides are available. Alternatives 2 and 3 include a greater variety of herbicides and would be less likely to result in repeated use of the same herbicide. However, for all alternatives, herbicide use is expected to be reduced at each site as invasive plants are controlled. Effects to non-target vegetation should be reduced as herbicide use is reduced. As new infestations and sizes of existing infestations are reduced, native plant communities will benefit. Adjacent private, state, county and other federal lands would be more protected from further invasion.

Invasive plants occur on many private lands throughout central Oregon. There are efforts being initiated to deal with this problem. The city of Sisters and Bend have adopted weed ordinances requiring landowners, yet these are rarely enforced. Educational weed pull days are aimed at increasing awareness about the problem. Partnerships have formed, such as the Central Oregon Weed Gang, to work together to begin to solve this problem. However, the sheer abundance of invasive plants on private lands and the fact that many of these sites are untreated will continue to cumulatively impact native plant habitats. Early Detection/Rapid Response strategies in Alternatives 2 and 3 would provide a defense against the constant threat of spread from private lands onto Forest Service lands.

Privately-owned property on the Metolius River near Camp Sherman may be treated for invasive plants (ribbongrass, reed canarygrass, and/or yellow flag iris are known to occur). A demonstration project is currently being conducted by Friends of the Metolius to test herbicide, manual (hand-pulling and digging) and solarization treatment methods on ribbongrass. Implementation of treatments on private property will benefit efforts on National Forest System lands by reducing the amount of invasive plants available to re-invade treated areas. This will improve the Forest's ability to meet site objectives and return native plant diversity to the banks and islands of the Metolius that have been impacted by ribbongrass.

In summary, with the layers of caution built into this project (see Section 3.2 and Fig. 4), we do not expect there would be significant cumulative effects from invasive plant treatments on native vegetation for Alternatives 2 and 3. There is a higher risk that invasive plants will continue to spread and degrade native plant communities under the No Action Alternative; these effects would be cumulative over time and are likely to become significant. Regional prevention, treatment and restoration standards are intended to help reduce potential spread, but existing sites must be contained, controlled or eradicated or they will continue to spread, increasing the risk of significant cumulative effects from invasive plants on native vegetation.

### Cumulative Effects for Sensitive and Survey & Manage Plants for All Alternatives

Some Sensitive and Survey & Manage plant species range beyond the Forests and Grassland and there may be additional populations that are threatened by invasive plants. The Forest Service, working with the Bureau of Land Management in the Interagency Special Status/Sensitive Species Program, has prioritized those Sensitive plants most needing conservation planning and identified National Forests that will work together to develop Conservation Assessments and Strategies for managing these rare species. Invasive plant treatments on other populations of Sensitive plants on other federal lands are possible; currently, the amount of treatment or specific risks from such treatments is unknown.

There will continue to be projects and activities on Forest Service lands, such as timber harvesting, fire suppression, fuel reduction, recreation, stream restoration projects, grazing, etc. On the Deschutes and Ochoco National Forests and the Crooked River National Grassland, Forest Service Botanists are always involved in planning these projects. Botanists conduct sensitive plants surveys and map populations. Within the Northwest Forest Plan Area on the Deschutes National Forest, surveys are conducted for Survey & Manage plants. Protection measures are developed to avoid and protect our sensitive plant species. Due to careful planning, impacts to sensitive plants are greatly minimized from these planning efforts.

Current grazing practices have been identified as a potential threat to the rare Peck’s mariposa lily. However, grazing practices are being modified through range allotment planning efforts. This should improve conditions for Peck’s mariposa lily in the long-term (USFS 2005e). Spread of invasive plants from grazing is expected to be reduced under Regional Invasive Plant Standard 6, which requires that we use available administrative mechanisms to incorporate invasive plant practices into rangeland management, such as revising permits and grazing allotment management plans, providing annual operating instructions, and using adaptive management. Over time, improved grazing practices combined with the proposed invasive plant treatments should benefit sensitive plants.

Treating invasive plants would protect and enhance sensitive plant habitat. There is a higher risk of cumulative effects on rare plant habitats from uncontrolled spread of invasive plants under the Alternative 1, which treats far fewer invasive plant sites than Alternatives 2 and 3.

There would be no cumulative effects to Sensitive plants and other native vegetation from herbicide spraying approved under other projects. There are no sensitive plants located within the 18 Fire Competing Vegetation Management project (USFS 2006d), which approved the use of spot herbicide treatments of grasses and shrubs using the herbicide hexazinone. There was potential habitat for green-tinged paintbrush, yet no plants were located by field surveys within the project area. The native vegetation that would be treated around planted trees in the 18 Fire area are species that abundantly occur on the Deschutes National Forest: greenleaf manzanita (*Arctostaphylos patula*), snowbrush (*Ceanothus velutinous*), Idaho fescue (*Festuca idahoensis*), and upland sedges (either *Carex rossii* or *Carex inops*). Cheatgrass would also be treated in the 18 Fire project, providing a beneficial cumulative effect by reducing this invasive species. There are no sensitive plants growing in a medusahead site within a rock pit that was approved for treating with herbicides (USFS 2005c).

# 3.5 Soils

## 3.5.1 Affected Environment

### Landscape and Soils

Soils present on lands currently under the jurisdiction of the National Forests and Grasslands included in this analysis are predominantly volcanic in origin. The majority of soils on the Deschutes and Ochoco National Forests are comprised of a surface component of airfall ash or pumice from Mt. Mazama ranging from one to many feet in depth, depending primarily on the distance from the source of the plumes. Subsurface soil horizons include older airfall ash, colluvium and/or paleosols weathered in place from underlying bedrock. Soils located on the Crooked River Grasslands have a thinner veneer of airfall ash over older soils comprised of colluvium, alluvium or directly weathered from underlying bedrock.

Controlling bedrock geology throughout the analysis area includes primarily basaltic, andesitic and rhyolitic features of various ages. Volcanics that comprise the Cascade Mountains on the Deschutes National Forest are relatively young in age and have been glaciated multiple times during past ice ages. The east slopes of the Cascade Mountains are underlain by glacial till and/or glacial outwash from this era. Other landforms on the Deschutes are primarily non-glaciated stratovolcanoes, cinder buttes and rhyolitic dome features located across the forest. Landforms on the Ochoco National Forest and the Crooked River Grasslands are predominantly associated with large basalt flows from the Miocene and early Pleistocene that cover older sedimentary and/or volcanic rocks. These landforms were not glaciated and are much older geologically than those on the Deschutes. Large landslide features are also present on the Ochoco National Forest associated with local faulting in the area.

Specific characteristics of soils located on the Deschutes are not necessarily descriptive of those located on the Grasslands and Ochoco. Primary features of the ash soils on the Deschutes are a coarse textural class, low to moderate cation exchange capacity (CEC), relatively low organic matter content (1-10%) and rapid infiltration rates. The moisture retention of the sandy loam and loamy sand Mazama ash soils on the Deschutes are relatively high when compared to soils of similar texture derived from granitic parent materials. The low CECs are reflective of relatively low organic matter contents that are concentrated in narrow surface horizons and low clay contents of the mineral soil. The moderate and rapid infiltration rates of these soils minimize overland flow volumes and energies during rainfall events in uncompacted areas.

Soils located on the Grasslands and the Ochoco are finer textured and generally have a higher clay content than those located on the Deschutes. As a result of these characteristics, infiltration rates are moderate to slow and overland flows during storm events tend to be higher than soils on the Deschutes. These soils also have moderate CECs and low organic matter composition that is generally concentrated at the surface. Organic matter content generally ranges from 3 to 5.5% in the surface mineral soil horizon for a small subset of representative landtypes (USDA 1977).

### Soil Conditions within Project Area Units

Proposed treatment areas have generally been physically disturbed by activities that have created bare mineral soil and/or compacted conditions. These activities include road construction, machinery traffic from commercial harvest operations, recreational uses, quarry excavations, pile burning of harvest slash, and wildfire. The majority of infested sites identified for treatment and the area they are expected to expand to are along road corridors (approximately 70% of project area units).

Soils conditions within proposed treatment areas generally include the loss or mixing of surface organics and mineral soil into subsurface mineral soil horizons as a result of displacement; and/or altered soil structure and porosity as a result of compaction of mineral soil. In general, conditions affecting vegetative growth such as available moisture holding capacities and soil porosity are likely to have been altered, creating conditions in which invasive species are able to out-compete native species. This is especially the case on road prisms 'maintained' for safety features such as shoulders. These conditions may be irreversible unless physical conditions at the site are rehabilitated or the invasive plants are removed and replaced with native individuals. However, passive restoration will in many cases allow native species the opportunity to establish along roadsides (see Native Vegetation section).

Some treatment sites included in the analysis area are in riparian locations that contain certain Phalaris species (reed canarygrass and ribbongrass). These species have out-competed native species and created monocultures through the establishment of dense rhizomatous mats. Reed canarygrass was purposely planted in many areas for cattle forage. A history of hydrologic diversions and grazing impacts in Big Marsh created conditions that allowed extensive colonization by invasive plants of this type. Introduced seed sources along the Metolius River have been more aggressive at establishment on site than the native species that are being excluded, apparently without extensive disturbance of the soil resource itself as a pre-requisite.

### Effects of Invasive Plant Infestations on Soils

Discussion of the effects of invasive plants on soil properties relates to the current population and species of invasive plants on site. The establishment of invasive plants on disturbed sites can affect soil quality by out-competing native species for water and nutrient resources in the soil (Olson 1999). Broadleaf weeds often produce deeper taproot systems and less canopy cover compared to the native species that they displace (DiTomaso 2000). These characteristics can decrease the soil holding capacity and increase erosion during rain and wind events. Invasive plants can have direct and indirect effects on soil properties as a result of the physiologic and morphologic differences from native species. Changes to the following properties that contribute to overall soil quality are likely to occur where invasive plant infestations are dense.

- **Soil Organic Matter Content -** Organic matter may be reduced or redistributed in weed-infested soil. Invasive plants tend to have deeper roots and less foliage than native species and the decay of these plants is likely to contribute less litter and organic matter at or near the soil surface. Additionally, invasive plants tend to decay more slowly than native plant species (Olson 1999a; Olson and Kelsey 1997) and result in less annual input of organic matter to the soil.

- **Soil and Water Interactions** – The rate and volume of water infiltration can be reduced on invasive plant sites due to reduced cover (DiTomaso 1999; Olson 1999a). Significantly greater surface water runoff, indicating less infiltration, has been measured from spotted knapweed dominated sites compared to adjacent native grass dominated sites (Lacey et al. 1989). Compaction in many weed infested sites also tends to reduce infiltration rates. Reductions in soil organic matter can also reduce the amount of water held in the soil profile, especially near the surface (Brady and Weil 1999; Tisdall and Oades 1982).

- **Vegetative Cover -** Total vegetative cover may be reduced on invasive plant sites from that provided by native vegetation and can result in higher evaporation from exposed mineral soil on the surface (Lauenroth et al. 1994, Olson 1999a). Soil water stored deeper in the profile may also be depleted more rapidly on sites where vegetative cover provided by invasive plants is dense and associated transpiration rates are high (Olson 1999a).

- **Soil Erosion** – Soil infested with invasive plants has been shown to be more susceptible to erosion than soil supporting native grass species (Lacey et al. 1989). Invasive plants are less able to dissipate the kinetic energy of rainfall, overland flow, and wind that cause soil erosion, primarily due to the loss of cover provided by native plants on site (Torri and Borselli 2000; Fryrear 2000).

- **Soil Biota -** The abundance of soil microbial biomass is generally related to the organic matter content of soils (Brady and Weil 1999). Weed-infested soils may support smaller populations of microorganisms than non-infested soils as a result of changes in organic matter input and decay rates on site. It is possible that infestations of weeds could result in a change to the size and/or distribution of soil microbial population when considering the deeper root distribution and reduced litter production of invasive plants compared to native grasses.

- **Soil Nutrient Availability** – Invasive plants directly limit nutrient availability by out-competing native species for limited soil resources. Invasive plants have high nutrient uptake rates and can deplete soil nutrients to very low levels, especially in cases where weed species germinate prior to native species and exploit nutrient and water resources before native species are actively growing (Olson 1999). Potassium, nitrogen, and phosphorous levels were shown to be 44, 62, and 88 percent lower, respectively, in spotted knapweed infested soil than in adjacent grass covered soil (Olson 1999). Areas infested with invasive plants may also indirectly limit nutrient availability as a result of soil erosion from compacted conditions or reduced effective cover. Erosion selectively removes organic matter and the finer sized soil particles that store nutrients for plant use, leaving behind soil with a reduced capacity to supply nutrients (Brady and Weil 1999).

### Soil Types within Project Area Units

Soil types within treatment areas have been mapped and described in fourth order surveys in the respective Soil Resource Inventories (SRIs) for the Deschutes and Ochoco National Forests (Larsen, 1976; Paulsen, 1977). Although mapping at this scale is relatively coarse, the characteristics described for soil types within proposed treatment areas are likely to be applicable for effects analysis, primarily due to the homogeneous nature of volcanic air fall deposits, bedrock and other parent material influences across the landscape. In addition, the general range of profile depths and soil characteristics described for the SRI soil types allows for some variability of conditions across the landscape. Some treatment areas contain multiple soil types as mapped by the SRI and queried in GIS.

Soil types within the analysis area vary widely in age and composition between the Deschutes and the Ochoco National Forests and Crooked River National Grasslands. The majority of the soil types located on the Deschutes are derived fully or partially from airfall ash volcanics emitted from the eruption of Mt. Mazama approximately 7,600 years ago. The depth and composition of material ejected from Mt. Mazama varies based on the distance and direction from the source of this eruption, as well as the amount of re-working from wind and water this material has experienced in the years following deposition. Representative taxonomy for soils formed in Mazama ash are typic vitricryands and typic vitrixerands. Other parent materials found on the Deschutes include volcanic sources such as Sand Mountain ash or Blue Lake cinders deposited near the Suttle Lake and Metolius River areas, larger pumice from Newberry Crater on the Ft. Rock district, and older residuum weathered from underlying volcanic bedrock.

Textural classes of soils comprised of ash fall from Mt. Mazama and located on the Deschutes National Forest are generally sandy loams and loamy sands. These soils have low cation exchange capacities (CECs) due to low organic matter contents and the lack of clay in the mineral soil. However, the presence of microscopic vesicles in the sand sized pumiceous ash material contributes to a higher water holding capacity than soils of similar texture derived from granitic parent material. As a result, the rate and extent to which water and associated substances in solution migrate down through the profile is reduced. Chemical residues in solution are more likely to be held within the biologically active portion of the soil profile where microbial degradation or hydrolysis can occur. Soils located on the southern portions of the Deschutes closer to the source of the Mazama eruption and those on the Ft. Rock District where the Newberry plume was deposited have coarser popcorn size pumice present in their profiles. Although coarser textured, these soils also have moisture holding capacities that would contribute to holding chemical substances in solution within the biologically active portions of the profile.

Soil types located on the Ochoco and Crooked River Grasslands are generally derived from ash sources or residuum weathered in place. Many soils have a surface veneer of finer ashfall from Mt. Mazama at depths ranging from 1 to 20". Representative taxonomy describes soils with a veneer of ash between 7 and 14" as Vitrandic intergrades and those with ash depths greater than 14" as Vitrixerands (USDA 1999). Lithic, loamy and loamy skeletal soils derived of residuum or older ash sources that are located in the shrub steppe, juniper woodlands and dry conifer vegetation types are generally classified as Lithic Argixerolls. Bottomland and riparian meadow locations on the Ochoco are classified as Typic Haplaxerolls and Typic Argixerolls (USDA 1999).

Textural classes of soils on the Ochoco and CRNG range from fine textured clay to fine sandy loams. Many of the Lithic Argixeroll soils are clay loams that contain significant cobble rock content within the profile. The finer textured soils have higher CECs capable of providing sites to adsorb chemical residues where microbial degradation or hydrolysis can occur. Vitrandic intergrades and Vitrixerands with a veneer of Mazama ash are generally sandy loam in texture overlying finer textured substrata. These profiles have surface horizons with lower CECs subsurface horizons with slightly higher CECs.

## 3.5.2 Environmental Consequences

The chemical characteristics of the ten herbicides proposed for application under this analysis, and their general effects on the soil resource, have been previously described within the Region 6 Invasive Plant FEIS (see Summary of Herbicide Characteristics that Influence their Potential Effect to Soils, Appendix D, pp 35 – 41). Multiple layers of caution integrated into the planning and implementation process of the Deschutes, Ochoco and Crooked River Grasslands Invasive Weeds EIS are expected to reduce the risks and effects of herbicide applications on the soil resource and maintain them within those described under the R6 ROD. These layers include State and Federal laws, EPA label requirements and SERA Risk Assessments, as well as the Region 6 Toxicity Levels of Concern for Federally Listed Anadromous fish which were implemented for all federal lands within the R6 2005 FEIS analysis area and tiered to by this project.

Additional reduction of risks and effects of herbicide applications to the soil resource are provided by Forest Plan Standards and Guidelines, Project Design Features, Proposed Treatment Methods and Applications, and Adaptive Management that includes compliance monitoring of implementation methods. R6 ROD Standard 12 directs the formulation of a long-term strategy for restoring infestations of invasive plants, which necessarily includes protecting or improving soil productivity and conditions for soil microorganisms. Standard 19 directs the use of site specific soils characteristics present in the respective Forest project areas for determining application rates of herbicides appropriate for minimizing effects to the soil resource.

Although overall effects of herbicide applications on the soil resource are not expected to be significant at the Forest scale, some adverse effects from these actions have been shown to be unavoidable. These primarily include localized effects on soil microorganisms and soil productivity as a result of the toxicity and persistence of herbicides, and changes to soil disturbance and/or cover levels as a result of manual and herbicide treatment methods (USFS 2005a).

Effects displayed in this analysis specific to herbicide characteristics and pathways are primarily derived from herbicide risk assessments (SERA 1999, 2001, and 2003). These contain pertinent information, when available, on the potential effects of herbicide applications on the soil resource, including effects to soil organisms, studies considered for the risk assessments, models of individual herbicide movement, and specific information about herbicide properties such as persistence, adsorption rates to mineral soil or organic matter, and solubility in water.

The extent and duration of effects to the soil resource described for the actions proposed under this EIS are assessed according to the individual characteristics of the volcanic soils within the analysis area. Differences in characteristics of soils located on the Forests and Grassland are distinctive enough to alter recommended applications and subsequent degradation pathways for some herbicides. The effects addressed and disclosed in this analysis reflect those differences where they are identifiable.

The effects of manual treatments of invasive plants are summarized in Appendix M of the R6 FEIS and discussed in this report. Manual treatments are likely to reduce effective cover or contribute to detrimental soil conditions on a localized basis as a result of ground-disturbance within areas identified for this type of treatment. Overall effects to the soil resource would be minimized as a result of Project Design Features to limit machine disturbances and the Deschutes and Ochoco Forest Plan Standards and Guidelines for maintaining soil productivity. These sideboards would effectively minimize detrimental ground disturbance such as compaction and long-term cover losses in order to maintain the productivity of the sites and allow for the re-establishment of native or more desirable species.

## ALTERNATIVE 1 – NO ACTION

The No Action alternative would continue the use of select herbicides (Dicamba, Picloram, Glyphosate, and triclopyr) approved under the guidelines of the Mediated Agreement (USFS 1992) on specific treatment sites analyzed in the 1998 Noxious Weed Control Environmental Assessment for the Deschutes National Forest (USFS 1998a), and on specific sites analyzed in the Integrated Weed Management Environmental Assessment and Decision Notice (USFS 1995) and Integrated Noxious Weed Management Environmental Analysis and Decision Notice (USFS 1998b) for the Ochoco National Forest and Crooked River National Grasslands.

The predicted acres of National Forest System lands on which herbicides would continue to be applied annually are included in Table 35. The effects of herbicide applications were analyzed for the soil resource in the previously mentioned NEPA documents and determined to meet a Finding of No Significant Impact (FONSI) for the soil and other environmental resources. Application rates and total acres treated with herbicides have decreased on these sites over the past five years (Oregon Department of Agriculture 2005) and minimized effects on the soil resource.

**Table 35.** Current Average Annual Net Acreage of Herbicide Application - NFS lands, Deschutes, Ochoco and Crooked River National Grassland.

| | Deschutes NF | Ochoco NF | Crooked River NG | Total |
|---|---|---|---|---|
| Herbicide | 82 | 85 | 108 | 275 |
| Mechanical | 0 | 0 | 0 | 0 |
| Manual | 555 | 663 | 47 | 1,265 |

## Manual Treatments

Manual treatments approved under existing NEPA document decisions would continue under the No Action alternative. While the relative amounts of such treatments vary between the alternatives, the differences in terms of effects from such treatments are negligible.

Effects of manual treatments were analyzed in the R6 2005 FEIS (Appendix M) and are summarized in this section. The treatment of invasive plants via lopping or shearing would contribute an input of organic material in the form of dead roots into the soil. Subsequent roots decomposition would release nutrients and provide additional organic matter to the soil. These treatments would reduce the amount of live vegetative cover on site in the short term and allow more erosion inducing raindrops to land unimpeded on mineral soil during rainfall events.

Weed wrenching of invasive plants would loosen and expose bare mineral soil on site to a greater extent than lopping and shearing. These activities also reduce vegetative cover and could cause slight increases in erosion from these sites in the short term until loosened soil settled and vegetative cover increased on site. This would slightly increase the risk of erosion on these sites in the short term, as well as the potential for delivery of fine sediment to streams where these activities occur within proximity to stream channels. The absence of mechanical treatments reduces the risk of extensive soil impacts from these activities.

Pulling invasive plants can also break mycorrhizal hyphae in the soil and possibly cause a transient reduction of mycorrhizal function in the soil environment from the species associated with the invasive weeds that area removed. Studies on crop plants have shown that leaving an undisturbed mycorrhizal network in the soil after harvest (e.g. zero-till agriculture) significantly increases the nutrient uptake of the subsequent crop (Evans and Miller 1988 and 1990). The natural re-establishment of native plants on treated sites may be less successful following manual treatments since bare soils combined with high nutrient levels can provide ideal conditions for the establishment of many invasive plants.

## Direct and Indirect Effects of Invasive Plants on Soils

The effects on the soil resource of not treating invasive plants located in treatment areas identified in this FEIS would be varied among currently infested weed sites. Without treatment, exotic plant invasions are likely to cause measurable changes to the physical, chemical, and biological properties of the soil resource. Invasive plants may increase the proportion of bare ground, increase or decrease the amount of organic matter in the soil, deplete the soil of nutrients or enrich the soil with certain nutrients, change fire frequency, and produce toxic chemicals that affect soil organisms and native vegetation.

The continued growth of invasive plants is likely to maintain lower ground cover (higher levels of exposed mineral soil) within these areas and increase the susceptibility of erosion during runoff events. Soil erosion in a simulated rainfall test more than doubled in spotted knapweed-dominated rangeland areas when compared to natural bunchgrass/forb grasslands, primarily due to significantly lower infiltration rates and higher levels of bare ground than present on the uninfested areas (Lacey and Marlow 1989). Additionally, lower canopy cover of native forbs and graminoids, as well as reduced populations of cryptogams, are likely to occur in untreated stands populated by spotted knapweed or common timothy (Tyser 1992).

Increases in bare ground caused by invasive plants can have negative effects on soil moisture content and populations of soil biota. More rainfall is likely to run off as surface flow in areas with lower surface cover provided by vegetation, decreasing infiltration and increasing erosion potentials. Modest losses of surface mineral soil can have large impacts on soil functions, since most of the biologically active organic matter is concentrated in the top 1 to 4 inches of soil. Soil erosion can also have negative impacts on water quality in associated aquatic systems and the reduction of infiltration decreases groundwater recharge.

During periods of little or no rainfall, the soil in areas of invasive plant establishment is directly exposed to solar radiation and tends to dry out faster. A dry soil surface hinders seedling establishment and will negatively impact plants with surface root systems, including many native grasses. Exposure of the soil surface causes soil temperatures to be more extreme, due to solar heating during the day and greater radiative cooling at night. These extreme temperatures make seedling establishment more difficult and may affect soil organisms (Sheley and Petroff 1999).

Changes in plant communities caused by non-native plant invasion can have large effects on the soil food web since the biota involved in nutrient cycling is powered by root exudates and decomposing vegetation from the plant community (Hobbie 1992; Van der Putten 1997). Nutrient cycling is a complex process that depends on a multi-level food web that is specific to the site, a system that includes bacteria, actinomycetes, fungi (pathogenic, saprobic, and mycorrhizal), amoebas, and a wide range of invertebrates. A study that compared soil organisms in native grasslands in a natural state and after invasion by cheat grass (*Bromus tectorum*) found that the cheat grass caused changes in most levels of the soil food web (Belnap and Phillips 2001). Although it is difficult to predict the specific effects of these changes, it is important to recognize that any change in the soil food web has the potential to interfere with critical nutrient cycling processes and to threaten the long-term integrity of the ecosystem.

Soils under exotic understory invasive plants were also found to have pronounced differences in soil properties when compared to soil under native shrubs, including significantly higher pH and extractable nitrate levels (Ehrenfeld, et al. 2001). Net nitrogen mineralization was also higher under the exotic plants, indicating changes in the composition or activity of soil microbes caused by the invasive plants. Invasive plants that increase the availability of nitrate in the soil may be promoting conditions that favor their own expansion at the expense of native plants that can tolerate lower nutrient levels.

Conversely, many non-native invasive plant species deplete soil nutrients, which can make it difficult for native plants to compete with the invasive plants and may also affect the soil biotic community. Although the long-term effects of these changes are not known, spotted knapweed has been implicated in reducing available potassium and nitrogen (Harvey and Nowierski 1989). Some invasive plants are allelopathic to other plants, and produce secondary compounds that can directly increase the population of soil microbes capable of metabolizing this compound, while decreasing the populations of other microbes (Sheley and Petroff 1999). These changes will affect the soil food web and nutrient cycling, and may have impacts on the native plant community.

Research on the impact of invasive plants on mycorrhizal fungi is lacking, but since plants and mycorrhizal fungi are strongly dependent on each other, it is likely that drastic changes in the plant community caused by the invasion of non-natives will be accompanied by changes in the mycorrhizal fungus community. Research comparing the mycorrhizal status of young slash pines (*Pinus elliottii* var. elliottii) in plots with weeds and plots that were kept weed free with herbicide, found the number of pine root tips colonized by mycorrhizal fungi to be 75 percent lower in the weedy plots than the weed free plots after 3 years. In addition, the species distribution of the mycorrhizal fungi associated with the trees had changed (Sylvia and Jarstfer 1997). Since the fungi associated with the invasive weeds are different than those associated with the pine, it is likely that competition from introduced fungi caused the decrease in the fungi associated with the trees.

It is likely in this study that competition from introduced fungi caused the decrease in the fungi associated with the trees since the fungi associated with the invasive plants are different than those associated with the pine. If mycorrhizal fungi associated with invasive plants successfully compete with native fungi, a redistribution of soil resources in favor of the invasive plant appears to occur. Species of mycorrhizal fungi associated with native plants may be lost from the area of infestation. It may then be difficult to reestablish native vegetation on the site after the invasive plants are removed. Researchers have found that specific “helper” bacteria in the soil promote the establishment of mycorrhizae and mycelial growth of mycorrhizal fungi (Garbaye and Bowen 1989). Although little is known about the ecological requirements of these organisms, invasive plants may not support the helper bacteria employed by native plants and fungi.

**Cumulative Effects**

There would be no cumulative effects on the soil resource as a result of implementing Alternative 1. No additional manual or herbicide treatments would occur from those already approved under existing NEPA documents. Seasonal application of herbicides and degradation rates would preclude the overlap accumulation of residues on site to a degree measurable in terms of effects on the soil resource.

### ALTERNATIVE 2 – PROPOSED ACTION

Ten herbicides are proposed for use in this project, including chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl and triclopyr. Applications would occur on invasive plant populations located within the Project Area Units (PAUs) designated in the project GIS layer. Each of the PAUs is categorized under one of eight site types that generally describe the location and environmental characteristics of the site (Chapter 2, Table 4). Between one and ten inventoried areas containing invasive plants proposed for treatment are present within a PAU boundary.

The analysis of effects on the soil resource is based on the potential herbicide and/or manual treatment of all inventoried acres over the life of the project, representing an upper end estimate of total acres treated. This ‘worst case scenario’ overestimates actual acres to which herbicides would be applied on an annual basis due to the physical and financial limitations of project implementation, as well as total treatment acres during the life of the project due to the varied densities of individual invasive plants within these boundaries.

## Types of Effects Described

The application of herbicides and/or the manual treatment of invasive plant populations proposed under the action alternatives of this FEIS have the potential to directly, indirectly and cumulatively affect various components of the soil resource. Overall effects of herbicide treatments to the soil resource are not expected to be outside the scope of those described under the R6 FEIS (USFS, 2005a). Although parent materials of local soils are unique in some cases, soil characteristics such as organic matter content, surface texture, and cation exchange capacity are within ranges used to described the effects of herbicide residues in the R6 FEIS and research literature.

The primary direct effect of proposed herbicide treatments on the soil resource is the potential toxicity of herbicide residues on soil microbes harbored in the organic and mineral soil. These effects are primarily determined by the inherent toxicity of the herbicide and soil properties that influence the extent to which herbicide residues are persistent and mobile in the environment. The toxicity, persistence and mobility in the soil environment of the various herbicides approved for use are included in Table 36 of this analysis. Soil properties influencing mobility and persistence are discussed in the existing conditions section of this report. However, since direct effects on microbes in the environment are not necessarily measurable by changes in microbial populations, research literature generally measures these effects indirectly by the level of soil productivity maintained on a treated site, of which fungal and bacterial populations are one component. This analysis considers maintenance of soil productivity to be reflected by the growth and production of vegetation on a given site.

**Table 36.** General Research Findings of Pertinent Herbicide Characteristics Pertinent to the Soil Resource.

| Herbicide | Toxicity to Soil Microbes | Adsorption | Degradation path and half life | Activation Mechanism |
|---|---|---|---|---|
| Chlorsulfuron | low | low | Hydrolysis<br>40 days | Acetolactate synthesis inhibitor (Selective: controls broadleaves and some grasses) |
| Clopyralid | low | strong | Soil microbes<br>14 to 29 days | Plant growth regulator (Very selective to broadleaves; post emergent) |
| Glyphosate | low | strong | Soil microbes<br>30 days | Inhibits 3 amino acids and protein synthesis (Non-selective; quickly absorbed by leaves with rapid movement through plant; no root absorption) |
| Imazapic | No info | moderate (Organic Matter) | Soil microbes<br>113 days | acetolactate synthesis inhibitor (Uptake by roots & leaves; active in soil as pre-emergent) |
| Imazapyr | Slight at high doses | low<br>(Organic Matter and low pH raise to moderate) | Soil microbes<br>25 to 180 days | acetolactate synthesis inhibitor (Uptake by roots & leaves; active in soil as pre-emergent) |
| Metsulfuron methyl | Short-term toxicity with little effects to populations over time | low | Slow microbial degradation at high pH, fast at low pH<br>Up to 120 days | Acetolactate synthesis inhibitor (Potent herbicide; uptake by roots & leaves) |
| Picloram | Can inhibit microbial growth | low | Slow microbial<br>90 days | Plant growth regulator (Selective: rate and season dependant; pre-emergent and soil active) |
| Sethoxydim | low | low to moderate (Organic Matter) | Rapid microbial<br>Up to 60 days | Inhibits acetyl co-enzyme (ACE) (Systemic that is absorbed rapidly by foliage and roots. |

| | | | | |
|---|---|---|---|---|
| Sulfometuron methyl | Some growth inhibition of microbes in lab | low | Soil microbes<br>10 to 100 days | Acetolactate synthesis inhibitor (Non-selective pre and post emergent - uptake by roots & leaves. Potent herbicide;) |
| Triclopyr | Inhibits fungal and bacterial growth | low | Soil microbes<br>46 days | Plant growth regulator (Absorbed thru roots, foliage and green bark) |

Additional direct effects include those of herbicide applications on riparian soils and the physical effects of manual and mechanical treatments. These effects are generally measured by the method and rate of herbicide application proposed for an individual site, and the aerial extent of manual or mechanical treatments, respectively.

Indirect effects of proposed treatments include the mobility of herbicide residues and their potential movement to ground or surface water sources through hydrologic pathways in soil solution or physical overland flows or erosion. This mobility is largely determined by the individual characteristics of the herbicide and the soil on which it is applied, and can be minimized by the method, timing and rate of application.

Cumulative effects on the soil resource generally center on the possibility of multiple applications of herbicides over a period of up to five years on an individual project area unit. These effects are measured by the half-life of the herbicide, which determines the extent of residues remaining in the soil when subsequent applications occur, and the effectiveness of the herbicide application on the invasive plant population, which determines the amount of herbicide needed for each successive application.

In addition, Project Design Features (PDFs) have been developed under this project in order to minimize the duration and extent of effects of proposed herbicide applications and manual treatments on local soils (Chapter 2.4, PDF #46, 48, 50, 53). The PDFs specific to the project apply to soil conditions identified as having the potential to exacerbate the mobility or persistence of herbicide residues following application within a Project Area Unit (PAU) and more generally for the site types described for the PAUs. Table 6, Chapter 2 summarizes the acres of proposed treatments by site type for Alternative 2. There are 289 PAUs in the EIS, the majority of them are located along roads. Some PDFs apply to the site type attributes summarized in Table 3 that were used to categorize the 289 PAUs proposed for treatment in the EIS.

## Direct Effects

### Herbicide Treatments

Known herbicide characteristics pertinent to the analysis of effects to the soil resource, including toxicity to microbes, adsorption properties, degradation rates, and activation mechanisms, are summarized in Table 35. Additional information about the characteristics of each herbicide that influence their potential effects on the soil resource is included in narrative summaries at the end of the Herbicide Information Appendix (Appendix D).

The effect of a herbicide treatment on the soil resource depends on the particular characteristics of the chemical used, the manner and rate of application, and the physical, chemical and biological characteristics of the soil medium. PDF (#43 - 53) would also minimize effects of herbicides on the soil where herbicide and soil characteristics would combine to create a known hazard of toxicity to microbes, measurable losses to productivity, or convey herbicide residues to surface or ground water resources at levels potentially toxic to aquatic species.

### Soil Microbes

The direct effects of herbicides on soil microbes are generally tiered from information on the product labels and the SERA Risk Assessments referenced in the R6 2005 FEIS (USFS 2005a). The SERA risk assessments display the effects of herbicides on soil microorganisms under typical and maximum application rates on the product label. These effects are based primarily on reviews of literature that have assessed the toxicity of each herbicide according to the increased persistence of residues as application rates increase (USFS 2005a). The potential effects on soil microbes are summarized in a comprehensive risk rating of toxicity (low, moderate, high) for each herbicide and listed in Table 36.

The direct effects of herbicide applications proposed in this project on soil microbes are expected to be negligible due to evidence from research and practicable applications rates. Application rates were analyzed under the R6 FEIS in order to compare residue accumulations with threshold toxicity levels of concern identified for anadromous fish (USFS 2005a). These threshold values are below those allowed by the Environmental Protection Agency in most cases. Application rates calculated to produce these threshold values at one point in the watershed using the GLEAMS model assumptions are identified as upper end allowable rates (refer to p. 225 for description of GLEAMS). Local herbicide applicators have indicated that they would not need to exceed typical application rates on the product labels for the majority of sites proposed for treatment, with a Russian knapweed site at Rimrock Springs Dam on the CRNG an exception (the site would require a higher application rate of the herbicide). Residue levels within the soil under the proposed application rates are likely to be at or below those identified by SERA as toxic to soil microorganisms and summarized in Table 35 and would incur reduced direct effects to soil microbes than those described under the SERA Risk Assessment for each herbicide.

The direct effects on fungal and bacterial soil microorganisms vary according to the chemical type, the percentage of the applied residues that actually reach the soil surface and the degradation rate/half-life characteristics of the herbicide. Although the chemical type of a respective herbicide is the primary factor influencing the direct toxicity to microbes, a residue that is toxic because of the chemical type must also be present in large enough quantities and available for assimilation by microbes in the soil in order to have a toxic effect. Thus, herbicide residues with chemical compositions toxic to microbes that are also readily adsorbed to mineral soil or organic matter have the highest risk of directly affecting soil microbes. Herbicides with these characteristics include picloram, sulfometuron methyl and triclopyr. Picloram (pyridcarboxylic acid chemical type) and sulfometuron methyl (sulfonylurea chemical type) are of particular concern due to their identified toxicity, even at low levels, and persistence in the soil (USFS 2005a).

Herbicides identified as having a low toxicity to soil microbes generally have a mode of action on plant species that does not affect soil microbes as they assimilate the compounds that comprise the residues. These include chlorsulfuron, clopyralid, and sethoxydim. An exception is glyphosate, which has been shown in research to be very toxic to microbes grown directly on this herbicide in the laboratory, but has un-measurable effects on microbes compared to treatment controls when applied directly to soil in the laboratory or in the outside environment (Busse, et al. 2001). This group of herbicides is unlikely to directly affect soil microbes to a measurable degree.

The magnitude of effects of herbicide applications on microorganisms is also influenced by the application method and rate. Herbicides that are spot applied or wicked on individual plants would have a low risk of accumulating residues on the soil surface that are available to microbial assimilation. Conversely, broadcast spray applications would have higher amounts of over spray likely to reach the mineral or organic soil surface and become assimilated by microbes. This process would promote the degradation of residues not taken up by the targeted invasive plants on site, regardless of whether or not they are toxic to microbes.

The duration of the toxic effects is primarily determined by the half-life of the applied herbicide that is available for microbial assimilation (Table 36). The half-life of each herbicide is influenced by the chemical characteristics of the herbicide (i.e. degradation rate and pathway), the physical characteristics of the soil profile, and the soil microbial environment. Local ash and residual soils have a component of bacterial and fungal species that is sufficient to degrade herbicide residues at rates comparable to those identified in Table 36.

Although studies have been conducted on the direct effects of herbicides on soil microbes, information about the effects of specific herbicides to each of the myriad of soil organisms is not necessarily available. Effects that have been identified are generally not measurable by quantified losses of microorganisms in the soil environment (Busse, et al. 2001). As a result, direct effects to soil microbes are generally alluded to by changes to productivity of the site, of which microbial composition is one component.

None of the herbicides under consideration for use has been shown to have a notable effect on soil productivity. Anecdotal observations of a spotted knapweed treatment area applied with picloram for two years on the Paulina District of the Ochoco National Forest confirm continued production of native and more desirable species on site (Mafera, Pers. comm.). The growth and expansion of desirable species in this treatment area indicates that productivity has not been compromised and microbial populations and functions have likely been maintained following successive herbicide applications. Additionally, studies of the effects of herbicides on mycorrhizal fungi and bacterial populations indicate relatively low impacts to microbial populations from herbicides (Busse, personal comm. 2006), even from multiple applications (Busse, et al. 2001).

### Herbicide Degradation

Herbicides not absorbed into vegetative roots, moved offsite by overland flows or degraded by sunlight are subject to microbial or hydrolysis degradation pathways within the soil profile. The herbicides proposed for application are primarily degraded by microbes after their adsorption to ionic sites provided by soil colloids and/or organic matter. Chlorsulfuron is an exception to this path and is primarily degraded by hydrolysis.

The persistence of herbicides within the soil is largely dependent on the specific degradation pathway and chemical characteristics of the herbicide residues. The half life listed for each herbicide in Table 35 displays the degradation rates of herbicides determined by research and testing for SERA labeling under generalized soil conditions. The rate at which the proposed herbicides degrade is driven by the adsorption characteristics of the herbicide listed in Table 36, the presence of microbes in the soil, and the Cation Exchange Capacity (CEC) of the soil profile. The CEC reflects the ability of the soil to hold compounds with positive charges within the zone of microbial influence, including sites on mineral soil colloids and organic matter in the soil.

Mineral soil colloids and organic matter within the A and A/C horizons of local soils are expected to allow herbicides to be adsorbed to the extent listed in Table 36. The CEC for soil types on the Deschutes National Forest range from approximately 5 to 20 meq/100g of soil. These CEC figures are moderate to low due to the minimal amount of clay colloids and relatively low organic matter content (generally <5%) in the mineral soil. The CEC for soil types on the Ochoco National Forest and the Crooked River Grasslands are slightly higher, ranging from approximately 8 to 28 meq/100g of soil. These CEC figures are moderate due to the slightly higher amounts of clay colloids from weathering and similarly low organic matter content (generally <5%) in the mineral soil. The mineral soil colloid and organic matter sites within the A and A/C horizons of local soils that these CECs reflect are sufficient to allow herbicides to be adsorbed to the extent listed in Table 36.

Conditions provided by local soils are also sufficient to degrade herbicide residues at rates listed in Table 36. Local soil properties include the presence of microbes capable of degrading the residues over time. Microbial biomass of selected pumice and ash soils on the Deschutes National Forest has been measured to range from 324 to 345 mg C/kg of soil (Busse, pers. comm.), while no data exists for the Ochoco or Crooked River Grassland soils. The presence of a similar component of surface ash in some Ochoco soils, as well as a generally observed breakdown and incorporation of annually produced organic matter suggests that there is a sufficient microbial component in soils located on the Ochoco and Grassland areas.

Although soil temperatures at the time of application are likely to be conducive to biological microbial activity, there could be a delay in initial degradation when temperatures are below levels necessary for measurable microbial activity. Soil temperatures conducive to biological microbial activity would be expected to be reached soon after the time of application and be maintained for four to five months each year. This analysis assumes that the maintenance of soil temperatures for this length of time is sufficient to degrade herbicide residues at rates shown to occur by research.

### Riparian Treatments

A number of herbicide treatments are proposed on invasive plants located on riparian soils. These are primarily sites in which reed canary or ribbongrass (*Phalaris* species) are targeted, including Trout Creek Swamp, and islands and banks of the Metolius River. Sites are nearly or entirely monocultures of these species and would be treated with an aquatic form of glyphosate using a wicking application method. Soils in these areas are primarily comprised of organic root masses and thatch from the *Phalaris* species, which build up annually and are slowly decomposed in the seasonally saturated environment.

Herbicide effects to the soil resource in these areas are expected to be minimal, primarily due to the wicking application method and the low toxicity of the aquatic formulation of glyphosate. Residues would not be expected to accumulate in the soil unless a rainfall event occurred within the first few days after application. Residues washed off of vegetation during a rainstorm would enter into solution during saturated conditions and be unavailable for microbes to assimilate. The effects of glyphosate on microbes located in unsaturated soils are also very minimal (Busse, et al. 2001). The exposure of bare mineral soil would be minimal as a result of herbicide applications as vegetation from affected plants falls down and decomposes on the existing mat of thatch and organic soil. Proposed re-vegetation of these sites following Standard 12 from the R6 ROD includes transplanting plugs of native sedges and other species which would reduce the amount of soil medium exposed in the short-term.

### Manual and Mechanical Treatments

Manual treatments approved under existing NEPA document decisions and described under the No Action alternative would continue under the Action alternatives. Additional sites would have all or portions of their area treated manually under this alternative with similar effects as those described under the No Action alternative.

The majority of manual treatments proposed would occur as the pulling or wrenching of invasive plants by hand or with shovels on upland sites. These methods would incur physical disturbance of the soil resource on individual sites like those described under the No Action alternative. While the relative amounts of manual treatments vary slightly between the alternatives, the differences in terms of effects from these treatments are negligible.

The manual pulling of invasive plants would incur an initial, short-term loss of live, vegetative cover, the length of which would depend on whether an active or passive restoration strategy is proposed on the site. There is a short term risk of surface erosion from sheet and rill overland flows during this period which would decrease over time as natural or active re-vegetation occurs on these sites. Potential erosion losses from treated areas in the short-term are not expected to compromise their productivity, as indicated by continued re-growth of both invasive and native plants on manually treated sites across the forest (Pajutee 2006b pers. comm). Erosion that occurs on upland sites located within 100 ft of surface waters could contribute sediment to stream channels or lakes in the short term. These areas would be expected to produce a negligible amount due to their small total surface area within any given watershed. This potential sedimentation is expected to decrease as cover increases on these sites.

Manual pulling could also occur on sites inhabited by reed canary or ribbongrass (*Phalaris* species). The majority of these sites are located on organic soils that are seasonally saturated and comprised nearly entirely of roots and thatch form these species. The organic soils on sites below bankfull levels on the Metolius River are located on top of stream cobbles and have a small amount of fine sediment incorporated into the thatch and root mass that could be released into the water as the plants are loosened and pulled. Some proposed treatment sites located on islands in the Metolius River have been probed and found to have similar conditions due to their location and relatively young age. Sites located on islands have not been probed to determine these conditions but are likely to be similar in nature due to their location and relatively young age. Soils located above bankfull levels are still predominantly organic in nature but have a higher content of mineral soil that could be exposed by manual treatments. There would be a short-term risk of erosion on these sites until active re-vegetation or natural regeneration occurred. Proposed re-vegetation of these sites following Standard 12 from the R6 ROD includes transplanting plugs of native sedges and other species which would reduce the amount of soil medium exposed in the short-term.

Invasive plant populations of reed canarygrass or ribbongrass (*Phalaris* species) located along the Metolius river and other areas may be treated with a method called soil solarization. This process involves the installation of plastic mats over an area in order to trap infrared radiation and raise soil temperatures to levels capable of killing plants, seeds, plant pathogens and insects. Solarization is an option for killing invasive plants without the use of herbicides and has been used effectively in horticulture (Tu, et al. 2001). The process is non-discriminate towards biological flora and fauna and would kill native and non-native species alike on site. Solarization would cause a direct loss of biological components of the soil resource from the heating process, although any losses of microbial diversity on the site appear to be short-term. Physical and chemical properties of the soil can also be altered as a result of the elevated soil temperatures, although a release of nutrients that are tied up in the organic component of the soil appear to be utilizable by plants introduced to the site after the plastic is removed (Tu, et al. 2001). The sites would be left with an exposed soil substrate following the removal of the plastic which would be susceptible in the short-term to erosion before re-colonization by planted or naturally regenerated species.

Mechanical treatment of invasive plants in the form of machine scarification is proposed in both action alternatives under this FEIS. Portions of approximately 149 project area acres within three harvest plantations on the Paulina District of the Ochoco NF would be machine scarified following herbicide treatments. Machine scarification would use a harrow implement pulled behind a small tractor in order to prepare the site for re-seeding of native or more desirable species. This operation would mechanically break up the surface mineral and organic horizons of the soil and variably mix them to depths of 1 to 4 inches.

Effects to soil productivity on these sites from the four-wheeler and harrow implement due to compaction or mixing are expected to be minimal. Harrowing would improve current conditions by breaking up and mixing the currently hardened mineral soil as the harrow tines are pulled through the surface mineral and organic horizons of the soil to depths of 1 to 4 inches. Prescribed burning of houndstongue prior to harrowing would not be expected to have detrimental effects on the soil resource due low densities of combustible material on the soil surface that would produce very short residence times. The organic matter of the plants combusted by fire, killed by herbicide, and/or cut or uprooted by the mechanical operations would be left on site and available to be incorporated into the mineral soil after the operations. Active seeding of grass and forb cultivars following mechanical treatment would be expected to be supported by the mineral and microbial components of the soil resource.

There would be a short-term risk of erosion on these sites following the mechanical treatment until seeded and naturally regenerated vegetation recovers. Rainstorm events on 20 to 30% slopes could produce overland flows capable of carrying the newly loosened mineral soil down slope toward the intermittent stream channel. A 50 ft buffer of non-treatment between the channel and an existing, parallel skid trail will reduce the energies of potential overland flows and help filter out a portion of the sediment before reaching the channel. Total contribution of eroded sediment from mechanically treated areas is expected to be negligible during low and medium intensity rainfall events.

## Indirect Effects

### Herbicide Application

The application of herbicides at rates necessary to control invasive plants could indirectly affect the productivity of the site in the short-term by altering the vegetative cover and associated organic input provided by plants. The loss of cover or a transition of species composition on sites treated with herbicides is likely to affect the soil microbial community more certainly than any direct toxic action by herbicide residues on the microorganisms (SERA, 2003 - sulfometuron methyl). The loss of invasive plant species functioning as hosts to certain mycorrhizal fungi may cause a temporary shift in microbial populations and composition within the soil environment. However, the possible shift in microorganisms during this transition period is not expected to completely remove mycorrhizal populations associated with native plants or bacterial populations associated with decomposition and nutrient cycling. As a result, the indirect effects on site productivity from the short-term transition of species composition are expected to be minimal.

The treatment of sites with herbicides could also indirectly affect site productivity in the short term through changes in total organic production on site and annual input into the soil. These effects would be most pronounced on sites that are currently very heavily infested with invasive plants and are moving toward monocultures, including those with ribbongrass, medusahead or houndstongue. Herbicide treated plants would die and become incorporated into the soil as organic matter during the first years following treatment. Annual input in subsequent years would be limited by the number of non-target species interspersed between invasive plants or the rate at which vegetation returned to the site. A short-term lag of organic input would temporarily reduce the amount of organic matter available for decomposition and nutrients, and thus indirectly affecting the productivity of the site. Although nutrient input would be reduced in the short-term, the successful re-establishment of native vegetation is not expected to be limited by the productivity of the site. Other aspects of productivity, including the microbial component, are not expected to be affected enough by proposed treatments to change the productivity of the site. Direct effects to soil organisms from herbicides applied at approved rates have been researched to be relatively benign and are expected to be minimal.

Sites on which active restoration such as seeding or planting with inoculated individuals would have minimal potential delays in the re-establishment of organic matter production and annual input to the soil resource. Sites with passive restoration strategies could have an indirect delay in the return of native species on heavily infested areas. Although any delays on these areas are expected to be relatively short, most sites are not monocultures of invasive plants and have enough native or more desirable species already on site to expand into open areas created with proposed treatments.

### Off-site Movement of Herbicides

Each herbicide proposed for use under this FEIS has a different solubility in water and adsorption rate to soil and organic matter (Table 36). Herbicides that are highly water soluble or strongly adsorbed to soil particles capable of becoming sediment carried by overland flows have the potential to move off site during the first few days following application (glyphosate would not be active as found to soil). Although applicators generally operate with an awareness of the current weather patterns and are less likely to apply within a day or two of measurable rainfall, rogue thunderstorms capable of capturing herbicide residues with these characteristics could occur. There is a slight risk of movement of residues to stream channels by overland flows on approximately 754 acres of invasive plant populations proposed for herbicide treatment under this alternative. Approximately 724 acres are located across nine sub-basins within 100 ft of class I-III stream channels, lakes and springs (see Fisheries Report), and 30 acres are located within the 3 ft boundary designating class IV stream channels. These acres are located within the maximum distances assumed from which 100% of applied herbicide is capable of reaching surface waters during a rainfall that produces overland flows within the first few days following application.

Herbicide residues on treatment sites along some road segments are also at risk of delivery to surface waters where overland flows soon after application are focused through hydrologically connected road ditches or road surfaces soon after application. Approximately 320 acres of proposed treatment areas are near or adjacent to road segments within 300 feet of where they cross stream channels. These road segments are assumed to be hydrologically connected and all of these acres are assumed to be herbicide treated under this analysis. Project design features that include spot or wicking applications of herbicides used for treatments within RHCAs and along hydrologically connected road segments would reduce the amount of herbicide applied in these areas and lower the amount of residues available to be soluble in overland flows or to adsorb to soil particles that could become sediment.

Individual herbicide characteristics and soil attributes influence the degree to which residues would be captured and moved by overland flows or percolated down through the soil profile to groundwater during rainfall events following application. Picloram and sulfometuron methyl have the highest risk of movement through the soil during their first half-life period. Application of these herbicides on coarse textured soil profiles with rapid infiltration rates could result in contamination of groundwater resources where soil moistures conducive to rapid percolation occur and seasonal water tables are present near the surface. Project design features (PDFs) included in this EIS restrict the application of these herbicides on sites with these characteristics in order to minimize the potential for groundwater contamination to occur.

Off-site movement of herbicides adsorbed to soil particles via wind or mass soil movement can also occur during the initial half-life of an applied herbicide. The herbicides in the sulfonylurea chemical family have the highest risk of off-site movement by these mechanisms. Although wind erosion does occur in local ash soils, transport of herbicide residues is not expected to occur at rates which are measurable, primarily as a result of PDFs for spot application of these herbicides at the lowest rates possible for effectiveness for most treatment sites (Chapter 2.4). Although broadcast applications of sulfometuron methyl are likely to occur on large medusahead sites on the Grasslands, fine textured soils that are less likely to erode are present on these sites. The lowest effective application rates are also recommended on all sites in order to minimize the amount of excess residue available for movement by this mechanism.

### Cumulative Effects

Multiple applications of herbicides over a number of years are likely on most sites proposed for herbicide treatment. Treatment assumptions include an 80% annual effectiveness per application, requiring a return application the following year in order to continue to reduce the population of invasive weeds on site. Applications could occur for up to five years or until populations are reduced sufficiently enough to allow manual treatments to be effective on site. The accumulation of residues from these applications is not likely to be incrementally detectable due to the time between applications and the half life of the various herbicides. Although some sites proposed for treatment under this EIS have been sprayed with herbicides under previous NEPA decisions they are not expected to be additive in herbicide accumulations for the same reasons. In some cases the type of herbicide may change, most likely to a less mobile and less toxic herbicide, as in the case of substituting clopyralid for dicamba on knapweed sites. Herbicides treatments are also proposed to be implemented in place of manual treatments found to be ineffective on some of these sites.

Agricultural use of herbicides on private land ownership is not likely to influence soils on Ochoco and Deschutes National Forest System lands due primarily to their lower watershed landscape positions. However, some Crooked River Grassland locations are immediately adjacent to private lands that could contribute to transfer in either direction. Although it is possible that herbicide residues could be introduced to treated sites from other sources, it is more likely that they could move from Deschutes and Ochoco National Forest System lands to other ownerships due to a generally higher location within the watershed. Regardless, this mechanism is likely to be relatively minimal considering that Forest Service use of picloram nation-wide is less than one percent of agricultural use (SERA, 2003-picloram), and Forest Service use of sulfometuron methyl nationwide is less than one percent of all use in California (SERA, 2003-sulfometuron methyl).

Other natural influences such as wildland fire could result in adverse effects on the soils and productivity of the treatment sites. The potential adverse effects to soils from herbicides are unlikely to incrementally change soil characteristics substantially enough to alter the productivity of any treated sites, thus not likely to be additive to other projects such as timber sales, recreation use or other activities. The cumulative effects of Alternative 2 would be small in comparison to the potential effects of untreated invasive plants described under the No Action Alternative. The treatment of invasive plants across the analysis area and subsequent passive or active restoration of healthy native plant communities envisioned under the action alternatives in this EIS would have generally beneficial impacts on soils in the short and long terms. Invasive plant control measures have such a small potential for affecting soil productivity, it is not additive to other projects, such as timber sales, recreation use, or other activities.

## ALTERNATIVE 3

The effects to the soil resource under Alternative 3 would be similar to those described for Alternative 2 on acres treated with herbicide or manual treatments. The amount of area treated with chemical herbicides would be reduced by approximately 250 acres due to the changes in application methods adjacent to intermittent stream channels and restrictions of certain chemicals within 300 ft of lakes, ponds, and fish bearing streams. The following restrictions are included as Project Design Features (PDFs) in Chapter 2 for Alternative 3:

- No herbicide application would occur within the definable channel of dry intermittent stream channels, described as 3 ft width centered on the channel (30 acres removed from Alternative 2) or within 10 ft of rivers, lakes, ponds, reservoirs, perennial or fish bearing streams, or flowing periods of intermittent streams (approximately 230 acres removed from Alternative 2).
- Non-aquatic triclopyr, picloram, non-aquatic glyphosate, and sethoxydim would not be applied within the 300 ft buffers of perennial streams or lakes. (approximately 1,288 acres)

- Broadcast spraying would not be allowed within the 300 ft buffers or along roads that are within 300 feet of perennial streams or lakes. (approximately 1,288 acres, including 320 acres along roads).

## Direct and Indirect Effects

Alternative 3 would have similar effects to the soil resource as those described for Alternative 2, except for areas identified within RHCA buffers in which herbicide may be substituted by manual treatments. Treatment areas within the 300 ft buffers proposed for the use of triclopyr, picloram or sethoxydim under Alternative 2 may be manually treated due to the ineffectiveness of other herbicides on the target species identified, including Russian knapweed, Scotch broom and Himalayan blackberry. These areas would have similar effects to the soil resource as described for manual treatments under Alternative 2. Soil disturbance from weed wrenching would be higher than that induced by treatment with herbicides. This alternative would slightly increase the risk of erosion and contribution of mineral soil to adjacent stream channels in the first year following treatment when compared to alternative 2. This risk would be relatively minimal and short lived until native or more desirable non-native species colonized the sites. However, clopyralid and aquatic glyphosate appear to be options for treatment of Russian Knapweed in these locations under this alternative.

Alternative 3 would reduce the amount of acreage proposed for herbicide application when compared to Alternative 2 by approximately 230 acres as a result of the addition of a 3 ft exclusion strip centered on intermittent stream channels and a 10 ft buffer on either side of perennial stream channels. These areas would be manually treated and would have similar effects to the soil resource as described for manual treatments under Alternative 2, including a reduction in the risk of toxic effects to soil microbes in these areas. Soil disturbance from weed wrenching would be higher than that induced by treatment with herbicides and would slightly elevate the risk of erosion and contribution of mineral soil to adjacent stream channels in subsequent years following implementation compared to Alternative 2. This risk would be relatively minimal and short lived as the number of invasive plant individuals needing to be pulled decreased and native or more desirable non-native species colonized the sites over time.

The total amount of herbicide applied to upland or riparian soils within 300 ft buffers would not be changed under this alternative as a result of changes from broadcast spray to spot spray application methods. However, this restriction would reduce the risk of off site movement of herbicides when compared to Alternative 2 due to the reduction of potential overspray and wind drift.

### Cumulative Effects

The cumulative effects to the soil resource associated with Alternative 3 would be similar to those described for Alternative 2. Changes in treatment methods or reductions in the extent of herbicide applications from Alternative 2 are not likely to alter or contribute to changing the cumulative effects described for Alternative 2.

# 3.6 Water Quality

## 3.6.1 Affected Environment

The planning area is highly variable geologically, chemically, and biologically. The Ochoco National Forest, the Crooked River National Grassland and much of the Upper Deschutes Sub Basin are in the Blue Mountains ecoregion, however almost all the watersheds on the Deschutes National Forest drain the Eastern Cascades Slopes and Foothills ecoregion or at higher elevations the Cascades ecoregion.

**Watersheds**

Watersheds are natural divisions of the landscape and the basic functioning unit of the hydrologic system. Watersheds are hierarchical – smaller ones nested within larger ones. Environmental changes commonly accumulate and appear on a watershed basis. For the purpose of analyzing and summarizing aquatic and vegetative data a hierarchy of watersheds and watershed boundaries was developed by the region using U.S. Geological Survey (USGS) protocols. The planning area for the Deschutes/Ochoco Invasive Plant Treatment EIS fits within four river basins (3rd field watersheds), the John Day Basin, Deschutes River Basin, Klamath Basin, and Oregon Closed Basins. The watersheds and subwatersheds within these basins are all listed in Appendix J to this FEIS. Refer to the Hydrology Report in the project file for information on which plans (i.e. Northwest Forest Plan, INFISH, etc.) apply to the watersheds, identification of key watersheds, and for a map of watersheds.

**Climate & Precipitation**

The analysis area has a climate of relatively low precipitation and humidity, large daily temperature fluctuations throughout the year, and high evaporation rates. The planning area is in the rain shadow of the Cascade Mountains with the majority of the precipitation falling on the west side of the divide resulting in a dryer climate in the Deschutes and John Day Basins. Summers are typically hot and dry and winters cool and moist. Prevailing winds are generally southwesterly through westerly.

Mean annual precipitation in the analysis area varies from a minimum of less than 10 inches per year in parts of the Crooked River National Grassland, to a maximum of about 33 inches per year in the Ochocos, and 140 inches per year at higher elevations in the Cascades on the Deschutes National Forest. Precipitation generally increases with increased elevation and on the Ochoco National Forest also tends to increase as you move north.

The majority of precipitation in the planning area occurs between November and March with most of it falling as snow at higher elevations. November, December, and January normally have the highest total monthly precipitation. Total precipitation usually declines through March and April then increases again in May and June as frontal movements bring late spring rains. July, August, and September have the lowest average monthly precipitation. August normally has slightly higher precipitation than July or September due to summer thunder storms which may be intense in limited areas. At lower elevations, the highest recorded total monthly precipitation for June, July and August may approach the highest recorded precipitation for the wet months of November and January due to the infrequent occurrence of intense summer thunderstorms. In dry years there may be no precipitation during some of the drier months. Refer to the Hydrologist Report for a precipitation map.

## Water Quality and the Clean Water Act

Federal and state laws, policies and regulations control the use of herbicides on National Forest system lands, including the Clean Water Act and the Federal Water Pollution Control Act. The Forest Plans also provide direction to protect and manage resources.

As specified in the Clean Water Act (CWA) of 1948 and subsequent amendments, water quality includes all attributes that affect existing and designated uses of a body of water which include fisheries and habitat needs as well as human uses. The CWA requires states to set water quality standards to support the beneficial uses of water. The Act also requires States to identify the status of all waters and prioritize water bodies whose water quality is limited or impaired. Where portions of streams do not meet the Federally-approved state water quality standards, they are listed as water quality limited under Section 303(d) of the CWA. A list of water bodies on the 2004/2006 Oregon State 303(d) List of impaired waters within the planning area is shown in Table 38. This latest list was approved by EPA on February 26, 2007.

There is no numeric State water quality standards for any of the herbicides or adjuvants that may be used in either of the action alternatives, so none of the streams are categorized as water quality limited based on the use of those herbicides.

The Forest Service responsibilities under the Clean Water Act are defined in a 2002 Memorandum of Understanding (MOU) between DEQ and the Forest Service. The MOU designates the Forest Service as management agency for the State on National Forest System Lands. Non-point pollution is the primary cause of impaired waters on National Forest System lands in the planning area. These cannot be tied to a point source such as a discharge pipe from a factory but are best controlled by good land management practices.

**Table 37.** 2004/2006 Oregon State 303(d) Listed Streams on the Deschutes and Ochoco National Forests, with Listing Parameter.

| Watershed | Water Body | 303 (d) Listing Parameter | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Temp | Temp (spwn) | Sed | Turb | pH | DO | Chlor a |
| ***John Day Basin*** | | | | | | | | |
| **Lower John Day Sub Basin** | | | | | | | | |
| Bridge Cr. | Bear Cr. | Y | | | | | | |
| | Bridge Cr. | Y | | | | | | |
| | Gable Cr. | Y | | | | | | |
| | Nelson Cr. | Y | | | | | | |
| **Upper John Day Sub Basin** | | | | | | | | |
| Lower South Fork John Day R. | South Fork John Day R. | Y | | | | | | |
| Middle South Fork John Day R. | Murray Cr. | Y | | | | | | |
| | Porcupine Cr. | Y | | | | | | |
| | Sunflower Cr. | Y | | | | | | |
| Mountain Cr. | Badger Cr. | Y | | | | | | |
| Rock Cr. | Rock Cr. | Y | | | | | | |
| Upr Mdl John Day R. | Cottonwood Cr. | Y | | | | | | |
| ***Deschutes Basin*** | | | | | | | | |
| **Lower Deschutes Sub Basin** | | | | | | | | |
| Headwaters Deschutes | Lake Simtustus | | | | | Y | | Y |
| Willow Cr. | Willow Cr. | Y | | | | | | |
| **Trout Creek Sub Basin** | | | | | | | | |
| Upper Trout Cr. | Auger Cr. | Y | | Y | | | | |

| Watershed | Water Body | 303 (d) Listing Parameter | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Temp | Temp (spwn) | Sed | Turb | pH | DO | Chlor a |
| | Big Log Cr. | Y | | Y | | | | |
| | Bull Cr. | Y | | Y | | | | |
| | Cartwright Cr. | Y | | Y | | | | |
| | Dick Cr. | Y | | Y | | | | |
| | Dutchman Cr. | Y | | Y | | | | |
| | Potlid Cr. | Y | | Y | | | | |
| | Trout Cr. | Y | | Y | | | | |
| **Upper Deschutes Sub Basin** | | | | | | | | |
| Wickiup/Browns Cr. | Deschutes R. | Y | | | | | | |
| | Odell Cr. | Y | | | | Y | | Y |
| | Odell Lake | | | | | Y | | Y |
| Crain Prairie/Charleton Cr. | Deschutes R | Y | | | | | | |
| | Lava Lake | | | | | | Y | |
| Fall River | Deschutes R. | Y | | Y | Y | | Y | |
| Lake Billy Chinook | Lake Billy Chinook | | | | | Y | | Y |
| Lower Metolius R | Lake Billy Chinook | | | | | Y | | Y |
| Middle Deschutes/McKenzie Canyon | Deschutes R. | Y | | | | Y | Y | |
| Pilot Butte | Deschutes R. | Y | | Y | Y | | Y | Y |
| Tumalo Cr. | Tumalo Cr. | Y | | | | | | |
| Whychus Cr. | Indian Ford | Y | | | | | | |
| | Whychus Cr. | Y | | | | | | |
| Upper Metolius R. | First Cr. | | Y* | | | | | |
| | Link Cr | Y | | | | | | |
| | Metolius R. | Y | | | | | | |
| | MFk S. Fork Lake Cr. | Y | | | | | | |
| | Middle Fork Lake Cr. | Y | | | | | | |
| **Little Deschutes Sub Basin** | | | | | | | | |
| Crescent Creek | Crescent Cr. | Y | | | | | | |
| | Big Marsh Cr. | Y | | | | | | |
| Lower Little Deschutes | Paulina Cr. | Y | | | | | | |
| Upper Little Deschutes | Little Deschutes R. | Y | | | | | Y | |
| | Hemlock Cr. | Y | | | | | | |
| **Lower Crooked River Sub Basin** | | | | | | | | |
| CR Nat. Grassland | Lake Billy Chinook | | | | | Y | | Y |
| | Crooked R. | Y | | | | Y | | |
| McKay Cr. | Little McKay Cr. | Y | | | | | | |
| | McKay Cr. | Y | | | | | | |
| Mill Cr. | East Fork Mill Cr. | Y | | | | | | |
| | Harvey Cr. | Y | | | | | | |
| | Mill Cr. | Y | | | | | | |
| | West Fork Mill Cr. | Y | | | | | | |
| Upper Ochoco Cr. | Marks Cr. | Y | | | | | | |
| | Canyon Cr. | Y | | | | | | |
| | Hamilton Cr. | Y | | | | | | |
| | Little Hay Cr. | Y | | | | | | |
| | Ochoco Cr. | Y | | | | | | |
| **Upper Crooked River Sub Basin** | | | | | | | | |

| Watershed | Water Body | 303 (d) Listing Parameter | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Temp | Temp (spwn) | Sed | Turb | pH | DO | Chlor a |
| Bear Cr. | Bear Cr. | Y | | | | | | |
| | Cow Cr. | Y | | | | | | |
| | Klootchman Cr. | Y | | | | | | |
| Camp Cr. | Double Cabin Cr. | Y | | | | | | |
| Deep Cr. | Crazy Cr. | Y | | | | | | |
| | Deep Cr. | Y | | | | | | |
| | Double Corral Cr. | Y | | | | | | |
| | Happy Camp Cr. | Y | | | | | | |
| | Jackson Cr. | Y | | | | | | |
| | Little Summit Cr. | Y | | | | | | |
| | Toggle Cr. | Y | | | | | | |
| Lower N. Fork Crooked | Fox Canyon Cr. | Y | | | | | | |
| | North Fork Crooked R. | Y | | | | | | |
| Upper N. Fork Crooked | Allen Cr. | Y | | | | | | |
| | Fox Cr. | Y | | | | | | |
| | Gray Cr. | Y | | | | | | |
| | Howard Cr. | Y | | | | | | |
| | Indian Cr. | Y | | | | | | |
| | Lookout Cr. | Y | | | | | | |
| | Lytle Cr. | Y | | | | | | |
| | North Fk Crooked R. | Y | | | | | | |
| | Peterson Cr. | Y | | | | | | |
| | Porter Cr. | Y | | | | | | |
| Upper Crooked Valley | Horse Heaven Cr. | Y | | | | | | |
| | Little Horse Heaven Cr. | Y | | | | | | |
| | Shortgun Cr. | Y | | | | | | |
| | Wildcat Cr. | Y | | | | | | |
| **South Fork Crooked River Sub Basin** | | | | | | | | |
| Lower Beaver Cr. | North Fork Wolf Cr. | Y | | | | | | |
| | Wolf Cr | Y | | | | | | |
| Upper Beaver Cr. | Beaverdam Cr. | Y | | | | | | |
| | Powell Cr. | Y | | | | | | |
| | Rager Cr. | Y | | | | | | |
| | Sugar Cr. | Y | | | | | | |
| Paulina Cr. | Dipping Vat Cr. | Y | | | | | | |
| | Dry Paulina Cr. | Y | | | | | | |
| | Roba Cr. | Y | | | | | | |
| South Fork Beaver Cr. | Begg Cr. | Y | | | | | | |

*Fish Use Map 130B shows that Oregon Water Quality Standard 340-041-0028(4)a) does not apply to First Creek; First Creek should have been delisted based on criteria change.

## Water Quality Parameters for Listed Streams

**Water Temperature –** Water temperature is an important factor which influences aquatic productivity. Temperature changes may result from natural climatic conditions or human manipulation of the riparian environment. Temperature is a function of flow, surface area, solar input, air temperature, and other variables. Aquatic biota is adapted to certain thermal conditions existing in the habitat for their survival and well being. It is known that sedimentation rates and physiological stress in fish increase as temperatures increase. State water temperature standards for the project area are found in Oregon

Water Quality Standards 340-041-0028(4)(a), (c) and (f), based on Fish Use Maps 130A, 130B, 170A, and 170B. The Riparian Management Objectives (RMOs) for PACFISH and INFISH indicate that there should not be any measurable increase in water temperature.

The state standard for salmon or trout rearing and migration is a floating 7-day maximum average of 18.0˚ C (64.4˚F) and for bull trout spawning and juvenile rearing 12.0˚C. The Confederated Tribes of the Warm Springs standard for bull trout in Johnson Creek and the Metolius River from the confluence of Johnson Creek to Lake Billy Chinook is 10.0˚C.

Most invasive plants identified in this document are too small to provide effective shade (less than 4 feet tall). Only riparian invasive plants close to the water's edge have a potential for contributing any shade to surface water, and the shade effect decreases with the width of a stream. Riparian invasive species inventoried in the project area include reed canary grass, ribbongrass, and yellow flag iris. These species can out-compete beneficial native plants such as alder. Therefore, shade loss can result from invasive plants replacing native vegetation that can grow and provide shade.

**Sediment –** Suspended sediment is a measure of suspended sand, silt, clay and organic matter which will settle in time to the stream bottom. It may adversely affect fish by filling in pools, reducing bottom fauna, and silting in spawning gravels. Sediment delivery to streams is dependent on the erosivity of the soil, slope, distance to a stream, amount of exposed soil (effective ground cover), and intensity and continuity of disturbance. Invasive plant sites have been found to be more susceptible to erosion than native vegetation, although this has not been observed in the project area.

Eliminating invasive plants can temporarily reduce effective ground cover, but the extent and continuity should be small. Burning can reduce effective ground cover and at higher intensities kill non target species, change soil chemical and physical properties, and retard the establishment of new vegetation. Manual and mechanical treatment can cause ground disturbance.

The streams listed for sediment in the Upper Trout Creek Watershed are within the planning area (Bull Creek, Cartwright Creek, Dick Creek, Dutchman Creek, Potlid Creek, Auger Creek, Big Log Creek, and Trout Creek).[13] There is no standard in the current state water quality rules for sediment and Total Maximum Daily Loads (TMDLs) have not yet been established for the Deschutes Basin.

**Turbidity –** Turbidity is the disturbance of water due to the presence of suspended matter such as clay, silt, organic debris, plankton, various effluents, and others. It is an expression of the optical property of a sample of water which causes light to be scattered and absorbed rather than transmitted in straight lines through a sample. Excessive turbidity reduces light penetration into water and therefore, reduces photosynthesis by photoplankton, algae, and submerged vegetation. Natural turbidities within watersheds may cause short term readings in excess of the recommended level due to spring runoff or seasonal freshets. Turbidity is often used as a surrogate to indicate changes in suspended sediment.

State water quality standards direct that turbidity levels should not exceed background levels by more than 10 percent. There is normally a close correlation between turbidity and suspended sediment in a given stream, but this correlation can change as organic material increases over the summer or if the percent of sediment from different sources in the drainage changes. Turbidity does not measure the amount of sediment being transported as bedload. There is no state standard for suspended sediment, bedload, or total sediment.

[13] These streams were originally listed for embeddedness by the state based on the Trout Creek Watershed Analysis (USFS 1995e), which used data derived from surveys conducted either while the watershed was in a cattle allotment or shortly after it was changed to a sheep allotment in 1989. Only a short reach on the upper west fork of Auger Creek is still in a cattle allotment. The portion of the Upper Trout Creek Watershed that lies in the planning area has been in a sheep allotment for 16 years, which has reduced bank and channel disturbance. Recent pebble counts indicate that embeddedness is below the 20% threshold and recent monitoring shows that suspended sediment levels are low.

The Deschutes River is listed for sedimentation and turbidity from Wickiup Reservoir downstream to River Mile 168.2. It appears this is the result of irrigation releases because turbidity levels increase by as much as 30 fold in the Deschutes when irrigation water is released in early spring and remains to twice background until late July.

**pH -** pH is a measure of the hydrogen ion activity in water. It is controlled naturally by the carbonate system consisting of carbon dioxide, carbonic acid, bicarbonate ions, and carbonate ions. pH is a very important factor in the chemical and biological systems of water because of its role in affecting the degree of dissociation of weak acids and bases and therefore, the toxicity of many compounds and nutrient availability. pH concentrations in streams vary seasonally and during the day due to biological activity. The Oregon State water quality standard for pH is 6.5 to 8.5. A pH range of 6.0 to 9.0 appears to provide protection for the life of freshwater fish and bottom dwelling invertebrates. pH concentrations outside this range can affect fish and other aquatic organisms by allowing acids or bases to penetrate external membranes causing physiological stresses. However some natural waters with a pH in the 4s support fish and other organisms. In these cases, the acidity is due primarily to carbon dioxide and humic acids and the water has little buffering capacity (low total alkalinity). Under these conditions trout can tolerate pH ranging from 4.1 to 9.5, and trout eggs and larvae can develop normally at pHs ranging from 4.5 to 9 (KY Water Watch, 2005). Listings in the planning area are due to pH values greater than 8.5.

**Dissolved Oxygen (DO) –** DO is a function of the temperature of the water, altitude and barometric pressure. The ability of water to hold oxygen decreases with increased water temperature, altitude, or dissolved solids (TDS). Inadequate dissolved oxygen is an indicator of decomposition, anaerobic conditions, or lack of photosynthetic activity. For cold water biota, it is desirable that DO concentrations be at or near saturation levels. This is especially important for fish spawning areas where DO levels should not be below 7 mg/l. For good growth and the general well being of trout, salmon, and associated biota, DO concentrations should not be below 6 mg/l. Warm water biota, including fish, should have DO concentrations above 5 mg/l.

The Regional Environmental Monitoring and Assessment Program (REMAP) is sponsored by the EPA. The Upper Deschutes River Basin R-EMAP (ODEQ 1999) attributed the large DO fluctuations to plant (or algal) respiration associated with photosynthesis from large algal and aquatic microphyte assemblages observed in the field. They also attributed the pH values that are above threshold to high oxygen production from photosynthesis on the South Fork of the Crooked River. Since the same three lakes and one stream are listed for being above threshold for both pH and chlorophyll a, it is reasonable to assume oxygen production is the cause here also.

**Chlorophyll a –** This parameter is used to identify streams, reservoirs, or lakes where photo plankton may impair the beneficial uses of that water and is usually indicative of high nutrient levels. High levels of photo plankton may result in swings in DO and pH between periods of photosynthesis and respiration and during die off.

GIS was used to determine where existing invasive plant sites and PAUs fall within 100 feet of the 2002 303(d) listed streams. The spatial information for the 2004/2006 list has not been made available by DEQ at the time of this publication. The difference would be slight, however, and PDFs will prevent any measurable impacts to any of the parameters.

**Table 38.** Mapped Invasive Plant Sites, Project Area Units, and Total Acres of Land within 100 feet of 2002 303(d) Listed Stream Segments on National Forest System Lands.

| Watershed | Acres within 100 feet of Streams on the 303(d) list | | |
|---|---|---|---|
| | Mapped Invasive Plant Site Acres | Project Area Unit Acres | Total 303(d) Acres |
| **John Day Basin** | | | |
| **Lower John Day Sub Basin** | | | |
| Bridge Cr | 0 | 3.5 | 137.9 |
| **Upper John Day Sub Basin** | | | |
| Lwr SFk John Day River | 9.8 | 15.5 | 18.2 |
| Mdl SFk John Day River | 0 | 18.7 | 134.6 |
| Mountain Creek | 0 | 0 | 91.6 |
| Rock Creek | 0 | 2.9 | 202.9 |
| Upr Mdl John Day River | 0 | 2.9 | 229.4 |
| **Deschutes Basin** | | | |
| **Lower Deschutes Sub Basin** | | | |
| Hdwtrs Deschutes | 0 | 0 | 34.3 |
| Willow Creek | 0.6 | 0.9 | 210.6 |
| **Trout Creek Sub Basin** | | | |
| Upper Trout Creek | 0.7 | 129.9 | 1357.0 |
| **Upper Deschutes Sub Basin** | | | |
| Wickiup | 4.7 | 5.7 | 705.3 |
| Crain Prairie | 12.9 | 28.8 | 41.2 |
| Fall River | 17.2 | 20.7 | 1207.7 |
| Lake Billy Chinook | 0 | 0 | 17.2 |
| Lwr Metolius R | 0 | 0.2 | 40.3 |
| Pilot Butte | 5.8 | 46.8 | 2132.7 |
| Whychus Creek | 60.5 | 294.0 | 450.1 |
| Middle Deschutes | 0 | 0 | 23.6 |
| Upper Metolius River | 7.3 | 593.3 | 593.3 |
| **Little Deschutes Sub Basin** | | | |
| Crescent Creek | 2.8 | 3.4 | 164.8 |
| Lwr Little Deschutes | 2.0 | 10.1 | 202.5 |
| Upr Little Deschutes | 0 | 1.6 | 428.9 |
| **Lower Crooked River Sub Basin** | | | |
| Crooked River Nat. Grassland | 0 | 0 | 206.2 |
| McKay Creek | 8.3 | 145.6 | 601.1 |
| Mill Creek | 0.6 | 58.1 | 399.9 |
| Upr Ochoco Creek | 2.7 | 99.5 | 735.7 |
| **Upper Crooked River Sub Basin** | | | |
| Bear Creek | 0.4 | 32.3 | 347.4 |
| Camp Creek | 0 | 0 | 0 |
| Deep Creek | 1.9 | 114.5 | 1283.3 |
| Lower North Fk Crooked River | | 22.7 | 425.0 |
| Upper North Fk Crooked River | 0.1 | 33.1 | 1290.0 |
| Upper Crooked River Valley | 6.5 | 15.2 | 337.6 |
| **South Fk Crooked R Sub Basin** | | | |
| Lower Beaver Creek | 6.7 | 99.1 | 550.6 |
| Upper Beaver Creek | 1.8 | 6.3 | 582.9 |
| Paulina Creek | 138.8 | 231.8 | 611.0 |

In the summers of 1997/1998, the Oregon DEQ tested waters in the Deschutes Basin above Lake Billy Chinook for several parameters, as part of the EPA sponsored Regional Environmental Monitoring and Assessment Program (ODEQ 1999). The basin was divided into three subbasins and each was placed in an overall water quality category. The Metolius was rated as excellent water quality. Scores in the Deschutes subbasin were variable, with lower scores occurring on the Deschutes River and on lower Whychus Creek. The lower scores on these two streams are to be expected based on the higher nutrients, low pH, and slightly higher total solids on Whychus Creek and the high temperatures, pH, DO saturation, and phosphate levels on the Deschutes River. In the Crook River subbasin water quality tends to be higher in the Ochoco mountains and poorer overall at the lower elevations. A more detailed description of procedures and conclusions can be found in the chemistry summary of the "Upper Deschutes River Basin R-EMAP" (ODEQ 1999).

## Water Sources and Special Uses

Most of the stream flow and groundwater in the planning area originates on National Forest System lands. National Forests were originally established to "maintain favorable conditions of flow" which includes clean water. Clean water is necessary for maintaining viable populations of fish and water dependent species as well as for state defined beneficial uses. Domestic and special uses that may be directly affected by management activities on National Forest System lands can be broken down into the following categories:

1. Potable Water
    a. Municipal Watersheds
    b. Community Water Systems
    c. Potable water at campgrounds and picnic areas
    d. Domestic water at special use cabins (Deschutes NF only)
    e. Special use diversions for domestic use off forest
    f. Domestic uses (source off forest) on in-holdings and adjacent to Forest boundaries
2. Non-potable water
    a. Irrigation diversions and irrigation ditches
    b. Cattle/Sheep allotment water developments
    c. Other

These beneficial uses are discussed in relation to existence of project area units (PAUs) and mapped invasive plant sites.

### Potable

*Municipal Watersheds (Bend, Sisters, Mitchell)*

A municipal supply watershed is one that serves a public water system as defined in Public Law 93-523 (Safe Drinking Water Act) or as defined in State safe drinking water regulations. The definition does not include communities served by a well or confined ground water unaffected by Forest Service activities. The only herbicide detected in a review of State-required water tests on the three municipal watersheds on the Ochoco and Deschutes National Forests plus 14 additional public systems in the planning area was 2, 4-D in the analysis for the backup water supply for the city of Sisters on 10/22/91. The Deschutes National Forest was not using 2, 4-D in 1991 and the contamination appears to have originated along the open ditch between the diversion on Forest Service administered lands and Sisters.

The Bend municipal watershed operates under a 1926 formal agreement between the city of Bend and the Secretary of Agriculture. Management within the watershed has been custodial with all actions being subservient to maintaining water quality. There are no inventoried invasive plant sites or PAUs above the diversion however there is a knapweed site just below the diversion and there is also a Canada thistle site further downstream.

The Sisters municipal watershed uses a tributary of Whychus Creek as an emergency backup to their primary water system. A review of the drainage area on the Forest found inventoried invasive plant sites for both Canada thistle and tansy ragwort. PAU 15-22 is in the municipal watershed.

The Mitchell municipal watershed diverts water from springs in the Bridge Creek Watershed. Project Area unit 71-23, along Forest Service Road 2630, is in the watershed above the Lillycrop ditch diversion. Invasive plant inventory maps show yellow star thistle and medusahead on the boundary of the Mitchell municipal watershed, but the actual sites are further to the east and outside the municipal watershed and yellow star thistle has not been observed here in several years (Lesko, pers. comm.). These species pose a risk for moving into the watershed.

**Table 39.** Municipal Watersheds with invasive plant Project Area Units (PAUs)

| Forest | District | Watershed | Municipality | PAUs |
|---|---|---|---|---|
| Deschutes NF | Bend-Fort Rock | 1707030105 | Bend | |
| | Sisters | 1707030108 | Sisters | 15-22 |
| Ochoco NF | Lookout Mtn. | 1707020403 | Mitchell | 71-23 |

*Community Water Systems*

A community water system is a public water system that has at least 15 service connections used by year-round residents and regularly serves at least 25 year-round residents. Most of the community water systems in the planning area are on wells and do not qualify as municipal watersheds. It is the policy of the State of Oregon to encourage public water systems and/or government entities to voluntarily develop local Wellhead Protection Plans to protect the groundwater resource which a Public Water System relies on. Some wellhead protection areas (WPA) have been delineated in the areas surrounding wells supplying public water systems, where there was a concern for contaminants moving toward and/or reaching that water well. Wellhead protection areas overlapping PAUs are shown in Table 41. In addition, overlap of project area units and community water source areas (where delineated) are shown in Table 42. It is not known how interconnected these aquifers are with surface soils, but many of the deeper aquifers are confined and have negligible interaction with the upper unconfined aquifers under PAUs.

**Table 40.** Wellhead Protection Areas (WPAs) Overlapping with Invasive Plant Project Area Units

| | District | Watershed | Water System | Wells | Invasive Plant Site within WPA | Project Area Unit |
|---|---|---|---|---|---|---|
| CRNG | CRNG | 1707030511 | Deschutes Valley | 3 | Yes | 75-10 |
| Deschutes | Bend-Ft Rock | 1707030101 | Lava Lake Lodge | 1 | Yes | 11-39 |
| | | | Mt. Bachelor | 2 | | 11-07 |
| | | 1707030102 | Twin Lakes Resort | 1 | Yes | 11-54 |
| | | 1707030103 | Avion - Wild River | 1 | | 11-01/02, 11-11 |
| | | 1707030104 | Avion – China Hat | 2 | Yes | 11-08 |
| | | | Avion - Conestoga | 1 | Yes | 11-01, 11-02 |
| | | | Avion - Gosney | 1 | Yes | 11-01/02, 11-28 |
| | | | Avion - Parrell | 1 | | 11-08 |

| | District | Watershed | Water System | Wells | Invasive Plant Site within WPA | Project Area Unit |
|---|---|---|---|---|---|---|
| | | | Avion – River Bend | 2 | | 11-08 |
| | | | Avion - Sundance | 1 | | 11-02 |
| | | | Avion - Tekempe | 3 | Yes | 11-08 |
| | | | Widgi Cr. Village | 1 | | 11-07 |
| | Crescent | 1707030202 | Manley's Tavern | 1 | Yes | 12-02 |
| | Sisters | 1707030108 | Black Butte Elem. | 1 | | 15-18 |
| | | | Sisters High Sch. | 1 | Yes | 15-06 |
| | | | Tollgate | 1 | Yes | 15-05 |

**Table 41.** Community Water Source/Recharge Areas (within Project Area Units)

| | District | Watershed | Sub-Watershed | Invasive Plant Site within Recharge Area | Project Area Units* |
|---|---|---|---|---|---|
| CRNG | CRNG | | 170702040303 | Yes | **71-10** |
| Deschutes | Bend-Ft Rock | Crane Prairie | 170703010101 | | **11-07** |
| | | Fall River | 170703010301 | | 11-12 |
| | | | 170703010303 | Yes | 11-08, 11-52 |
| | | | 170703010305 | Yes | **11-11** |
| | | | 170703010306 | Yes | 11-10, **11-50** |
| | | Pilot Butte | 170703010401 | Yes | 11-01, 11-19 |
| | | | 170703010402 | Yes | 11-08, 11-68, 11-69, 11-70, 11-71 |
| | | | 170703010403 | Yes | 11-01, 11-07, 11-08, 11-65, 11-66, 11-67, 11-68 |
| | | | 170703010405 | Yes | **11-01** |
| | | | 170703010406 | Yes | **11-02, 11-27,** 11-28, 11-29 |
| | | | 170703010407 | Yes | 11-07, 11-58, 11-60, 11-61, 11-62 |
| | | Tumalo Cr. | 170703010502 | Yes | 11-06, **11-15** |
| | Crescent | Wickiup | 170703010201 | | 12-02 |
| | Sisters | Whychus Cr | 170703010802 | Yes | 15-22 |
| | | | 170703010803 | Yes | 15-22 |
| | | | 170703010805 | | **15-07** |
| | | | 170703010806 | Yes | 15-05, **15-06,** 15-22 |
| | | | 170703010807 | Yes | 15-05, 15-06 |
| | | Upper Metolius | 170703010904 | Yes | 15-18 |
| | | | 170703010906 | | 15-18 |
| Ochoco | Lookout Mtn. | Upper Ochoco | 170703050203 | | 71-02, **71-30** |
| | Paulina | Upper Beaver Cr | 170703030802 | Yes | **72-01** |

*PAUs in bold type are in the DEQ 0- year recharge zone.

*Ranger Stations, Guard Stations & Government Housing*

No inventoried invasive plant sites are located within the wellhead protection areas for potable water sources for Deschutes and Ochoco National Forest Guard Stations. Guard Station wellhead protection areas overlapping PAUs are shown in Table 43. There are no PAUs within the wellhead protection areas for the Cabin Lake, Fall River, Crescent Lake, or Cold Springs Guard Stations.

The Ochoco Ranger Station has two wells. At this time, only one is being used. This water system serves the Ranger Station, government housing, the bunk house and Ochoco Campground. The storage tank is not in any inventoried invasive plant sites or PAUs. The recharge area for these wells has not been delineated. The wellhead protection areas for both wells overlap PAU 71-19.

The Rager Ranger Station has only one well. This water system serves the Ranger Station, government housing, and the bunkhouse. PAU 72-01 overlaps the wellhead protection area. Whitetop, teasel, medusahead, spotted knapweed, and St. Johnswort are inventoried in the compound or are immediately adjacent to it and are within the well recharge area. The water tank appears to be outside the proposed project area unit.

**Table 42.** Potable Water at Ranger Stations, Guard Stations, & Government Housing

| | District | Facility | Well | Non | Invasive Plant Sites Present | WPA in PAU |
|---|---|---|---|---|---|---|
| Deschutes | Bend-Ft Rock | Elk Lake GS | X | | | 11-07* |
| | | Cabin Lake GS | X | | | * |
| | | China Hat GS | X | | | 11-02 |
| | | Fall River GS | | X | | |
| | Crescent | Crescent Lake GS (on CG system) | X | | | |
| | Sisters | Allingham GS | X | | | 15-32* |
| | | Suttle Lake GS (on resort well) | X | | | 15-05/09* |
| CRNG | CRNG | CRNG Fld. Hq. | | X | | |
| Ochoco | Lookout Mtn. | Ochoco RS/GH | X | | | 71-19 |
| | | Cold Spr. GS | X | | | * |
| | Paulina | Rager RS/GH | X | | Yes | 72-01 |

* wellhead protection area not delineated

*Potable water at campgrounds and picnic areas*

Potable water systems for the campgrounds, organizational camps, horse camps, and day use areas were identified within the planning area. The state water rights data and water rights INFRA data base do not appear to be current. Some wellheads are more than a quarter mile from use points. Some of these systems qualify as public water systems. Water sources needing further verification have been identified. The Water Quality Report lists current sites with potable water and the type of system at the diversion point. Recreation sites are also listed in the recreation section, 3.13.

*Domestic water at special use cabins (Deschutes NF only)*

Water systems for special use cabins or other facilities are not mapped in the Forest Geographic Information System (GIS). The water rights on the Forest's INFRA data base, dated to the early 1980s, give location to 40 acres (¼, ¼ section), do not designate who the permittee was, and many appear to be for surface water diversions that probably no longer in use. However it is suspected that some permittees of special use cabins are still taking water from the river or lakes for domestic use.

Special use cabins are located in six general areas on the Deschutes National Forest as shown in Table 44.

A review of the maps showing inventoried invasive plant sites and project area units indicate that all special use cabins and other permitted facilities have a potential to be in proposed project area units.

**Table 43.** Potable Water at Special Use Cabins/Lodges (Deschutes NF)

| District | Watershed | Special Use Name | Project Area Unit |
|---|---|---|---|
| Bend-Fort Rock | 1707030101 | Elk Lake | 11-07 |
| | 1707030207 | Paulina Lake | 11-03 & 11-33 |
| Crescent | 1707030202 | Crescent Lake | 12-03 |
| | 1707030102 | Odell Lake | 12-02 & 12-16 |
| Sisters | 1707030109 | Metolius River | 15-18 & 15-32 |
| | 1707030109 | Suttle Lake | 15-05 & 15-09 |

*Special use diversions for domestic use off forest*

Reviews of the special use files at the Ochoco National Forest Supervisors Office and at the Ranger Districts on the Deschutes National Forest identified 11 domestic use diversions. There do not appear to be any special use diversions for domestic use off Forest on the Deschutes National Forest. Some diversion points are difficult to identify (for example, the Edmonds spring box is covered with sod and does not have an exclosure fence). Only three of the identified diversions fall within PAUs. There are two special use permits within PAUs on the Crooked River National Grassland.

*Domestic uses (source off forest) on in-holdings and adjacent to Forest boundaries*

Homes and summer cabins, on in-holdings or adjacent to Forest boundaries, have some source of domestic water. While some people are hauling water in from offsite, many have wells or spring systems. It is suspected that some may even be using surface water. The Forests do not know where most of the small or individual systems are located.

### Non-Potable

*Irrigation diversions and irrigation ditches*

Irrigation diversions and ditches are not shown on the planning data base. Irrigation ditches are included on the interagency reconciled stream layer REO maps. A review of Forest special use permits identified 30 permitted ditches. See the Water Quality Report for details.

*Cattle/Sheep allotment water developments*

There are three types of improvements used to provide water to livestock in the planning area: spring developments, ponds, and wells. In addition on the Crooked River National Grassland, storage tanks are used in conjunction with wells to provide water on extended water systems. At spring developments, the springs may be fenced but a substantial number are not. If the springs are not fenced, they may not be obvious until you are on top of them. During hunting season, some recreationists use water from the springs for domestic uses and with the filter systems being used by campers now, domestic use is probably increasing. On the east side of the Bend/Ft. Rock District, water is hauled to grazing allotments and all springs and ponds that could be used by livestock are fenced for wildlife. There are no spring developments on any active allotments on the Deschutes. Water rights on cattle/sheep allotments are listed in the Water Quality Report.

*Other*

Other non-potable water sources that occur in the planning area are wildlife ponds, horse troughs in horse camps and along trails, wildlife guzzlers, natural lakes, sag ponds (landslide feature), and ponds in rock pits. Many of these are not mapped, but may have substantial wildlife use.

### Invasive Plant Species in Riparian Areas

Native riparian vegetation plays a key role in forming aquatic habitat for fish and other aquatic species. The roots of native vegetation help stabilize stream banks; the forest canopy provides large wood and protects streams from solar radiation in the summer. Invasive plants in riparian areas can cause a loss of functional riparian communities, loss of rooting strength and protection against erosion, and subsequent impacts on water quality (Donaldson 1997). Invasive plants can be especially difficult to control in riparian areas because they thrive in the moist environment and treatment measures are often limited. Ribbongrass is an example of an invasive plant that is affecting riparian areas. It is replacing native vegetation and does not provide the high quality habitat for aquatic plants and animals (including fish and amphibians), particularly in winter when the plants die back. Nor does it provide high quality habitat for insects and the birds and animals dependent on these insects for food.

Applicable to the area covered by the Northwest Forest Plan, the Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands (USDA USDI 1994a, B-9). The approach seeks to maintain and restore ecosystem health at watershed and landscape scales, prevent further degradation, and restore habitats over broad landscapes.

Existing Watershed Analyses were consulted for information on watershed and riparian condition. The documents address the existence of invasive plants and provide some general recommendations for prevention and control. Watershed analysis has not been completed for watersheds that do not contain key watersheds and that fall mostly outside the Northwest Forest Plan area. Invasive plant sites in these watersheds occur primarily along roadways, such as State Highway 58 and 97.

The following table displays 5th field watersheds that are at least partially within the range of the northern spotted owl, and managed under the Aquatic Conservation Strategy of the Northwest Forest Plan. The table also shows if a Watershed Analysis was completed, and acres of invasive plant sites within riparian reserves/RHCAs.

**Table 44.** Watersheds at least partially within the range of the Northwest Forest Plan, and amount of invasive plants present.

| 5th Field Watershed | Watershed Analysis Referenced | Size of Watershed (acres) | Acres of Invasive Plants in Riparian Reserves/ RHCAs |
|---|---|---|---|
| Wickiup | Browns/Wickiup WA 1997<br>Odell WA 1999<br>Snow Lakes 2006 | 131,858 | 129 |
| Fall River | N/A | 116,468 | 21.4 |
| Pilot Butte | N/A | 147,970 | 43.9 |
| Crane Prairie | Cascade Lakes WA 1995<br>Snow Lakes WA 2006 | 167,889 | 65.2 |
| Tumalo Creek | Forks/Bridge WA 1995 | 37,711 | 6.7 |

| | | | |
|---|---|---|---|
| Deep Canyon | N/A | 95,727 | 0 |
| Whychus Creek | Why-Chus WA 1998 | 161,629 | 341.2 |
| Upper Metolius River | Metolius WA Update 2004 | 140,809 | 490 |
| Lower Metolius River | Metolius WA Update 2004 | 145,494 | 219.8 |
| Upper Little Deschutes River | N/A | 80,021 | 16 |
| Crescent Creek | Big marsh WA 1997 | 118,932 | 162.3 |
| Middle Little Deschutes River | N/A | 48,608 | 0 |
| Little Walker Mtn. | N/A | 86,454 | 4.5 |

Aquatic Conservation Strategy Objectives number 5 and 7 of the Northwest Forest Plan state that National Forests within the range of the Northern Spotted Owl will be managed to maintain or restore the diversity and productivity of native and desired non-native plant communities in riparian zones and to maintain or restore habitat to support populations of well-distributed native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian dependent communities. In the PACFISH EA (USDA, USDI 1994b) and INFISH EA (USDA, USDI 1995) these are referred to as Riparian Goals and are addressed in goals (5) and (8).

Table 45 was compiled to identify inventoried invasive plant sites and Project Area Units (PAUs) within Riparian Reserves (RRs) and Riparian Habitat Conservation Areas (RHCAs), and to show where these occur within 100 feet of streams. The first 100 feet adjacent to water normally has the highest risk of delivery of sediment and other contaminants, and is within the band where label restrictions for distance are applied (demonstrated in Figure 3, page 56). Table 46 identifies inventoried populations and PAUs adjacent to lakes, reservoirs, ponds, and springs, and in or adjacent to wetlands by sub-basin.

**Table 45.** Acres of Invasive Plant Sites (Inv.) and Project Area Units (PAU) in Riparian Reserves, Riparian Habitat Conservation Areas (RHCAs), and within 100 feet of streams on National Forest System lands.

| | ≤ 100 ft Class I-II (acres | | ≤ 100 ft Class III (acres) | | ≤ 100 ft Class IV (acres) | | Cat 1-4 RHCAs & RRs (acres) | |
|---|---|---|---|---|---|---|---|---|
| | Invasive Plant Site | PAU | Invasive Plant Site | PAU | Invasive Plant Site | PAU | Invasive Plant Site | PAU |
| **John Day River Basin** | | | | | | | | |
| ***Upr John Day Sub Basin*** | | | | | | | | |
| Mdl SFk John Day River | 0.1 | 37.5 | 0.3 | 6.0 | 0.9 | 33.0 | 2.5 | 113.1 |
| Lwr SFk John Day River | 9.8 | 34.1 | 0 | 9.3 | 0.7 | 23.6 | 13.0 | 210.1 |
| Upr Middle John Day R | 0.5 | 3.1 | 0 | 0 | 0 | 0.7 | 0.7 | 9.1 |
| Mountain Creek | 0.1 | 1.1 | 0 | 4.9 | 0 | 1.0 | 0.9 | 16.2 |
| Rock Creek | 0.1 | 8.4 | 0 | 5.1 | 0.4 | 6.0 | 0.5 | 56.7 |
| Sub Basin Total | ***10.6*** | ***84.2*** | ***0.3*** | ***25.3*** | ***2.0*** | ***64.3*** | ***17.6*** | ***405.2*** |
| ***Lwr John Day Sub Basin*** | | | | | | | | |
| Bridge Creek | 6.5 | 68.7 | 11.6 | 41.0 | 8.3 | 61.9 | 50.9 | 425.9 |
| Sub Basin Total | ***6.5*** | ***68.7*** | ***11.6*** | ***41.0*** | ***8.3*** | ***61.9*** | ***50.9*** | ***425.9*** |

| | < 100 ft Class I-II (acres | | < 100 ft Class III (acres) | | < 100 ft Class IV (acres) | | Cat 1-4 RHCAs & RRs (acres) | |
|---|---|---|---|---|---|---|---|---|
| | Invasive Plant Site | PAU | Invasive Plant Site | PAU | Invasive Plant Site | PAU | Invasive Plant Site | PAU |
| **Deschutes River Basin** | | | | | | | | |
| ***Upr Deschutes Sub Basin*** | | | | | | | | |
| Crane Prairie | 4.0 | 61.2 | 0 | 0.7 | <0.1 | 7.0 | 65.2 | 440.1 |
| Wickiup | 11.6 | 25.5 | 0.8 | 0.8 | 0.9 | 2.0 | 129.0 | 272.0 |
| Fall River | 4.9 | 6.1 | 0 | 0 | 0 | 67.6 | 21.4 | 123.7 |
| Pilot Butte | 0.5 | 5.9 | | 1.3 | 11.6 | 59.3 | 43.9 | 147.2 |
| Tumalo Creek | 2.3 | 111.6 | 0 | 0 | 0 | 23.8 | 6.7 | 319.7 |
| Deep Canyon | 0 | 0 | 0 | 0 | 0 | 3.8 | 0 | 39.9 |
| Middle Deschutes | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Whychus Creek | 70.9 | 198.4 | 4.7 | 8.5 | 88.5 | 135.2 | 341.2 | 739.2 |
| Upper Metolius River | 137.8 | 174.1 | 3.9 | 16.0 | 164.4 | 297.2 | 490.0 | 994.2 |
| Lower Metolius River | 33.5 | 52.4 | 3.8 | 7.1 | 80.9 | 197.9 | 219.8 | 456.8 |
| Lake Billy Chinook | 0 | 0 | 0 | 0 | 48.0 | 66.7 | 51.0 | 72.0 |
| Sub Basin Total | ***265.5*** | ***635.2*** | ***13.2*** | ***34.4*** | ***394.3*** | ***860.5*** | ***1368.4*** | ***3604.8*** |
| ***Ltl Deschutes Sub Basin*** | | | | | | | | |
| Upr Little Deschutes R | 0 | 1.0 | 0 | 0 | 2.7 | 3.8 | 16.0 | 28.3 |
| Crescent Creek | 14.9 | 17.0 | 0 | 0 | 3.8 | 14.3 | 162.3 | 205.8 |
| Mdl Little Deschutes R | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sellers Creek | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Little Walker Mountain | 0 | 0 | 0 | 0 | 0 | 0 | 4.5 | 6.2 |
| Long Prairie Slough | 0 | 0 | 0 | 0 | 0 | 2.9 | 0 | 2.8 |
| Lower Little Deschutes R | 1.3 | 9.0 | 0 | 0 | 0 | 1.2 | 11.1 | 45.9 |
| Sub Basin Total | ***16.2*** | ***27.0*** | ***0*** | ***0*** | ***6.5*** | ***22.2*** | ***193.9*** | ***289.0*** |
| ***South Fk Crooked R Sub Basin*** | | | | | | | | |
| South Fork Beaver Creek | 0 | 0 | 0 | 0 | 0 | 0.8 | 0 | 0.8 |
| Upper Beaver Creek | 4.0 | 9.7 | 0.7 | 5.9 | 1.0 | 21.4 | 11.6 | 60.0 |
| Paulina Creek | 22.4 | 35.6 | 122.8 | 190.6 | 268.0 | 429.2 | 445.0 | 788.3 |
| Lower Beaver Creek | 4.7 | 104.2 | | 1.6 | 1.3 | 37.6 | 9.3 | 243.8 |
| Sub Basin Total | ***31.1*** | ***149.5*** | ***123.5*** | ***198.1*** | ***270.3*** | ***488.9*** | ***465.9*** | ***1093.0*** |
| ***Upr Crooked Sub Basin*** | | | | | | | | |
| Crooked River abv NFk | 0.2 | 5.2 | | 0.7 | 0.1 | 11.7 | 0.6 | 28.8 |
| Camp Creek | 0.3 | 4.9 | | 1.5 | 0.1 | 7.2 | 0.6 | 27.5 |
| Upper NFk Crooked River | 0.6 | 74.4 | | 21.6 | 1.8 | 34.6 | 2.7 | 317.4 |
| Deep Creek | 1.5 | 99.2 | 0.4 | 36.3 | 15.9 | 51.5 | 28.5 | 478.2 |

| | ≤ 100 ft Class I-II (acres | | ≤ 100 ft Class III (acres) | | ≤ 100 ft Class IV (acres) | | Cat 1-4 RHCAs & RRs (acres) | |
|---|---|---|---|---|---|---|---|---|
| | **Invasive Plant Site** | **PAU** | **Invasive Plant Site** | **PAU** | **Invasive Plant Site** | **PAU** | **Invasive Plant Site** | **PAU** |
| Lower NFk Crooked River | 0.1 | 17.9 | | 9.7 | 0.8 | 29.3 | 1.7 | 91.3 |
| Upper Crooked Valley | 3.9 | 50.6 | 1.4 | 15.3 | 1.6 | 37.1 | 15.8 | 210.3 |
| Bear Creek | 0.5 | 42.9 | 0.2 | 10.2 | <0.1 | 19.3 | 1.8 | 156.1 |
| Prineville Reservoir | 0 | 0 | 0 | 0 | 0.1 | 0.4 | 0.1 | 0.4 |
| Sub Basin Total | ***7.1*** | ***295.1*** | ***2.0*** | ***95.3*** | ***20.3*** | ***191.1*** | ***51.8*** | ***1310.1*** |
| ***Lwr Crooked Sub Basin*** | | | | | | | | |
| Upper Ochoco Creek | 1.5 | 255.1 | 0.1 | 65.4 | 1.4 | 99.3 | 7.7 | 864.6 |
| Mill Creek | 0.8 | 78.2 | 0.1 | 10.9 | 0.1 | 32.7 | 1.9 | 212.7 |
| Lower Ochoco Creek | 0 | 0 | 0 | 0 | 0 | 2.1 | 0 | 2.0 |
| McKay Creek | 5.2 | 82.4 | 0.3 | 18.0 | 0.7 | 25.9 | 12.9 | 260.0 |
| Badlands | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.6 |
| Upr Dry River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lwr Dry River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lwr Crooked R Valley | 0 | 0 | 22.1 | 26.0 | 149.8 | 260.8 | 179.8 | 296.6 |
| Crooked River Grassland | 0 | 0 | 0 | 0 | 8.3 | 19.5 | 8.2 | 19.2 |
| Sub Basin Total | ***7.5*** | ***415.7*** | ***22.6*** | ***120.3*** | ***160.4*** | ***440.2*** | ***210.5*** | ***1656.8*** |
| ***Lwr Deschutes Sub Basin*** | | | | | | | | |
| Hrwtrs Deschutes River | | | | | 0.9 | 7.4 | 0.9 | 7.2 |
| Willow Creek | 8.8 | 29.8 | 58.4 | 82.3 | 164.2 | 274.5 | 295.9 | 546.3 |
| Sub Basin Total | ***8.8*** | ***29.8*** | ***58.4*** | ***82.3*** | ***165.1*** | ***281.9*** | ***296.8*** | ***553.6*** |
| ***Trout Creek Sub Basin*** | | | | | | | | |
| Upper Trout Creek | 0.4 | 59.2 | 0.1 | 20.6 | 0.2 | 36.1 | 2.0 | 235.8 |
| Hay Creek | | | | | | | | |
| Mud Springs Creek | | 2.0 | | | 52.6 | 122.5 | 55.9 | 159.4 |
| Sub Basin Total | ***0.4*** | ***61.2*** | ***0.1*** | ***20.6*** | ***52.8*** | ***158.6*** | ***57.9*** | ***395.2*** |

* On values within 100 feet of streams 1 acre = 218 feet & 24.24 acres = 1 mile approximately
Class I-II streams are fish bearing; Class III streams are perennial non-fish bearing; Class IV streams are intermittent non-fish bearing.

**Table 46.** Acres of Invasive Plant Sites and Project Area Units (PAU) in and Adjacent to Lakes (including reservoirs and ponds), Wetlands, and Springs.

| Sub-Basin | ≤ 100 ft Lakes* (acres) | | ≤ 100 ft Wetlands (acres) | | ≤ 100 ft Springs (acres) | |
|---|---|---|---|---|---|---|
| | Invasive Plant Site | PAU | Invasive Plant Site | PAU | Invasive Plant Site | PAU |
| Upper John Day River | 0 | 0.1 | 12.9 | 178.9 | | 0.5 |
| Lower John Day River | 0 | 0 | 5.5 | 114.4 | 0.7 | 3.5 |
| Upper Deschutes River | 57.9 | 200.2 | 492.7 | 1241.9 | 0.8 | 5.5 |
| Little Deschutes River | 49.9 | 59.8 | 92.6 | 142.7 | 0 | 0 |
| SFk Crooked River | 8.0 | 15.0 | 6.1 | 9.2 | 3.0 | 6.3 |
| Upper Crooked River | 0.4 | 0.5 | 8.5 | 438.1 | 0.2 | 4.2 |
| Lower Crooked River | | 2.3 | 4.0 | 425.4 | <0.1 | 5.2 |
| Lower Deschutes River | 7.4 | 23.0 | 20.0 | 94.3 | 0 | 0 |
| Trout Creek | 0 | 0 | 5.1 | 13.6 | 0 | 1.4 |
| Summer Lake | 0 | 0 | 0 | 0 | 0 | 0 |
| Williamson | 0 | 0 | 0 | 0 | 0 | 0 |

## 3.6.2 Environmental Consequences

#### Herbicide Reaching Water

An issue for this analysis is the potential for herbicides to enter streams and impact water sources and/or aquatic organisms. The routes for herbicide to contaminate water are direct application, drift from spraying, runoff, and leaching through the soil into ground water or streams. No direct application of herbicide to water is intended in any alternative. The potential for drift, runoff, and leaching were considered during project design. Project Design Features (PDFs), including buffers along waterbodies are outlined in Chapter 2.4. These PDFs address these potential routes of herbicide delivery and minimize or eliminate potential adverse effects.

Buffers for application method are listed in Tables 16 and 17. These buffers are expected to be effective in reducing the chance for herbicide to enter water. Spot and hand treatments nearest the waterbodies are inherently far less likely to deliver herbicide to water because the herbicide is applied to individual plants, so drift, runoff, and leaching are greatly minimized. Berg (2004) compiled monitoring results for broadcast herbicide treatments given various buffers along waterbodies. The results showed that any buffer helps lower the concentration of herbicide in streams adjacent to treatment areas. In California, when buffers between 25 and 200 feet were used, herbicides were not detected in monitored streams (detection limits of 1 to 3 $mg/m^3$).

Even smaller buffers have successfully protected water quality. For example, where imazapyr was aerially sprayed without a buffer, the stream concentration was 680 mg/ml. With a 15-meter buffer, the concentration was below detectable limits (Berg 2004).

Berg collected samples of several herbicides (including sulfometuron methyl and glyphosate) following roadside application one, seven, and fourteen days after treatment. Rainfall of one-third inch occurred throughout the period. Berg detected concentrations of sulfometuron-methyl and glyphosate along road shoulders through the period. In the fall the road was again sprayed, and the ditch line of the road was checked during rainstorms for three months. Sulfometuron-methyl was detected along the shoulder in the ditch line, but was below detectable limits in the nearby stream. Glyphosate was not found at the shoulder, ditch line, or stream.

This study indicates that the greatest risk of herbicides moving off site is from large storms soon after herbicide application. In addition, this study also indicates that sulfometuron methyl may persist in the environment as it was detectable along the shoulder of the road (but not in the stream) the entire duration (three months) of the study.

Berg also reported that herbicide applied in or along dry ephemeral or intermittent stream channels may enter streams through run-off if a large post-treatment rainstorm occurred soon after treatment. This risk is minimized if intermittent and ephemeral channels are buffered (Berg 2004). If a large rainstorm occurs sediment contaminated by herbicide could be carried into streams.

#### Accidental Spill

Accidental spills are not considered within the scope of the project. Project design features would reduce the potential for spills to occur, and if an accident were to occur, the PDFs minimize the magnitude and intensity of impacts. An herbicide transportation and handling plan is a project requirement. This plan would address spill prevention and containment.

The concentration of herbicide in the water as a result of an accidental spill depends on the rate of application and the streams' ratio of surface area to volume. The persistence of the herbicide in water depends on the length of stream where the accidental spill took place, velocity of stream flow, and hydrologic characteristics of the stream channel. The concentration of herbicides would decrease rapidly down-stream because of dilution and interactions with physical and biological properties of the stream system (Norris et al. 1991).

## Alternative 1

The Deschutes National Forest, Ochoco National Forest, and Crooked River National Grassland GIS layers for the 1998 Weed EAs were compared to the current proposed action. The results are shown in Table 48. The 1998 Weed EA for the Deschutes National Forest included five treatments with herbicide prescribed for only 42 percent of the treatment area. The Ochoco National Forest and Crooked River National Grassland were a little more complicated with treatments varying by species within the Treatment Area (TA). Less than one percent of the TAs did not have any herbicide treatments. Approximately 67 percent of the TAs have a prescription of manual/herbicide. This prescription indicates that as a general rule, small populations of less than 10 plants would be hand pulled while larger infestations would be sprayed with herbicide. Herbicides currently being used on the two Forests and the Crooked River National Grassland and available under this alternative are picloram, glyphosate, and dicamba.

Table 47 provides a comparison between the 1998 Weed EAs for the Deschutes NF, Crooked River National Grassland, and the Ochoco NF and the current inventoried invasive plant sites and the proposed Project Area Units (PAUs) in Alternative 2 and 3. Column 2, Total 1998 TA, depicts the total acres in Treatment Areas in the 1998 EAs. The 1998 EAs authorized treatments along road right of ways outside National Forest System lands within the original congressionally designated reserve boundaries. Alternatives 2 and 3 only propose treatments on National Forest System lands. Column 3, Treatment Areas overlapping PAUs, indicates the number of acres in the 1998 Treatment Areas that still have invasive plants or that the weed coordinators on the Ranger Districts felt had a good chance of invasive expansion and still warranted treatment options under Alternatives 2 and 3. Column 4, Invasive Plant Site within TAs, shows the acres of currently inventoried invasive plant sites that are in 1998 designated Treatment Areas. Some of the species identified have been newly inventoried since the 1998 documents. Newly identified invasive plant sites tend to initially be small in size so the area outside the 1998 Treatment Areas can account for a large number of inventoried sites.

**Table 47.** 1998 Weed EA Treatment Areas compared to current Project Area Units.

| Sub-Basin | Total acres 1998 TAs | Acres of TAs overlapping PAUs | Acres Invasive Plant Site within TAs |
|---|---|---|---|
| Upper John Day R. | 506.4 | 426.2 | 3.5 |
| Lower John Day R. | 1590.0 | 990.6 | 176.8 |
| Upper Deschutes R. | 4628.1 | 3360.2 | 2008.6 |
| Little Deschutes R. | 2355.0 | 927.5 | 866.4 |
| South Fork Crooked R. | 623.0 | 491.5 | 20.9 |
| Upper Crooked River | 2238.3 | 1967.4 | 141.2 |
| Lower Crooked R. | 2313.5 | 1697.1 | 231.3 |
| Lower Deschutes R. | 779.9 | 577.1 | 61.0 |
| Trout Creek | 1237.1 | 856.4 | 7.4 |
| Summer Lake | 258.1 | 234.0 | 233.9 |
| Williamson | 0 | 0 | 0 |

Table 47 shows there are substantial areas outside the 1998 Treatment Areas that are currently infested with invasive plants. Herbicide treatments within the Treatment Areas have substantially decreased, due to effectiveness (see Chapter 3.3).

## Direct and Indirect Effects

The 1998 NEPA documents authorize pulling, clipping, burning, biological, and herbicide treatments. Based on the treatments authorized under the Environmental Assessments for treating weeds on the two Forests and the Grassland, it was determined that treatments greater than 100 feet from water were low risk. Treatment Areas within 100 feet of streams, lakes, springs, wetlands, and Riparian Habitat Conservation Areas (PACFISH & INFISH) or Riparian Reserves (NWFP) were evaluated. A table showing treatment areas where herbicide treatments are permitted within 100 feet of hydrologic areas of concern is shown in Table 48. As indicated previously, less than one percent of the area where herbicide application was authorized is currently being so treated annually.

***Sediment and Turbidity***

Two Treatment Areas were proposed for burning in 1998. Burning is no longer recommended for treatment of medusahead and recent experience with burning reed canarygrass without a follow-up treatment was unsuccessful. No additional burning is planned, and there will not be any sediment delivery from burning under this alternative. Manual treatment normally consists of pulling but may include cutting the root off or breaking them free with a shovel or Pulaski. This can result in some ground disturbance. The amount of disturbed soil is very small, tends to lack continuity, and should not result in measurable delivery to streams. Herbicide treatments leave the dead vegetation in place, thus maintaining effective ground cover, and will not result in any measurable increase in sediment or turbidity. Alternative 1 will not produce any measurable increase in sediment or turbidity within streams in the planning area and meets State water quality turbidity standards.

***Water Temperature***

Pulling and killing invasive plants can reduce shade which can increase the amount of solar input into streams. However, most invasive plants provide little or no shade to streams and several factors play a part in determining whether loss of stream shading would result in water temperature increase. Dead vegetation, if not removed, would continue to provide shade where adjacent to a stream's edge. Clipping reed canarygrass on the Deschutes National Forest will not produce any measurable decrease in shade.

Ongoing treatments under Alternative 1 will not produce any measurable increase in water temperatures. Without a program for active eradication or control, riparian invasive plants are likely to spread. Potential shade loss can result from invasive plants out-competing native vegetation such as alder.

***Water Chemistry***

Herbicides used under the existing NEPA documents could enter water through spray drift, surface water runoff, percolation into groundwater, and wind blown transport of herbicide attached to soil particles. Table 48 displays the acres of treatment areas from the 1998 EAs that occur near water. The 1998 EA for the Deschutes contained design elements (in addition to EPA regulations) to reduce the risk to water quality from herbicides.

**Table 48.** 1998 TAs within Hydrologic Areas of Concern with Herbicide Treatments*

| Sub-Basin | ≤ 100 ft Cls I-III (ac) | ≤ 100 ft Cls IV (ac) | ≤ 100 ft Lakes (ac) | ≤ 100 ft Wetlands (ac)** | ≤ 100 ft Springs (ac) | Cat 1-4 RHCA/RR (ac)** |
|---|---|---|---|---|---|---|
| Upr. John Day River | 19.6 | 7.4 | 0 | 33.8 | <0.1 | 73.1 |
| Lwr. John Day River | 128.9 | 61.5 | 0 | 26.8 | 1.8 | 371.6 |
| Upr. Deschutes | 84.6 | 61.6 | 8.6 | 106.7 | 2.4 | 323.5 |
| Little Deschutes R. | 2.2 | 0 | 0 | 3.0 | | 14.4 |
| SFk Crooked River | 63.8 | 11.9 | 0 | 5.1 | 0.3 | 159.9 |
| Upr. Crooked River | 220.0 | 93.9 | 1.6 | 256.9 | 3.5 | 775.2 |
| Lower Crooked River | 359.4 | 108.0 | 30.1 | 259.5 | 1.7 | 1003.5 |
| Lwr. Deschutes R. | 59.7 | 54.9 | 25.3 | 109.8 | 0 | 200.9 |
| Trout Creek | 111.2 | 55.5 | 0 | 1.4 | 1.6 | 316.8 |
| Summer Lake | 0 | 0 | 0 | 0 | 0 | 0 |
| Williamson | 0 | 0 | 0 | 0 | 0 | 0 |

* Includes all Ochoco/CRNG TAs and about 42% of Deschutes TAs
** Wetlands may double count stream, lake, and spring buffers. RHCA/RRs include al the previously listed hydrologic systems but buffer widths may be different.

The 1998 Weed EA for the Deschutes National Forest directs that herbicides not be applied within 100 feet of water (including wetlands). On the Crooked River National Grassland and the Ochoco National Forest approximately 1045 acres in Treatment Areas (TAs) had herbicide prescriptions for at least some species within 100 feet of Class I-III streams and perennial lakes, reservoirs, and ponds or about 56 percent of the area in Project Area Units (PAUs) with herbicide treatments in Alternative 2 for these areas. Approximately 701 acres in TAs had herbicide prescriptions for at least some species within 100 feet of wetlands and springs. This is about 54 percent of area in PAUs with herbicide prescriptions in Alternative 2. The 1998 EAs did not authorize broadcast spraying on the CRNG or Ochoco NF and it could only be used on the Deschutes NF greater than 100 feet of perennial stream, live intermittent streams, or standing water. To minimize the risk of herbicide entering water, only wicking was authorized within 10 feet of live water on the CRNG and Ochoco NF. Currently a total of less than 300 acres on average (including uplands) are being treated with herbicides annually between the CRNG, Deschutes NF, and the Ochoco NF.

**Potable Water**

A review of identified potable water sources in the project area was accomplished. Treatment Areas where herbicide treatments are permitted within 200 feet of wells or springs and delineated recharge areas overlain by TAs are shown in Table 49. There were no herbicide treatments in any of the municipal watersheds in this alternative. Water sources not delineated in GIS were visually verified and 0.4 acres was added to the area within the wellhead protection area. Recharge areas were estimated by the Oregon Water Resources Department for larger public systems. Not all potable water sources have delineated source areas and smaller ones probably never will. It is not known how interconnected the surface is with the aquifers.

The Deschutes is using glyphosate, manual treatments, or biological treatments within ¼ mile of public water systems. There is no special project design criteria for wells on the Ochoco National Forest or the CRNG. There is currently no restriction in effect for the use of herbicides within a specified distance of public water wells.

**Table 49**. Potable Water areas with Potential Herbicide Treatments

| Sub-Basin | Wellhead Protection Areas (WPAs) | | Drinkable Water Source Area (DWSA) | |
|---|---|---|---|---|
| | Number of Treatment Areas** | Acres | Number of Treatment Areas | Acres* |
| Upr. John Day River | 0 | 0 | 0 | 0 |
| Lwr. John Day River | 0 | 0 | 1 | 1.3 |
| Upr. Deschutes | 5 | 14.7 | 12 | 330.5 |
| Little Deschutes R. | 2 | 24.5 | 2 | 23.3 |
| SFk Crooked River | 1 | 2.8 | 1 | 13.7 |
| Upr. Crooked River | 3 | 1.2 | 0 | 0 |
| Lower Crooked River | 4 | 4.1 | 2 | 143.4 |
| Lwr. Deschutes R. | 0 | 0 | 0 | 0 |
| Trout Creek | 0 | 0 | 0 | 0 |
| Summer Lake | 0 | 0 | 0 | 0 |
| Williamson | 0 | 0 | 0 | 0 |
| Total** | 15 | 47.3 | 17 | 512.2 |

* The source area for each well or diversion is counted so the contributing area from a Treatment Area (TA) may be counted more than once.
** A Project Area may be in more than 1 Sub-basin

The 1998 EAs concluded that the herbicide treatments posed no significant impact to fish, aquatic invertebrates, workers or public health. Alternative 1 meets State Water Quality Standards for toxic substances.

### Riparian Areas

Where treatment of invasive plants is authorized under existing NEPA documents, it will help in maintaining or improving native plant species diversity and productivity. However, many new sites have been inventoried since 1998 and cannot be treated under Alternative 1. Without effective control, riparian invasive plants, such as reed canarygrass, ribbongrass and yellow flag iris, which were not identified as target species in the 1998 EAs, will continue to spread and displace native vegetation. The Snow Lakes Watershed Analysis notes that reed canarygrass has a strong potential to spread from sites on the Upper Deschutes River downstream and out of the watershed. There is potential for water quality to degrade as ribbongrass continues to create a monoculture that replaces the diverse native vegetation along the Metolius River.

### Cumulative Effects of Alternative 1

Treatment of invasive plants near water is limited in Alternative 1 (see tables 47 and 48). Project design in the 1998 EAs limited the potential for water contamination by herbicides or sediment. In addition to the discussion included in this EIS, indirect, direct and cumulative effects to the aquatic environment for current treatment programs are contained in each of the existing NEPA documents.

In general, these documents do not anticipate any indirect, direct or cumulative adverse effects to the aquatic environment, due to the implementation of mitigation measures.

## Alternative 2 – Proposed Action

This alternative proposes biological, herbicide, cultural, fire, and manual treatments, or a combination of these as described in Chapter 2. Distance to water from an area of invasive plant treatment is a primary factor in determining the risk of affecting water quality. Based on the treatments proposed in Alternative 2, it was determined that treatments within 100 feet of water had the highest risk of affecting water quality. Project Area Units (PAUs) within 100 feet of streams, lakes, springs, and wetlands were evaluated for potential adverse effects. PAUs were not designed to be treated all at one time but are areas where a particular treatment could be applied should the invasive plant sites present in the project area unit expand outside where originally found. Invasive plants within an inventoried site may cover a very small percentage of the area.

For streams that are listed for pH, chlorophyll a, or dissolved oxygen (DO), treatments within 100 feet of 303(d) listed waterbodies will not add measurable amounts of organic matter or nutrients to streams or lakes or further degrade these parameters.

A review of scoping comments on the proposed invasive plant treatments indicated that the primary concern about water is related to herbicide application. Allowed use of herbicides near water is displayed in Table 15, Chapter 2. PAUs where herbicide treatments are permitted within 100 feet of hydrologic areas of concern is shown in Table 50.

***Sediment and Turbidity***

Eliminating invasive plants can temporarily reduce effective ground cover which can increase erosion and sediment delivery, but the extent and continuity would be small. As invasive plant sites are treated and monitored, the need for active revegetation would be assessed. PDF #50 requires revegetation or erosion control where the removal of invasive plants could result in delivery of measurable levels of sediment to fish critical habitat.

Manual treatment normally consists of pulling but may include weed wrenching, cutting the root off or breaking them free with a shovel or other tool. This can result in some ground disturbance. The amount of disturbed soil is very small, tends to lack continuity, and will therefore not result in measurable delivery of sediment to streams. Mowing, weed whacking, tarping (solarization), and herbicide application leave the dead vegetation in place, thus maintaining effective ground cover until revegetated, and therefore not causing any measurable increase in sediment or turbidity.

Turbidity levels generated by manually pulling reed canarygrass and ribbongrass that is growing in channel will be reduced by dilution and mixing as it moves downstream. Turbidity generated by pulling plants off large woody debris in the channel should move downstream with the current rather rapidly but ribbongrass pulled/dug in backwater areas and side channels will take longer to dissipate. Based on the discharge of the Metolius, limiting the number of people pulling plants to no more than three should keep turbidity levels under threshold but a large group pulling in a concentrated area has the potential of producing substantially more turbidity, especially when pulling plants on the side of the channel adjacent to the bank. If turbidity can visually be seen 100 feet below where the activity is occurring, the workers will need to be dispersed further up and down stream. Pulling or digging invasive plants in the channel will need to be within the dates permitted by the State of Oregon for in channel activities.

Other proposed treatments that have a potential to increase erosion and sediment delivery are burning and scarification. Burning can reduce effective ground cover and at higher intensities kill non target species, change soil chemical and physical properties, and retard the establishment of new vegetation.

Scarification to prepare a seedbed for planting or to reduce compaction causes ground disturbance and exposes soil. However, on the two sites where these treatments are proposed, a 50-foot buffer is applied next to the creeks to filter potential sediment delivery. The two Project Areas Units are located on intermittent reaches of Dipping Vat Creek in the Dry Paulina Creek subwatershed. Fire is proposed to reduce large concentrations of standing dead houndstongue to allow access to new growth for either herbicide or manual treatments in PAU 72-15 and 72-37.

About 13 acres of the 390 acres in the two PAUs is proposed for burning and scarification. Scarification would be accomplished by pulling a harrow behind a small tractor to reduce the effects of previous logging practices and prepare the site for seeding of native or desirable non native grasses and forbs. Harrowing would break up the soil to a maximum depth of 1 to 4 inches. Organic matter uprooted by the harrowing would be left in place. There would be no tilling in the RHCA (50 feet) along the east and west fork of Dipping Vat Creek to filter potential sediment delivery.

Based on the slope, the distance to Dry Paulina Creek and Dipping Vat Creek, and the ground disturbance resulting from the burning and harrowing, there is a risk of sediment delivery until seeded and natural vegetation recovers. Scarification is restricted to outside the 50 foot RHCAs. Based on studies of buffers used during logging, this distance will substantially reduce the amount of sediment delivered to streams and seeding would result in an additional 25 percent reduction (Packer and Christensen, 1964). Reshin et al. (2006) found a 10 meter (32.8 ft.) setback for felling and yarding activities prevented sediment delivery to streams from about 95 percent of harvest-related erosion features. Lynch et al. (1985) determined that a 30 meter (98.4 ft.) buffer from logging operations removed an average of about 75 to 80 percent of the suspended sediment in stormwater. Only 1.8 acres would potentially be harrowed between 50 and 100 feet on 5 treatment sites along the intermittent east & west forks of Dipping Vat Creek. Erosion should return to pre-treatment levels within a year and fall below current levels within five as grasses and forbs become established on the old landings. Based on the low intensity of the ground disturbance and the small number and dispersion of acres treated, sediment delivery should be negligible and there should not be measurable increase in turbidity.

While fire can cause nutrient flushes resulting from rapid mineralization and mobilization of nutrients (Baker 1988; Tiedeman and others 1978), the effects of burning concentrations of houndstongue on 14 acres will be negligible. Most of the increased available nutrients would be taken up by plants or bound to soil, roots, or debris and if they did reach a stream would tend to get bound up in primary production and associated communities. Most of the increase in nutrient levels would occur in the first two storms after the burn and nutrient release resulting from the fire should not persist past the first winter (Van Wyk 1982).

Alternative 2 will not produce any measurable increase in sediment or turbidity within streams in the planning area and will meet State water quality turbidity standards and PACFISH, INFISH, and NWFP objectives.

***Water Temperature***

Riparian invasive plants currently inventoried in the planning area and proposed for treatment in this analysis are reed canarygrass, ribbongrass, and yellow flag iris. Ribbongrass, reed canarygrass, and iris are found on the Metolius River, and there are an additional 15 PAUs that have reed canarygrass as one of the target species. These riparian invasive species to not provide significant shade anywhere they occur.

Riparian areas that are a dense monoculture of reed canarygrass or ribbongrass will be revegetated with native sedges, grasses, forbs, and shrubs. Any loss of stream shade is expected to be temporary. In PAUs where active restoration is proposed, re-establishment of native plants will take place within one to two seasons.

Alternative 2 meets State water quality standards, Confederated Tribes of Warm Springs Water Quality Standards, PACFISH and INFISH RMOs, and the Aquatic Conservation Strategy Objectives and Riparian Management Objectives for water temperature.

**Table 50.** PAUs within Hydrologic Areas of Concern with Herbicide Treatments

| Sub-Basin | ≤ 100 ft Cls I-III (ac) | ≤ 100 ft Cls IV (ac) | ≤ 100 ft RHCAs (ac) | ≤ 100 ft Lakes (ac) | ≤ 100 ft Wetlands (ac)* | ≤ 100 ft Springs (ac) | ≤ 100 ft RHCA/RR (ac)* |
|---|---|---|---|---|---|---|---|
| Upr. John Day River | 109.5 | 64.3 | 405.2 | 0.1 | 178.9 | 0.5 | 405.2 |
| Lwr. John Day River | 109.7 | 61.9 | 425.9 | 0 | 114.4 | 3.5 | 425.9 |
| Upr. Deschutes | 669.6 | 860.5 | 3604.8 | 200.2 | 1241.9 | 5.5 | 3604.8 |
| Little Deschutes R. | 27.0 | 22.2 | 289.0 | 59.8 | 142.7 | 0 | 289 |
| SFk Crooked River | 347.6 | 488.9 | 1093.0 | 15.0 | 9.2 | 6.3 | 1093 |
| Upr. Crooked River | 390.4 | 191.1 | 1310.1 | 0.5 | 438.1 | 4.2 | 1310.1 |
| Lower Crooked River | 536.0 | 440.2 | 1656.8 | 2.3 | 425.4 | 5.2 | 1656.8 |
| Lwr. Deschutes R. | 112.1 | 281.9 | 553.6 | 23.0 | 94.3 | 0 | 553.6 |
| Trout Creek | 81.8 | 158.6 | 395.2 | 0 | 13.6 | 1.4 | 395.2 |
| Summer Lake | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Williamson | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

* Wetlands may double count stream, lake, and spring buffers. RHCA/RRs include all the previously listed hydrologic systems but buffer widths may be different.

### *Water Chemistry*

Best Management Practices (BMPs) are employed to help assure that water quality is not degraded. Relevant Water Quality BMPs are incorporated into the Project Design Features listed in Chapter 2.4. The objective of the PDFs is to keep herbicide residues in surface and ground water below levels that may be harmful, may chemically change to harmful forms, or that may accumulate in sediments or bio-accumulate in aquatic life to levels that adversely affect public health, aquatic life, wildlife, or other designated beneficial uses. Measures to reduce the risk of herbicide entering the hydrologic system include limiting drift (PDFs 15, 16), limiting runoff (PDF 17), reducing potential for and effects from accidental spills (PDFs 18, 19, 20, 21, 25), applying buffers around water bodies (PDFs 54, 55), using only the lowest effect rate (PDF 12).

No direct application of herbicides into water is proposed in this alternative. Application method is one of the primary measures that will reduce the risk and amount of herbicide available to enter water. Table 15 “Minimum Buffers (ft) for Herbicide Application used in Alternative 2” shows how close to water an application method may be used for each proposed herbicide.

Hand wicking eliminates the risk of drift. Spot spray targets individual plants and reduces to risk of over spray. Broadcast patch spraying applies herbicide to a patch of invasive plants and then the spray is turned off. In some cases where there is a high density of target species in a patch, broadcast patch spraying can actually apply less herbicide to a given area than spot spraying because of the lower concentration of herbicide in the broadcast spray mix (less herbicide is needed because of more complete plant coverage). Broadcast spraying can treat large areas rapidly but presents a higher risk of herbicide entering water through vaporization and drift.

Wicks are designed to be dripless, however, it is possible that drip from some wicks or plants overhanging the water could occur during hand wicking applications to reed canarygrass or ribbongrass. Aquatic formulations would be used for these applications. The quantities entering a stream from drip would be undetectable and below any level that approaches a threshold.

Effects from drift, runoff and leaching were considered in the herbicide risk assessments, prepared for the R6 2005 FEIS, assuming broadcast treatment occurring directly adjacent to streams. The Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model was used to estimate the amount of herbicide that may potentially reach a reference stream via runoff, drift and leaching in a 96 hour period, assuming broadcast treatments on a 50-foot strip along about 1.6 miles of perennial stream. SERA risk assessments evaluated the hazards associated with each herbicide based on the concentrations of herbicide predicted by the GLEAMS model using these parameters.

Because broadcast spraying is not permitted under Alternative 2 any closer than 50 feet (or 300 feet depending on the herbicide) of perennial streams, GLEAMS likely overestimates the amount of herbicide concentrations that would plausibly enter streams from this project. Spot or hand treatments are inherently far less likely to deliver herbicide to water because the herbicide is applied to individual plants, so drift, runoff, and leaching are greatly minimized.

The highest risk of getting herbicides in surface or ground water occurs within 100 feet of live streams, perennial lakes, reservoirs, and ponds, wetlands, and springs. The closer you get, the higher the risk. Table 15 in Chapter 2 of the EIS shows what distance different application methods may be used for the herbicides proposed for use in this alternative. Some herbicides cannot be used up to the water or wetland. Within 10 feet of water, only wicking of authorized herbicides is proposed. Table 15 indicates that the aquatic formulations of glyphosate and imazapyr may be spot sprayed in this buffer but this is not proposed under Alternative 2.

Herbicide prescriptions are found in 6.0 percent of the project area units within 100 feet of Class I-III streams and perennial lakes, reservoirs and ponds, and 3.7 percent of the area in wetlands or within 100 feet of wetlands and springs. Currently inventoried invasive plant sites, which is greater than what would be treated in any year, are only found in 1.6 percent of the area within 100 feet of Class I-III streams and perennial lakes, reservoirs and ponds, and 0.9 percent of the area in wetlands or within 100 feet of wetlands and springs. Following Environmental Protection Agency (EPA) product labeling instructions and Project Design Features (PDFs) will minimize herbicide from getting into the water or limit delivery to a very small amount well within state standards. Studies by Evens and Dusej (1973) and Johnson and Warskow (1980) showed rapid dilution after entering water.

Detailed discussions about herbicide delivery and fate are contained in the herbicide risk assessments completed by SERA. This information is also summarized in Appendix D – Herbicide Information and PDF Crosswalk.

**Potable Water**

The PDFs in place for the protection of soils, water quality and fisheries, the use of the lowest effect label rates, and the low intensity of the treatments are sufficient to protect groundwater recharge areas. Two surface water sources, 14 springs, and 78 wells used for domestic purposes were identified on or immediately adjacent to the Crooked River National Grassland, Deschutes National Forest, and the Ochoco National Forest. The location of potable water sources used by permittees in Special Use Cabins along the Metolius River and around Crescent Lake, Elk Lake, Odell Lake, Paulina Lake, and Suttle Lake are not known but Project Area Units (PAUs) adjacent to these areas have been identified. A review of identified potable water sources in the project area was accomplished. PAUs where herbicide treatments are permitted within 200 feet of wells or springs and delineated recharge areas overlain by PAUs are shown in Table 51. Water sources not delineated were visually verified and 0.4 acres was added to the area within the wellhead protection area (WPA). Recharge areas were estimated by the Oregon Water Resources Department for larger public systems. Not all potable water sources have delineated source areas and smaller ones probably never will. Project Area Units that intersected the recharge area are identified in Table 42. It is not known how interconnected the surface is with the aquifer. DEQ delineated sensitive areas within surface drinking water source areas will be evaluated during coordination with municipal departments in charge of the water system under PDF 27.

**Table 51.** WPAs and Water Source Areas with Potential Herbicide Treatments

| Sub-Basin | Wellhead Protection Areas | | Drinkable Water Source Area | |
|---|---|---|---|---|
| | # of PAUs | Acres | # of PAUs | Acres |
| Upr. John Day River | 0 | 0 | 0 | 0 |
| Lwr. John Day River | 0 | 0 | 1 | 1.3 |
| Upr. Deschutes | 15 | 45.6 | 28 | 1794.2 |
| Little Deschutes R. | 4 | 2.4 | 0 | 0 |
| SFk Crooked River | 1 | 3.7 | 1 | 17.4 |
| Upr. Crooked River | 2 | 0.8 | 0 | 0 |
| Lower Crooked River | 3 | 10.3 | 3 | 737.0 |
| Lwr. Deschutes R. | 2 | 0.8 | 0 | 0 |
| Trout Creek | 1 | 0.4 | 0 | 0 |
| Summer Lake | 1 | 0.8 | 0 | 0 |
| Williamson | 0 | 0 | 0 | 0 |
| Total** | 27 | 64.7 | 33 | 2549.9 |

* The source area for each well or diversion is counted so the contributing area from a PAU may be counted more than once.
** A Project Area Unit may be in more than 1 Sub-basin

To address concerns with wells and springs, Project Design Features (PDFs) were included in Alternatives 2 and 3 that precluded the use of herbicides within 100 feet of wells and spring boxes. In addition, no broadcast spraying would be permitted within 200 feet. To further protect ground water, PDFs were developed restricting the use of designated herbicides within areas based on soils.

Alternatives 2 and 3 include PDFs to protect water in Municipal Watersheds by requiring coordination with the managing agency or association on all treatments in the watershed other than biological or manual. Herbicide applications may include spot spraying individual plants, stem injection, or dabbing (wicking). Broadcast spraying could not be used without consulting with the entity managing the watershed. Herbicides would not be applied within 100 feet of the water intake or within 100 feet of the stream for the first 600 feet above the intake.

Picloram can be highly mobile in soils; furthermore, where shallow water table exists, picloram can result in groundwater contamination. As a result of these inherent properties, project design features have been developed that will reduce the risk of contaminating water by buffering waterbodies, limiting applications to once per year, and reducing drift (see Appendix D, page 20).

There are herbicide treatments proposed in the Mitchell and Sisters municipal watersheds in both Alternative 2 and 3. Picloram is listed as the second choice for at least one target species in the PAUs within both municipal watersheds. Only five of the 27 PAUs that intersected Wellhead Protection Areas (WPAs) and two of the 33 PAs that crossed Drinking Water Source Areas (DWSAs) delineated by the state did not have picloram as the first or second choice herbicide for at least one of the target species. Of special concern are surface water sources, springs, special use cabin areas, and shallow wells with unsealed casings. Avoiding highly permeable soils, sites with high water tables, adhering to established buffers and limiting rates to typical, will protect water quality in watersheds of concern where picloram may be applied.

Picloram has been found in public water systems (Neary 1985); however, the application rates that were studied were far above those used by the Forest Service. This project limits broadcast application of picloram to less than 0.5 lbs per acre. The SERA risk assessment for picloram concluded that it did not present a substantial cancer risk.

None of the herbicides proposed for use in Alternative 2 are on the State Water Quality Criteria Summary Tables 33A-C (criterion not to be exceeded in waters of the State in order to protect aquatic life and human health). The footnote below Table 33C states, that while not having designated values, a review of scientific literature may be appropriate to derive guidance values for other chemicals with toxic effects. This was accomplished for all herbicides proposed for use under this alternative.

Alternative 2 meets State Water Quality Standards for toxic substances.

## Cumulative Effects

### *Water Temperature*

Measurable increases in water temperature are not expected to occur as a result of the invasive plant treatments proposed; therefore, there will be no effect to accumulate with other actions occurring in the watersheds. Project Design Features are in place to protect water quality, revegetation and restoration of treated sites will take place where necessary, and the areas to be treated are small in relation to stream or waterbody size. Improvement in growth of native vegetation may occur in areas where riparian invasive plants are treated on non-National Forest System lands, thereby providing additional improvements to streamside vegetation.

### *Sediment and Turbidity*

Within the Dry Paulina Creek Subwatershed, roads and livestock are the two primary management activities currently resulting in surface sediment levels above background, even though the open road density in the watershed is 1.76 mi/sq mi. (far below the 3 mi/sq mi guideline in the Forest Plan). Livestock are probably the second largest non-background contributor of sediment in the planning area. Surface erosion can result from trampling and trailing but the primary affect is to channel condition. Channel condition can be affected by hoof action (i.e. trampling, hoof shear, post holing) and the reduction and vigor of palatable woody streamside vegetation. Work is beginning on an update to the Allotment Management Plan in this area. Sediment delivery from harrowing in PAUs 72-15 and 72-37 would not contribute significantly to the existing sediment levels because a 50 foot buffer will be maintained alongside the stream channels, only a small area will be scarified, and active revegetation will take place to return grasses and forbs to the site.

### *Herbicides*

Most of the National Forest System lands being analyzed for this EIS are in headwater areas (upstream of other sources of herbicides). Most herbicide use is downstream of the National Forests on private lands; however, there is herbicide application on some inholdings. The exception to this is on Willow Creek and Whychus Creek on the Crooked River National Grassland, where there is a large area of agricultural land upstream of the Grassland boundary.

There is a small risk of herbicides originating on National Forest System lands moving downstream and mixing with herbicide residue originating from other sites or outside National Forest System lands. As described in Section 4.1.1 of the R6 Invasive Plant FEIS (USFS 2005a), and at the beginning of Chapter 3, the effects could be additive or synergistic in nature. Based on the water concentration analysis in the Fisheries section, and taking into account dilution and mixing as it moves downstream, the concentration of herbicide should be so small that it would be highly unlikely to create an additive or synergistic effect. Evens and Duseja (1973) found picloram concentrations diluted 85 to 98 percent 100 meters below treatments areas, and below detection levels at 1000 meters following a 1.5 inch rainstorm within the first week of spraying at a rate of 1 and 2 lb/ac on test plots ranging from 1 to 2 acres.

The timing of applications to not overlap reduces the risk even further. The State of California conducted monitoring on surface water where 40,631 pounds of active ingredient of 13 herbicides and 19 insecticides were applied within the privately-owned watersheds upstream of sampled locations. No detectable concentrations of any herbicides were identified (reliable detection limits ranged from 0.04 to 2.0 ppb). The analysis included glyphosate and triclopyr. The results could have been due to several months passing between dry weather application and the first rain, potentially allowing chemical degradation or adsorption to soil; or dilution of streamflow between application and monitoring sites may have contributed to the lack of positive detections (Jones et. al., 2000).

Accumulation of residue from repeated treatments is not a concern. Given the half life of the herbicides being used, PDFs restricting those with longer half lives to only one application in a calendar year, buffers and application methods limiting the risk of herbicides reaching water, and the time between treatments, measurable concentrations would be very unlikely.

Treating ribbongrass and reed canarygrass on the Metolius River will help maintain the river's historic channel type and hydrologic function. If private landowners also treat invasive species such as ribbongrass and yellow flag iris along the Metolius, the treatments proposed on National Forest System lands will have a better chance of being effective and not becoming re-infested from other property. Private landowners may use a variety of techniques to control ribbongrass, such as solarization, herbicide application, seed head clipping, and hand pulling/digging. Coordination with the Forest Service on timing of treatments could limit the possibility of impacts from National Forest System lands to accumulate with the effects of treatment on private property. Restoration of fish habitat in the Metolius is planned for the near future through the addition of instream wood, which could provide additional footholds for ribbongrass. Preventing the spread of ribbongrass during that project's implementation will be planned for.

## Alternative 3

Alternative 3 was developed to address issues and concerns related to fisheries and other aquatic organisms. The PAUs are the same as those in Alternative 2. The buffers on all fish bearing streams, all perennial non-fish bearing streams, and all perennial lakes, ponds, and reservoirs were expanded to 300 feet. See Chapter 2 for a description of this alternative.

### Direct and Indirect Effects

The effects of invasive plant treatments to water quality would be similar to those in Alternative 2 except where Alternative 3 limits the use of certain herbicides and application methods. Where triclopyr, picloram, or sethoxydim are the first choice herbicide within 300 feet of water, the treatment would move to the second choice or to non-herbicide methods. Scotch broom in this buffer would need to be treated manually.

Due to restrictions on the use of herbicides within 10 feet of fish bearing streams, non-fish bearing perennial streams, or perennial lakes, ponds, and reservoirs, invasive non-native vegetation (e.g. reed canarygrass and ribbongrass) could not be treated by hand application of herbicide so would be treated with non-herbicide methods such as hand pulling and digging or solarization. This could increase the risk of causing sedimentation when the invasive plants are removed by hand pulling and/or digging. It could also mean that some sites would not be treated because manual treatment would be infeasible (see Chapter 3.3 Treatment Effectiveness).

The total amount of herbicide applied would be reduced due to changes in application method and restricting herbicide applications to outside the defined channel of dry intermittent streams or within 10 feet of fish bearing streams, non-fish bearing perennial streams, flowing intermittent streams or perennial lakes, ponds, and reservoirs.

This alternative reduces the area within 100 feet of Class I-III streams and perennial lakes, reservoirs, ponds, wetlands and springs that can be treated with herbicide by about 10 percent from Alternative 2. Herbicide application to currently inventoried invasive plant sites within 100 feet of perennial streams, springs and lakes would be reduced by 32 percent. These restrictions, in addition to following Environmental Protection Agency (EPA) product labeling instructions and Project Design Features

(PDFs) will prevent herbicide from getting into the water or limiting it to a very small amount within state standards.

Effects to potable water from Alternative 3 would be the same as those described for Alternative 2.

Where effective treatment can be implemented, it will help maintain or improve native plant species diversity and productivity within riparian areas. By treating new infestations while they are small, the early detection-rapid response strategy will help prevent newly discovered invasive plant sites from becoming large and expanding into uninfested areas. But where riparian invasive plant species cannot be effectively controlled by non-herbicide methods, they will continue to displace native vegetation.

Alternative 3 meets State Water Quality Standards for water temperature, turbidity, and toxic substances. Alternative 3 is consistent with the ACS, PACFISH, and INFISH.

## Cumulative Effects

Herbicides cannot be applied within 10 feet of any waterbody; therefore, the potential for direct or indirect effects from herbicides are even less than those for Alternative 2, and there would be no effects to accumulate at any measurable level. At the 5$^{th}$ field watershed scale, invasive plant treatment would not add significantly to effects from other land management activities or invasive plant treatment activities occurring on other ownerships. Because the amount of herbicide use is less than Alternative 2, the concern over cumulative effects associated with herbicide application isles than Alternative 2, which is very low.

Rhizomatous species such as ribbongrass and reed canarygrass will continue to spread if not effectively controlled manually and monocultures would continue to develop and expand. If the ribbongrass on the Metolius River causes the number and size of islands in the river to increase, there is a moderate risk of the river shifting toward an anastimozing channel type over the next 20 to 50 years. Placement of instream wood for improving fish habitat in the Metolius River is planned for the near future. Without effective treatment of ribbongrass along the Metolius, the wood could become colonized with ribbongrass.

## Aquatic Conservation Strategy Objectives

The Northwest Forest Plan directs the Forest Service to manage riparian-dependent resources to maintain the existing condition or implement actions to restore conditions (USDA USDI 1994a). Invasive plant treatments and subsequent re-establishment of native vegetation will lead to improved riparian conditions and therefore meet the intent of the Aquatic Conservation Strategy (ACS). The amount of inventoried invasive plants within the Riparian Reserve/RHCA portions of watersheds is minute when compared to the size of the watersheds; most cover less than one-tenth of one percent (see Tables 45 and 46).

Invasive plant treatments in the scope of this document are not likely to retard achievement of ACS objectives because the scale of treatment is small and the potential for harm is low.

- Less than one half of one percent of National Forest Service system lands within any 5$^{th}$ field watershed is currently infested.
- The proposed invasive plant treatments are expected to aid in restoration of riparian reserve conditions by allowing native vegetation to return to sites currently invested by invasive plants.
- The proposed project has a risk of adding some minor amounts of sediment and herbicide to surface water, but the amount is insignificant and not expected to affect watershed function. Most of the treatments areas are previously disturbed roadways and trails so ground disturbance is not a significant concern. Modification of surface ground cover can also change the timing of run-off. Treatment areas comprise a small portion of any watershed so no effects to stream

flows are plausible from the result of manual/mechanical treatment and/or site preparation for planting.

- Removal of some invasives would reduce cover for a short period of time along the stream's edge. However, a significant amount of vegetation would need to be removed to change water temperature in a stream, and shade would have to be provided only by the invasive plant removed. One reason treatment of invasive plants is being proposed is to recover vegetation structure and, in time, provide more stream shade with the establishment of native coniferous and deciduous trees. The PDFs prohibits broadcast applications to invasive plants closest to the water. This will protect overhanging non-target vegetation and smaller trees that are currently providing shade closest to the stream and other waterbodies.

Proposed invasive plant treatments that will take place in Riparian Reserves are consistent with the recommendations found in Watershed Analyses (see Table 44). Also, the proposed invasive plant treatments that will take place in Riparian Reserves are consistent with applicable standards and guidelines from the Northwest Forest Plan (identified in Appendix C). The standards and guidelines help to ensure that a project will meet or not prevent attainment of ACS Objectives.

The following is a summary of how this project compares to each of the Aquatic Conservation Strategy Objectives (ROD B-11); effects analysis of specific sites is contained in the water quality and fisheries sections.

*ACS Objective #1: Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.*

This project would at least maintain, if not enhance the distribution, diversity and complexity of watershed and landscape-scale features because of the protection that the Riparian Reserves provide to the aquatic and terrestrial systems and restoration of the Riparian Reserves through invasive plant eradication. This project does not involve activities such as roading or logging that could fragment aquatic habitat. Channel components that contribute to channel complexity (pool quantity and quality, substrate, flows) would be maintained because invasive plant treatments will have no impact on those features.

*ACS Objective #2: Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.*

The project would maintain spatial and temporal connectivity within and between watersheds. Nothing proposed with this project would reduce the spatial and temporal connectivity.

*ACS Objective #3: Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.*

This project would maintain the physical integrity of the aquatic system, including streambanks, side channels (refugia), and channel bottom configurations. Native vegetation provides more bank stability than invasive plant species. Project design features will reduce risk of erosion, and the project does not involve any new stream crossings, so there is no risk of increased peak flow, or resulting bank erosion and channel bed scour. Insignificant short-term inputs of sediment are expected to be very localized if they occur. This project would result in long term benefits to Riparian Reserve conditions, but it is unclear whether they would be noticeable at the fifth-field scale for this objective.

*ACS Objective #4: Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological,* *physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.*

This project would maintain water quality necessary to support healthy ecosystems through project design features. The amount of work to be done that could contribute sediment is small and PDFs aimed at reducing erosion would maintain the overall sediment levels in the long term, but there is a low risk of a short term, limited increase at sites where invasive plants are removed, that would last until native vegetation is restored. In addition, PDFs aimed at minimizing herbicide introduction into surface water, such as restrictions on application method, would keep concentrations at an insignificant level. Since the amount of these is so small and not expected to effect watershed function, the project would maintain this element.

*ACS Objective #5: Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.*

This project would maintain sediment regimes through PDFs. Invasive plant treatments would be followed by planting of native vegetation or use of erosion control measures as necessary to prevent delivery of measurable levels of sediment to streams. There is a low risk of slight inputs of sediment from treatment areas, but they are anticipated to be very small and localized.

*ACS Objective #6: Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.*

This project would maintain in-stream flows. There is no potential for increased peak flows as a result of this project.

*ACS Objective #7: Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.*

This project would maintain the timing, variability, and duration of floodplain inundation through PDFs; there is not potential for the project to affect peak flows.

*ACS Objective #8: Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.*

This project would aid in restoration of the species composition and structural diversity of plant communities in riparian areas and wetlands through invasive plant eradication and native vegetation establishment. The improvements in conditions will be particularly noticeable in areas where invasive plants have created a monoculture, excluding the establishment of native riparian plant species such as alder.

The implementation of invasive plant treatments can cause a short-term loss of vegetation in localized areas, but revegetation would take place as necessary.

**Figure 7.** Photo on left is diverse native vegetation on the Metolius River. Photo on right shows an area where ribbongrass has created a monoculture, displacing the native vegetation.

*ACS Objective #9: Maintain and restore habitat to support well-distributed populations of native plant invertebrate, and vertebrate riparian-dependent species.*

This project would aid in restoration of habitat to support well distributed populations of native plant and riparian dependent species through invasive plant eradication and native vegetation re-establishment. In some areas, invasive plants contribute overhead cover, so removing it could have short term impacts (see Fisheries section). Riparian-dependent species will benefit from the restoration of native vegetation that serves as habitat.

# 3.7 Fisheries and Aquatic Organisms

## Introduction

Fish species within the aquatic environment being analyzed here include the Columbia River bull trout, Middle Columbia River (MCR) steelhead and Columbia spring chinook salmon Essential Fish Habitat (EFH) and redband trout. Columbia River bull trout and MCR steelhead are listed as a threatened species by the U.S. Fish and Wildlife Service and National Marine Fisheries Service, respectively. Redband trout are on the Forest Service Region 6 Sensitive species list. Other native fish species present but not federally listed include mountain whitefish, various sculpins, various suckers, speckled dace and long nosed dace. Introduced game fish species within the project area include, but are not limited to, brown trout, kokanee salmon (native only to Suttle lake), brook trout, lake trout, rainbow trout (non-native strains) and cutthroat trout.

## Management Direction

### Forest Plan Standards and Guidelines

The following are the standards and guidelines related to herbicide use found in the Northwest Forest Plan, the Ochoco and Deschutes National Forests Land and Resource Management Plans, Inland Native Fish Strategy (INFISH) or The Strategy for Managing Anadromous Fish Producing Watersheds in the eastern Oregon, Washington and Northern California (PACFISH).

- INFISH RA-3- Apply herbicides, pesticides and other toxicants and other chemicals in a manner that does not retard or prevent attainment of Riparian Management Objectives (see Tables 1 and 2 in the Fisheries Report) and avoids adverse effects on inland native fish. Not all of the described features may occur within a specific stream segment of a stream within a watershed, but all generally should occur at the watershed scale for stream systems of moderate size.
- PACFISH RA-3- Apply herbicides, pesticides and other toxicants and other chemicals in a manner to avoid impacts that are inconsistent with attainment of Riparian Management Objectives (see Tables 1 and 2).
- NWFP RA-3- Apply herbicides, pesticides and other toxicants and other chemicals in a manner that does not retard, or prevent attainment of the Aquatic Conservation Strategy Objectives.

### Pacific Northwest Region Invasive Plant Program FEIS

The effects on aquatic organisms, including special status fish were assessed in the Pacific Northwest Region Invasive Plant Program FEIS Biological Assessment (USFS 2005d). The main aquatic issue in the regional EIS was that herbicides could leach, drift, spill or run off into aquatic habitats and harm aquatic organisms. One aquatic approved herbicide, glyphosate, has been shown to affect fish. Others may affect aquatic plants. Fish kills are not likely with the concentrations of active ingredients that are being proposed to be applied near the water. In rare circumstances, high concentrations of herbicides could wash into streams from unforeseen rainfalls shortly after herbicide application along road ditches or other surfaces that rapidly generate overland flows, or as a result of an accidental spill.

Standard 19 requires use of site-specific soil characteristics, proximity to surface water and local water table depth to determine herbicide formulation, size of buffers needed, if any, and application method and timing. It also requires to only consider those herbicides and herbicide mixtures registered for aquatic use when evaluating herbicide use near streams or surface water.

## Fish Species and Their Status

The following table and discussions of fish species in the planning area are taken from the Fisheries Report. More detailed information and maps of watersheds and fish distribution are contained in the Fisheries specialist report.

**Table 52.** Summary of Fish Species and their Status in the Planning Area.

| Species | Status |
|---|---|
| **COLUMBIA RIVER BULL TROUT - *Threatened*** | |
| Metolius River Population | Subpopulation of Deschutes Recovery Unit, considered healthy. Habitat generally in good condition. |
| Metolius Bull Trout Critical Habitat | Designated near the mouth of Lake Cr., Abbot Cr., Heising Spring and along ½ mile of Metolius River. |
| Upper Deschutes River Populations | Upper Deschutes River/Little Deschutes River and Crescent Lake/Crescent Creek populations probably extinct. |
| Odell Lake Population | Reproductively isolated from the rest of Upper Deschutes Basin, and only remaining population in Upper Deschutes River drainage. At high risk of extinction with less than 100 adult spawners. |
| Crooked River Populations | Extinct above Ochoco Reservoir since dam built in 1920. |
| Lower Deschutes River Population | Warm Springs River and Shitike Cr. population at moderate risk due to low redd counts and abundance of brook trout; Metolius River population at low risk; population in Lake Billy Chinook sustaining a quality trophy fishery. |
| **MIDDLE COLUMBIA RIVER STEELHEAD - *Threatened*** | |
| Deschutes River Basin | Summer steelhead populations declining in the lower Deschutes River. Pelton-Round Butte dam prevents upstream passage. Trout Creek watershed is the only network of drainages on both Forests where Deschutes River summer steelhead spawning and rearing occurs. |
| John Day River Basin | Longest free-flowing river with wild steelhead in Columbia River Basin. Production is limited by existing rearing conditions. |
| **SPRING CHINOOK SALMON - *Proposed, but not Warranted*** | |
| Upper Deschutes Basin | Chinook salmon and sockeye salmon released on an experimental basis into Metolius River and selected tributaries. |
| Chinook Salmon Essential Fish Habitat | Upper Deschutes and Crooked River basins identified as EFH under the Magnuson-Stevens Act. |
| **INTERIOR COLUMBIA BASIN REDBAND TROUT – *Forest Service Region 6 Sensitive*** | |
| Crooked River Basin | Populations are considered very depressed; thought to be declining in the basin. |
| Metolius River Basin | Population increasing in recent rears. |
| Whychus Creek Drainage | Some populations at risk from rainbow trout from irrigation ponds; unscreened irrigation diversions are a problem. |
| Upper Deschutes Basin | Population status is considered excellent with several strongholds (Odell Creek, Tumalo Creek, and Upper Deschutes River near Benham Falls). Redband in Little Deschutes River are scarce. |
| Lower Deschutes and Tributaries | Robust population in Lower Deschutes; less abundant in |

| | |
|---|---|
| | tributaries. Redband trout dominate the Trout Creek drainage. |
| John Day River Basin | Found in tributaries to the John Day River and South Fork John Day River, overlapping with steelhead populations. |
| OTHER FISH SPECIES | |
| Crooked River Basin | Other fish include mountain whitefish, speckled dace, bridgelip suckers, introduced brook trout, northern pikeminnow, chisel mouth, large scale suckers; small mouth bass and brown bullhead. |
| Deschutes River Basin | Other fish include brown and brook trout, mountain whitefish, sculpins, dace, and bridgelip, large scale suckers, kokanee salmon. |

## Columbia River Bull Trout - *Threatened*

Bull trout characteristically occupy high quality habitat, often in less disturbed portions of a drainage. Necessary key habitat features include high channel stability, spawning substrate with a very low percentage of fine sediment, abundant and complex habitat, deep pools, cold water temperatures, and no barriers inhibiting connectivity (Reiman and McIntyre 1993).

### Metolius Bull Trout Status and Distribution

The Metolius bull trout population continues to recover since listing in 1988, with redd counts peaking in 2004 at over 1,000 redds. Continued protection of the spawning population made through restrictive angling regulations in the entire watershed has resulted in this recovery. Bull trout spawn in most perennial tributaries of the Metolius River. Recent surveys have found bull trout are expanding spawning habitat to include Spring Creek, and the Metolius River upstream of Lake Creek. Additional rearing only habitat includes Brush Creek, Abbot Creek and recently Lower Lake Creek.

The Metolius River bull trout population contains a mixture of both river dwelling and lake dwelling fish. Some resident fish may exist in the upper Jefferson Creek tributaries. All life strategies use tributaries to the Metolius River for spawning. Spawning occurs in spring-fed reaches of Jack Creek, Heising Spring, Canyon Creek, Roaring Creek, Candle Creek, Jefferson Creek and Whitewater River. Main stem river spawning has been documented in only a 0.5 mile reach of the upper Metolius River near the mouth of Jack Creek. Rearing habitat is known in all spawning streams plus Brush Creek, Spring Creek near Lake Creek, and the Metolius River. Abbot Creek is dominated by redband trout but an occasional bull trout is reported during annual surveys. Lake Billy Chinook (Round Butte Dam) provides additional rearing habitat. Street and Spring Creeks, tributaries to the Metolius Arm of Lake Billy Chinook, are suspected to provide additional secondary rearing habitat for the Metolius bull trout population. Fish surveys of these two streams found only one juvenile in Street Creek but not in Spring Creek.

Most juveniles move out of the spawning and rearing streams at age 2 and move into the Metolius River and eventually into Lake Billy Chinook. Primarily, age 3 and older bull trout reside in the lake. At age 5, most bull trout mature and move up the Metolius River and into tributaries to spawn.

In the Metolius basin, young bull trout less then 100 mm were found most consistently in the coldest, spring-influenced tributaries (Ratliff 1992). In the Metolius River system, bull trout Age 0+ range between 20-40 mm, 1+ range between 60-99 mm, 2+ range between 100-159 mm and 3+ are greater than 160 mm (Ratliff et al. 1996). In other systems, bull trout less than 110 mm feed on aquatic insects, macro-zooplankton, and mysids while those larger are primarily piscivorous (Horner 1978; Shepard et al. 1984). Growth differs little between resident and migratory forms during stream residence but diverges as migratory fish move into larger and more productive waters. Resident adults range from 150 to 300 mm in length (Geotz 1989; Mullan et al. 1992) while migratory bull trout commonly exceed 600 mm (Pratt 1984; Shepard et al. 1984; and Goetz 1989).

The Metolius River/Lake Billy Chinook bull trout is a sub-population of the Deschutes Recovery Unit and is healthy as stated by Ratliff and Howell (1992) and Buchanan et al. (1997). Trends in spawning population size have increased since 1986 from 27 redds to over 1000 redds by 2004. The increase is attributed to protection from harvest by more restrictive angling regulations (Riehle et al. 1997). The Metolius bull trout population is the only population with an allowable angler harvest in the state of Oregon. Oregon Department of Fish and Wildlife regulations allow one bull trout over 24 inches to be harvested daily on Lake Billy Chinook.

The known spawning areas in the Metolius River are confined to a ½ mile reach near the mouth of Jack Creek, where there is significant groundwater upwelling in the channel and from various spring along the riverbank. Spawning habitat has expanded with the increased numbers of adults in the system. Newly documented spawning areas have been found in Spring Creek and the Metolius upstream of Lake Creek. Juvenile bull trout have been found in Lower Lake Creek, near the springs. The Blue Lake/Link Creek/Suttle Lake bull trout group in the Metolius Basin has not been observed since 1961.

Juvenile bull trout densities in the tributaries and in the upper Metolius River monitoring sites have remained relatively unchanged. The most change in juvenile densities was noted from a high in 1995 and a decrease after the 1996 flood (USFS 2004f); most significantly in rearing only streams. Juvenile densities recovered within a short period after the flood. Densities of bull trout in the streams in which rearing but no spawning occurs have been more variable. The year 1995 was a significantly high year for Brush Creek and Upper Canyon Creek (USFS 2004f).

Growth of bull trout within this drainage is slow for juveniles due to cold temperatures, yet fast for ages three and older that move to Lake Billy Chinook (Pratt 1991). There is some evidence from the trap at the mouth of the Metolius River that fry growth rates may be decreasing, possibly a result of increased densities (Scott Lewis, Portland General Electric, personnel communication). Growth rates in Lake Billy Chinook are some of the highest reported in the literature (Riehle et al. 1997). Survival estimates have not been calculated but the population has increased with more restrictive angling regulations since 1983 (Riehle et al. 1997).

Bull trout habitat in the Metolius River drainage and Upper Deschutes below Steelhead Falls are generally in good condition. Water temperature in most spawning and rearing streams are below 10° C during spawning and rarely exceed 12° C during the peak of the summer. Juvenile habitat in the form of undercut banks, overhanging vegetation, aquatic vegetation and wood is abundant in many of the rearing streams tributary to the Metolius River. Wood density is high compared to other basins. Due to the stability of the streams, little wood is transported out during normal spring flows. Fine sediment in spawning areas is a concern and may have increased from past road construction and riparian logging. The low gradient, spring-fed reaches are particularly sensitive to fine sediment loading due to their low sediment transport rates. The percentage of fine sediment in spawning gravel monitored is moderate to low and has declined as a result of the 1996 flood (Houslet and Riehle 1998). If fine sediment had historically increased from past management activities, we may still be witnessing the effects to the springs today, due to their stable nature.

### Metolius Bull Trout Critical Habitat

Responding to a court order, the U.S. Fish and Wildlife Service announced in September of 2005 that it had revised its designation of critical habitat for the bull trout under the Endangered Species Act in the Columbia and Klamath River basins of Oregon, Washington, and Idaho. Critical habitat was only designated on private lands. The Service also recognized conservation and management efforts by states, tribes and agencies.

Critical habitat refers to specific geographic areas that are essential for the conservation of a threatened or endangered species and which may require special management considerations. In the Metolius Basin, critical habitat was designated near the mouth of Lake Creek, Abbot Creek, Heising Spring and along the Metolius River on a ½ mile reach between Wizard Falls and Bridge 99. The Heising Spring area, including Jack Creek and the Metolius River is an important spawning habitat for bull trout. The Metolius River reach downstream of Wizard Falls has good island and side channel habitat for rearing bull trout but no spawning has been documented in that segment.

**Upper Deschutes River Bull Trout Status and Distribution**

Upper Deschutes River bull trout populations have probably been reproductively isolated upstream from Big Falls for approximately 18,000 years and 5,500 years ago a lava flow further divided the upper Deschutes population into the Odell lake population and the Upper Deschutes population above Big Falls (Larry Chitwood, DNF Geologist 1998, personal communication). The Upper Deschutes Basin bull trout populations were further reproductively isolated upon completion of Crane Prairie Dam (1922), Crescent Lake Dam (1928), and Wickiup Dam (1949), which are used for storing irrigation water. These dams do not have fish passage facilities and have blocked access for adult bull trout migrating to the upper Deschutes River spawning areas.

Increased water temperatures, loss of quality juvenile rearing habitat, altered stream flow regimes, barriers to spawning areas, competition with non-native fish species, and over-harvest eliminated remnant bull trout populations in the Deschutes River above Big Falls during the 1950s (Stuart et al. 1997). Bull trout were last observed in Crane Prairie, Wickiup, and Crescent Lake in 1955, 1957, and 1959, respectively. The last known bull trout observation in the Deschutes River above Bend occurred in 1954 (Ratliff et al. 1996). The upper Deschutes River/Little Deschutes River and Crescent Lake/Crescent Creek bull trout populations are probably extinct (Ratliff and Howell 1992). There may have been separate populations in Fall River and Tumalo Creek, but bull trout spawning remains undocumented (Ratliff et al. 1996).

**Odell Lake Bull Trout Status and Distribution**

The Odell Lake bull trout population is the only remaining population in the Upper Deschutes River drainage and is the only natural adfluvial population remaining in Oregon. This population was cut off from the rest of the Upper Deschutes when a lava flow cut off access and created Davis Lake about 5,500 years ago (Larry Chitwood, DNF Geologist 1998, pers. comm.). Historically, they were found in Davis Lake and the stream systems associated with these water bodies; they are now primarily found in Odell Lake and Trapper Creek.

Redd counts have been conducted on Trapper Creek since 1995. In the last few years redd counts have been conducted on parts of Odell Creek and some of its tributaries, no redds have been confirmed in these areas. Redd numbers in Trapper Creek have been very low and ranged from 0 to 24 redds. This population is estimated to be less than 100 adult spawners and is at high risk of extinction.

Juvenile snorkel surveys have been performed on Trapper Creek since 1996 and numbers ranged from 26 in 1996 to a high of 208 in 2001 (Dachtler 2004). Recently snorkel and electrofishing surveys have found juveniles in Maklaks Creek, Fire Creek, Crystal Creek, Odell Creek and a spring fed tributaries that feeds into Odell Creek (Dachtler 2003). A complete channel restoration project was performed on the lower half mile of Trapper Creek in 2002 and 2003 in order to restore hydrologic function and improve fish habitat. Fishing regulations were put in place during 1992 and 1993 in Odell Creek, Odell Lake, and Trapper Creek to protect bull trout (ODFW 1996). Reasons for this populations decline can most likely be attributed to over harvest, interaction with exotic species (brook and lake trout), Tui Chub eradication efforts in Davis Lake and Odell Creek during 1961 and impacts to habitat from the railroad, Highway 58, roads and timber harvest.

### Crooked River Bull Trout Status and Distribution

Crooked River bull trout populations are assumed to have gone extinct above Ochoco Reservoir soon after the reservoir was competed in 1920. The assumption is based on the historic condition of the riparian areas at the time the Blue Mountain Forest Reserve was formed and because migration of bull trout was eliminated by the dam.

### Lower Deschutes River Bull Trout Status and Distribution

The Warm Springs River bull trout population is considered at moderate risk and bull trout populations at the Metolius River and Shitike Creek are considered at low risk (Ratliff and Howell 1992). A more recent status review by Buchanan et al. (1997) downgraded the status of bull trout in Shitike Creek to moderate risk due to the abundance of brook trout and recent low redd counts. Round Butte Dam was built in 1964 on the Deschutes River creating Lake Billy Chinook. Due to its position, which is lower in the system, there have been fewer impacts, since critical spawning areas are above it. Presently, the bull trout populations in Lake Billy Chinook are sustaining a quality trophy fishery.

## Middle Columbia River Steelhead - Threatened

### Deschutes River Basin Status and Distribution

All steelhead in the Columbia River Basin upstream from The Dalles Dam are summer-run steelhead (Schreck et al. 1986, Reisenbichler et al. 1992, and Chapman et al. 1994). Life history information for steelhead of this ESU indicates that most Middle Columbia River steelhead smolts at 2 years and spend 1 to 2 years in salt water prior to re-entering fresh water, where they remain up to 1 year prior to spawning (Howell et al. 1985).

Wild summer steelhead juveniles rear in the lower Deschutes River for 1 to 4 years before migrating to the ocean. Lower Deschutes River origin wild summer steelhead typically return after 1 or 2 years in the Pacific Ocean. A total of eight life history patterns were identified on scales collected from a sample of lower Deschutes River origin wild adult summer steelhead (Olsen et al. 1991). Typical of other summer steelhead stocks, very few steelhead return to spawn multiple times.

Passage conditions for both juvenile and adult anadromous fish at Columbia River main stem dams contribute to declines in wild summer steelhead. The Dalles Dam, which all Deschutes River migrants must pass, has one of the lower rates of juvenile salmonid passage efficiency for main stem Columbia River dams due to a lack of turbine screening and effective juvenile bypass facilities. Bonneville Dam, particularly Powerhouse 2, does not have an effective juvenile turbine screening. Increased spill of water at both The Dalles and Bonneville dams, to increase survival of ESA-listed Snake River salmon, should result in better survival of wild lower Deschutes River summer steelhead at these dams. Longer travel time for juveniles through dam-created reservoirs in the Columbia River, increased water temperature in the reservoir environment, and increased predation near main stem dams all contribute to increased losses of juvenile and adult wild summer steelhead.

Summer steelhead occur throughout the main stem lower Deschutes River below Pelton Reregulating Dam (RM 100) and in most tributaries below the dam. Before construction of the Pelton Round Butte hydroelectric complex, summer steelhead were also found in the Deschutes River upstream to Big Falls (RM 128), in Squaw Creek, and in the Crooked River (Nehlsen 1995). Historic summer steelhead presence in the Metolius River is uncertain (Nehlsen 1995).

Construction of Pelton and Round Butte dams, completed in 1958 and 1964, respectively, included upstream passage facilities for adult chinook salmon and steelhead and downstream facilities for migrating juveniles. By the late 1960s, it became apparent that the upriver runs could not be sustained naturally with these facilities, due primarily to inadequate downstream passage of juveniles through the complex, and summer steelhead production upstream of the dam complex was lost.

The Lower Deschutes River summer steelhead is currently classified as a wild population on Oregon's Wild Fish Management Policy Provisional Wild Fish Population List (OAR 635-07-529[3]). A population meets ODFW's definition of a wild population if it is an indigenous species, naturally reproducing within its native range, and descended from a population that is believed to have been present in the same geological area prior to the year 1800. Human-caused genetic changes, either from interbreeding with hatchery origin fish or habitat modification, do not disqualify a population from the wild classification under this definition. It is likely the current wild steelhead population in the lower Deschutes River has undergone some of these genetic changes particularly from recent interbreeding with hatchery origin summer steelhead. Irrespective of this, naturally produced summer steelhead in the lower Deschutes River meet ODFW's definition of a wild population.

Wild summer steelhead spawn in the lower Deschutes River, Warm Springs River system, White River, Shitike Creek, Wapinitia Creek, Eagle Creek, Nena Creek, the Trout Creek system, the Bakeoven system, the Buck Hollow Creek system and other small tributaries with adequate flow and a lack of barriers to fish migration. Spawning in White River is limited to the 2 miles below White River Falls, an impassable barrier. A natural barrier also limits spawning opportunities in Nena Creek.

The Warm Springs River system is believed to contribute a large portion of the tributary-spawned wild summer steelhead in the lower Deschutes River. Tributary spawning ground counts are incomplete most years because many tributaries are inaccessible during spawning. The Warm Springs system is particularly valuable as a refuge for wild summer steelhead since all hatchery marked or suspected hatchery origin summer steelhead are not allowed to pass the barrier dam at Warm Springs National Fish Hatchery (WSNFH Operational Plan 1992-1996). This effectively excludes all non-Deschutes River origin summer steelhead except stray wild summer steelhead. The number of stray wild summer steelhead being passed above the barrier dam is unknown.

Spawning in the lower Deschutes River and westside tributaries usually begins in March and continues through June. Spawning in eastside tributaries occurs from January through mid-April, and may have evolved to an earlier time than westside tributaries or the main stem because stream flow tends to decrease earlier in the more arid eastside streams (Olsen et al. 1993).

Fry emerge in spring or early summer depending on time of spawning and water temperature during incubation. Zimmerman and Reeves (1996) documented summer steelhead emergence in late May through June. Juvenile summer steelhead emigrate from the tributaries in spring at age 0 to age 3. Many of the juveniles that migrate from the tributaries continue to rear in the main stem lower Deschutes River before smolting.

The Pelton Round Butte hydroelectric complex at RM 100 is currently a complete upstream passage barrier to anadromous and resident fish and does not have functional downstream juvenile passage. Although much historic summer steelhead habitat and production in the Crooked River has been lost due to dams on that river, historic and current production potential in the main stem Deschutes River below Steelhead Falls, Squaw Creek, and the Metolius River has been lost because of the Pelton Round Butte hydroelectric complex (Nehlsen 1995).

Most tributaries used by wild summer steelhead for spawning and rearing experience low flows and high temperatures, both of which are related to streambank degradation, poor riparian habitat conditions, and water withdrawals. Streambank degradation is a problem throughout the subbasin both in tributaries and portions of the main stem.

The Trout Creek watershed covers approximately 675 square miles with about 140 miles of main stem and tributaries. Trout Creek is the upper-most, eastside tributary of the Deschutes River below the Pelton Round Butte complex. The headwaters originate in the Ochoco Mountains with a main stem distance of 52 river miles. The Trout Creek watershed is currently the only network of drainages on both the Ochoco and Deschutes NFs where Deschutes River summer steelhead spawning and rearing occurs. Trout Creek enters the Deschutes River downstream from the Pelton Round Butte complex at RM 88.5.

Ongoing summer steelhead redd surveys are being conducted on various drainages within the Trout Creek watershed. The average number of miles that were surveyed within the Trout Creek watershed was 22 for the years of 1988 – 2000. The average number of fish per mile was 0.7, while the average number of redds per mile was 1.9 (ODFW 2000b).

A summer steelhead out migration study on Trout Creek is currently ongoing at RM 3.7, approximately 13.7 miles north of Madras, Oregon. Preliminary results indicate that Trout Creek is, in all likelihood, a substantial spawning and rearing tributary for wild Deschutes River summer steelhead (Nelson 2000). Further investigations as to what percentages of these spawning fish are hatchery or wild summer steelhead is expected to be answered in subsequent years of the study. Until such time, concerns for whirling disease from hatchery steelhead still exist.

Prolonged drought conditions from 1984 or 1985 to approximately 1994, exacerbated main stem and tributary habitat deficiencies and may have contributed greatly to declining summer steelhead populations in the lower Deschutes River.

A variety of man's activities outside the subbasin constrained natural production in the subbasin. Streambank degradation, primarily caused by livestock and recreational use, may also limit production by providing a chronic source of sedimentation and decreasing available juvenile rearing habitat by inhibiting growth of riparian plant communities.

**John Day River Basin Status and Distribution**

The John Day River is the longest free flowing river with wild steelhead in the Columbia River Basin. The John Day Basin has the distinction of being one of the few large basins in Oregon with no steelhead hatchery program. In the early 1960s, managers released approximately 500,000 hatchery winter steelhead fry and limited numbers of pre-smolts used for experimental purposes. Few likely survived due to the use of improper stocks and hauling mortality (90% of the fish were dead on arrival to the release site). No production releases of hatchery steelhead pre-smolts were ever made in the John Day Basin. Hatchery releases for any purpose ceased in 1966 in favor of wild stocks. There are five populations of John Day steelhead: Lower Main stem (below Picture Gorge), Upper Main stem (above Picture Gorge), North Fork, Middle Fork, and South Fork.

Wild summer steelhead juveniles rear in the lower John Day River for 1-4 years before migrating to the ocean. John Day River-origin wild summer steelhead typically returns after 1 or 2 years in the Pacific Ocean. Typical of other summer steelhead stocks, very few steelhead return to spawn multiple times.

Although stray hatchery steelhead are caught in the Lower Main stem John Day River, especially below Cottonwood Bridge, they have been rare in the upper John Day basin. Stray rates have been estimated at 4-8% or less. A rate accepted by experts to be normal and necessary to maintain genetic diversity of the wild stock.

Summer steelhead enter the John Day River Basin in late August and or September when stream temperatures drop and stream flows increase. Steelhead reach spawning areas from March through mid-May while stream flows are suitable. They spawn from March through mid-June. Fry emergence is usually from May through mid-July depending on time of spawning and water temperature during incubation. Fry emergence has been noted as late as August. Rearing is from 1-4 years and juvenile summer steelhead emigrate from April to July. Survival of egg to smolts typically ranges from 0.5-

1.5%. Survival of smolts to adults range from 2-5%.

The Ochoco NF manages partial stream reaches in Bridge Creek, Mountain Creek, Rock Creek, Lower South Fork, and Upper Middle John Day watersheds. Summer steelhead access stream reaches in all of these watersheds. Redd surveys are conducted annually in coordination with ODFW on various stream reaches within the basin. The average number of miles that were surveyed within the John Day River Basin was 26.6 for the years of 1959-2000. The average number of steelhead observed was 41.3 per mile, while the average number of redds was 5.9 per mile. Surveys have shown that preferred steelhead spawning streams on the Ochoco NF include, but are not limited to: Badger Creek, Rock Creek, Black Canyon Creek, Cottonwood Creek, and Wind Creek. Barriers on private land are the most limiting factor to upstream migration onto Forest Service administered lands.

In the John Day River Basin, summer steelhead production is limited primarily by existing rearing conditions. Livestock overgrazing, water withdrawals for irrigation, clearing of land, road building, logging, and channelization degrade fish habitat by disturbing or destroying riparian vegetation and destabilizing stream banks and watersheds. The results are wide, shallow channels, low, warm summer flows; high turbid spring flows; high sediment loads; and decreased fish production.

Low flow and high water temperatures in the Columbia River during drought years magnify main stem dam passage difficulties for both adult and juvenile summer steelhead. Streambank degradation, primarily caused by livestock and recreational use, may also limit production by providing a chronic source of sedimentation and decreasing available juvenile rearing habitat by inhibiting growth of riparian plant communities.

## Chinook Salmon Essential Fish Habitat

**Spring Chinook, ESA Status – Proposed but not Warranted**

Spring chinook salmon (*Oncorhynchus tshawytscha*) historically spawned in the Warm Springs River system, Shitike Creek, the main stem Deschutes River upstream from the location of the Pelton Round Butte hydroelectric complex, Squaw Creek, and the Metolius River. Historic use of the Crooked River by spring chinook salmon is documented but conflicting reports exist on when this population was lost (Nehlsen 1995).

Construction of Pelton and Round Butte dams, completed in 1958 and 1964, respectively, included upstream passage facilities for adult chinook salmon and steelhead and downstream facilities for migrating juveniles. By the late 1960’s, it became apparent that the upriver runs could not be sustained naturally with these facilities due primarily to inadequate downstream passage of juveniles through the project. As a result, in 1968, PGE agreed to build and finance the operation of an anadromous fish hatchery at the base of Round Butte Dam to mitigate for losses above the dams.

Oregon’s Provisional Wild Fish Population List currently recognizes natural production of spring chinook from two separate populations: one in the Warm Springs River and one in Shitike Creek, both located on the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWS). It is uncertain at this time, however, if the two groups have enough genetic differences to qualify as separate populations. Spawning occurs in the Warm Springs River and tributaries Mill Creek and Beaver Creek, and in Shitike Creek.

**Life History and Population Characteristics**

Wild spring chinook adults enter the Deschutes River in April and May. The run arrives at Sherars Falls in mid-April and peaks in early to mid-May with most spring chinook salmon passing the falls by mid-June.

Wild spring chinook salmon spawning in the Warm Springs River occurs primarily above WSNFH. Wild spring chinook salmon begin arriving at WSNFH in late April or early May, once water temperatures exceed 50° F, and continue until late September. All fish passing WSNFH must enter a trap at the hatchery and be passed above that facility to gain access to the spawning areas. Since 1986, only wild spring chinook have been allowed upstream into the spawning areas (WSNFH Operational Plan 1992-1996). The wild population currently meets the strictest guidelines of OAR 635-07-527, Oregon's Wild Fish Management Policy.

The run peaks at the hatchery by the first of June, with a second smaller peak in late August or early September. In most years, approximately 70% of the run arrives at Warm Springs Hatchery by June 1 and 90% by July 1 (Lindsay et al. 1989). Most of the fish that pass WSNFH are believed to hold in the Warm Springs River canyon within about 7 miles of the hatchery until August when they continue upstream to the spawning areas.

The run size of wild spring chinook salmon in the Deschutes River has been estimated annually since 1977 by summing harvest and escapement. Estimated total harvest has been obtained each year since 1977 (except 1985 and 1986) by conducting statistical harvest surveys of the tribal subsistence and sport fisheries at Sherars Falls. With the exception of a small number of wild spring chinook that spawn downstream from WSNFH or in Shitike Creek, all others are captured and counted at WSNFH. The average run size of wild spring chinook into the Deschutes River from 1977 through 1995 was 1,913, with a range of 241 to 3,895.

Redd counts in Shitike Creek indicate an estimated average spawning escapement of 49 adult spring chinook annually from 1982 to 1995. Of 17 spring chinook carcasses sampled during redd counts in Shitike Creek from 1986 through 1995, no hatchery origin spring chinook were found, indicating that this escapement is composed of wild spring chinook (CTWS unpublished data).

The Shitike Creek spring chinook population is recognized as a separate population on Oregon's Provisional Wild Fish Population List and qualifies as a small population under Oregon's Wild Fish Policy. Managers are unsure if spring chinook spawning in Shitike Creek are a separate population or if they are the same population that spawns in the Warm Springs River. No escapement goal for spring chinook into Shitike Creek has been established and insufficient information on production potential and adult escapement is available. The CTWS have used an upstream migrant adult trap in Shitike Creek in year 2000 to better quantify the number of spring chinook entering the system.

State and Tribal managers assume that, absent a specific escapement goal for spring chinook in Shitike Creek, an adequate number of spawning adults will reach Shitike Creek and the population's genetic resources will be protected if wild spring chinook in the lower Deschutes River are managed to meet the optimum spawning escapement goal into the Warm Springs River. The escapement goal is 1,300 adults over the WSNFH barrier dam. An additional assumption is that Shitike Creek spring chinook are subject to similar harvest and mortality rates prior to spawning as Warm Springs River origin wild spring chinook.

Emergence of spring chinook salmon in the Warm Springs River probably begins in February or March. Information on completion of emergence in the Warm Springs River is not available but may be similar to the John Day River, where emergence is completed by May (Lindsay et al. 1989).

Juvenile spring chinook migrate from the Warm Springs River in two peaks, a fall migration from September through December, and a spring migration from February through May (Lindsay et al. 1989). The fish migrating in the fall are age 0, range in size from 3.1 inches to 4.3 inches fork length, and do not have the appearance of smolts. Most spring migrants are age-1 fish, range in size from 3.5 inches to 5.1 inches fork length, and have the bright silver coloration characteristics of smolts. The total number of fall and spring migrants from the Warm Springs River ranged from 28,038 fish to

131,943 fish for the 1975 through 1993 broods, the last brood to complete migration (CTWS unpublished data).

Wild spring chinook salmon that migrate from the Warm Springs River in the fall at age 0 appear to rear over winter in the Deschutes or Columbia Rivers before entering the ocean the following spring at age 1. During research activities in the late 1970's, spring chinook salmon that were marked in the fall as age-0 migrants from the Warm Springs River were recaptured in the Deschutes River the following spring. Wild spring chinook salmon smolts generally migrate through the Columbia River in April and May at age 1 based on recoveries of marked smolts (Lindsay et al. 1989).

**Natural Production Constraints**

Habitat constraints in the Warm Springs River and Shitike Creek system are related to degraded stream banks and riparian areas, and water quality and quantity conditions, especially during years of below-normal precipitation and low stream flow. High water temperature, low flow, sedimentation, and gravel quality affect production in the lower Warm Springs River and its tributaries.

The Pelton Round Butte hydroelectric complex at RM 100 is currently a complete upstream passage barrier to anadromous and resident fish. The Pelton fish ladder was built to facilitate anadromous fish passage at the complex. This ladder was abandoned after facilities at Round Butte Dam failed to effectively pass juvenile salmonids downstream. The Pelton ladder extends from below Pelton Reregulating Dam to Pelton Dam, which impounds Lake Simtustus. The ladder is 10 feet wide, 6 feet deep, and 2.8 miles long, and was originally designed and constructed to allow passage of adult chinook salmon and summer steelhead around the Reregulating Dam to Lake Simtustus. From Lake Simtustus, fish were passed over Round Butte Dam by means of a trap and tramway. Some limited downstream migration is possible, as evidenced by successful passage of kokanee, hatchery rainbow, and brown trout from the reservoir complex into the Deschutes River, below the Pelton Reregulating Dam. However, efforts to perpetuate natural spawning runs above the hydroelectric complex were abandoned because of the lack of effective downstream passage of juvenile salmonids. Hatchery compensation was initiated by PGE in 1968 (Nehlsen 1995).

The number of adult spring chinook that spawned above the hydroelectric complex is unknown. The Metolius River was thought to be the major spring chinook spawning and rearing area of the upper Deschutes subbasin. Up to 580 adult spring chinook were captured at a hatchery rack in the Metolius River during the years 1948 to 1958 and this number of fish was thought to be considerably less than what was historically present (Nehlsen 1995). Regardless of the true production potential upstream of the hydroelectric complex, loss of these areas currently constrains natural production in the subbasin. This constraint would be reduced if passage for spring chinook was reestablished over the hydroelectric complex.

**Hatchery Produced Spring Chinook**

Available information indicates that very few hatchery-origin spring chinook adults spawn in the main stem Deschutes River, Shitike Creek, or the Warm Springs River below WSNFH. Rather, they return to their respective hatchery and do not spawn in the wild. Lindsay et al. (1989) makes reference to RBH adults being observed in Shitike Creek, but the absence of spawned-out hatchery fish during carcass surveys suggests that these fish left the system rather than spawning there. One of 14 spring chinook carcasses examined during spawning surveys in the Warm Springs River downstream of WSNFH from 1986 to 1995 was a hatchery-origin spring chinook as determined by fin mark. Hatchery-origin spring chinook have not been allowed access into the Warm Springs River spawning grounds above WSNFH with the exception of 1982 to 1986; these fish are retained at the hatchery for brood stock. Since 1986, only wild fish have been allowed upstream to spawn.

Round Butte Hatchery is funded by PGE, the current operator of the Pelton Round Butte hydroelectric complex, and was constructed and funded to mitigate for lost production of wild spring chinook salmon and summer steelhead above the Pelton Round Butte hydroelectric project. RBH is operated by the ODFW. Operation of the hatchery began in 1972 after it was agreed that natural production above the hydroelectric facility was not adequate to sustain the runs.

The spring chinook salmon production program at RBH currently consists of two different rearing techniques. Both techniques result in the release of full-term smolts that migrate through the lower Deschutes River rapidly. This is believed to minimize interaction with wild fish. One technique involves rearing approximately 25,000 to 30,000 juvenile chinook salmon at the hatchery until spring of their second year (age 1+), and then trucking them 10 miles downstream for release immediately below Pelton Reregulating Dam. The second scenario involves rearing approximately 200,000 juvenile chinook salmon at the hatchery until fall of the year following egg-take (Age 0+) and trucking them to Pelton ladder in November where they rear over winter until they are allowed to migrate volitionally the following April at age 1+.

Warm Springs National Fish Hatchery (WSNFH) was constructed on the Warm Springs River after the CTWS Tribal Council requested that the Bureau of Sport Fisheries and Wildlife (now the FWS) determine the feasibility of a permanent fish hatchery on the reservation. WSNFH was authorized by Federal Statute 184, on May 31, 1966, to stock the waters of the CTWS reservation with salmon and trout. The FWS operates WSNFH on lands leased from the CTWS. The current production goal is the release of 750,000 juveniles (WSNFH Operational Plan 1992-1996). Actual current spring chinook production varies according to brood stock availability.

**Upper Deschutes Basin Spring Chinook Salmon Status and Distribution**

Chinook salmon and sockeye salmon have been released on an experimental basis into the Metolius River and selected tributaries. The upper Deschutes and Crooked River basins have been identified as Essential Fish Habitat under the Magnuson-Stevens Act. This act protects habitat important to commercial ocean fisheries. The Listing included the Upper Deschutes Subbasin with the likelihood future passage of anadromous fish will be passed through Deschutes River dams. Under the proposed new hydropower operating license for Pelton Round Butte Dams, fish passage will be a part of the new operation at the dam complex on the Deschutes River. This proposed reintroduction marks a return to anadromy to the watershed. Chinook salmon may be released for reintroduction as early as 2008 under the fish passage plan for Pelton Round Butte Dams. Returns of adult salmon to the Metolius River are not expected until at least 2012.

Habitat for chinook salmon was documented in historic reports in a review by Nehlsen (1995). She described chinook salmon spawning in the Metolius River and collections were made in the Camp Sherman area to supply the hatchery with eggs. Historic reports of salmon being caught in traps in Lake Creek were given as evidence of use in that stream. The upper reach of the Metolius River is thought to be the primary spawning habitat for historic Chinook salmon populations. Recent growth rates examined of age 1 chinook were fastest in the experimental fry released in the springs at the Head of the Metolius River and condition factors were good in lower Lake Creek. (Jens Lovtang, OSU, pers. comm.). Although rearing could occur in other tributaries and lower in the Metolius River, the springs may be important for early rearing and spawning habitat.

Rearing habitat is thought to be within the optimum temperature range for Chinook salmon in limited reaches of the Metolius River and in most of the year in Lake Creek. Juvenile Chinook salmon caught in juvenile trap in the mouth of the Metolius River were found to be small on average. It is unknown if additional rearing and growth would occur after the juvenile chinook migrate out of the Metolius River system. Larger smolts would have better survival to the ocean

## **Interior Columbia Basin Redband Trout -** Forest Service Region 6 Sensitive Species

Redband trout are the native form of rainbow trout in the interior Columbia River basin. This subspecies is adapted to arid conditions east of the Cascade Mountains and generally have a high tolerance for high stream temperatures. Redband trout are spring spawners, depositing eggs in a redd in the gravel in cool, clean water. Emergence from the gravel occurs in June and July and the fish grow and often reside in the same stream were they were spawned (Stuart et al. 1996). Generally growth rates are slow and fish rarely reach lengths greater then 10 inches. Redband trout in the Crooked River downstream of Bowman Dam have faster growth rates and attain larger sizes. Maturity is reached at age 3, or approximately 5-6 inches. Spawning Occurs in April or May (Stuart et al 1996).

### Redband Trout of the Crooked River Basin

Redband trout populations throughout much of the Crooked River Basin and the Ochoco National Forest can be characterized as “very depressed” (ODFW 2003). Redband trout are present throughout the basin, except in Haystack Reservoir, Reynolds Pond, Walton Lake and possibly Antelope Flat Reservoir. Historically, there were two groups in the basin separated by a geologic barrier in the North Fork Crooked River. Today, there are several separate smaller populations isolated by artificial barriers such as impoundments, irrigation diversions and culverts. Redband trout populations are thought to be declining in the basin and have been listed as a Sensitive species by the State of Oregon and the Forest Service (Stuart et al. 1996).

Redband trout in the Crooked River Basin were found to occupy 75% of their historic range and their abundance was a fraction of historic levels (Stuart et al 2002, draft report). Many streams in the southwest portion of the drainage may have lost populations due to habitat degradation, reduced flows and high water temperatures. Strong populations exist in 7% of the basin, including the Crooked River just downstream of Bowman Dam and just upstream of Lake Billy Chinook. Other strong holds for redband trout in the Crooked River Basin included headwaters streams on the Ochoco National Forest (Stuart et al 2002, draft report).

A joint USFS and ODFW study undertaken from 1997-2003 on Deep Creek redband trout populations has documented a marked population decline (ODFW 2003). No particular age-class declined markedly compared to one another, suggesting a reduction due to non-selective influences. The study concluded that drought largely caused the population crash and that fish numbers will not likely recover until normal climatic conditions return. It also states that low-quality habitat conditions have left these populations susceptible to climatic and anthropogenic disturbances. Additionally, a water-born pathogen (*Ichthyoptherius multifilis*) in Little Summit Creek in the summer of 1998 resulted in approximately 60% mortality among the redband trout and speckled dace (*Rhinichthys osculus*) populations within a two mile reach (ODFW 2003).

### Redband Trout of the Metolius River Basin

Redband trout (*Oncorhynchus mykiss gairdneri*) are found in Lake Creek, Link Creek, Canyon Creek, First Creek, Abbot Creek, Suttle Lake and the Metolius River. The Metolius River population has been increasing in recent years and the adult spawning population has more than tripled in the last five years. The cause of the increase is unknown, but may be the result of recovery after drought, lack of hatchery fish and/or increased large wood in the upper river (Mike Riehle, Sisters R.D. Fisheries Biologist, personal communication). Lake Creek is a spawning stream for redband trout although the spawning timing is slightly later than for the Metolius River. Hatchery rainbow trout from Wizard Falls Trout Hatchery were stocked in the Metolius River until 1995 when the program was discontinued to protect wild fish. Numbers of adult spawning fish have increased since 1995 by three fold in the upper river and has stabilized in recent years (USFS/ODFW data on file).

**Redband Trout of the Whychus Creek Drainage**

Indian Ford and Trout Creek are located within the Whychus Creek drainage. Within the Whychus Creek drainage, redband trout (*Oncorhynchus mykiss gairdneri*) are found in Squaw Creek, Indian Ford Creek, Snow Creek and Trout Creek. Migration barriers such as dry channel reaches and irrigation diversion dams impede movement of redband trout in Squaw Creek and tributaries during the summer months of dry years. Redband trout populations in Indian Ford Creek and Whychus Creek are at risk from hatchery strains of rainbow trout from irrigation ponds and recreation ponds in the watershed (USFS 1998d). Unscreened irrigation diversions remain a problem within the watershed. In October 1997, the Three Sisters Irrigation District reported that approximately 5,000 fish were recovered from District ditches and released into the District and private ponds. One diversion is screened on Indian Ford Creek (USFS 1998d).

Trout Creek, a tributary to Indian Ford Creek, is intermittent in its lower reaches and flows into Indian Ford Creek only during high precipitation events. An extant population of redband trout survives in this stream and in the vicinity of Trout Creek Swamp (USFS 1998d). The connection, although infrequent, between Trout Creek and Indian Ford Creek is important for redband trout genetic exchange and repopulation if a catastrophic event were to occur. Without this connection the current isolated population of redband trout in Trout Creek remains highly susceptible to loss due to habitat manipulations, catastrophic events, over fishing, exotic species introduction or disease.

**Redband Trout of the Upper Deschutes Basin**

Upper Deschutes River has a strong hold for redband trout in the reach near Benham Falls to Bend (ODFW 1996). Electrofishing surveys showed redband population status to be excellent and this is likely due to water inputs in this reach that are less influenced by storage and release of irrigation water. Redband trout are managed for in and above Crane Prairie Reservoir and native stock has been introduced to the hatchery program for the reservoir and other waterbodies. This high use recreational fishery on both the reservoir and river upstream attracts many anglers to the area. Other strongholds for redband trout in the upper Deschutes River Basin include Odell Creek, and Tumalo Creek.

Populations of redband trout in Big Marsh and Crescent Creek are present but there status is unknown. Recent fish surveys above Big Marsh have not found any redband and surveys in Crescent Creek above Big Marsh Creek have only found a few fish (Dachtler 2004 and USFS data on file). Redband were documented in 1998 only below the 6020 road in Big Marsh Creek during an electrofishing survey (Dachtler 1998). In Big Marsh Creek competition from brook and brown trout are the most likely the reason for the decline. In Crescent Creek extreme low flow conditions during the winter are most likely why they are scarce above Big Marsh Creek

Little Deschutes River has a native population of redband trout historically but in recent years few if any redband trout have been reported (rated as scarce). The majority of the river is dominated by brown trout today, with brook trout in the upper reaches and tributaries (ODFW 1996). Surveys of the Little Deschutes and its tributaries above Crescent by the USFS in recent years have not found any redband trout.

**Redband Trout of the Lower Deschutes River and Tributaries**

Redband trout in the Lower Deschutes River is an abundant and robust population which dominates the salmonid community in the lower river and is less abundant in the tributaries, where juvenile steelhead trout dominate. The upper Trout Creek drainage is dominated by resident redband trout where they coexist with steelhead trout.

**Redband Trout of the John Day River Basin**

Redband trout are also found in tributaries to the John Day River and the South Fork John Day River. These populations overlap with steelhead populations and in some cases their range extends farther upstream in the headwaters than steelhead trout. Steelhead migration to reach several headwater tributaries is limited by natural migration barriers and in some cases by man made barriers such as culverts and irrigation diversions. Little is know about the status or health of redband trout populations in tributaries to the South Fork John Day. Tributaries to the South fork of the John Day River may not have strong populations.

### Other Fish Species

In the Crooked River Basin, redband trout dominated most fish bearing streams (Stuart et al 2002, draft report). Other species found included mountain whitefish, speckled dace, bridgelip suckers, introduced brook trout, northern pikeminnow, chisel mouth, large scale suckers. Near reservoirs, small mouth bass and brown bullhead are present (Stuart et al 2002, draft report). Below Bowman Dam mountain whitefish are found in abundance.

In the Deschutes River Basin, redband trout dominate most drainages, with brown trout and brook trout, mountain whitefish, sculpins, dace and bridgelip and large scale suckers common in some streams. In the Metolius River Basin, bull trout are more common in the tributaries, but brown trout, brook trout, mountain whitefish, sculpins, longnose dace and bridgelip suckers are common in the Metolius River. Kokanee salmon spawn in many rivers and streams that flow into lakes and reservoirs, including the Metolius River, the Deschutes River, and tributaries to Odell Lake, Suttle Lake, Crane Prairie Reservoir, and Wickiup Reservoir.

### Riparian Reserves and Riparian Habitat Conservation Areas

Riparian Reserves (RR) are management areas along lakes, streams, and wetlands within the Northwest Forest Plan (NWFP) area. Riparian Reserves are portions of watersheds where riparian-dependent resources receive primary emphasis and where special standards and guidelines apply. Standards and guidelines prohibit and regulate activities in Riparian Reserves that retard or prevent attainment of Aquatic Conservation Strategy objectives.

East of the NWFP area, strategies for the management of anadromous fish (PACFISH) and inland native fish (INFISH) has designated Riparian Habitat Conservation Areas (RHCA) which are managed to protect aquatic resources and fish by being consistent with Riparian Management Objectives. These management areas were assessed to describe the location of the proposed activities in relation to fish habitat and waterbodies that affect fish habitat.

The areas of invasive plant infestations are widespread throughout the Riparian Reserve and RHCA network. Within most of the subwatersheds on the two forests, invasive plant infestations occur in the RR/RHCA where fish habitat also occurs. Large acreage of invasive plant infestation is associated with wetland or reservoir shoreline treatments most commonly associated with reed canarygrass or ribbongrass infestations. Fish habitat around and downstream of reed canarygrass infestations on National Forest System lands are important because of the value of the habitat for bull trout and chinook salmon in the Metolius River, and redband trout in the Deschutes River, Fall River and Metolius River. These infestations are located on the streambank or lake shoreline and are in close proximity to fish habitat or serve as fish habitat depending on life stage and time of year.

Areas where fish species and fish habitat overlap with invasive plant sites is summarized below:

- Overlap of redband trout and invasive plant sites are found throughout the analysis area with the exception of the east side of the Bend/Fort Rock Ranger District, the upper Little Deschutes River and some isolated closed systems adjacent to Wilderness.
- The wide distribution of redband trout in the Deschutes, and John Day basins makes them the most likely species to be exposed to treatments in riparian areas.

- Bull trout are in proximity to weed infestations in the Davis Lake, Odell Lake, and Metolius River watersheds.
- The Metolius River ribbongrass infestation overlaps with the majority of the Chinook salmon EFH (Essential Fish Habitat).

A limited amount of invasive plant treatment sites are along streams that are known to support steelhead populations. This indicates steelhead are at low risk from invasive plant treatments.

### Roads that Drain to Streams

Roads within Riparian Reserves and RHCAs can drain to streams at either road crossings or where roads parallel the streams or lakes. In some watersheds, roads can be an important source of runoff of water drainage to streams. These roads that occur in the RR/RHCA are summarized in Appendix H, Table H-1. Subwatersheds with high miles in RR/RHCA include Upper Bridge/Bear, Upper Lake, First, Wolf, Lower Deep, Ochoco, Marks, and Upper McKay. Approximately 380 miles of road are proposed for treatment in RR/RHCAs. Roads are often sites where invasive plants first become established from the passing vehicles.

Roads that cross streams can be conduits for runoff into streams as they dip down to the stream at the crossing. Ditch drainage flows to the creek between where the last relief culverts drain the runoff from the road and the stream. This length of road draining directly into the stream will vary with particular road maintenance level and relief culvert spacing and topography. The number of road crossings occurring within Project Area Units are summarized in Appendix H, Table H-2.

Roadside ditches can act as delivery routes for herbicide residue during periods of heavy precipitation or during snowmelt off. Because the proposed action includes treatment of road prisms and ditches with herbicides, the concern for herbicides being indirectly delivered to waterbodies containing fish via roadside ditch lines was addressed by: identifying areas within 300 feet of a road crossing that were within PAUs or invasive plant sites, limiting herbicide use in ditches to those that are considered low and moderate risk to fish or are approved for aquatic use, and by analyzing potential effects to fish from ditch runoff.

### High Risk Riparian Reserves/RHCA

High risk RR (riparian reserves) and RHCA (riparian habitat conservation areas) are those that provide habitat or contribute to streams that provide habitat for threatened, endangered, or sensitive (TES) fish species, fish species of concern or highly valued fisheries. These streams are generally class 1 and 2 streams or lakes that provide a high quality fishery or provide habitat for listed fish (e.g. Metolius River bull trout habitat). Stream class definitions are as follows:

**Class 1:** Fish bearing, perennial or intermittent, threatened or endangered species, anadromous species or domestic water supply.

**Class 2:** Fish bearing, perennial or intermittent, any species.

**Class 3:** Non-fish bearing, perennial.

**Class 4:** Non-fish bearing, intermittent

Riparian Reserves and Riparian Habitat Conservation Areas (RR/RHCA) are displayed in the following table. Invasive plant sites and Project Area Units that occur within RR/RHCA are displayed in Table 45 of the Water Quality section.

**Table 53.** Width of Riparian Reserves and Riparian Habitat Conservation Areas on the Ochoco and Deschutes National Forests.

| Classification | Riparian Reserves Within NWFP (ft) | RHCA Outside of NWFP in Priority Watersheds (ft) | RHCA Outside of NWFP in Non Priority Watersheds (ft) | Metolius River Watershed (ft) |
|---|---|---|---|---|
| Class 1 | 300 | 300 | 300 | 320 |
| Class 2 | 300 | 300 | 300 | 320 |
| Class 3 | 150 | 150 | 150 | 160 |
| Class 4 | 100 | 100 | 50 | 100 |
| Wetlands>1acre | 150 | 150 | 150 | 160 |
| Wetlands<1acre | 100 | 100 | 50 | 100 |
| Lakes | 300 | 150 | 150 | 320 |
| Ponds | 150 | 150 | 150 | 150 |
| Reservoirs | 150 | 150 | 150 | 150 |
| Springs | 100 | 100 | 50 | 100 |

Analysis of effects uses the functional definition of a riparian area rather than Riparian Reserve definition. Riparian area is defined as a three-dimensional zone of direct interaction between terrestrial and aquatic ecosystems. Boundaries of riparian areas extend outward to the limits of flooding and upward into the canopy of streamside vegetation. Riparian areas can be viewed in terms of the spatial and temporal patterns of hydrologic and geomorphic processes, terrestrial plant succession and aquatic ecosystems (Gregory et al. 1991). For analysis of alternatives, an aquatic influence zone of 100 ft on either side of stream was used to determine where effects to fish in streams, rivers and lakes may occur from herbicide application. Within the analysis area there are riparian areas wider than 100 feet, but Level 2 Stream Survey data (USFS 1989-2005 unpublished data, Deschutes Headquarters files) indicates that the majority of true riparian vegetation around major class 1 and 2 streams within the analysis area is less than 100 ft.

**Aquatic Project Design Features and USFWS and NMFS Conservation Measures**

Treatments under either action alternative will follow specific Project Design Features (PDFs) to ensure adverse effects are minimized. In this way, these important habitats will have an added level of protection to ensure that effects to special status fish species are minimized.

Project Design Features listed in Chapter 2.4 are designed to reduce the potential for adverse effects to listed fish and to native fish species (e.g. PDFs 42-60). Tables 16 and 17 in Chapter 2 display the restrictions on herbicide applications near water.

The biological and conference opinion for the Pacific Northwest Region Invasive Plant Program offered the following list of conservation recommendations relating to herbicide application that may be necessary for ESA compliance at the project level, depending on site specific considerations. They are designed to provide guidance in selecting appropriate conservation measures and practices in future ESA consultations on actions implementing the proposed direction. The Conservation Recommendations are included in the following table, with reference to this project's corresponding Project Design Features from Chapter 2.4:

**Table 54**. Conservation Recommendations from Biological Opinion and Corresponding Project Design Features.

| Conservation Recommendation from R6 BO | Project Design Feature of this EIS |
|---|---|
| 1. Where applicable, ground application adjacent to waters should only be done by hand wicking, wiping, dripping, painting or injecting. | #54 and #55 aquatic buffers (shown in Tables 16 and 17) |
| 2. Riparian buffer zones should be flagged before beginning herbicide applications. | #54 and #55 aquatic buffers in consultation with fisheries biologist |
| 3. Broadcast application should only occur when winds are not expected to cause drift into streams. | #15 wind velocity; #16 droplet size; and aquatic buffers |
| 4. During broadcast application, consider monitoring weather conditions periodically by trained personnel at spray sites. | #15 monitor weather conditions |
| 5. Consider not applying if precipitation has been forecasted to occur within 24 hours of spraying. | #17 precipitation |
| 6. When applicable, use water to mix (dilute) herbicide products for application. | #9 herbicide carriers limited to water or vegetable oil |
| 7. The applicator should only use surfactants or adjuvants in riparian areas that do not contain any ingredients on EPA's List 1 and 2, where listing indicates a chemical is of toxicological concern, or is potentially toxic with high priority for testing (U.S. EPA 2000a). If surfactant or adjuvant that contains any List 1 or 2 ingredients is considered, the risk to ESA-listed species and their habitat with that chemical should be evaluated before a use decision is made. | #54 and #55 aquatic buffers; consistency with R6 standard 18. |
| 8. Maintenance and calibration of spray equipment should occur at least annually to ensure proper application rates. | #22 calibration of equipment |
| 9. If consistent with project site objectives, use herbicide formulations containing clopyralid, glyphosate, imazapyr, metsulfuron methyl, or sulfometuron methyl, in riparian areas beside habitat used by ESA-listed salmonids. | #43 low risk to aquatic herbicides |
| 10. Aerial applications should be designed to deliver a median droplet diameter size appropriate to reduce drift. | No aerial application proposed |
| 11. Aerial spray should be released at the lowest height consistent with invasive plant control and flight safety. | No aerial application proposed |

Consistency with these design features and conservation measures will ensure that the effects to fish are within those estimated in the Regional Invasive Plant EIS (USFS 2005a), the NMFS Biological and Conference Opinion (USDC 2005) and the USFWS Biological Opinion Concurrence and Conference Report (USDI 2005). Following these guidelines will ensure that the aquatic effects are minimized and the effects to listed fish are within those estimated in the Regional EIS ESA/MSA consultation.

### Site Specific Project Design Features

A complete list of project design features that apply to the entire project area can be found in Chapter 2.4. The following site-specific project design features manage risks to fish and aquatic biota where treatments can be modified to still be effective while reducing chances for adverse effects.

**Table 55.** Unit-Specific Project Design Features, Alternative 2 and 3.

| Watershed Name and Number | Project Area Number | Species Affected | Project Design Feature |
|---|---|---|---|
| Willow Creek 1707030602 | 75-20 | Redband trout | Use clopyralid or aquatic glyphosate in place of picloram to treat Russian knapweed |
| Willow Creek 1707030602 | 75-24 | Non Native Fish | Use clopyralid or aquatic glyphosate in place of Picloram to treat Russian knapweed |
| Upper Trout Creek 1707030701 | All | Steelhead<br>Redband Trout | Use of picloram restricted to treating sulphur cinquefoil weed populations. |
| Lower Whychus 1707030108 | 75-56 | Steelhead<br>Bull Trout<br>Redband Trout | Use of clopyralid, and sulfometuron to treat medusahead, and diffuse knapweed restricted to 10 acres per year in canyons where slopes exceed 10 % and within 300 ft of perennial water. |
| Odell Lake 1707030102 | 12-02<br>12-16 | Bull Trout<br>Redband Trout | Use chlorsulfuron in place of picloram to treat butter and eggs or Dalmation toadflax |
| Bridge Creek 1707020403 | All | Steelhead<br>Redband Trout | Use of picloram restricted to treating sulphur cinquefoil and field bindweed species. |
| Mountain Creek 1707020113 | All | Steelhead<br>Redband Trout | Use of picloram restricted to treating sulphur cinquefoil and field bindweed species. |
| Rock Creek 1707020114 | All | Steelhead<br>Redband Trout | Use of picloram restricted to treating sulphur cinquefoil and field bindweed species. |
| Upper Middle John Day 1707020113 | All | Steelhead<br>Redband Trout | Use of picloram restricted to treating sulphur cinquefoil and field bindweed species. |
| Lower SF John Day 1707020113 | All | Steelhead<br>Redband Trout | Use of picloram restricted to treating sulphur cinquefoil and field bindweed species. |
| Dry Paulina Creek 1707030309 | 72-15<br>72-37 | Redband Trout | No scarifying, burning or fire line construction within 50 feet of intermittent channels in areas selected for this treatment. |

## 3.7.2 Environmental Consequences

The environmental consequences discussion focuses on the potential impacts of removing invasive plant populations by herbicides application, manual methods, prescribed fire, or mechanical methods. These methods could affect fish and aquatic biota from herbicide entering the water, sedimentation to spawning areas or reduction of overhead cover within riparian areas. Some discussion on impacts to aquatic invertebrates, aquatic macrophytes and algae are included where pertinent information is available. The effects analysis is tiered to The Pacific Northwest Region Final Environmental Impact Statement for the Invasive Plant Program (USFS 2005a), where most of the quantitative information related to potential concentrations of herbicides in water and their effects on fish and their habitat are covered. The PDFs listed in Chapter 2.4 and in the above table have been designed to add site-specific protection in addition to that provided by standards in the BO/BA from USFWS and NOAA for the R6 2005 FEIS (USDC 2005).

The effects analysis covers methods proposed for this project and generalized effects from these actions. Effects for each method proposed are included with more emphasis on herbicide effects and pulling of invasive plants. These two methods are the most common treatment methods and will be used across the analysis area. Site specific analysis is included for all watersheds that have the potential for effects to Threatened or Sensitive fish species. Also, effects are analyzed for watersheds where salmon or steelhead are proposed for reintroduction. Redband trout is the only sensitive fish species on the Regional Forester's list that occurs in the project area. Redband trout are found throughout the analysis area; effects were analyzed alongside other federally listed fish where they overlap. Some of the watersheds with only redband trout were analyzed separately or where larger project area units existed or where treatment methods were different than those analyzed for federally listed fish species.

Six different treatment methods (manual, mechanical, biological, cultural, fire, and herbicides) were analyzed in the R6 2005 FEIS and are being proposed for this EIS. To understand effects, one must be familiar with the different methods proposed. Refer to Table 10 Chapter 2 for descriptions of the treatment methods. More details on methods specific to target species are included in Appendix B.

The following section discusses generalized *potential* effects to fish and aquatic biota from the described methods. Site-specific and quantitative analysis of the effects from this project will be discussed in more detail for each of the alternatives and for specific watersheds that contain large invasive plant sites and/or TES species.

**Manual** --- Pulling of invasive plants by hand or with tools will disturb small patches of soil which depending on proximity or location could add very small amounts of fine sediments to fish bearing streams. All the native species of fish found within this project area are stream or river spawners. Fine sediments that enter a stream could enter a redd and cause increased egg mortality by filling in the spaces between the cleaned gravels in the redd cutting off flow and oxygen to the redd. This can suffocate fertilized eggs or alevin and lead to decreased survival of offspring from the redd. Weed pulling most often occurs on small populations or scattered individual plants. Amounts of fine sediments produced from this action would be undetectable against natural sources and other man made sources of fine sediment

**Mechanical ---** Scarifying or "harrowing" can have the same effects as hand pulling described above except it has a greater potential of adding fine sediments to a stream since it is generally done on a larger area that leads to more exposed and disturbed soils until vegetation reestablishes itself. Depending on size of area and location and proximity to a stream, this method could add measurable amounts of fine sediments to a stream and negatively impact spawning success.

Mowing and weed whacking are not ground disturbing activities but they would remove vegetative cover that could be import for juvenile fish rearing in the margins of streams, rivers and lakes. The reduction in cover and shade could potentially increase the amount of solar radiation reaching the water surface. Weed species associated with riparian areas such as ribbongrass would have the greatest potential for reducing shade. However this is unlikely to have much effect on water temperatures as most shade comes from topography, aspect and larger streamside trees and shrubs.

**Biological** --- Effects from biological agents are analyzed by APHIS before being approved for use. Only biological agents approved by APHIS and the state of Oregon, and that comply with standards in the Forest Plans, would be approved for use under this document. Biological agents such as insects that target noxious weeds have very little to no chance of having direct, indirect or cumulative effects on listed fish species or their habitats. This method will be compliant with Standard #14, is assumed to have no effect and will not be discussed any further in this document.

**Cultural** --- Soil enhancement such as amendments and mulching should help to stabilize soils and provide increased growth to native plants that already existed or have been planted as part of active restoration efforts. This should be a beneficial effect to areas where invasive plants have been eliminated through different treatment methods.

Tarping may be tried experimentally in areas where moderate to small patches of reed canarygrass or ribbongrass are present to kill rhizomes and prevent regrowth. This method will require a tarp to cover an infested area for 3 months to 2 years and allow shade and heat to kill the plants and essentially sterilize the soil. Bare soil would be present after the tarp was removed which could contribute fine sediments to streams. Active restoration of bare soil patches with native plantings and possible use of mulching and soil amendments may be required with this method.

**Fire ---** Areas burned could produce varying amounts of fine sediments depending on the size and intensity of the burn along with soil characteristics, slope, rainfall and proximity to stream channels. The intent of fire is to reduce the biomass of the target invasive plant in areas that have dense populations. Usually these areas treated with fire will be followed up with herbicide treatments.

**Herbicide ---** Some formulations of herbicides could have direct negative effects to fish and aquatic organisms. This would be especially true if a spill occurred into a small waterbody although effects from a spill will not be analyzed as this is not part of the proposed action. Herbicides that do not directly affect fish may affect the food chain through effects to riparian or aquatic plants, algae, terrestrial and aquatic invertebrates and vertebrates. Sub- lethal effects such as behavior changes could result in increased vulnerability to predators. However, for both alternatives general PDFs should prevent herbicides from having any detrimental effects on aquatic organism populations in most of the project areas. Some project areas may have a higher likelihood to effect individuals of a population depending on location, treatment method, invasive plant species and several other factors. Project areas that are of greatest concern will have specific design features to further prevent potentially detrimental effects to fish and aquatics.

Risk assessments for individual herbicides proposed for this EIS have been compiled for the Forest Service by Syracuse Environmental Research Associates, Inc. (SERA 2001, 2003, 2004). These risk assessments were designed to help identify potential risk to fish from the use of each herbicide. The SERA risk assessments also cover studies for the effects of a given herbicide on aquatic plants, algae, macroinvertebrates, and water chemistry when information from these types of studies is available. Studies on effects to aquatic fungi or unicellular organisms are generally not available. Herbicide effects to these types of organisms are possible but standards to protect other aquatic organisms should serve to protect these organisms as well. Selected summaries of SERA (2001, 2003, and 2004) risk assessments on the effects to fish and aquatic organisms for each herbicide that is being proposed for use are located in Appendix C.

Herbicides can enter the water by atmospheric deposition, spray drift, surface water runoff, percolation, groundwater contamination and direct application. PDFs such as timing of application, buffers, droplet size restrictions, and application rates have been created to minimize or avoid water contamination. In addition to these PDFs the EPA approved label guidelines for each herbicide will be followed during application.

### Risk Factors for Herbicides

Herbicides were rated into three categories based on their potential for affecting fish and other aquatic life. These ratings are relative only among the ten herbicides analyzed here. Ratings are based on the effects reviewed by the Pacific Northwest Region Invasive Plant EIS (USFS 2005a) and are primarily based on the findings in the SERA Risk Assessments. With these findings, the herbicides considered for use with this project were rated into categories for level of concern regarding effects to fish and aquatic species such as algae, macroinvertebrates and aquatic macrophytes:

- **Lower level of concern** – could affect aquatic plants only: clopyralid, imazapic, metsulfuron methyl
- **Moderate level of concern** – only exceeds LOC on aquatic plants, algae, and invertebrates: chlorsulfuron, imazapyr, sulfometuron methyl
- **Higher level of concern** – exceeds LOC for fish: glyphosate, picloram, sethoxydim, triclopyr

Aquatic approved herbicides include specific formulations of: glyphosate w/o POEA, triclopyr TEA, and imazapyr.

The following are brief descriptions of properties, potential effects and associated hazards for each of the High Risk herbicide mentioned above:

**Glyphosate** in only the aquatic formulation will be used near water because surfactants in non-aquatic formulations can substantially increase toxicity to fish. It is the first choice herbicide for treating reed canarygrass and ribbongrass. The aquatic formulation exceeds the level of concern for fish only using the maximum risk assumptions. This herbicide binds well to fine soil particles and organic matter, which allows for low runoff potential. When bound to soil, it is not biologically available to fish. The average half-life in soil is 25-47 days.

**Picloram** is toxic to fish and modeled exposures exceed levels of concern for fish at typical and highest application rates. Its use will be very limited near water through buffer restrictions because of its high water solubility, which creates more potential for leaching and runoff. Soil degradation rates are slow (90 day avg. ½ life) and it has very high mobility with the greatest leaching potential in sandy soils. It is the 1st choice herbicide for Russian knapweed, field bindweed, leafy spurge, Dalmatian toadflax, butter and eggs and sulphur cinquefoil. These plant species are not water or riparian-dependant species but they can be found in riparian areas.

**Sethoxydim** is highly toxic to fish due to its petroleum inert ingredient but it is rapidly degraded by soil microbes (5 day avg. ½ life) and will probably not be used within 50 feet water. It is not a 1st or 2nd choice herbicide for any invasive plant species covered under this analysis.

**Triclopyr** has a salt/acid formulation that is approved for aquatic use. It exceeds the level of concern for coldwater salmonids at the typical application rate. The salt formulation is highly soluble in water, which allows for increased runoff and leaching potential. It is also highly mobile in soils but is degraded by microbes (30 day avg. ½ life). This herbicide is the 1st choice for scotch broom and Himalayan blackberry and application method is restricted to spot spraying and hand application only.

### Hazard Rating for Herbicide Use

Hazard Quotients (HQ) were calculated for each herbicide proposed for use with soil type, precipitation, and application rate used as input variables. Based on risk assessments developed during the Regional Invasive Plant Program EIS, the goal for use of herbicide in RR/RHCA and within roadsides that drain to fish habitats would be to use herbicides that result in an HQ less than 1. Table 56 is taken from the Region 6 FEIS Biological Assessment (USFS 2005d) for the "indirect effects" portion of their analysis displays instances where the HQ exceeded the "level of concern" (LOC) for each species group as a result of predicted herbicide concentrations in the SERA risk assessments. The LOC was defined as when the hazard quotient exceeded a value of 1. The hazard quotient is defined as a ratio of the predicted environmental concentration to an effects threshold concentration.

**Table 56.** Potential for increased concern for listed aquatic species when use of local environmental factors are likely to increase stream herbicide concentration predictions (USFS 2005d).

| Hazard Quotient Value | Potential for Concern for Increased Risk to Listed Aquatic Species | Site-specific Project Analysis Procedure Recommendation |
|---|---|---|
| 1HQ >1 | Yes | Use local parameters |
| 0.1 ≤ HQ ≤ 1 | Likely | Use local parameters |
| 0.01 ≤ HQ < 0.1 | Not likely | Use local parameters if project size/intensity > SERA scenario |
| HQ < 0.01 | No | Use of local parameters not necessary |

The choice of whether an herbicide is used over other control methods would be based on integrated weed management principles. Decisions would be made based on whether other methods or combinations of methods are known to be effective on the species in similar habitat. The choice of herbicide would be based on the invasive species; how it reproduces, its seed viability, the size of its population, site conditions, known effectiveness under similar site conditions and the ability to mitigate effects on non-target species. In most cases, if an herbicide were selected, it would be used in combination with other methods such as hand pulling. For example, initial treatment on an invasive species may be done by an herbicide, but then manual methods would be implemented as maintenance treatments over the long term. Large established populations such as medusahead on the Crooked River Grasslands would be less apt to undergo complete herbicide treatment. Such populations may be controlled at their perimeters and along travel routes to maintain "weed-free" zones and reduce further spread. Some species may be candidates for biological control. Application methods used would be based on site accessibility and size of the invasive plant population.

## Discussion of Assumptions, Methods and Models for the Fish and Aquatics Analysis

The following sections describe the methods and processes used in conducting this analysis as they pertain to the treatment of invasive plants with herbicides.

### Scope of Effects

The direct and indirect effects of herbicide treatment were analyzed by 6th field subwatershed. On the Forests and Grassland, invasive plant project area units are located within 180 subwatersheds that range from 6,391 acres to 47,959 acres with an average size of 19,877 acres. Cumulative effects are analyzed to the 5$^{th}$ field watershed level unless there was a reason to expand the analysis further. There are 51 watersheds within this analysis area (see Appendix J).

Data for this analysis consists of the invasive plant infestations grouped into Project Area Units (PAUs). Within each PAU there is one to several known invasive plant sites (listed in Appendix A). The infested invasive plant sites do not entirely consist of invasive plant species, but may be patchy or consist of scattered individuals. District botanists and weed coordinators have made a professional estimate as to what percent of the infested areas actually contain invasive plants; these are termed net acres. For this project, no more than the current documented infested acres of invasive plants per subwatershed will be treated on a yearly basis. In most cases, only a portion of the invasive plants will be treated in a subwatershed on a yearly basis due to funding and workforce limitations; however, it is possible that all mapped invasive plants in a subwatershed could be treated in one year.

Effects are analyzed for treatment of known invasive plant sites in their currently inventoried location. Treatments of new or currently uninventoried populations may occur under the early detection/rapid response strategy (see Chapter 2 and Appendix F), but knowing the exact location or size of these populations is not possible. Most likely, these new populations will occur within the PAUs and will be small and treated by either hand pulling or spot spraying. Before new or currently uninventoried populations are treated, the implementation planning process described in Appendix F will be used to determine if a comparable analysis of effects is contained in this EIS. To be treated without further NEPA, an analysis of a comparable site type, treatment method, and expected effects must already be completed in this EIS. The comparable analysis would have to include water body type, infested area proximity to the waterbody, soils, precipitation, and treatment method. A separate NEPA analysis may need to be performed if a comparable analysis has not been made with an already inventoried invasive plant site. Effects from spot spraying or hand pulling these new populations should be minimal and project design features would be adequate to protect fish and aquatic biota in both alternatives. Alternative 3 takes extra steps toward caution in how herbicides are applied and to what areas near water. The trade off for alternative 3 will be that effective treatment will not be possible for large invasive plant populations in riparian areas or near water bodies such as sites with ribbongrass or reed canarygrass.

**Forest Service/SERA Risk Assessment Worksheets and Water Contamination Model**

Forest Service /SERA Risk Assessments for the Invasive Plant Program were modeled in the Regional BA (USFS 2005d) for each herbicide considered under the Proposed Action The SERA (1998, 2001, 2003, 2004) risk assessments model the amount of chemical that can reach water under several different scenarios, then compares results to existing monitoring data to check the accuracy of the Water Contamination Rate (WCR) model. A stream or water body contaminated by runoff and percolation immediately after application of an herbicide is the scenario used to predict acute exposure to aquatic species. Herbicide concentration levels in water are estimated from monitoring and modeling data. Dissipation, degradation and other environmental processes are considered to predict chronic exposure for aquatic species. Under the risk assessments, three types of estimates were used for the concentration of each herbicide in ambient water: acute, accidental, and chronic exposure. Acute exposures are short-term while chronic exposures occur over time.

Herbicide effects to stream aquatic resources from ground-based application methods was analyzed by SERA (2001, 2003, 2004) for each herbicide being considered in a hypothetical scenario designed to represent a plausible "worst case" application that was expected to occur in National Forests nationwide. This application scenario was analyzed in risk assessments for each of the 10 herbicides included in the Region 6 Weed EIS (USFS 2005a) using outputs from the WCR model which incorporates surface water contamination rates into the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) chemical fate mode and dilution estimates. The SERA risk assessments are accessible via the internet at http://www.fs.fed.us/foresthealth/pesticide/risk.shtml.

The hypothetical application scenario analyzed in each SERA document was even broadcast application of the herbicide (with no streamside buffers) to a 10 acre site, adjacent to a stream with a discharge of 1.8 cubic feet per second (cfs). Three input parameters were varied, soil type (clay, loam, sand), rainfall (5-250 inches), and herbicide application rate to display how stream herbicide concentrations could vary under different conditions. Typical herbicide application rates were based on reported Forest Service use, while high application rates were the highest application rate reported for Forest Service use.

Under the Region 6 FEIS the application of herbicides was not expected to result in mortality to listed aquatic species (USDA 2005a). Most direct effects from herbicides on listed aquatic species are likely to be from sub-lethal herbicide effects, rather than from direct mortality as a result of herbicide exposure, or from non-herbicide treatment methods. Sub-lethal effects are considered under the ESA to constitute "take", if the sub-lethal effect "harms" a listed aquatic species (50 CFR 222.102). The ecological significance of sub-lethal effects depends on the degree to which they influence behavior essential to the survival and reproductive potential of individual listed aquatic species. Sub-lethal effects are not readily apparent and it may be difficult or impossible to detect or monitor changes to fish or their behaviors in the wild.

A summary of acute and chronic toxicity indices for listed aquatic species is provided on page 218 of the Region 6 BA (USDA 2005b). These toxicity indices were used to determine whether estimated herbicide concentrations may pose a toxicity risk to ESA listed aquatic species. Risk can be estimated by first calculating a hazard quotient (HQ), defined as the estimated environmental concentration (EEC) of the herbicide divided by the most sensitive acute or chronic toxicity index available. Toxicity indices used were either no observable effect concentrations (NOEC), or 0.05 (one-twentieth) of an LC50, whichever is lowest. If the HQ is $\leq$ 1, then the estimated exposure is less than the toxicity index. At this exposure, the risk of adverse effects to ESA listed aquatic species is expected to be discountable. The Forest Service SERA (2001, 2003, 2004) risk assessments provide a matrix of EECs for each herbicide, with rainfall and soil type as the varied input parameters.

For this project SERA worksheets (WCR Model) were run for different locations with a variety of different chemicals focusing on larger treatment areas, areas with TE listed fish and areas where higher risk chemicals might be used. The worksheets include outputs from the GLEAMS model and dilution factors and provide a method for quantifying estimates of water contamination. The WCR model provides a method for identifying areas where more caution should be applied or site specific PDFs should be added to reduce potential for effects to fish. The variables for soil type, average annual rainfall, chemical type and chemical application rate were matched as close as possible to what might be found in a given subwatershed. The herbicides were modeled at the typical application rates, for average annual rainfall rates and for an average two year thunderstorm event rainfall rate. Results showed that the hazard quotient of 1.0 for the peak ECC was not exceeded at any location with any chemical (Table 57). The worksheets calculations do not account for the local slope, water volume, forest vegetation, buffer zones, application locations or application method. How these localized variables differ and could potentially overestimate or underestimate the outcome of the model are displayed in Table 58. These differences would change the amount of chemical that reaches a waterbody, its concentration once in the waterbody and consequently its effects to fish or other aquatic biota. The amount of change to peak ECC outcomes from local variables to what the model uses is unknown but is expected to be a decrease because of the influence of the PDFs.

For the selected subwatersheds in Table 58 Picloram showed a higher hazard quotient in the Odell Lake or Crescent Watershed but the use of picloram would be on small isolated patches of the invasive plant butter and eggs. Another difficulty encountered when trying to asses the potential on the ground effects from chemical treatment were the fact that some mapped invasive plant sites contain more than one species which can vary the type of chemical used to be effective in treatment. Also within a mapped infested weed site the exact location of plants on the ground is often unknown. The location weed plants and proximity to fish bearing waters could make a difference in amounts of chemical that could enter a waterbody and what effects that might actually have on individual fish because actual amounts applied, location, stream size, slope and vegetation would differ from the scenario used in the risk assessments and the potential effects to fish would likely be much less. It also does not take into account the PDFs for this project which include application methods and associated buffers which were designed based on the potential toxicity of each herbicide to fish and aquatics.

**Table 57.** Results of WCR model outcomes for aquatic biota using 1st choice herbicides in selected subwatersheds. Only central hazard quotients are displayed for peak EEC values. Results are for typical herbicide application rates unless otherwise noted. Hazard quotients for sensitive fish, macroinvertebrates, macrophytes and algae were used if available. Hazard quotients of 1.0 were not exceeded for any organism.

| Subwater-shed Name | Chemical | Rainfall Rate | Estimated H20 Contam-ination Rate mg/l | Predicted Concentra-tion in H20 mg/l | Hazard Quotient Sensitive Fish | Hazard Quotient Macro Inverts. | Hazard Quotient Macro-phytes | Hazard Quotient Algae |
|---|---|---|---|---|---|---|---|---|
| Upper Lake Creek | Clopyralid | Average | 0.0006 | 0.0002 | <**0.0001** | <0.0001 | 0.002 | <0.0001 |
| Upper Lake Creek | Clopyralid | Storm Event | 0.0008 | 0.0003 | <0.0001 | <0.0001 | 0.003 | 0.0004 |
| Canyon Creek | Clopyralid | Average | 0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.0004 | <0.0001 |
| West Branch Bridge Creek | Clopyralid | Average | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| West Branch Bridge Creek | Clopyralid | Storm Event | 0.0005 | 0.0002 | <0.0001 | <0.0001 | 0.0019 | <0.0001 |
| Odell Lake or Crescent Lake | Picloram | Average | 0.0016 | 0.0006 | 0.0140 | <0.0001 | <0.0001 | 0.0020 |
| Odell Lake or Crescent Lake | Picloram | Storm Event | 0.0024 | 0.0008 | 0.0200 | <0.0001 | <0.0001 | 0.0040 |
| Bridge Creek | Picloram | Average | 0.0012 | 0.0004 | 0.0100 | <0.0001 | <0.0001 | 0.0020 |
| Bridge Creek | Picloram | Storm Event | 0.0016 | 0.0006 | 0.0100 | <0.0001 | <0.0001 | 0.0020 |
| Headwaters Metolius River | Aquatic Glyphosate | Average | <0.0001 | 0.0001 | 0.0002 | <0.0001 | <0.0001 | NA |
| Headwaters Metolius River | Aquatic Glyphosate | Storm Event | 0.0006 | 0.0012 | 0.002 | <0.0001 | 0.0004 | NA |
| Cottonwood Creek | Triclopyr | Average | 0.0001 | 0.0001 | 0.0004 | <0.0001 | <0.0001 | <0.0001 |
| Cottonwood Creek | Triclopyr | Storm Event | 0.0008 | 0.0008 | 0.0030 | <0.0001 | 0.0002 | 0.0002 |

NA = No available data for algae

**Table 58.** Conceptual differences between WCR model assumptions that can not be modified and on the ground conditions for selected subwatersheds in the previous table. This shows potential influence on Hazard Quotient outcomes based on generalized hydrology, vegetation, topography and herbicide application method.

| Subwatershed Name | Chemical | Model 1.8 cfs stream | Model 10% Slope | Model Sparse Grass Vegetation | Model Single 10 Acre Plot Adjacent to Stream | Model Broadcast Spray |
|---|---|---|---|---|---|---|
| Upper Lake Creek | Clopyralid | + + | - | + + | - | - |
| Canyon Creek | Clopyralid | + + | - | + + | - - | - |
| Rimrock Springs | Clopyralid | = | - - | + | = | - |
| West Branch Bridge Creek | Clopyralid | = | = | + + | - | - |
| Odell Lake or Crescent Lake | Picloram | + | - | + + | - - | - - |
| Headwaters Metolius River | Aquatic Glyphosate | + + | - - | + + | - - | - - |
| Upper Paulina | Metsulfuron Methyl | = | - | + | + | = |
| McAllister Slough | Chlorsulfuron | - | - | = | + | = |
| Cottonwood Creek | Triclopyr | = | = | + + | - - | - - |

= similar to model assumption, + slightly greater than model assumption, + + much greater than model assumption, - less than model assumption, - - much less than model assumption

The worksheet results (Table 57) show no HQs greater than 1; some chemicals in some locations would potentially cause limited mortality of aquatic macrophytes and algae. Slight reductions in this portion of the food web would have limited indirect effects to fish populations by slightly reducing forage for aquatic insects and young fry. These reductions in forage would most likely be localized and short term until algae and macrophyte populations recovered. After considering on the ground conditions that in most cases would lessen chemical effects from what the model results show along with application of PDFs indicate chemicals proposed for use would not cause direct harm to individual fish or fish populations. The use of high risk chemicals such as picloram in proximity to waterbodies and sensitive fish populations have been modified on a subwatershed basis by using site specific PDFs. This adds an extra precautionary measure to make sure harm to TE fish populations is avoided.

### Buffer Zones

Buffers or filter strips are strips of land between project activities and waterbodies commonly applied for protection of aquatic resources. For the purposes of this project they are designed to prevent direct deposition into surface waters from drift or inadvertent direct spray or to reduce herbicides in runoff and subsurface flow before it reaches the surface water. Forested buffer zones provide protection from herbicides reaching streams and waterbodies through spray, drift, percolation, or runoff. Buffer widths in conjunction with application methods have been developed for both alternatives in the PDFs section (Tables 15 and 16). Buffer zones were developed from looking at existing studies or from best professional judgment based on the literature.

Spray drift can be minimized by using larger droplet size and methods that get closer to the target plant. There is no drift associated with methods such as wiping and wicking or injecting plants while some types of spraying have a higher probability of drift. One study showed that a fine spray mist particle (100 micron droplet) traveled horizontally 77 feet when released from a height of 10 feet off the ground (USDC NOAA 2002b in Berg 2004). Most herbicide for this project would be applied at 5 feet or less from the ground. Using coarse sprays with larger droplets as is required under this document and by following minimum wind speed requirements should reduce the potential for drift in most application scenarios. Forested buffers will provide vegetation cover to help intercept herbicide droplets if drift does occur.

Amounts of herbicides reaching streams or waterbodies can vary depending on several factors. These include amount and type of herbicide applied, precipitation amount and timing after herbicide application, buffer distance and vegetative cover/organic matter associated with the buffer. Soil permeability will dictate how much herbicides can runoff or percolate through the soils. Sandy coarse soils generally don't have as much runoff as clay or fine textured soils. Organic matter in soils holds more water than other soil components increasing the ability of the soil to hold dissolved herbicides in the root zone where plants can access them (Berg 2004). Organic matter also often holds more soil microbes that increase some herbicide degradation rates. Slope steepness and topography can impact the amount of herbicide that reaches a stream or waterbody. Even slightly soluble herbicides and those strongly absorbed to soil particles can be carried down slope in storm water, with steeper slopes elevating the hazard (Durkin 2003 in Berg 2004).

Models for buffer effectiveness have focused primarily on drift with aerial herbicide application and for runoff in agricultural croplands. Available models do not take into account forest canopy cover, droplet runoff from different foliar types and forest topography (Berg 2004). Different forest types along with soil types and topography can influence effectiveness of buffer strips and studies are lacking on effectiveness for all these scenarios. The effectiveness of buffers reducing runoff-caused water quality effects has not been able to be modeled in forested situations because flow from runoff is concentrated only through parts of the buffer and channeling caused by micro-relief reduces the surface area of the buffer that comes in contact with flow. The complex characteristics of forested buffers are highly variable making them difficult to model.

Buffer widths and how they are determined vary by state and agency. The state of Oregon aggregates buffer width by stream type and by application method (generally 60 ft for aerial and 10 ft for ground). Other states and agencies use wind speed, application method, and toxicity to determine buffers. NCASI (2000) compared widths needed for 90% effectiveness (measured LC 10 or as <0.1% of application rate) between aerial and ground application techniques and found that ground applications require considerably smaller buffer widths to achieve 90% effectiveness. Comerford et al. (1992 in Berg 2004) concluded that for forestry, application strips of 15 m (49.2 feet) or larger were effective in minimizing pesticide residue that may enter streams. These authors also added that subsurface macropore flow can cause much wider buffers to be ineffective at completely keeping residues out of surface waters.

**Roads with Ditches that Drain to Streams**

A majority of the mapped invasive plant sites and PAUs are associated with roads; some of which may be hydrologically connected to streams, lakes, or wetlands via roadside ditches. Roadside ditches can act as delivery routes particularly during periods of heavy precipitation or during snowmelt off. Because the proposed action includes treatment of road prisms with herbicides, the concern for herbicides being delivered to waterbodies containing fish via roadside ditch lines was addressed by identifying portions of invasive plant sites within 300 feet of a road-stream crossing. These locations could act to deliver herbicide residue to streams. An Ochoco and Deschutes Forest-wide roads analysis (USFS 1999e) identified high-risk roads for potential sedimentation inputs to streams for their entire road length. However, it only assessed major arterial and collector roads. This is not helpful in identifying which segments of individual local roads actually have the potential for sediment inputs to streams. For this analysis we instead used a 300 foot zone around all road crossings on class 1, 2 and 3 streams (see Appendix H, Table H-2). This included the 100 ft aquatic influence zone for all class 1, 2 and 3 streams. This approach summarizes acres and numbers of mapped road crossings. Further ground identification of roadside ditches that lead to streams will be performed prior to implementation of any herbicide treatment where roads and perennial waterbodies are involved. Actual road segments that have any potential to deliver herbicides to waterbodies with federally listed fish will be identified prior to treatment and appropriate PDFs applied (PDF 54, 55).

Road ditches on the Forests and Grassland generally do not run water during the late spring and summer months. Some roadside ditches at higher elevations and depending on yearly snow pack can run water into the late spring. Precipitation during this time period usually does not occur except for occasional thunderstorms, which can at times produce heavy precipitation for a short period of time. Soils with a volcanic ash and pumice component generally have good drainage and exist on the Deschutes NF except for the northern half of the Sisters Ranger District. Soils on the Ochoco NF and Grassland generally have more of a clay component, which allows for more surface water runoff.

Roads identified as having the potential to deliver herbicides to streams with federally listed fish will be ground verified prior to herbicide application by a district fisheries biologist. Actual road segments (milepost to milepost) that have the potential to deliver herbicides to any waterbody will be identified prior to treatment and appropriate PDFs applied.

Different factors affect the yield of herbicide applied within ditches and intermittent channels from that resulting from riparian application. As stated in Huang *et al*. (2004), "the runoff potential of herbicides applied along highways may differ from those applied to agricultural plots because (i) the application zone is frequently a low organic carbon, coarse material such as gravel that would not be expected to retain herbicides as effectively as agricultural soils; (ii) many highway sites feature relatively steep slopes; and (iii) nearly all of the rain falling on the adjacent pavement becomes surface runoff. Herbicides applied within ditches and intermittent stream channels are delivered to fish-bearing streams primarily by leaching, dissolution directly into ditch or stream channel flow, and erosion. The contribution from erosion is likely to vary considerably among sites.

The primary determinants of exposure risk from ditch/intermittent channel treatments are soil type, herbicide properties, application rate, extent of application, application timing, precipitation amount and timing, and proximity to habitat for listed salmonids. Monitoring of storm runoff has documented that the highest concentrations of pollutants occur during the first storm following treatment (Caltrans 2005; USGS 2001). More specifically, the highest pollutant concentrations generally occur during the early part of storm runoff, relative to concentrations later in the runoff event (Caltrans 2005). The discharge of ditch/intermittent channel runoff in the early stages of the storm hydrograph is generally low, but is exposed to the greatest amount of pollutants available for dissolution. The ratio of low discharge to highest amount of available pollutant results in early runoff solute concentrations that are high relative to those occurring later in the runoff event. Runoff later in the hydrograph occurs at a higher discharge, and dissolved pollutant concentrations are lower, even though mass movement of pollutants can be greater. Therefore, exposure of listed salmonids and their critical habitat elements to the highest concentrations of herbicides resulting from application to ditches and intermittent channels is likely to occur early in storm runoff. The most relevant exposure locations are at or near confluences with perennial streams.

No monitoring data is available regarding specific concentrations of herbicides likely to occur in runoff from treated ditches. The USGS (2001) monitoring report cited above provides data for concentrations of sulfometuron and glyphosate in runoff from treated roadside plots into ditches in western Oregon. Sulfometuron was applied at 0.13 lbs/acre (target rate was 0.23 lbs/acre) and was measured in plot runoff at 0.119 – 0.253 mg/L one day after application. Glyphosate was applied at 1.29 lbs/acre (target rate was 2.0 lbs/acre) and was measured in plot runoff at 0.323 – 0.726 mg/L one day after application. The samples were collected in the initial 15 liters of runoff from simulated rainfall at a rate of 0.3 inches per hour, and lasting 0.5 – 1.4 hours. Samples were collected directly from the roadside plots and not from the ditch adjacent to the plots.

The fisheries report includes an analysis of runoff concentration and resulting HQ values. These values are estimates only. Since applicable quantitative roadside ditch runoff data was only available for herbicides applied to the portion of the ditch adjacent to the road, the runoff yield data was extrapolated to include herbicide application occurring throughout the ditch. This may have resulted in overestimation or underestimation of runoff yields from herbicide application in the ditch bottom and on the far slope.

The following is a summary of potential effects to listed fish species and their habitat when a storm occurs 24 hours after herbicide application on a ditch/intermittent channel that confluences with perennial streams:

- Steelhead on the ONF and CRNG and bull trout in Lower Whychus Creek could see some localized direct effects from ditch runoff of glyphosate and triclopyr. However, this is very unlikely because only small amounts of triclopyr are proposed for use on a few scattered invasive plant populations that are not specifically associated with roadside ditch treatments. Glyphosate is not identified as a 1st choice herbicide to treat invasive plant infestations anywhere in this area. Indirect effects to fish from other herbicides could occur if algae, macroinvertebrates and macrophytes die off. There is a low likelihood that this would occur often or at a large scale because runoff potential is low and unlikely for several months after application because of the low rainfall rates in these areas. Average annual precipitation in watersheds with steelhead or where they may be reintroduced on the ONF and CRNG is 11-21 inches (USDC and NOAA 1973).
- Bull Trout and reintroduced salmon and steelhead in the Metolius River Drainage could see some localized direct effects from ditch runoff of glyphosate and triclopyr. However, this is very unlikely because only small amounts of triclopyr are proposed for use on a few scattered scotch broom populations that are not specifically associated with roadside ditches. Glyphosate readily binds to soil particles and would only be available for transport very soon after application. Indirect effects to fish from other herbicides could occur if algae, macroinvertebrates and macrophytes die off. There is a low likelihood that this would occur often or at a large scale because of the relatively flat topography of the area and the high infiltration rates of soils.
- Bull Trout in the Odell Lake Drainage could see some localized direct effects from ditch runoff of glyphosate and triclopyr. However, this is very unlikely because these are not identified as 1st choice herbicides to treat invasive plant infestations in this area. Indirect effects to fish from other herbicides could occur if algae, macroinvertebrates and macrophytes die off. There is a very low likelihood this would occur often or at a large scale because of the very high soil infiltration rates.

Actual exposure concentrations and durations at or near confluences with perennial streams will depend on a variety of factors, including the extent of the herbicide application within the ditch/intermittent stream, soil characteristics, application rate, extent of riparian applications, and rainfall timing, intensity, and amount.

### Differences between Alternatives

The No Action alternative would continue the use of currently approved herbicides and treatments on the Deschutes and Ochoco National Forests and Crooked River National Grassland, as described in Chapter 2. No new sites or increased herbicide use would be added to what is already covered by these documents.

The Proposed Action (Alternative 2) restricts certain methods of invasive plant treatment and the use of herbicides within certain buffers of perennial streams, waterbodies, springs and wetlands. The aquatic-approved herbicide formulations of glyphosate, triclopyr, and imazapyr could be used up to the waters edge with spot spray and beyond for hand wicking or wiping application. The aquatic formulation of glyphosate would be used most often in this situation to treat ribbon/reed canary grass. Triclopyr would be used on scotch broom and Himalayan blackberry, which may occur near the water but are not a water dependent species. Imazapyr could be used but it is unlikely because it has not been identified as a first choice herbicide for any invasive plant proposed for treatment. This alternative would allow treatment of weeds in intermittent and ephemeral channels using aquatic approved and low risk herbicides if they are non fish bearing and are dry. This alternative would allow broadcast spray of aquatic approved, low risk and moderate risk herbicides within 50 or 100 feet of perennial streams and waterbodies depending on the herbicide. Broadcast spray of high risk herbicides such as picloram would only be allowed 300 feet or more from perennial streams and waterbodies.

Under Alternative 3**,** no herbicides could be applied within any intermittent or ephemeral channels. This would reduce chances of any residue washing into streams with fish before herbicides have enough time to break down. No herbicides could be applied within 10 feet of any perennial stream or waterbody. This would reduce the chance for overspray or inadvertent direct spray to surface waters. Ten feet is approximately three times the average spray width for spot spray applications. Under this alternative broadcast spraying of any herbicide would only be allowed outside 300 feet of perennial streams and water bodies. This would further reduce the chances of herbicide residue from reaching waterbodies especially when larger infestations are treated with the broadcast spray application method.

## Alternative 1 - Direct and Indirect Effects to Fisheries

The 1998 Deschutes and Ochoco Weed EAs concluded that there would be no significant impact and no direct impacts to fisheries or aquatic invertebrates, respectively. Continuing treatment of these sites under the No Action alternative is unlikely to adversely affect any fish species or aquatic biota. Many of the sites are being effectively controlled, and the use of herbicides at them has declined. However, infestations not covered under the 1998 EAs would not be able to be treated. Untreated populations of invasive plants in or adjacent to riparian areas would have the potential to indirectly affect fisheries and aquatic biota. Many species of invasive plants are not as effective at stabilizing soils or preventing erosion as native riparian species. The displacement of native vegetation increases the potential for fine sediments to enter the aquatic environment.

Reed canary grass species have the highest potential to impact fisheries and aquatic biota since it generally grows in the riparian zone and along the waters edge. Although reed canary grass does provide some cover and shade for fish along the margins there are several species of native sedges and plants that serve the same purpose. Areas with dense reed canary infestations could actually prohibit native deciduous shrubs such as alder, willow and ninebark from becoming established. These shrubs are important components of the riparian ecosystem for providing shade during the summer and nutrients to the stream when they lose their leaves in the fall. Certain feeding groups of aquatic insects rely on deciduous leaf litter as food while others would use the shrubs for habitat during their adult life stage.

## Alternatives 2 and 3 - Direct and Indirect Effects Common to Both

### Herbicide Treatment – Areas of No Effect to Threatened or Sensitive Fish Species

Within 79 of the 180 subwatersheds covered by this analysis, all of the mapped invasive plant sites are 300 feet or more from any class 1, 2 or 3 streams or perennial lakes, ponds or reservoirs. (Appendix H, Table H-3 lists these subwatersheds). Many of these sites are located in subwatersheds where there are no perennial waterbodies at all or the watershed has a few small infested sites that do not cross any streams, including class 4 streams. A few of these subwatersheds have only non-herbicide methods proposed. There is no chance of having any effect to fish and chances of detrimentally affecting aquatic biota is very remote because of the amount of filtration and dilution that would occur from the surrounding forests soils, vegetation, and organic matter that would break down or dilute any herbicide residue before it reaches a waterbody that sustains fish populations of other aquatic biota. Nevertheless, seven of these 79 subwatersheds were investigated further because they contain either listed fish species, have sites that cross intermittent class 4 streams, or have large infested areas proposed for herbicide treatment. The attributes of sites in these seven subwatersheds are listed in the following table. Because of the invasive plant site distances from perennial waterbodies and the use of PDFs in this project, measurable adverse effects to fisheries and aquatic biota is not expected.

**Table 59**. Description of subwatersheds where herbicide use is not of concern for perennial waterbodies, but existence of intermittent streams or listed fish species in the subwatershed pose a concern.

| Subwatershed | HUC6 Number | Species | Comments |
|---|---|---|---|
| Carcass Canyon | 170703011102 | Bull Trout | All Sites > 2.5 river mi from Deschutes R. Four medusahead sites that cross 3 int. streams totaling 651 ac, treat with sulfometuron. One knapweed site 30 ac, treat with clopyralid. |
| Lake Simtustus | 170703060103 | Bull Trout | All sites > 0.6 river mi from Lake Simtustus. Three sites with medusahead and knapweed that cross 1 int. stream, total 4.4 ac. Treat with sulfometuron and clopyralid. |
| Lower Crooked River Gorge | 170703051102 | Bull Trout | All sites > 0.2 mi from Crooked R. Four sites with Medusahead, knapweed and scotch thistle totaling 109 ac., ones site crosses 1 int stream. Treat with sulfometuron and clopyralid. |
| Middle Bridge Bear Creek | 170703060205 | Steelhead | All sites > 0.2 mi from unnamed stream. Ten road sites that total 1 ac. and cross no int. streams. |
| Upper Bridge Creek | 170702040303 | Steelhead | All sites > 600 ft from perennial steams and 450 ft from pond. Three road sites that total 28 ac. and cross no int. streams. Medusahead, star thistle and houndstongue. Treat with metsulfuron, sulfometuron and clopyralid. |
| Upper Mountain Creek | 170702011301 | Steelhead | All sites > 600 ft from perennial steams. Six sites that total 1.1 ac. and cross no int. streams. Musk thistle and medusahead. Treat with sulfometuron and clopyralid |
| Upper Mud Springs Creek | 170703070401 | -- | All sites > 450 ft from perennial steams. Eight sites that total 362 acres and cross 4 int. streams. Medusahead and knapweed. Treat with sulfometuron and clopyralid. |

Eighty-six of the 180 subwatersheds contain infested weed sites within 100 feet of class 1, 2 and 3 streams and perennial lakes, ponds and reservoirs. Acres of mapped invasive plant sites and acres within each type of waterbody are presented in Appendix H, Table H-26. Class 1, 2 and 3 streams are broken out if their flow was less than 2 cubic feet per second (cfs) or greater than 2 cfs. This is important in relation to the GLEAMS model outputs plus dilution estimates used to estimate herbicide concentrations that could enter streams, because streams and rivers with more flow will have a greater dilution effect if herbicides do reach the water.

A 300 foot buffer around road crossings was used to identify potential high risk roads segments where ditches could lead to herbicides entering streams if a rainstorm occurred following application (as described previously). Analysis of these potential effects was discussed above.

### Differences between Direct and Indirect Effects of Alternatives 2 and 3 on Fisheries

Both alternatives have Project Design Features (PDFs) that are expected to prevent any major impacts to any fish populations. Alternative 3 is more restrictive on how close herbicides can be used near perennial waterbodies and does not allow for herbicide treatment of any intermittent channels. Alternative 3 also does not allow for any herbicide to be broadcast spayed within 300 ft of a perennial waterbody or to be applied in any manner within 10 ft of any perennial waterbody. The restrictions in alternative 3 would further reduce, but not eliminate, the chance for herbicide to reach a waterbody. This would add a small buffer for any runoff or drift that could reach the water. In alternative 2 only aquatic approved herbicides would be allowed in intermittent channels. There would be much less risk in alternative 3 for aquatic approved herbicides to wash downstream into fish bearing waters, before herbicides could completely break down. The actual difference in acres that could be treated with herbicide is small (Table 60). Under alternative 3 plants within 10 feet of water would have to be pulled or dug manually which would cause more soil disturbance, potentially leading to small localized sediment inputs near perennial streams and in intermittent channels. But even under alternative 3, hand pulling is not expected to produce enough sediment to affect fish populations or aquatic organisms they depend on. Hand pulling will not be as effective in eradicating certain invasive species from a site, such as rhizomatous species. Alternative 3 would make effective treatment and eradication of reed canarygrass/ribbongrass sites impossible.

**Table 60**. Acres of invasive plants that are proposed for treatment with herbicide within the 100 foot and 300 foot of intermittent streams, perennial streams, springs and lakes.

| Alt. | Total acres herbicide treatment of invasive plant sites | Herbicide treatment acres on int. streams | Herbicide treatment acres on intermittent and dry lakes | Herbicide treatment acres within 100’ of perennial streams, springs and lakes | Herbicide treatment acres within 300’ of perennial streams springs and lakes |
|---|---|---|---|---|---|
| 2 | 13,587 | 30 | 0 | 724 | 1,518 |
| 3 | 13,357 | 0 | 0 | 494 | 1,288 |

These acres only represent sites proposed for herbicide treatment which is usually combined with or followed by manual pulling or other treatment methods. The difference between the action alternatives for herbicide treatment within 100 feet or 300 feet of perennial water is 230 acres: this represents that portion of the invasive plant sites that could be treated with herbicide in Alternative 2, but could *not* be treated with herbicide under Alternative 3, because that is the area within 10 feet of perennial water and Alternative 3 does not allow any herbicide application within 10 feet. Similarly, 30 acres of invasive plants are proposed for herbicide treatment on intermittent stream channels, but under Alternative 3, herbicides could not be used. These acres are for areas where invasive plant sites have been mapped; actual acres of invasive plants on the ground are generally less than this.

Under Alternative 2, 1518 acres that are within 300 feet of perennial water could be treated with broadcast spraying of herbicide (in accordance with Table 15), and under Alternative 3, none of those acres within 300 feet of perennial water could be treated with broadcast application of herbicide; but 1,288 acres could be treated with spot or hand application of herbicide.

## Alternatives 2 and 3 Effects to Threatened and Sensitive Fish Species and their Habitat

This section will address effects to listed fish populations and their habitats. Individual watershed discussions were moved to Appendix H and summarized here. Redband trout are Forest Service Region 6 Sensitive and occur throughout the project area except for some areas on the Fort Rock portion of the Bend/Fort Rock Ranger District where there are no perennial streams or lakes, some areas of the upper Little Deschutes River, and a few other small closed systems that were historically fishless such as Sparks and Hosmer Lakes. Effects analysis for threatened fish species also applies to redband trout, except where effects to redband trout could be greater or different depending on treatment methods. Such effects to redband trout are discussed after the bull trout and steelhead discussions.

### Threatened Species and Essential Fish Habitat (EFH)

#### Manual, Mechanical and Cultural Methods

Hand pulling of weeds will occur on small populations or individual plants. The amount of sediment produced by these actions would not be large enough to be measured against other activities that have occurred in the planning area. With the exception of ribbongrass and reed canarygrass, discussed below, invasive plants under this analysis are not water dependent and individuals may be found anywhere their seeds have been spread, usually in disturbed areas. Individual plants or populations may occur along waterbodies but disturbance to fish from pulling or sedimentation is expected to be very minimal. Weed whacking to reduce biomass could be used on reed canarygrass populations.

An analysis for each set of subwatersheds that contain populations of federally-listed fish or Essential Fish Habitat (EFH) was performed and it showed that manual, mechanical, or cultural methods that may take place in these watersheds, such as weed pulling or weed whacking, will have no effect that is measurable or detrimental to habitat for bull trout populations, steelhead populations or areas listed as EFH except in the Metolius River which is explained below.

Along the Metolius River at project area unit 15-32, weed whacking and pulling or digging ribbongrass may cause disturbance to juvenile bull trout and a temporary reduction in overhead cover which could cause fish to seek new rearing habitats exposing themselves to predation or other stresses that could lead to mortality. Overhead cover reduced by pulling or weed whacking would be replaced in the long term with native vegetation that would serve the same purpose. Many of the native species would supply overhead cover throughout the year. Ribbongrass provides little cover during the winter months when it dies back. Removing ribbongrass would reduce cover for Metolius River redband trout, bull trout and EFH where these plants are removed. This could displace a few juvenile fish or cause stress to individuals that spooked from their hiding or foraging areas when the invasive plants are removed. This disturbance would be short term lasting 1 to 2 days a year for pulling or whacking and reduction in overhead cover for 1-2 years until native vegetation reestablishes itself or is replanted. Bull trout are found in the upper river where the largest concentration of ribbongrass is located from Gorge Campground to Lake Creek but the majority of the bull trout spawning and rearing occurs in tributaries downstream of this section of river and would not be effected by these activities. The ribbongrass infestation from Gorge Campground to Lake Creek (2.0 river miles) presently covers only 7.6 % of the lineal stream banks so there is still 92.4 % of the riverbank habitat along the margins that will remain undisturbed and available for juvenile rearing (USFS 2006 data on file). Below Gorge Campground, ribbongrass populations become much less numerous and are found in scattered small clumps. From Wizard Falls Fish Hatchery to Candle Creek (4.3 river miles) only 0.1 % of the river banks were infested.

Analysis of pulling or weed whacking ribbongrass along the upper Metolius River found that increases in water temperature would not occur from a reduction in shade after plant removal (See hydrology report.) No other mechanical or cultural methods are being proposed in subwatersheds that contain federally listed bull trout, steelhead or contain EFH.

Effects to redband trout and their habitat were analyzed along with steelhead and bull trout where these species occur together. Some additional analysis of subwatersheds with only redband trout was performed for other areas besides the Metolius River where ribbongrass or reed canarygrass treatments are proposed, in subwatersheds that had larger invasive plant sites near water and in the Dry Paulina Subwatershed where some scarifying and prescribed burning are proposed. The analysis of redband trout "only" subwatersheds is located at the end of this document.

**Herbicide Treatment Methods**

None of the alternatives have the potential to influence stream flow and channel morphology due to the small portion of any watershed that would be treated. Treating invasive plants would improve riparian stability where invasive plants have taken over along stream channels and out-competed native species. All invasive plant treatments carry some risk that removing invasive plants could increase stream instability. In most areas, the amount of disturbance is not large enough or concentrated enough next to waterbodies to cause a problem. Areas with reed canary/ribbongrass that are treated may pose this problem, so revegetation will take place as needed in riparian areas (see Appendix A, Table A-3 for areas proposed for active restoration).

A primary issue for this analysis is the potential for herbicides to enter streams and impact domestic drinking water sources and/or aquatic organisms. Project Design Features (PDFs) minimize the possibility that herbicides would enter water and impact water quality. Streamside buffers were developed based on characteristics of herbicide movement and toxicity to fish and aquatic organisms. The pathways for herbicides to contaminate water are: direct application, drift into streams from spraying, runoff from a large rain storm soon after application, and leaching through soil into shallow ground water or into a stream. The following discussion addresses each of these delivery routes.

No direct application of herbicide to water is intended in any alternative. Some invasive plants may grow in wetlands or stream channels and hand treatment of these plants may result in limited delivery to surface waters (particularly at ribbon/reed canary grass). Aquatic formulations would be used in these situations and concentrations of herbicide that could reach streams from these treatments will be below levels of concern (see following analysis of listed fish and other aquatic organisms for more information).

Effects from drift, runoff, and leaching were considered in the herbicide risk assessments, prepared for the R6 2005 FEIS, assuming broadcast treatments occurring directly adjacent to streams. The GLEAMS model was used to estimate the amount of herbicide that may potentially reach a reference stream via runoff, drift and leaching in a 96 hour period. SERA risk assessments evaluated the hazards associated with each herbicide based on the concentrations of herbicide predicted by the GLEAMS model using these parameters.

Even considering the steepest, smallest, dry season drainage occurring on the Forest, GLEAMS modeling likely overestimates the herbicide concentrations that would plausibly enter streams from this project, mainly because broadcast treatments are prohibited directly adjacent to perennial streams in all alternatives (under alternative 2 broadcast application of any herbicide except aquatic formulations are prohibited within 100 feet of perennial streams). Spot treatments using herbicides of higher concern to aquatic organisms along streams would also be buffered. Hand and spot treatments are inherently far less likely to deliver herbicide to water because the herbicide is applied to individual plants, so drift, runoff and leaching are greatly minimized. Small amounts of some herbicides can trans-locate from the plant to the soil or adjacent plant, but the concentration of herbicide that may be delivered to streams from this mechanism is likely to be several times less than GLEAMS predictions for broadcast treatment.

Berg (2004) compiled monitoring results for broadcast herbicide treatments given various buffers along waterbodies. The results showed that any buffer helps lower the concentration of herbicide in streams adjacent to treatment areas. In California, when buffers between 25 and 200 feet were used, herbicides were not detected in monitored streams (detection limits of 1 to 3 $mg/m^3$), buffers of 30 meters (comparable to 100 feet) during ground applications of the herbicides imazapyr, picloram and triclopyr resulted in no detectable concentrations of herbicide in monitored streams (USDA HFQLG EIS, Appendix B, 2003b).

Even smaller buffers have successfully protected water quality. For example, where imazapyr was aerially sprayed without a buffer, the stream concentration was 680 mg/ml. With a 15-meter buffer, the concentration was below detectable limits (Berg 2004). The Berg study indicates that the greatest risk of herbicides moving off site is from large storms soon after herbicide application.

Berg also reported that herbicide applied in or along dry ephemeral or intermittent stream channels may enter streams through run-off if a large post-treatment rainstorm occurred soon after treatment. This risk is minimized if intermittent and ephemeral channels are buffered. If a large rainstorm occurs sediment contaminated by herbicide could be carried into streams. Dry sediment contaminated by herbicide could plausibly be carried by wind and enter a stream or water body. This is an unlikely scenario as most of the analysis area is well vegetated so there is little bare soil for movement by wind.

Concentrations of herbicides in the water as a result of an accidental spill depend on the field concentration and the stream’s ratio of surface area to volume. The residence of the herbicide in water depends on the length of stream where the accidental spill took place, velocity of stream flow, and hydrologic characteristics of the stream channel. The concentration of herbicides would decrease rapidly down-stream because of dilution and interactions with physical and biological properties of the stream system (Norris et al. 1991).

Accidental spills are not considered within the scope of the project. Project design features would reduce the potential for spills to occur, and if an accident were to occur, minimize the magnitude and intensity of impacts. An herbicide transportation and handling plan is a project requirement and would address spill prevention and containment.

Herbicides affect lakes and wetlands differently than streams. Dilution by flow or tributary inflow is generally less effective in lakes. Dilution is partially a function of lake size, but dilution could be rapid in small lakes with large water contributing areas. Decreases in herbicide concentration in lakes, ponds, and other lentic water bodies are largely a function of chemical and biological degradation processes rather than of dilution. Evaporation of water from a lake’s surface can concentrate chemical constituents. As vegetation within water dies the oxygen level within the lake can decrease.

Some invasive plants may grow in wetlands along stream margins, pond margins or lake shores and treatment of these plants may result in some herbicide reaching surface waters (primarily at ribbon/reed canary grass infested sites). No specific wetlands are targeted for treatment except for areas associated with ribbon/reed canary grass infested sites.

The Metolius ribbongrass treatment analysis showed that treating ribbongrass with glyphosate could contaminate an alcove pool just slightly above the threshold that would affect fish but this did not take into account water moving through the alcove and assumed that all herbicide applied on the adjacent ribbongrass would reach the water. This indicated direct effects to individual fish are possible but unlikely.

In the Bridge Creek Watershed, application of picloram to treat sulphur cinquefoil populations has the potential for some small amount of herbicide to reach the stream. The weed sites along Bridge Creek are small and but some are near streams that feed into other streams that steelhead occupy. Redband trout do occupy streams adjacent to these sulphur cinquefoil weed sites and have a greater chance of being effected should some picloram residue reach the water. GLEAMS model HQ results indicate this is unlikely. The streams in this portion of the Bridge Creek Watershed are small (<2 cfs) and would not have as much water to dilute herbicides if they did reach the steam.

Redband trout populations in all subbasins except Trout Creek have the potential for some indirect effects that could cause a temporary reduction in aquatic algae and macrophytes. These effects will most likely be seen in smaller waterbodies and would likely occur to juvenile fish using the margins of stream or lake habitat. Redband trout are found in most streams on the forest and each population has a chance for some indirect effects to their food base and habitat from herbicides affecting aquatic algae, macrophytes or a reduction in rearing cover from ribbon/reed canary grass treatments.

Redband trout individuals have a slight chance of being directly affected in areas other than the Metolius River where glyphosate is being proposed for use to eradicate reed canarygrass.

The only area that EFH has the potential to be affected is along the Metolius River in the form of a short term reduction in rearing cover from ribbongrass treatments. However, once native vegetation is reestablished this should be a long term beneficial effect by providing more diverse native riparian species instead of monoculture patches of ribbongrass.

## Watersheds with Threatened Species (Bull Trout and Steelhead)

Subwatersheds that contain Threatened, Endangered, or Sensitive (TES) fish, EFH, lead to TES fish waterbodies or may have TES fish reintroduced to them in the next five years were analyzed for site specific effects from proposed invasive plant treatments. The effects to these populations were based on a combination of several factors including distance to occupied habitat, forest types, terrain and slope, risk of herbicides proposed for use, and size of waterbodies involved. The following table lists the watersheds included in the analysis with the listed fish species present or expected to be reintroduced.

**Table 61**. Watersheds and Subwatersheds where Effects of Invasive Plant Treatments are analyzed for Threatened Fisheries. Species in italics are proposed for reintroduction within the next five years.

| Watershed | Subwatersheds | Species | Comments |
|---|---|---|---|
| **Lower Deschutes Subbasin** | | | |
| Willow Creek | Upper Willow Creek<br>Rock Springs<br>Middle Willow Creek<br>Dry Canyon<br>Lower Willow Creek | Bull Trout<br>*Steelhead* | Long distance from project areas to occupied habitat. |
| Headwaters | Lake Simtustus | Bull Trout | Long distance downstream from project |

| | | | |
|---|---|---|---|
| Deschutes River | | *Steelhead* | areas to occupied habitat. Low and moderate risk herbicides. |
| Upper Trout Creek | Headwaters Trout Cr. Foley Creek, Opal Creek | Steelhead | Small sites, Sites where high risk herbicides may be used are small and away from streams. |
| Mud Springs | Upper Mud Springs Cr., Sagebrush Creek | Bull Trout<br>*Steelhead* | Long distance from project areas to occupied habitat. Low and moderate risk herbicides. |
| **Upper Deschutes** | | | |
| Upper and Lower Metolius River | Dry Cr., Cache Cr., Upper Lake Cr., Lower Lake Cr., Headwaters Metolius River, First Creek, Jack Creek, Canyon Creek, Abbot Creek, Candle Creek, Middle Metolius River, Upper Fly Creek, Lower Fly Creek, Juniper Cr., Lower Metolius River | Bull Trout<br>*Spring Chinook*<br>*Sockeye* | Potential effects from treatment of ribbongrass. |
| Lake Billy Chinook | Stevens Canyon, Carcass Canyon, Geneva, Round Butte Dam | Bull Trout<br>*Spring Chinook*<br>*Sockeye*<br>*Steelhead* | Long distance from project areas to occupied habitat. Low and moderate risk herbicides. |
| Whychus Creek | Upper Whychus Cr. Middle Whychus Cr. Lower Whychus Cr. | Bull Trout<br>*Steelhead* | Low and moderate risk herbicides. |
| Wickiup<br>(Odell/Davis Lakes) | Odell Lake, Odell Creek, Moore Cr., Davis Lake | Bull Trout | Low and moderate risk herbicides. |
| **Lower Crooked River Subbasin** | | | |
| Lower Crooked River Valley and Crooked River National Grassland | Upper Crooked River Gorge, Lower Crooked River Gorge | Bull Trout<br>*Steelhead* | Long distance from project areas to occupied habitat. |
| McKay Creek | Upper McKay Creek, Allen Creek | *Steelhead* | Project areas along streams that have low summer flows |
| **Lower John Day Subbasin** | | | |
| Bridge Creek | Headwaters Bridge Cr., Upper Bridge Cr., Upper Bridge Bear Cr., West Branch Bridge Cr. | Steelhead | Project areas along streams that have low summer flows; high risk herbicides proposed |
| **Upper John Day Subbasin** | | | |
| Mountain Cr., Rock Cr., Upper Middle John Day, and Lower South Fork | Wind Cr., Corner Cr., Black Pine Cr., Black Canyon Cr., Jackass Cr., Cottonwood Cr., Upper Mountain Cr., Middle Mountain Cr., Upper Rock Cr. | Steelhead | Low and moderate risk herbicides |

The following table displays the watersheds where there is potential for negative effects to fish species. The analysis and discussion for each watershed is contained in Appendix H.

**Table 62.** Subwatersheds showing the areas where the potential effects to federally listed or Region 6 Sensitive fish species are analyzed (including those to be re-introduced within the next five years).

| Watershed | Bull Trout | Steel-head | Spring Chinook | Sock-eye | Redband | Summary |
|---|---|---|---|---|---|---|
| Willow Creek | X | X | n/a | n/a | X | Approx. 8 acres herbicide treatment within 10 feet of perennial water. No effect from herbicide to listed fish populations because suitable and occupied habitat is several miles downstream. Site-Specific PDFs apply (Table 15). Redband trout in Rimrock Springs Wildlife Area. |
| Headwaters Deschutes River | X | X | n/a | n/a | X | Zero acres of invasive plants sites within 300 feet of perennial water. Long distance downstream from project areas to occupied habitat. Low and moderate risk herbicides. All invasive plant sites > 300 feet from perennial waterbodies. |
| Upper Trout Creek | n/a | X | n/a | n/a | X | Approx. 0.03 acres herbicide treatment within 10 feet of perennial water. Small sites, Sites where high risk herbicides may be used are small and away from streams. |
| Mud Springs | X | X | n/a | n/a | X | Zero acres invasive plant sites within 10 feet of perennial water. Long distance from project areas to occupied habitat. Low and moderate risk herbicides. potential for short-term indirect effects |
| Upper & Lower Metolius River Watersheds | X | | X | X | X | Approx. 123 acres herbicide treatment within 10 feet of perennial water. Treatment of ribbongrass poses primary risk. Manual treatments can cause disturbance of sediment and cause disturbance to bull trout and redband trout juveniles along slow water margins. Herbicide concentrations calculated for areas where emergent vegetation would be treated. |
| Whychus Creek | X | X | X | n/a | X | Approx. 8 acres herbicide treatment within 10 feet of perennial water. Low and moderate risk herbicides. Annual limit on treatment within 300 feet of streams and where slopes > 10%. Indirect effects to aquatic plants and algae. |
| Lake Billy Chinook | X | X | X | | X | Zero acres invasive plant sites within 10 feet of perennial water. Long distance from project areas to occupied habitat. Low and moderate risk herbicides. |
| Wickiup (Odell/Davis Lakes) | X | n/a | n/a | n/a | X | Approx. 1.25 acres herbicide treatment within 10 feet of perennial water. Low and moderate risk herbicides. Calculations on site conditions led to PDF that prohibits use of picloram in the watershed. |
| Lower Crooked R. Valley & Crooked R. National Grassland | X | X | X | X | X | Zero acres invasive plant sites within 300 feet of perennial water. Long distance from project areas to occupied habitat. |
| McKay Creek | n/a | X | n/a | n/a | X | Approx. 0.33 acres of herbicide treatment within 10 feet of perennial water. Project areas along streams that have low summer flows. |
| Bridge Creek | n/a | X | n/a | n/a | X | Approx. 1.71 acres herbicide treatment within 10 feet of perennial water. Project |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | areas along streams that have low summer flows; high risk herbicides proposed. Picloram restricted to treating sulphur cinquefoil only. Long distance from steelhead usage. |
| Upper John Day Watersheds | n/a | X | n/a | n/a | X | Approx. 4 acres herbicide treatment within 10 feet of perennial water. Picloram restricted to treating sulphur cinquefoil only. Small sites and use of buffers prevents direct adverse effects to fish. |

Table 62 summarizes the analysis in Appendix H for each watershed listed. Implementation of invasive plant treatments with potential to affect listed or R6 Sensitive fish would be timed to avoid spawning timeframes and follow ODFW in-water work periods.

## Watersheds with R6 Forest Service Sensitive Species – Redband Trout

### Selected Redband Trout Watersheds with Manual, Mechanical and Cultural Treatments

This section will cover effects to redband trout and other fish species where no federally-listed Threatened species are present. Effects will be discussed for selected subwatershed where there are large weed infestations close to waterbodies that may be treated with herbicides. Effects for all sites where ground disturbing methods such as scarifying and burning are proposed will be covered in this section. Effects to subwatersheds that contain redband trout or other fish but are not explained here will be less than the selected subwatersheds discussed in this section and previous sections with Threatened species.

The interior Columbia Basin redband trout is the only sensitive fish species in the analysis area and they are found in most perennial streams throughout the project area. The few exceptions being waterbodies they have been extirpated from or areas that were historically fishless. The findings are similar to those for TE fish, in that manual, mechanical or cultural methods will have no effect on these populations except in areas treated for reed canary/ribbongrass. Weed whacking or pulling reed canary grass may cause disturbance to juvenile bull trout and a temporary reduction in overhead cover which could cause fish to seek new rearing habitats exposing themselves to predation or other stresses that could lead to mortality. Under Alternative 3, effective treatment with herbicides would not be possible, so there is more potential for disturbance from manual pulling. This disturbance would be short term lasting 1 to 2 days a year for weed pulling or whacking and reduction in overhead cover for 1-2 years until native vegetation reestablishes itself or is replanted. Overhead cover reduced by pulling or weed whacking would be replaced in the long term with native vegetation and many of the native species would supply overhead cover throughout the year. Reed canary/ribbongrass does not provide much cover during the winter months when it dies back. A reduction in overhead cover may have some indirect effect to a few juvenile fish by disrupting their established rearing locations.

### Ribbon Grass / Reed Canarygrass Sites

Effects to fish and aquatic biota from herbicide treatment of ribbongrass and reed canarygrass with aquatic glyphosate should be less or similar to those discussed for the Headwaters Metolius Subwatershed because other infested sites are less than half the size. The locations, fish species and size of all ribbongrass and reed canarygrass treatments are presented in Table 63.

**Table 63.** Reed canarygrass treatment areas proposed for mowing and then hand wick and spot spray application of aquatic glyphosate. The infested % length of shoreline is based on available reproductive habitat for that fish population. Values are for mapped invasive plant sites.

| Treatment Area (s) | Waterbody | Location | Trout Species **TES in Bold** | Shoreline Infested Length Ft. | % | Mapped Infested Area ac. |
|---|---|---|---|---|---|---|
| 11-10* | Deschutes River | Island near Rd 42 crossing | **Redband** | NA | NA | 0.3 |
| 11-24 | Wickiup Res. | SE shore | **Redband** | 3,290 | 1.23 | 5.3 |
| 11-33 | Paulina Lake | West Shore | Brown | 4,220 | 11.91 | 5.2 |
| 11-34 | Hosmer Lake | West Shore | Brook | 230 | 0.76 | 1.0 |
| 11-35 | Deschutes River | Blue Lagoon | **Redband** | 2,300 | 2.56 | 7.5 |
| 11-39 | Lava Lake | Most of Shoreline | Rainbow | 13,100 | 72.36 | 22.2 |
| 11-54 | South Twin Lake | West Shore | Rainbow | 1,210 | 1.60 | 1.8 |
| 11-56<br>11-53 | Crane Prairie Res. | West Shore<br>Rd. 4285 and SE arm | **Redband** | 10,370 | 8.80 | 26.4 |
| 11-66 | Deschutes R. | Ryan Ranch Meadow | **Redband** | 340 | 0.06 | 10.6 |

| Treatment Area (s) | Waterbody | Location | Trout Species **TES in Bold** | Shoreline Infested Length Ft. | % | Mapped Infested Area ac. |
|---|---|---|---|---|---|---|
| 11-80 | Deschutes R. | Rd. 44 at Bull Bend | **Redband** | 230 | 0.02 | 1.1 |
| 12-05 | Big Marsh | East Ditch | **Redband** | 5,520 | 5.59 | 2.7 |
| 15-22 | Trout Creek | Trout Creek Swamp | **Redband** | 5,950 | 7.96 | 44.8 |
| 15-32** | Metolius River | Upper River | **Bull/Redband** | 86,500 | 20.07 | 119.2 |

* Site 11-10 is not mapped but is estimated to be less than 0.3 acres and is located on an island of the Deschutes River between Crane Prairie and Wickiup Reservoir.
****** Actual on the ground surveyed values are much less than mapped values see Table H-10.

### Selected Herbicide and Manual Treatment Sites

The amount of fine sediments delivered to the stream using the manual pulling method will depend on the amount of disturbance, time of year and its proximity to a stream. Hand pulling will be used on small patches of weeds, where there are only a few scattered individuals distributed over large or sensitive areas or when the potential effects of hand pulling outweigh the potential effects of herbicide application. Hand pulling is not expected to add any measurable amounts of fine sediments to streams.

The redband trout subwatersheds listed in Table 64 have the greatest potential for effects from herbicide treatment because of the large size of infestations and the proximity of these infestations to intermittent streams and perennial waterbodies. Because of the use of primarily low and moderate risk herbicides and PDFs to protect aquatic resources, the effects to redband trout, aquatic biota and their habitats are expected to be similar or less than those in the previously analyzed TES watersheds of this document. For each site in these watersheds, restrictions under Alternative 3 would reduce, but not eliminate, the risk of herbicide contamination or sedimentation.

**Table 64.** Subwatershed with waterbodies at higher risk of herbicide contamination due to size of weed infestations and proximity to perennial water and fish bearing waterbodies.

| Subwatershed Name | Subwatershed Number | Infested Weed Acres within 100' of Int. Streams | Infested Weed Acres within 100' of perennial water and fish bearing Streams | Infested Weed Acres within 300' of perennial water and fish bearing Streams |
|---|---|---|---|---|
| Upper Paulina Creek | 170703030901 | 180.08 | 136.08 | 378.54 |
| Crescent Lake | 170703020204 | 0 | 46.91 | 95.22 |
| McAllister Slough | 170703051005 | 27.35 | 22.12 | 70.63 |
| Dry Paulina Creek | 170703030902 | 76.70 | 19.34 | 39.15 |
| Cold Creek | 170703020205 | 0 | 10.24 | 39.04 |
| Lava Lakes | 170703010104 | 0 | 18.80 | 38.12 |
| Crane Prairie | 170703010109 | 0 | 22.71 | 37.48 |
| Upper Trout Creek | 170703010803 | 0 | 10.32 | 24.04 |
| Pringle Falls | 170703010305 | 0 | 7.38 | 18.33 |
| Lower Indian Ford | 170703010807 | 0 | 4.63 | 16.68 |
| Drake Creek | 170703040602 | 0 | 3.52 | 10.24 |

**Scarify and Control Burning Sites**

Scarify and control burning followed by herbicide treatment for houndstongue is proposed in portions of two treatment areas (72-15 and 72-37). These two treatment areas are both within the Dry Paulina Creek subwatershed (HUC: 170703030902), that is part of the Paulina Creek Watershed (Figure 8).

Scarifying is proposed in five locations that total 14.3 acres along or adjacent to two intermittent streams. The goal of scarifying will be to break up the soil surface, not to dig deep or turn over soil (see soils report for more discussion). These two intermittent streams feed into Dipping Vat Creek and an unnamed stream that contains redband trout. Following RHCA buffer guidelines for Infish non priority watershed, no discing will be allowed within 50 feet of the intermittent streams to prevent sediments from entering these channels and washing downstream into potential redband trout spawning areas.

Fire is proposed in the same five locations that scarifying will be used to reduce weed biomass and seed beds. Following RHCA buffer guidelines for Infish non priority watersheds, no ground disturbing or duff removing activities including the building of fire lines will be allowed within 50 feet of these intermittent streams under either action alternative to prevent sediments from entering these intermittent channels and washing downstream into potential redband trout spawning streams. Scarifying and herbicide application will be used in conjunction with the prescribed fire treatments. The scarifying and controlled burn activities will most likely occur once per season for no more than two seasons and will most likely be done during the spring when soil moisture and fuel moistures are appropriate. Herbicide application will be done later in the spring or summer.

Weed species at these sites are primarily houndstongue and smaller infestations of Canada thistle. The herbicides of choice to treat these species are metsulfuron and clopyralid, respectively. These herbicides will not adversely affect Redband trout under either Alternative 2 or 3 because they are low toxicity to fish and are not expected to enter the perennial streams. However, if some herbicides do reach perennial streams some indirect effects to aquatic macrophytes and algae could be seen. These effects would only occur for a short period of time if herbicides were washed into these intermittent channels and downstream to areas containing redband trout. This would most likely occur if a large thunderstorm event occurred within a few weeks of the herbicide application.

Houndstongue infested sites proposed to be burned, scarified, chemically treated and revegetated.

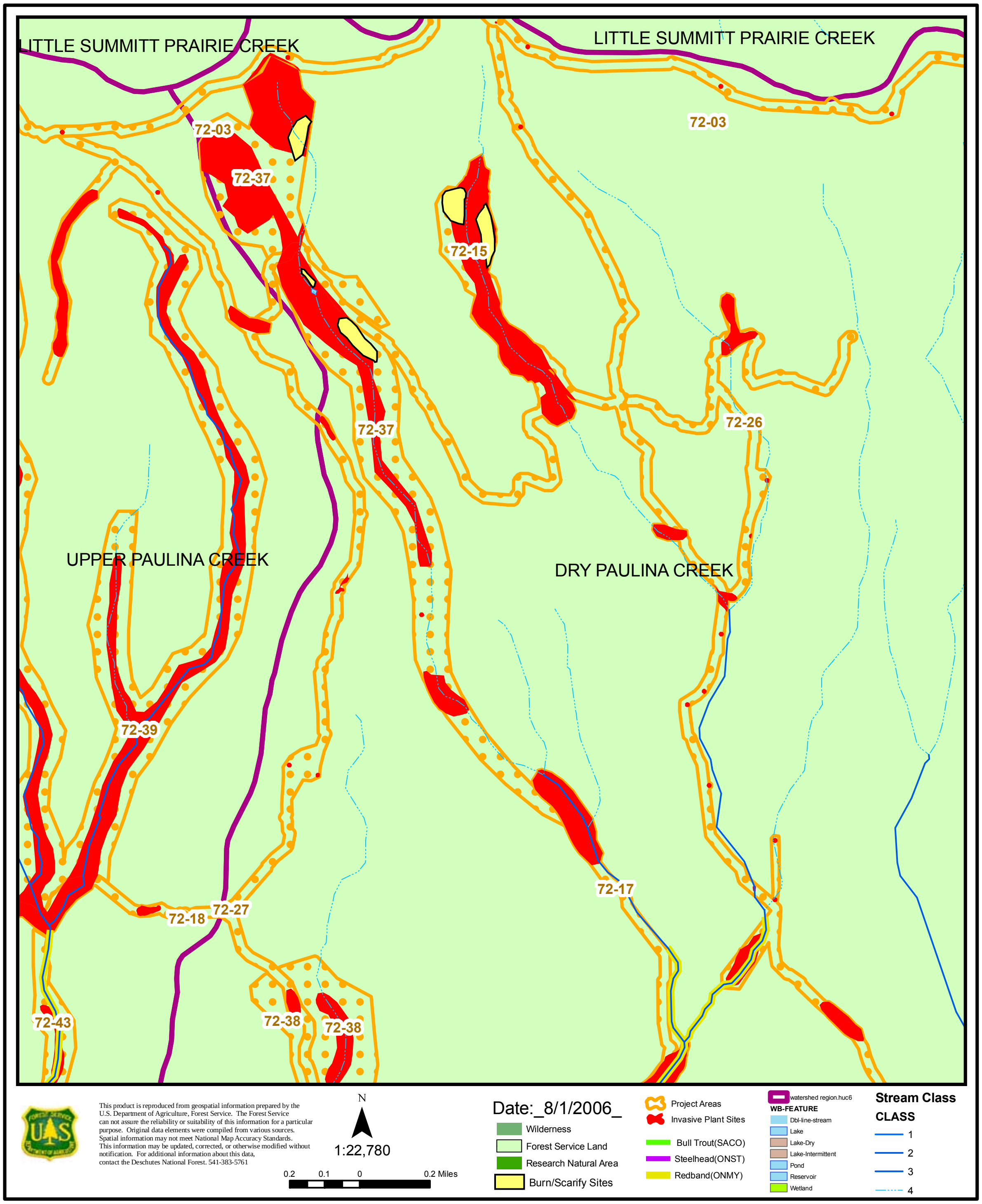


**Figure 8.** Sites proposed to be scarified and burned prior to herbicide treatment in the Dry Paulina Subwatershed.

# 3.8 Human Health – Worker and Public Exposure to Herbicides

The effect of herbicides on human health is a primary concern of the public. This section focuses on plausible effects to workers and the public from herbicide exposure. The R6 2005 FEIS evaluated human health risks from herbicide and non-herbicide invasive plant treatment methods. Hazards normally encountered while working in the woods (strains, sprains, falls, etc) are possible during herbicide and non-herbicide invasive plant treatment operations. Such hazards are mitigated through worker compliance with occupational health and safety standards and are not a key issue for this project-level analysis.

Many people express concern about the effects of herbicides on human heath. Workers and the public may be exposed to herbicides used to treat invasive plants under all alternatives in this project, however no exposures exceeding a threshold of concern are predicted. This conclusion is based on facts about chemistry of the herbicides considered for use and the mechanisms by which exposures of concern might occur.

The R6 2005 FEIS considered potential hazards to human health from herbicide active ingredients, metabolites, inert ingredients, and adjuvants. As a result, the R6 2005 ROD standards were adopted to minimize herbicide exposures of concern to workers and the public. Site-specific Project Design Features (PDFs) were developed to further minimize or eliminate exposures of concern to workers and the public given the regional standards. The PDFs ensure that herbicides and surfactants are used in rates low enough, or methods selective enough, to avoid exposures of concern.

The R6 2005 FEIS relied on professional risk assessments completed Syracuse Environmental Research Associates, Inc (SERA) using peer-reviewed articles from the open scientific literature and current EPA documents, including Confidential Business Information. Full citations for the SERA Risk Assessment are listed in Chapter 3.2. Appendix Q of the R6 2005 FEIS provides detailed information about the human health hazards associated with herbicide use.

The basis for risk assessments consists of the following parts:

1. Hazard Characterization—What are the dangers inherent with the herbicide?
2. Exposure Assessment—Who gets what and how much?
3. Dose Response Assessment—How much is too much?
4. Risk Characterization—Indicates whether or not there is a plausible basis for concern

The integration of the exposure rate and the dose response actually characterizes the risk for a particular herbicide. In other words, the inherent hazard of the chemical (e.g. known to cause liver damage) may be discounted if the exposure and dose are below a no observable adverse effect level (NOAEL); therefore, no liver damage occurs. Some herbicides may cause liver damage at high rates of exposure in combination with a high dose, but without this combination the risk characterization is very low. Refer to section 3.2 for explanations of much of the terminology used to discuss herbicide toxicology.

The effects analysis focuses on plausible herbicide exposure scenarios given site conditions, life history of organisms in the area, herbicide application methods and herbicide properties and risks. Project Design Features minimize or eliminate the chance that plausible exposures of concern may occur.

**Endocrine Disruption**

In 2007, the Environmental Protection Agency released a draft list of 73 pesticides, based on the high potential for human exposure, which will be tested for potential to cause endocrine disruption. Glyphosate is the only herbicide considered for use on the Forests that is included in the EPA testing. Endocrine disruption and glyphosate was studied by SERA in 2002 (SERA 2002) and considered in the R6 FEIS and its Appendix Q.

SERA report "Three specific tests on the potential effects of glyphosate on the endocrine system have been conducted and all of these tests reported no effects. The conclusion that glyphosate is not an endocrine disruptor is reinforced by epidemiological studies that have examined relationships between occupational farm exposures to glyphosate formulations and risk of spontaneous miscarriage, fecundity, sperm quality, and serum reproductive hormone concentrations… the approach taken in the SERA risk assessment used by the Forest Service is highly conservative and no recent information has been encountered suggesting that this risk assessment is not adequately protective of any reproductive effects that might be associated with glyphosate exposure."

## 3.8.1 Affected Environment

Many people live near, spend time, work in, drink water from, or depend on forest products from the Deschutes and Ochoco National Forests and Crooked River National Grassland. These people may be inadvertently exposed to herbicides from invasive plant management projects on the Forests. Municipal watersheds, dispersed and developed recreation areas (trailheads, campgrounds, picnic areas, recreation sites, boat ramps, ski areas, work centers, etc) and special forest product collection areas currently occur in the vicinity of invasive plant sites.

Many groups use the forest to collect personal use and commercial forest products routinely and seasonally. Special forest products found here include a variety of mushrooms, blackberries, huckleberries, roots, and herbs. American Indian Tribes use the Forests and Grassland for collecting plants that are used to make things, such as basketry, and for eating. The Forests also have extensive pine cone collection for the commercial decoration market, firewood gathering, and quarry sites where red cinder, lava and tabular rocks are gathered for landscaping or ornamentation. Some of these products are targeted commercial species for export, such as matsutake mushroom, but more are not. Matsutake mushroom harvesters are a large group that come together on the Deschutes National Forest, primarily Crescent Ranger District, during a specified commercial season in the fall. The majority of invasive plant sites are along roadsides, whereas special forest products are more often found in natural settings. Special forest product harvesters may have more contact with contaminated vegetation than the general public.

Recent studies of commercial permit holders on the Gifford Pinchot National Forest demonstrated that the largest ethnic groups involved with forest product gathering were Hispanics and Southeast Asians (Khmer, Khmer Krom, Laotian and Vietnamese). National Forest system lands are adjacent to other land ownerships; the majority of watersheds on the Forest also contain American Indian Lands, commercial forestlands, or other private parcels. Several municipal watersheds lie on the Forest (see Soil and Water section above).

Infested sites are scattered and occupy less than 3 percent of Deschutes & Ochoco National Forest system lands. Invasive plant treatments on the Forests are implemented in partnership with the local counties. Crews most often come from the communities in and around the National Forest boundary. Herbicide applicators are well-trained in safe herbicide handling and transportation practices (Lucero presentation, May 2005).

## 3.8.2 Environmental Consequences

***Worker Herbicide Exposure Analysis***

Herbicide applicators are more likely than the general public to be exposed to herbicides. Worker exposure is influenced by the application rate selected for the herbicide; the number of hours worked per day; the acres treated per hour; and variability in human dermal absorption rates. Appendix Q: Human Health Risk Assessment in the R6 2005 FEIS displayed risks for typical and maximum label rates under a range of conditions. Four potential exposure levels were evaluated for workers, ranging from predicted average exposure (typical application rate-typical exposure variables) to a worst-case predicted exposure (maximum application rate-maximum exposure variables).

In routine broadcast and spot applications, workers may contact and internalize herbicides mainly through exposed skin, but also through the mouth, nose or lungs. Contact with herbicide formulations may irritate eyes or skin.

The ten herbicides allowed under the action alternatives, used at rates and methods consistent with PDFs, have little potential to harm a human being. Appendix Q of the R6 2005 FEIS lists the HQ values for all herbicides considered for this project. In most cases, even when maximum rates and exposures are considered, HQ values were less than 1 (range = 0.01-1.0).).

Risk assessments indicate concern for worker exposure to triclopyr, especially the Garlon 4 formulation. This is one reason why broadcast application of triclopyr is not allowed under R6 2005 ROD Standard 16. However, a potential worst-case scenario exists exceeding a level of concern for workers given a backpack (spot) application of the Garlon 4 formulation of triclopyr. PDFs eliminate this scenario by favoring use of Garlon 3A, minimizing application rates of all triclopyr formulations, and following safe work practices and label advisories.

For all other herbicides and surfactants, the amount of plausible worker exposure is below levels of concern for all application methods, including broadcast. Project Design Features for all action alternatives reduce both the application rate and the quantity of drift if triclopyr and/or NPE are used. Broadcast of triclopyr is not permitted in any situation (as per Standard 16), and non-NPE surfactants would always be favored where effective.

Chronic (daily over a period of time) worker exposure was also considered in SERA Risk Assessments; chronic exposures also do not amount to levels of concern because the herbicide ingredients are water-soluble and are not retained in the body (they are rapidly eliminated).

***Public Herbicide Exposure Analysis***

The general public would not be exposed to substantial levels of any herbicides used in the implementation of this project. R6 2005 FEIS Appendix Q considered plausible direct, acute and chronic exposures from herbicide ingredients. Few plausible scenarios exist that exceed even the most conservative threshold of concern for public health and safety. Below the threshold of concern, the risk is extremely low for any observable adverse effects due to the particular exposure scenario. Appendix Q shows Risk Assessment results assuming a human being contacts sprayed vegetation or herbicide or consumes sprayed vegetation, contaminated water, and/or fish.

***Direct Contact***

There is virtually no chance of a person being directly sprayed given broadcast, spot and hand/select methods considered for this project. A person could brush up against sprayed vegetation soon after herbicide is applied. Such contact is unlikely because public exposure would be discouraged during and after herbicide application, through notification and/or signing. For all herbicides except triclopyr, direct contact with sprayed vegetation would not exceed a level of concern. The exception is triclopyr:

exposures exceeding a conservative level of concern could occur if a person accidentally contacts vegetation spot-sprayed with triclopyr (especially Garlon 4). The use of Garlon 4 is limited by the PDFs (for instance, no use of Garlon 4 would be allowed within 150 feet of any water body or stream channel; Garlon 4 would be avoided in special forest product gathering areas, campgrounds, or administrative sites; and in special forest product areas, triclopyr will only be applied using a direct targeted application to individual invasive plants). Gathering areas, campgrounds and administrative sites may be closed during and after triclopyr application to eliminate accidental exposures.

***Eating Contaminated Fish, Berries or Mushrooms***

The public may also be exposed to herbicide if they eat contaminated fish, berries, or mushrooms (etc). Several exposure scenarios for recreational and subsistence fish consumption were considered in the SERA Risk Assessments; none are near any herbicide exposure level of concern. Fish contamination is unlikely given the Project Design Features that reduce potential herbicide delivery to water. (see Section 3.7)

Members of the public could eat invasive blackberries that have been sprayed, however the target vegetation would quickly be browned and unappetizing. Non-target, native berries or mushrooms may be affected by drift or runoff.

The R6 2005 FEIS considered exposure scenarios for both short term and chronic consumption of contaminated berries. The herbicide dose from eating a quantity of mushrooms would be greater than for the same quantity of berries (Durkin and Durkin 2005). The dose, however, would be less than the dose from a dermal contact with sprayed vegetation scenario and below a threshold of concern.

Appendix Q of the R6 FEIS displayed the exposure scenarios and HQ values associated with eating berries or other herbicide contact. Of the ten herbicides considered in this project, triclopyr remains the single herbicide with exposure scenarios exceeding a level of concern if berries or mushrooms containing herbicide residue are consumed. To respond to this concern, PDFs limit the application methods and rate of application for triclopyr (especially Garlon 4). In addition, under worst-case scenarios and maximum label rates, exposure to NPE surfactant may also exceed a level of concern. Thus PDFs limit the rate of NPE that may be applied. Special forest product gathering areas may be closed to public use immediately after triclopyr application to avoid inadvertent exposure.

People who both harvest and consume special forest products or cultural-use plants (Table 65) may be exposed both through handling contaminated plant material and chewing or eating it. Chewing and eating contaminated plant material cause different exposure and dose patterns. Such doses would be additive, but are unlikely to exceed a threshold of concern (see cumulative effects, below).

**Table 65.** Some culturally-important plants in Central Oregon.

| Scientific Name | Common Name | Plant Family Common Name | Cultural Use |
|---|---|---|---|
| *Achnatherum hymenoides (= Oryzopsis hymenoides* | Indian ricegrass | Grass family | Food |
| *Allium spp.* | Wild onions | Lily family | Food |
| *Asclepias* spp. | Milkweed | Milkweed family | Basketry materials |
| *Camassia* spp. | camassia | Lily family | Food |
| *Cornus sericea* | Redosier dogwood | Dogwood family | Basketry materials |
| *Daucus carota* | Wild carrot | Carrot family | Food |
| *Lewisia rediviva* | Bitterroot | Purslane family | Food |
| *Leymus cinereus (= Elymus cinereus)* | Basin wildrye | Grass family | Food |
| *Lomatium canbyi* | Canby's biscuitroot; Canby's lomatium | Carrot family | Food |
| *Lomatium* spp. | Lomatiums | Carrot family | Food |
| *Nuphar polysepalum* | Pond lily; wokas, wada | Water-lily family | Food |
| *Perideridia* spp. | Yampah | Carrot family | Food |

| Scientific Name | Common Name | Plant Family Common Name | Cultural Use |
|---|---|---|---|
| *Prunus virginiana* | Chokecherry | Rose family | Food |
| *Ribes* spp. | Currants | Currant family | Food |
| *Rosa* spp. | Wild rose | Rose family | Food |
| *Sagittaria cuneata* | Wapato, arumleaf, arrowhead | Water plantain family | Food |
| *Salix* spp. | Sometimes called red & coyote willows | Willow family | Basketry materials |
| *Sambucus* spp. | Elderberry | Honeysuckle family | Food |
| *Scirpus* spp. (some species now in the genus *Schoenoplectus*) | Tule | Sedge family | Basketry materials |
| *Thuja plicata* | Western red cedar | Cypress family | |
| *Typha* spp. | Cattail | Cattail family | Basketry materials |
| *Vaccinium* spp. | Huckleberries | Heath family | Food |
| *Xerophyllum tenax* | Beargrass | Lily family | Basketry materials |

***Drinking Contaminated Water***

Acute exposures and longer-term or chronic exposures from direct contact or consumption of water, fruit or fish following herbicide application were evaluated in the R6 2005 FEIS. Risks from two hypothetical drinking water sources were evaluated: 1) a stream, contaminated with herbicide residues by runoff or leaching from an adjacent herbicide application; and 2) a pond, into which the contents of a 200-gallon tanker truck that contains herbicide solution is spilled. The only herbicide scenarios of concern would involve a person drinking from a pond contaminated by a spill of a large tank of herbicide solution. The risk of a major accidental spill is not linked in a cause-and-effect relationship to how much treatment of invasive plants is projected for a particular herbicide; a spill is a random event. A spill could happen whenever a tank truck involved in an herbicide operation passes a body of water. The potential risk of human health effects from large herbicide spills into drinking water are mitigated by Project Design Features that require an Herbicide Transportation and Handling Plan be developed as part of all project safety planning, with detailed spill prevention and remediation measures to be adopted.

Section 3.6 details the existing water sources in use across the Forests and effects in terms of water contamination.

## Environmental Justice and Disproportionate Effects

The R6 2005 FEIS found that some minority groups may be disproportionately exposed to herbicides, either because they are disproportionately represented in the pool of likely forest workers, or they are disproportionately represented in the pool of special forest product or subsistence gatherers.

The R6 2005 FEIS suggested that Hispanic forest workers and American Indians may be minority groups that could be disproportionately affected by herbicide use.

Hispanic and non-Hispanic herbicide applicators would be more likely to be exposed to herbicides than other people. Contractors for the Forest and/or County would likely implement herbicide treatments. County invasive plant control departments do not indicate that they employ any specific population group that could be disproportionately affected during invasive plant treatments. Regardless, effects to all County or contract employees engaged in invasive plant control would be negligible due to Project Design Features and compliance with occupational health and safety standards.

People of Hispanic and Southeast Asian (Khmer, Khmer Krom, Laotian and Vietnamese) descent are minority groups that tend to gather mushrooms. The season that matsutake are harvested is generally outside the timeframe that herbicides are used for treatments. However, no mushrooms are target species and Project Design Features are in place to protect fungi. Whenever herbicide treatment is scheduled to occur, the Forest will notify tribes, plant collectors and the general public with media postings, handouts attached to permits, annual tribal contacts and on-the-ground signing. Information about invasive plant treatments would be added to the multi-lingual mushroom gathering permit material to eliminate inadvertent exposures. Some areas may be closed to gathering following treatment to avoid exposures. Even given plausible inadvertent exposures, minority forest workers or subsistence gatherers are not likely be exposed to a dose which exceeds a threshold of concern.

## Direct and Indirect Effects of the Alternatives

### No Action

The herbicide applications approved in No Action were previously analyzed in the 1998 EAs and found to pose no significant potential risks to health for workers or the public.

### Action Alternatives

Both alternatives similarly resolve issues related to human health. No individual worker or public exposures of concern are predicted for any alternative. Alternative 3 has the least risk of adverse effects from herbicide use of the action alternatives because it eliminates or restricts herbicide on those portions of invasive plants sites that are near streams and other water bodies. However, the Project Design Features, particularly the perennial stream buffers, and limitations on application rate of some herbicides also eliminate plausible exposures of concern in Alternative 2. No adverse effects to public drinking water supplies or health and safety are predicted in any alternative.

**Table 66.** How Human Health Concerns are Addressed

| | **Project Design Feature to Address Concern** |
|---|---|
| **Workers** | Reduced application rates of some herbicides; limitations on broadcast of triclopyr as per Standard 16. |
| **Public** | Reduced application rates of some herbicides; limitations on broadcast of triclopyr as per Standard 16. These limitations reduce risks to the general public, even considering multiple exposures. |
| **Special Forest Projects** | Reduced application rates of some herbicides; posting areas, supplying info to permittees; Using flagging to mark treated areas; Ensuring some areas are available that will not be treated. Detectable impacts are implausible except in the event of an unpredictable exposure. Even multiple exposures (eating contaminated fish, drinking contaminated water, skin irritation) would not result in exposure levels of concern. |
| **Cultural Use Plants** | Where an area is known as a collecting area, the use of herbicides will be avoided during season of collection and when the cultural use plants are present. Annual consultation with American Indian tribes will help ensure notification. |
| **Drinking Water** | Reduced application rates of some herbicides;<br>Transportation and Handling Safety Plan and Spill Plan.<br>Detectable impacts are implausible except in the event of a spill. |

### Cumulative Effects of All Alternatives

The proposed use of herbicides in all alternatives could result in cumulative doses of the same or different herbicides to workers or the general public. Cumulative doses are possible within the context of this project, or when combined with herbicide use on adjacent private lands or home use by a worker or member of the general public. However, the risk is very small that a person would receive additive exposures during the time period in which the herbicide remains unmetabolized in their body. These herbicides do not bioaccumulate in humans and are rapidly eliminated from the body. Thus one-time exposures, even if repeated at infrequent intervals, are unlikely to accumulate to a level of concern.

Where long term repeated exposures might be plausible, the SERA Risk Assessments evaluated chronic exposure scenarios, including repeated drinking of contaminated water, repeated consumption of contaminated berries, and repeated consumption of contaminated fish. The potential for cumulative human health effects from any herbicide use proposed in this EIS, combined with other potential herbicide applications in the analysis area, is encompassed in the health risks estimated for chronic exposure scenarios.

A person could be exposed to herbicides by more than one scenario, for instance, a person handling, and then consuming sprayed berries. The cumulative impact of such cases may be quantitatively characterized by adding the HQs for each exposure scenario. The herbicides together would not bioaccumulate.

Using glyphosate as an example, the typical levels of exposure for a woman being directly sprayed on the lower legs, staying in contact with contaminated vegetation, eating contaminated fruit, and consuming contaminated fish leads to a combined (acute) HQ of 0.012. Similarly, for all of the chronic glyphosate exposure scenarios, the addition of all possible pathways lead to HQs that are two orders of magnitude less than 1, indicating an acceptable level of cumulative risk even with multiple exposure scenarios.

Even if an herbicide with a greater hazard quotient than glyphosate were used, berry harvesting (dermal exposure) and the subsequent eating (oral exposure) would allow the body to metabolize some of the initial dose before receiving the second dose, thus reducing the cumulative dose. These factors make the risk implausible that a combined dose would exceed the threshold of concern. Slight exceedences could cause clinically detectable physiologic changes, but are unlikely to produce any frank symptoms detectable by a person.

The R6 Invasive Plant FEIS considered the potential for synergistic effects of exposure to two or more herbicides: "Combinations of chemicals in low doses (less than one tenth of RfD[14]) have rarely demonstrated synergistic effects. Review of the scientific literature on toxicological effects and toxicological interactions of agricultural chemicals indicate that exposure to a mixture of pesticides is more likely to lead to additive rather than synergistic effects (ATSDR, 2004; U.S.EPA/ORD, 2000). Based on the limited data available on chemical combinations involving the twelve herbicides considered in this EIS, it is possible, but unlikely, that synergistic effects could occur as a result of exposure to the herbicides considered in this analysis. Synergistic or additive effects, if any, are expected to be insignificant." (USFS 2005a, p. 4-3).

All alternatives comply with standards, policies and laws aimed at protecting worker safety and public health.

[14] RfD = A daily dose which is not anticipated to cause any adverse effects in a human population over a lifetime of exposure. These values are derived by the U.S. Environmental Protection Agency.

# 3.9 Terrestrial Wildlife Species of Local Interest

### Introduction

The Deschutes and Ochoco National Forests and Crooked River National Grassland (hereinafter referred to as the "project area") provide diverse habitats for wildlife, ranging from wet meadows to dry sagebrush, and from mountain hemlock with subalpine fir to open dry stands of ponderosa pine. These varied habitats provide for a diverse array of wildlife species, including amphibians and reptiles. The project area is located within the Pacific Flyway, which is a major migratory route for thousands of migratory birds. Many species that do not reside in or on the Forest may be found here during migration.

The project area provides important habitat for several rare species, including two federally listed threatened species, three species that are federal candidates, and several species included on the Regional Forester's Sensitive Animal List (USFS 2004b). No federally listed endangered species occur in the project area. In addition, the forests and grassland have identified several animals as Management Indicator Species in their respective land management plans and the project area provides habitat for neotropical migratory birds of concern. Information on all these wildlife species is included in the section titled "Affected Environment."

Invasive plant species have become established in the project area and continue to spread, causing a loss of wildlife habitat and posing a risk of injury to wildlife. Methods used to control invasive plants have the potential to have adverse effects to individual animals as well as wildlife habitat. The Deschutes and Ochoco National Forests and the Crooked River National Grassland have proposed to conduct invasive plant control projects within their administrative boundaries. This section of the FEIS will summarize the effects on wildlife from invasive plants and methods used to control invasive plants. The Wildlife Specialist Report/Biological Evaluation is located in the project file.

## 3.9.1 Affected Environment

#### Invasive Plants and Wildlife Resources

Some wildlife species utilize invasive plants for food or cover. For example, American goldfinch (*Carduelis tristis*), and red-winged blackbird (*Agelaius phoeniceus*) utilize purple loosestrife (Kiviat 1996; Thompson, Stuckey, and Thompson, 1987), and native bighorn sheep will utilize cheatgrass (Csuti et al., 2001). It has been reported that elk, deer and rodents eat rosettes and seed heads of spotted knapweed. Doves, hummingbirds, honeybees, and the endangered southwestern willow flycatcher (*Empidonax trailii extimus*) are known to use saltcedar (Barrows 1996). However, the few uses that an invasive plant may provide do not outweigh the adverse impacts to an entire ecosystem (Zavaleta 2000).

Invasive plants have adversely impacted habitat for native wildlife (Washington Dept. of Fish and Wildlife 2003). Any species of wildlife that depends upon native understory vegetation for food, shelter, or breeding, is or can be adversely affected by invasive plants. Species restricted to very specific habitats, for example pond-dwelling amphibians, are more susceptible to adverse effects of invasive plants.

Displacement of native plant communities by non-native plants results in alterations to the structure and function of ecosystems (MacDonald et al., in press), and constitutes a principal mechanism for loss of biodiversity at regional and global scales (Lacey and Olsen, 1991; Risser 1988 as cited in Johnson et al., 1994). Mills et al. (1989) and Germaine et al. (1998) found that native bird species diversity and density, were positively correlated with the volume of native vegetation, but were negatively correlated or uncorrelated with the volume of exotic vegetation. Invasive plants can adversely affect wildlife species by eliminating required habitat components, including surface water (Brotherson and Field, 1987; Dudley, 2000; Horton, 1977), reducing available forage quantity or quality (Bedunah and Carpenter 1989; Rice et al., 1997; Trammell and Butler 1995); reducing preferred cover (Rawinski and Malecki, 1984; Thompson et al., 1987); drastically altering habitat composition due to altered fire cycles (D'Antonio and Vitousek, 1992; Mack 1981; Randall 1996; Whisenant 1990); and physical injury, such as that caused by long spines or "foxtails" (Archer, 2001). In the case of common burdock (*Arctium minus*), the prickly burs can trap bats and hummingbirds and cause direct mortality to individuals (Raloff 1998; and documented in photo by Clay Grove, USFS, and Rosa Wilson, NPS). Invasive plants that grow large and densely (e.g., giant reed, Himalayan blackberry) can act as physical barriers to water sources and essential habitat (Bautista, S., personal observation; Fiedler, C., personal observation).

Invasive plants can act as a population sink by attracting a species and then exposing them to increased mortality or failed reproduction (Chew 1981). For example, Schmidt and Whelan (1999) reported that native birds increased their use of exotic *Lonicera* and *Rhamnus* shrubs over native trees, even though nests built in the exotic shrubs experienced significantly higher mortality rates.

Some invasive plants (such as knapweed) contain chemical compounds that make the plant unpalatable to grazing animals. Chemical compounds in these invasive plants disrupt microbial activity in the rumen, or cause discomfort after being ingested, resulting in a reduced or avoided consumption of the invasive plant (Olson 1999).

Habitats that become dominated by invasive plants are often not used, or used much less, by native and rare wildlife species. Washington Department of Fish and Wildlife (2003) identified noxious weeds, such as yellow starthistle and knapweed, as threats to upland game bird habitat. Some hunters and wildlife managers are concerned that invasive plants are degrading the quality of remaining habitat for deer and elk and are adversely affecting the animal's distribution and hunting opportunities. Trammell and Butler (1995) found that deer, elk, and bison avoided sites infested with leafy spurge (*Euphorbia esula*). Tamarisk stands have fewer and less diverse populations of mammals, reptiles, and amphibians (Jakle and Gatz, 1985; Olson, 1999). Invasion by purple loosestrife makes habitat unsuitable for numerous birds, reptiles and mammals (Kiviat 1996; Lor, 1999; Rawinski 1984; Thompson, Stuckey, and Thompson, 1987; Weihe and Neely, 1997; Weiher et al., 1996). Reed canarygrass has been implicated in the loss of Oregon spotted frog habitat may have contributed to contractions in the range of the Oregon spotted frogs in western Oregon (Hayes 1997, McAllister and Leonard 1997, Watson 2003).

Of the federally listed species that occur in the project area, none are known to be adversely affected by invasive plants within the project area. Bald eagle mortality in other parts of the U.S. has been linked to a toxin produced by a cyanobacteria that grows on the invasive aquatic plant, *Hydrilla verticillata* (Wilde 2005).

In summary, invasive plants are known or suspected of causing the following effects to wildlife:

- Embedded seeds in animal body parts (e.g. foxtails), or entrapment (e.g. common burdock) leading to injury or death.
- Scratches leading to infection.
- Alteration of habitat structure leading to habitat loss or increased chance of predation. (Schmidt and Whelan 1999)
- Change to effective population size through nutritional deficiencies or direct physical mortality.
- Poisoning due to direct or indirect ingestion of toxic compounds found on or in invasive plants.

- Altered food web and nutrient cycling (Allison and Vitousek 2004, Ehrenfeld 2003).
- Source-sink population demography, with more demographic sinks than sources.
- Lack of proper forage quantity or nutritional value at critical life periods.

## Threatened, Endangered, and Sensitive Species

### Federally Listed Species

One species listed as "threatened" under the Endangered Species Act of 1973 (as amended) (ESA), is found in the project area. In addition, the U.S. Fish and Wildlife Service (FWS) maintains a list of "candidate" species. Candidate species are those taxa which the FWS has on file sufficient information on biological vulnerability and threats to support issuance of a proposal to list, but issuance of a proposed rule is currently precluded by higher priority listing actions (U.S. Fish and Wildlife Service 2006a).

Threatened or candidate species thought to occur presently or historically on the Deschutes and Ochoco National Forests and the Crooked River National Grassland include the northern spotted owl (*Strix occidentalis*), Oregon spotted frog (*Rana pretiosa*), Columbia spotted frog (*Rana luteiventris*), and the fisher (*Martes pennanti*). The bald eagle (*Haliaeetus leucocehpalus*) is no longer Threatened under the Endangered Species Act, and is discussed under Regional Forester's Sensitive Species, The Canada lynx (*Lynx canadensis*) has not been documented in the project area and Forest Service review found there is insufficient habitat to support lynx. The Canada lynx is discussed in more detail in the following text. Listed and candidate species found in the project area are included in the following table.

**Table 67.** Federally listed or candidate species potentially within the project area.

| Species | Status | Critical Habitat | Presence* |
|---|---|---|---|
| Canada lynx | Threatened | None | not present |
| Bald eagle (see Sensitive Species) | Delisted | None | DES, OCH, CRNG |
| Northern spotted owl | Threatened | Designated | DES |
| Oregon spotted frog | Candidate | None | DES |
| Columbia spotted frog | Candidate | None | OCH, CRNG |
| Pacific fisher | Candidate | None | DES |

*DES = Deschutes National Forest; OCH = Ochoco National Forest, CRNG = Crooked River National Grassland

The bald eagle was removed from the endangered species list (delisted) on June 28,1007 (USFWS 2007). As per Forest Service policy, it is now included on the Region 6 Regional Forester's Sensitive Species List, but is included in the Federally Listed Species section of this report due to formatting considerations and the late change relative to completion of the FEIS.

The Oregon spotted frog, Columbia spotted frog and Pacific fisher are also included in the Regional Forester's Sensitive Species List and are discussed in the section titled "Forest Service Sensitive Species."

Brief general descriptions of the species' life history, threats, conservation measures, and their occurrence on the ONF are given below. Much more detailed accounts can be found in the Biological Assessment prepared for the Regional Invasive Plant Program (USFS 2005d). This Biological Assessment is incorporated by reference.

**Canada Lynx**

The Canada lynx is a federally listed Threatened species. The Forest Wildlife Biologists for the Deschutes and Ochoco National Forests and the Crooked River National Grassland have made a determination based on the best available science that neither Canada lynx nor their habitat are currently present on these administrative units (Jeffries and Zalunardo 2003). There is only one verified Canada lynx record from the Deschutes National Forest collected near Lava Lake in 1916, and there are no verified records of lynx from the Ochoco National Forest or the Crooked River National Grassland. There are only 12 verified records in all of Oregon since 1897. Lynx records in Oregon are related to population dynamics of lynx in Alaska and Canada; declines in prey populations following peaks in lynx populations likely resulted in southward dispersal of lynx. Self- maintaining populations of lynx in Oregon have not existed historically (Verts and Carraway 1998; McKelvey and Aubrey 2001). Surveys for lynx were conducted on the Deschutes National Forest in 1999, 2000, and 2001. There were no lynx detections confirmed from the survey effort.

The Lynx Biology Team reported that all investigations into lynx habitat in the southern part of its range show an association between lynx and lodgepole pine cover types within the subalpine fir series. The best available scientific information suggests that subalpine fir plant associations capable of supporting a minimum density of snowshoe hares is a reasonable surrogate for describing lynx habitat conditions to support survival (primary vegetation to support survival and reproduction and constitute a Lynx Analysis Unit). In addition, the Lynx Conservation Assessment and Strategy (Reudiger et al. 2000) identified the need for at least 10 square miles of primary vegetation to support lynx survival and reproduction and constitute a lynx analysis unit. On the Deschutes National Forest, four subalpine fir plant associations (subalpine fir-Englemann spruce, alpine parkland sedge, alpine parkland woodrush, and alpine parkland sagebrush) could be considered primary vegetation that could contribute to lynx habitat. About 3,650 acres of subalpine fir plant associations occur across the entire Deschutes National Forest and most of those acres (3,500) are “parklands” which do not support snowshoe hare. About 3,800 acres of subalpine fir plant associations occur on the Ochoco National Forest. There is not adequate primary vegetation to identify lynx habitat or a Lynx Analysis Unit on the Deschutes or Ochoco National Forests or the Crooked River National Grassland.

*Action Area Information*

No Canada lynx habitat exists within the action area. This species will not be discussed further in this report.

## Northern Spotted Owl

The current range and distribution of the spotted owls extends from southern British Columbia through western Washington, Oregon, and California, as far south as Marin County (U.S. Fish and Wildlife Service 1990a). More detailed descriptions of the spotted owl’s taxonomy, status and conservation history, can be found in: Fish and Wildlife Service (FWS) Status Reviews (U.S. Fish and Wildlife Service 1987 and 1990b); Status Review Supplement (U.S. Fish and Wildlife Service 1989); the Interagency Scientific Committee (ISC) Report (Thomas et al. 1990); the Final Rule designating the spotted owl as a threatened species (U.S. Fish and Wildlife Service 1990a); and the Northern Spotted Owl Five Year Review (Courtney et al. 2004). The Final Draft Recovery Plan for the Northern Spotted Owl (U.S. Fish and Wildlife Service 1992a) also provides biological information and the framework for the steps needed to restore viable spotted owl populations.

In addition, information regarding the environmental baseline and critical habitat in the project area can be found in the Programmatic Biological Assessment for the Forests’ activities (USDA/USDI

2006). This information is incorporated by reference and is summarized in the Action Area Information section.

### *Life History*

The spotted owl is a relatively long-lived bird (average life span approximating 8 years) with a naturally low reproductive rate. Spotted owls do not reach sexual maturity until after 2 years; once an adult, females lay an average of 2 eggs per clutch (range 1-4 eggs). Nest sites are usually located within stands of old-growth and late-successional forest dominated by Douglas-fir, and consist of existing structures such as cavities, broken tree tops, or mistletoe (*Arceuthobium* spp.) brooms (Forsman et al. 1984; Blakesley et al. 1992; LaHaye and Gutierrez 1999). In general, courtship and nesting behavior begins in February to March with nesting occurring from March to June: however timing of nesting and fledging varies with latitude and elevation (Forsman et al. 1984). After the young fledge from the nest, they are still dependent on their parents until they are able to fly and hunt on their own. Parental care continues post-fledging into September (U.S. Fish and Wildlife Service, 1990b), and sometimes into October (Forsman et al. 1984). During this time the adults may not roost with the young during the day, but they will respond to begging vocalizations by bringing food to the young (Forsman et al. 1984).

The spotted owl's primary prey items vary geographically and by forest type. An analysis of local spotted owl pellets showed the primary prey species for the Deschutes NF is the northern flying squirrel with red-backed vole, bushy-tailed woodrat (*Neotoma cinerea*), western pocket gopher (*Thomomys mazama*), Douglas squirrel (*Tamiasciurus hudsonicus*), snowshoe hare (*Lepus americanus*), voles (*Microtus* spp.), mice (*Peromyscus* spp.), and insects as secondary prey items (referred to in USDA /USDI 2006b).

### *Habitat Description*

Spotted owls rely on older forested habitats because they contain the structures and characteristics required for nesting, roosting, foraging, and dispersal. These characteristics include the following: a multilayered, multi-species canopy dominated by large overstory trees; moderate to high canopy closure; a high incidence of trees with large cavities and other types of deformities; numerous large snags; an abundance of large, dead wood on the ground; and open space within and below the upper canopy for owls to fly (Thomas et al. 1990; U.S. Fish and Wildlife Service 1990a). Forested stands with high canopy closure also provide thermal cover as well as protection from predation. In some ecotypes, recent landscape-level analyses suggest that a mosaic of late-successional habitat interspersed with other vegetation types may benefit spotted owls more than large, homogeneous expanses of older forests (Franklin et al. 2000; Meyer et al. 1998).

### *Threats*

The northern spotted owl was listed as threatened throughout its range "due to loss and adverse modification of suitable habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and wind storms" (U.S. Fish and Wildlife Service 1990a). The draft recovery plan for the northern spotted owl (U.S. Fish and Wildlife Service 1992a) identified significant threats to the owl by physiographic province. These threats are summarized as follows: low populations, overall population decline, limited habitat, declining habitat, distribution of habitat or populations, isolation of provinces, predation and competition, lack of coordinated conservation measures, and vulnerability to natural disturbance.

Since listing of the northern spotted owl, new information suggests that hybridization with the barred owl (*Strix varia*) is less of a threat (Kelly and Forsman 2004) and competition with the barred owl is a greater threat than previously anticipated (Courtney et al. 2004). Barred owls apparently compete with spotted owls through a variety of mechanisms: prey overlap (Hamer et al. 2001); habitat overlap

(Hamer et al. 1989; Dunbar et al. 1991; Herter and Hicks 2000; Pearson and Livezey 2003); and agonistic encounters (Leskiw and Gutiérrez 1998; Pearson and Livezey 2003).

West Nile virus has been identified as a potential threat of unknown magnitude to the northern spotted owl (Courtney et al. 2004).

### *Critical Habitat*

Critical habitat for the spotted owl was designated on January 15, 1992 (U.S. Fish and Wildlife Service, 1992b). Primary constituent elements for owl critical habitat consist of habitat features that support nesting, roosting, foraging, and dispersal.

The attributes of nesting and roosting habitat include moderate to high canopy closure (60 to 80 percent); a multi-layered, multi-species canopy with large (>30 inches dbh) overstory trees; a high incidence of large trees with various deformities; large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for owls to fly (Thomas et al. 1990).

Foraging habitat varies across the range of the owl and contains attributes similar to nesting and roosting habitat, but may also include more open fragmented habitat. Dispersal habitat consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities.

### *Action Area Information*

Northern spotted owls do not occur on the OCH or CRNG. Nesting, roosting, and foraging (NRF) habitat for the northern spotted owl on the Deschutes NF includes stands of mixed conifer, ponderosa pine with white fir understory, and mountain hemlock with subalpine fir. Suitable nest sites are generally in cavities in the boles of either dead or live trees. Platform nests may also be used (but more rarely), which include abandoned raptor nests, broken treetops, mistletoe brooms, and squirrel nests. Relatively heavy canopy habitat with a semi-open understory is essential for effective hunting and movement.

An analysis of local spotted owl pellets showed the primary prey species is the northern flying squirrel with red-backed vole, busy-tailed woodrat (*Neotoma cinerea*), western pocket gopher (*Thomomys mazama*), Douglas squirrel (*Tamiasciurus hudsonicus*), snowshoe hare, voles, mice, and insects as secondary prey items.

Habitat conditions that support good populations of northern flying squirrels (*Glaucomys sabrinus*), western red-backed voles (*Clethrionomys californicus*), and other nocturnal or crepuscular small mammals, birds, and insects are essential to supporting spotted owls. Edge effects from large forest openings may adversely impact the microhabitat conditions necessary for suitable owl habitat as well as contribute to increasing the risk to spotted owls imposed by predators or to competition from the barred owl (*Strix varia*). Spotted owls will use younger, managed forests provided that key habitat components are available. These younger forests provide dispersal habitat for owls and foraging habitat if near nesting or roosting areas.

Recurring wildfires have impacted spotted owl habitat on the Deschutes NF. For example, the Link and B&B fires in 2003 destroyed a total of 10,492 acres of habitat for spotted owls, including 2,710 acres of critical habitat within CHUs OR-3 and OR-4. Smoke from very large wildfires was implicated in increased mortality to spotted owls in one study area in California (Tilghman and Paton 1988).

A Programmatic Wildlife Biological Assessment (Programmatic BA) for the DES-OCH (USDA Forest Service 2006) identifies breeding season limited operating periods near northern spotted owls. Table 95 lists the disturbance and disruption distances for nesting spotted owls. If disturbance-causing activities occur farther away from nesting spotted owls than the distances specified in Table 68, then no adverse effect will occur. Breeding period is from March 1 – September 30.

**Table 68.** Disturbance and disruption distances for nesting spotted owls.

| Activity | Disturbance Distance | | |
|---|---|---|---|
| | Breeding period (March 1 – Sept. 30) | Spotted owl critical breeding period (March 1 – July 15) | Remainder of the spotted owl breeding period (July 16 – Sept. 30) |
| Use of Chainsaws | 440 yards (0.25 mile) | 65 yards | 0 yards |
| Use of Heavy Equipment | 440 yards (0.25 mile) | 35 yards | 0 yards |

There are a total of 1,275 acres of nesting, roosting, and foraging habitat within 40 project area units for invasive plant treatment, the majority of which are roadside treatments. Of these suitable acres, there are only 413 acres of project area units that plan to use mechanical treatments, in combination with other treatments.

Three project area units propose some mechanical treatment within 35 yards of spotted owl core areas. A total of 181 acres of these spotted owl core areas are in these project area units.

### *Critical Habitat in the Action Area*

There is designated critical habitat only on the Deschutes NF. Twenty-five project areas include portions of critical habitat units (CHUs) OR-3 through OR-7. A total of 2,502 acres of critical habitat are included within project area units (project file GIS query). Of these 2,500 acres, 423 acres of critical habitat are within project area units that propose using mechanical treatments, in combination with other treatments.

## Forest Service Sensitive Species

Terrestrial wildlife species found in the project area that are included in the Region's "Special Status/Sensitive Species Program" are listed in Table 69. The "Special Status/Sensitive Species Program" and the Regional Forester's Sensitive Species List are proactive approaches for meeting the Agencies obligations under the Endangered Species Act and the National Forest Management Act (NFMA), and National Policy direction as stated in the 2670 section of the Forest Service Manual and the U.S. Department of Agriculture Regulation 9500-4. The primary objectives of the Sensitive Species program are to ensure species viability throughout their geographic ranges and to preclude trends toward endangerment that would result in a need for federal listing. Species identified by the FWS as "candidates" for listing under the ESA, and meeting the Forest Service criteria for protection, are included on the Regional Forester's Sensitive Species Lists.

**Table 69.** Wildlife species within the project area that are included on the Regional Forester's Sensitive Animal List (July 2004).

| Common Name | Scientific Name | Occurrence[1] | | |
|---|---|---|---|---|
| **Mammals** | | **DES** | **OCH** | **CRNG** |
| California wolverine | *Gulo gulo* | D | D | |
| Pacific fisher[2] | *Martes pennanti* | D | | |
| Pygmy rabbit | *Brachylagus idahoensis* | S | S | S |
| **Birds** | | | | |
| Horned grebe | *Podiceps auritus* | D | | |
| Red-necked grebe | *Podiceps grisagena* | S | | |
| Bufflehead | *Bucephala albeol* | D | D | D |
| Harlequin duck | *Histrionicus histrionicus* | D | | |

| Common Name | Scientific Name | Occurrence[1] | | |
|---|---|---|---|---|
| Yellow rail | *Coturnicops noveboracensis* | D | | |
| Upland sandpiper | *Bartramia longicauda* | | S | |
| Greater sage grouse | *Centrocercus urophasianus* | D | D | Extirp |
| American peregrine falcon | *Falco peregrinus anatum* | D | S | |
| Gray flycatcher | *Empidonax wrightii* | S | D | D |
| Tricolored blackbird | *Agelaius tricolor* | D | S | S |
| **Amphibians** | | | | |
| Oregon spotted frog | *Rana pretiosa* | D | | |
| Columbia spotted frog | *Rana luteiventris* | | D | D |
| **Invertbrates** | | | | |
| Crater Lake tightcoil | *Pristiloma arcticum crateris* | D | | |

1 – **DES** = Deschutes NF; **OCH** = Ochoco NF; **CRNG** = Crooked River National Grassland;
**D** = Documented – in the context of the Forest Service sensitive species program, an organism that has been verified to occur in or reside on an administrative unit.
**S** = Suspected – in the context of the Forest Service sensitive species program, an organism that is thought to occur, or that may have suitable habitat, on Forest Service land or a particular administrative unit, but presence or occupation has not been verified.
**Extirp** = extirpated from the CRNG in 1950s.
2- Included via its listing as a federal candidate species.

## Bald Eagle

The bald eagle ranges throughout much of North America, nesting on both coasts and north into Alaska, wintering as far south as Baja California. The largest breeding populations in the contiguous United States occur in the Pacific Northwest states, the Great Lake states, Chesapeake Bay and Florida. Oregon and Washington are important for wintering bald eagles in the conterminous United States. The project area provides wintering habitat for migratory eagles as well as residents.

### *Life History and Habitat Description*

Detailed accounts of habitat requirements of the bald eagle may be found in the Pacific Bald Eagle Recovery Plan (U.S. Fish and Wildlife Service 1986).

Bald eagles are most common along coasts, major rivers, lakes and reservoirs (U.S. Fish and Wildlife Service 1986), and require accessible prey and trees for suitable nesting and roosting habitat (Stalmaster 1987). Food availability, such as aggregations of waterfowl or salmon runs, is a primary factor attracting bald eagles to wintering areas and influences the distribution of nests and territories (Stalmaster 1987). Bald eagles feed primarily on fish during the breeding season, and eat waterfowl, seabirds and carrion during the winter (U.S. Fish and Wildlife Service 1995).

Bald eagles usually nest in trees near water, but are known to nest on cliffs and (rarely) on the ground. Nest sites are usually in large trees along shorelines in relatively remote areas that are free of disturbance. The trees must be sturdy and open to support a nest that is often 5 feet wide and 3 feet deep. Adults tend to use the same breeding areas year after year, and often the same nest, though a breeding area may include one or more alternative nests (U.S. Fish and Wildlife Service 1999).

Wintering eagles can be found concentrated at salmon spawning areas and waterfowl wintering areas. Wintering eagles can sometimes be found in large communal roosts during the winter. Isolation is an important feature of winter habitat and night roosts are usually in remote areas with less human disturbance. In Washington, 98 percent of wintering eagles tolerated human activity at a distance of 300 m (328 yards), but only 50 percent tolerated activity within 150 m (164 yards) (Stalmaster and Newman 1978).

### *Threats*

Currently, mortality to bald eagles occurs from habitat loss, disturbance by humans, pesticide and mercury contamination, decreasing food supply, electrocution, impacts with wind turbines, and illegal shooting (U.S. Fish and Wildlife Service 1999, Wiemeyer et al. 1993). Human disturbance can flush eagles from a nest. Nesting can fail if disturbance is frequent (U.S. Fish and Wildlife Service 1999).

A recent threat to bald eagles is mortality caused by a new disease, avian vacuolar myelinopathy (AVM) (USDI Fish and Wildlife Service 1999). AVM, first reported in 1994, has been the cause of death for at least 100 bald eagles (and 1,000s of American coots) at 11 sites from Texas to North Carolina. A recent hypothesis implicates a type of 2004). The cyanobacteria are thought to produce a neurotoxin that is fatal to herbivorous birds and their avian predators. Mortalities caused by AVM can have localized impact on bald eagles but there is currently no evidence that the overall recovery of the population is affected (U.S. Fish and Wildlife Service 1999).

### *Conservation*

Bald eagles are still protected by The Bald and Golden Eagle Protection Act, The Lacey Act, and The Migratory Bird Treaty Act. With the delisting of the bald eagle imminent, the Fish and Wildlife Service released new National Bald Eagle Management Guidelines (USFWS 2007). The guidelines contain recommendations for avoiding disturbance to nesting, roosting, and foraging eagles. The activity and distance recommendations are generally 660 feet away from nest for activities such as building construction, mining, chainsaw operation, and clearing of vegetation. Topography, visibility from the nest, and ongoing similar activities in the area are modifying factors and some activities may occur as close as 330 feet from the nest.

Agencies are also directed by the Recovery Plan to address the issues of forested habitat management, prey species management, forest insect risk management, and contingency planning for wildfire risks to eagle habitat. Additional biological and management direction specific to Forest Service managed lands is available in the Bald Eagle Species Management Guide for Region 6 (Rees and Lee 1990).

### *Action Area Information*

The Recovery Plan designated Recovery Zones for each state. The action area occupies three Recovery Zones: Zone 9 - Blue Mountains, Zone 11 - High Cascades, and Zone 22 - Klamath Basin. The main threats identified by the Recovery Plan for Zone 9 are riparian logging, loss of perch and roost trees, human recreation, shooting, trapping, possible poisoning, and loss of anadromous fish populations. In Zone 11, the threats are recreation disturbance, logging, shooting, and trapping. Threats for Zone 22 are shooting, logging, pesticides, land development, and human disturbance. However, since the plan's approval, new habitat issues have evolved: in recent years, large potential nesting or roosting trees (e.g., ponderosa pine and Douglas-fir) have been significantly impacted by insect, disease, blowdown, wildfire, and timber harvest.

Table 68 outlines the reproductive history of the bald eagles within the action area. Data have been collected since 1971. This table displays data from 1996-2005.

**Table 70.** Reproductive results and numbers of nestlings observed from bald eagle pairs or nests on the Deschutes and Ochoco National Forests from 1996 to 2005. Key on following page.

| Bald Eagle Pair Name | Ownership | Year Nest First Located or Info Collected | Status 96 | Status 97 | Status 98 | Status 99 | Status 00 | Status 01 | Status 02 | Status 03 | Status 04 | Status 05 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Antelope Flat Res. | ONF | 1998 | N/A | N/A | oF | F | 1 | 1 | 2 | 1 | 1 | 1 |
| Miller Lake | ONF | 1999 | N/A | N/A | N/A | A? | 2 | 2 | 1 | oF | oF | oF |
| Rock Creek Lake | ONF | 1992 | 1 | 1 | 2 | 1 | A? | 1 | oF | 2 | 2 | 1/c |
| Shady Creek Res. | ONF | 1997 | N/A | oF | 2 | 2 | 2 | *oF | O? | F | 2 | 1 |
| Wolf Creek | ONF | 1998 | N/A | N/A | oF | 2 | 1 | 2 | 2 | 2d | 2 | 1 |

| Bald Eagle Pair Name | Ownership | Year Nest First Located or Info Collected | Status 96 | Status 97 | Status 98 | Status 99 | Status 00 | Status 01 | Status 02 | Status 03 | Status 04 | Status 05 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Benchmark Butte | DNF | 1971 | F | oF | 2 | 2 | NS | NS | OF | F | Of | oF |
| Big Bend | DNF | 2003 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | oF | 2 | 2 |
| Browns Creek | DNF | 1971 | 1 | 2 | F | 2 | 2 | 2, ND | 2 | 1 | F | 1 |
| Browns Crossing | DNF | 2001 | N/A | N/A | N/A | N/A | N/A | N/A | oF | oF | oF | U |
| Browns Mt. | DNF | 1975 | 1 | 2 | 1 | 2 | F | oF | F | oF | oF | oF |
| Cloverdale | DNF | 1986 | oF | oF | oF | O? | 1 | 2 | 2 | 2 | 2 | 2 |
| Crane Prairie NE | DNF | 1971 | oF | oF | oF | oF | O? | CG,O? | O? | GG,U | CG,U | CG |
| Crane Prairie Res E | DNF | 1971 | oF | oF | 2 | 2 | oF | 2 | 1 | 1 | 2 | O |
| Crane Prairie Res S | DNF | 1971 | 2 | 1 | F | 2 | oF | F | 1 | 2 | F/c | 1 |
| Crane Prairie Res SW | DNF | 1993 | 1 | 1 | 2 | 1 | F/c | 2 | F | 1 | 2 | oF |
| Crane Prairie W | DNF | 1974 | 2 | 2 | 1 | F | oF | oF | 1 | F | 1 | 1 |
| Crescent Lake | DNF | 1971 | F | 1 | oF | 2 | F | F | 1 | oF | F | oF |
| Cultus River | DNF | 2000 | N/A | N/A | N/A | N/A | F | 1 | 2 | 2 | 1 | 1 |
| Davis Creek | DNF | 1971 | TD, F | oF | 1 | 2 | 1 | oF | 1 | 2 | 2 | 2 |
| Davis Lake NW | DNF | 1973 | oF | 2 | F | oF | F | 1 | 1 | 1/n | *oF | 2 |
| Davis Lake SE | DNF | 1971 | F | oF | oF | F | 2 | *2 | oF | 2/n | 1/s | 2 |
| Davis Lake W | DNF | 1985 | RT | al | al | al | al | al | 1 | 1 | 2 | 1 |
| Deschutes R. Oxbow | DNF | 1990 | 1 | 1 | oF | 1 | 2 | F | 1 | 1 | 1 | 2 |
| East Lake | DNF | 1973 | 1 | 1 | oF | oF | 2/c | oF | oF | oF | 1 | O |
| Eaton Butte | DNF | 1981 | oF | oF | 1 | 1 | 2 | 2 | 2 | 1 | 1 | F |
| Flat Top | DNF | 1997 | N/A | 1 | oF | 2 | 2 | 1 | 2 | 2 | 1 | O |
| Hosmer Lake/Elk Lk | DNF | 1971 | oF | oF | 2 | 1 | 2 | 2 | 2 | 2 | O? | 1 |
| Lava Flow | DNF | 1993 | 1 | F | 1 | 1 | 1 | 2 | 2 | 1 | oF | oF |
| Lava Lake | DNF | 1987 | oF | oF | oF | oF | oF | 2 | oF | F | 2 | 1 |
| Monty Camp/Eyerly | DNF | 1981 | oF | 2 | 1 | F | F | 2 | 1/n | oF | 1 | O? |
| Odell Creek/Resort Ridge | DNF | 2004 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 2 | 2 |
| Odell Lake NE | DNF | 1979 | NL | NL | NL | 2 | NL | NL | NL | Of | oF | oF |
| Odell Lake NW/W | DNF | 1976 | 2 | 1 | 2 | 1 | 1 | 2 | F/j | *2d | 1 | oF |
| Odell Lake SE | DNF | 1978 | 1 | F | 1 | 2 | oF | oF | 1 | F | 1 | 1 |
| Pebble Bay/Breezy Point/Crystal Creek | DNF | 1997 | | 1 | F | 1 | 1 | 2 | 2/j | 2 | oF | oF |
| Pengra Pass | DNF | 1998 | | | 1 | 1 | F | 1 | 2 | 2 | 1 | 1 |
| Quinn River/Lemish Butte | DNF | 1972 | 1 | 1 | 1 | F | oF | 2 | oF | oF | Of | oF |
| Round Swamp | DNF | 1971 | oF | oF | 1 | 2 | oF | F | 2 | 2,ND/n* | 2/s | 1 |
| Spring Creek | DNF | 1996 | F | F | oF | 1 | F | 2 | 1/n | 1 | 1d | 1 |
| Suttle Lake | DNF | 1971 | 1 | 1 | 2 | oF | oF | 2 | 1 | 1d/n | A?/s | 2 |
| Tetherow Meadow | DNF | 1988 | F | oF | 1 | 1 | 1 | 1 | F | F | 1 | 1 |
| Tranquil Cove | DNF | 2002 | N/A | N/A | N/A | N/A | N/A | N/A | 1 | 2d | 1 | 2 |
| Triple Thunder | DNF | 1975 | 2 | 2 | 2 | NS | 1 | 1 | 2 | 2 | 1 | 2 |
| Wickiup Dam | DNF | 1980 | 2 | 2 | 2 | 1 | 2 | 1 | oF | 1 | 1 | F |
| Wickiup Res N | DNF | 1971 | oF | 1 | oF | 1 | 2 | F | 2 | oF | oF | oF |
| Wickiup Res S | DNF | 1978 | F | 1 | 2 | oF | oF | oF | oF | oF | 2 | 2 |
| Wizard Falls | DNF | 1995 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2d | 2 |
| Wuksi Butte | DNF | 1993 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 2 |

| Bald Eagle Pair Name | Ownership | Year Nest First Located or Info Collected | Status 96 | Status 97 | Status 98 | Status 99 | Status 00 | Status 01 | Status 02 | Status 03 | Status 04 | Status 05 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

Sources: Isaacs and Anthony, 2004; Forest records.
**A** = Active outcome unknown; evidence of eggs observed, outcome
**al** = Alternate outcome unknown; evidence of eggs observed; outcome not determined
**CG** = Nest used by Canada Geese
**/c** = Nest used or locations uncertain; need to determine territories
**/d** = Downy
**F** = Failure; nest with evidence of eggs, but no fledged young (active or nesting failure)
**GH** = Nest used by great horned owls
**/n** = Nest tree burned in wild
**N** = Nest no longer exists
**ND** = Nest down
**NS** = Site not surveyed not determined
**O?** = Eagle(s) observed; no nest located, outcome unknown or eagles associated with another site
**oF** = Site occupied, at least one adult and a nest observed during breeding season; no evidence of eggs or young (occupied or breeding failure)
**TD** = Nest tree blown down or the top broke out; tree can no longer support a nest
**U** = Site unoccupied
j = Camera installed

The Deschutes National Forest LRMP (USFS 1990c) identified Bald Eagle Management Areas (BEMAs), which have specific requirements for maintenance and protection of eagle habitats. A total of 21,891 acres are included in 33 BEMAs across the Deschutes, Ochoco, and Crooked River National Grassland (CRNG). BEMAs include existing or historic nest sites and are closely associated with lakes and streams. No BEMAs have been established to protect roost sites on the Deschutes NF. There are specific standards and guidelines in the Deschutes NF LRMP (WL-1-3 and M3-1-38) that provide management direction for BEMAs.

The Ochoco NF LRMP (USFS 1989, Part 1) contains direction specific to bald eagle winter roost sites (MA-F12) and does not contain specific direction for nest sites. A total of 570 acres contained in 5 areas are designated for management for winter bald eagle roost sites. The CRNG LRMP (USFS 1989, Part 2) does not identify any bald eagle management sites. At the time of completion of these LRMPs, there were no known bald eagle roost areas or nest sites on the CRNG or nest sites on the Ochoco NF. Since the publication of these LRMPs, five bald eagle nesting territories have been discovered on the Ochoco NF. As new nesting territories are discovered, nest plans are being written which designate BEMAs. To date, the Ochoco has one BEMA in draft stage (M. Feiger, personal communication, 2006). In 1998, a plan was written for the Shady Creek and Sugar Creek territories. In addition, bald eagles are currently foraging and day roosting year round on the CRNG (Roberts, A, pers. comm. 2006).

The Recovery Plan requires that the cooperating agencies design and implement plans on a site-specific basis throughout the recovery area. On the Deschutes NF, site-specific management plans have been completed on the following BEMAs: Benchmark Butte, Browns Creek, Browns Mountain, Cloverdale, Crane Prairie Reservoir East, Crane Prairie Reservoir Northeast, Crane Prairie Reservoir West, Davis Creek, Eaton Butte, North Twin Lake, Round Swamp-Wickiup Reservoir South, Wickiup Butte, and Wickiup Reservoir North. Site-specific plans for BEMAs associated with Davis Lake, Wickiup South, Crescent, and Odell Lake include adjacent nest and alternate nest sites as well as those within the BEMA. Other BEMA plans are nearing completion, including Oxbow and Bates Butte, and the Wickiup Butte plan is being updated. The Ochoco NF has completed a site-specific management plan for one winter roost sites (Sugar Creek) and for two nest territories (Rock Creek Lake and Shady Creek).

Table 71 summarizes the occurrence and number of bald eagle BEMAs, nest sites, and roosts within the project area.

**Table 71.** Approximate numbers of bald eagle nest sites and roosts in the project area.

| Administrative Unit | BEMAs | Nest Sites | Winter Roosts |
|---|---|---|---|
| Deschutes | 33 | 46 | unknown |
| Ochoco | 2 | 5 | 5 |
| CRN Grassland | 0 | 0 | 0 |

A Programmatic Wildlife Biological Assessment (Programmatic BA) for the DES-OCH (USDA/USDI 2006b) identifies nesting and winter limited operating periods near bald eagles. Table 93 lists the disturbance distances for nesting and wintering eagles. If disturbance-causing activities occur farther away from nesting or roosting eagles than the distances specified in Table 70, then no adverse effect will occur. These distances are greater than those recommended in the new Bald Eagle Management Guidelines (USFWS 2007). Nesting season is January 1 to August 31. Winter roosting occurs between November 1 and April 30$^{th}$.

**Table 72.** Disturbance distances for bald eagle within which adverse effects may occur, as specified by FWS office in Bend, Oregon.

| Activity | Dates | Distance |
|---|---|---|
| Human disturbance above base levels | January 31 – August 31 | 0.25-mile no line-of sight, or 0.50-mile line-of-sight |
| Activities with potential to disturb winter roosts | November 1 – April 30 | 400 m |

There are a total of 27 bald eagle sites within 0.5 mile of treatment areas and 17 sites within 0.25 mile. All sites will involve the presence of operators or crews. Eight sites within 0.25 mile propose the use of mechanical equipment (motorized string trimmers). One additional project area proposing use of a string trimmer is located within 0.5 mile of an eagle site.

The proposed treatments within 0.5 miles of eagle sites are primarily along roads that have infestations of invasive plants; two project areas are along lake shores and one is in a meadow.

Currently, there are no invasive plants adversely affecting bald eagles in the project area.

### California Wolverine

Wolverine range in the contiguous United States is thought to include Idaho, Montana, Oregon, Washington, Wyoming and possibly California (U.S. Fish and Wildlife Service 2003b). In California, Oregon and Washington, the wolverine inhabits various forest types in remote wildernesses with adequate food (Banci 1994). Wolverines inhabit dense coniferous forests and use open sub-alpine forests up to and beyond timberline. Typically, they use high elevation alpine wilderness areas in the summer and montane forest habitats in the winter. They are associated with rocky outcrops, steep mountainous areas and transition zones between primary cover types. Forested riparian zones at upper elevations are likely to be important forage habitats for these furbearers and provide relatively safe travel corridors that allow for animals to move within and between watersheds. They most commonly use areas with a high diversity of microhabitats and high prey populations. Prey items include small and medium-sized mammals, birds and their eggs, insects, fish, roots, berries, and carrion.

Wolverines are known to regularly avoid human generated disturbance, and are sensitive to any disturbance; they will move natal den-sites several miles if disturbance is in the area of their den.

### *Action Area Information*

Carnivore surveys were conducted across the Crescent District in 1993-1996 and 1998 using baited camera sets, snow tracking and track plates. There were no detections of wolverine from these surveys. There are past records of wolverines from both the Deschutes and Ochoco National Forests. Wolverine habitat is not mapped on the forests. The higher elevation and more dense forests preferred by wolverines are not typically impacted by invasive plants, except along road shoulders. Wolverines generally are not found in the disturbed sites in which invasive plants occur.

**Fisher**

In April 2004, the FWS determined that federal listing for the West Coast Distinct Population Segment (DPS) of the fisher was "warranted, but precluded by other higher priority listing actions" (U.S. Fish and Wildlife Service 2004a). This DPS includes Washington, Oregon, and California.

Populations in Washington are thought to be extirpated, or contain only remnant scattered individuals. In Oregon, the fisher apparently has been extirpated from all but two portions of its historical range (Aubry and Lewis 2003). Within Oregon the two known extant populations are in the southwestern portion of the state: one in the southern Cascade Range that was established through reintroductions of fishers from British Columbia and Minnesota that occurred between 1961 and 1981, and one in the northern Siskiyou Mountains of southwestern Oregon that is presumed to be an extension of the population in northern California. Genetic testing has revealed the populations are isolated from each other (Aubry et al 2005). The same study revealed juvenile male fishers are capable of long distance dispersal with one collared male relocating to the Crescent Ranger District in the summer of 1999 having traveled fifty-five kilometers from point of capture on the Rogue River National Forest. The radio signal from this animal was lost in December 1999 and it is unknown if this animal is still alive on the district or where it may have eventually occupied a territory.

Threats to the fisher include loss and fragmentation of habitat, mortalities and injuries from incidental captures, decreases in prey base, increasing human disturbance, and small isolated populations. Pacific fishers have more habitat specific requirements than other forest carnivores. Fishers use landscapes containing primarily coniferous forests with dense canopies, old growth (or large trees), and ample downed woody material (Powell and Zelinski 1994), yet ecological relationships between fisher and habitat are largely unknown.

Fishers are opportunistic hunters and will eat a wide variety of prey. Prey items used by fisher include porcupines, small mammals, birds and their eggs, a few reptiles and amphibians, insects, nuts, fruit, and carrion (Powell and Zielinski 1994). Fishers use a variety of resting sites such as hollow logs, rock piles, and snow dens, but the maternal den is almost always in a tree.

### *Action Area Information*

Carnivore surveys were conducted across the Crescent District in 1993-1996 and 1998 using baited camera sets, snow tracking and track plates. There were no detections of fishers from these surveys. The 1999 telemetry data remains the only confirmed fisher data on the Crescent District. There is no known or confirmed reproducing population of fishers within the action area. Any fishers that could occur within the project area are likely to be solitary transient individuals. Like the wolverine, the dense canopy forests most likely used by fishers are not heavily impacted by invasive plants, except along road shoulders. They would not be expected to be found in disturbed sites in which invasive plants occur.

**Pygmy Rabbit**

The pygmy rabbit is an extreme habitat specialist and is the smallest native rabbit in the U.S. Pygmy rabbits typically occur in dense stands of big sagebrush growing in deep loose soils. An isolated population occurs in Douglas County, Washington, has been classified by the USFWS as a “distinct population segment”, and is federally listed as endangered. The Washington population may be extirpated in the wild and remaining wild rabbits were captured for a captive breeding program (U.S. Fish and Wildlife Service 2004b).

Pygmy rabbits also occur within the Great Basin in Oregon, but this population is not federally listed. Pygmy rabbits are highly dependent upon big sagebrush (*Artemesia tridentata*) for food, thermal cover, and protection from predation (U.S. Fish and Wildlife Service 2005b, McAdoo et al. 2004). While big sagebrush is the main food of this species, native grasses and forbs are also eaten in mid-late summer.

These rabbits may be active at any time of the day or night. Predation is the main cause of pygmy rabbit mortality, which can be very high on an annual basis (U.S. Fish and Wildlife Service 2005b).

Pygmy rabbits dig their own burrows and need deep loose textured soils for burrow construction. Breeding season can occur in February or March and young are born about a month later. They can have up to three litters per year, with four to eight young per litter (Csuti et al. 1997). They are relatively slow and subject to predation in open areas. Accordingly, pygmy rabbits tend to stay close to their burrows and have small home ranges, but home range size and movement distance is variable (U.S. Fish and Wildlife Service 2005b). Because of their hesitancy to cross open areas, habitat fragmentation readily isolates populations. Habitat degradation and fragmentation are the primary causes of decline. Agriculture, livestock grazing and associated developments, type conversions of big sagebrush to livestock forage, prescribed and wild fires, invasive plants, and roads also degrade their habitat. The invasive cheatgrass (*Bromus tectorum*) is of particular concern because it invades the understory of big sagebrush shrubs making a critical habitat site unsuitable for the rabbit (Weiss and Verts 1984). Cheatgrass and other invasive plants replace important forage species, introduce a perpetuating fire cycle into big sagebrush habitat (Whisenant 1990), may reduce predator detection, impede movement, and limit dispersal of the pygmy rabbit. McAdoo et al. (2004) stated that weed control is an example of the highest priority habitat treatments for sagebrush-associated wildlife.

A petition to list the pygmy rabbit occurring in the conterminous Intermountain and Columbia Basin region as threatened or endangered was submitted to the USFWS in April 2003. The USFWS published a 90-day finding in May 2005 and concluded that the petition did not provide substantial information indicating that listing may be warranted (U.S. Fish and Wildlife Service 2005b).

### *Action Area Information*

Pygmy rabbits are suspected to occur on both the Deschutes and the Ochoco NFs where suitable habitat exists, but none have been documented. Most suitable habitat occurs on the CRNG. One pygmy rabbit may have occurred on the Grassland in 1992, but only potential burrows have been documented since then (USFS 2004e). An intensive survey of the last known site was completed in April 2003 and rabbit signs were found, but no pygmy rabbits were sighted. The model WILDHAB was used to estimate about 29,800 acres of potential pygmy rabbit habitat on the Grassland, based on vegetation (USFS 2004e). Because pygmy rabbits have specific soil needs in order to dig burrows, not all of the above acres would provide suitable burrow habitat. Potential pygmy rabbit sites, with suitable vegetation and soil for burrowing are much more restricted. All but one of the potential pygmy rabbit sites are within grazing exclosures on the Grassland (Roberts, A., pers. comm. 2006).

Invasive plants are currently degrading habitat for the pygmy rabbit within the action area. Two treatment area units are within suitable pygmy rabbit habitat on the CRNG. One unit, 75-44, is infested with spotted knapweed and is within suitable vegetation, but not in suspected burrow habitat. This site is outside of any exclosures for pygmy rabbits. This site would likely be treated with people utilizing backpack sprayers, or with a horse-mounted spray hose. It may be treated with an ATV-mounted spray hose if an exception to off-road vehicle use is obtained. In all cases, the application would be a spot spray on the target vegetation and non-target vegetation would be avoided to the fullest extent practical.

The other site on the CRNG, project area unit 75-54, is within an exclosure, but not within the suspected burrow site. The infestation is diffuse knapweed that is growing in a previously burned area. Recent burn areas are not suitable pygmy rabbit habitat (U.S. Fish and Wildlife Service 2004b). This site would be treated using backpack sprayers.

**Horned Grebe**

Horned grebes breed from Alaska and northern Yukon south to eastern Oregon and Idaho. The species' winter range extends along the Pacific coast from the Aleutian Islands to Baja California. Rarely, horned grebes will breed east of the Cascade Range in Oregon (Marshall 2003). Nesting habitat is found in tall vegetation in shallow water.

*Action Area Information*

Horned grebes migrate through the Deschutes National Forest, and may be observed at Wickiup Reservoir during October and November as they move to winter habitat areas. Potential breeding habitat for both grebe species exists at high-elevation lakes and ponds within the action area, but no known breeding sites are located within the project area.

There are seven project areas that include or are adjacent to grebe winter locations or potential habitat. One site proposes to use biological controls and the other six sites propose to use a combination of herbicide, manual, mechanical, and cultural techniques.

**Red-necked Grebe**

The red-necked grebe is the second largest grebe in North America. The species breeds from British Isles east to Siberia and in North America from central Alaska south to eastern Oregon and Idaho (Spencer 2003). The only consistent breeding population in Oregon is found at the Upper Klamath Lake National Wildlife Refuge (Spencer 2003). They nest on a floating platform of fresh and decaying reeds which is built by both parents in shallow water on marshy lakes and ponds, and winter along the Pacific Coast. They feed on small fish, aquatic insects and their larvae, amphibians, and mollusks (Spencer 2003).

Wetland habitat loss has been suggested as the primary cause of population decline in the Pacific Northwest.

*Action Area Information*

Potential breeding habitat for both grebe species exists at high-elevation lakes and ponds within the action area, but no known breeding sites are located in the project area.

There are seven project areas that include or are adjacent to grebe winter locations or potential habitat. These are the same sites listed above for the horned grebe. One site proposes to use biological controls and the other six sites propose to use a combination of herbicide, manual, mechanical, and cultural techniques.

**Bufflehead**

The bufflehead is a tree-nesting, diving duck whose population has declined throughout some of its range due to clear cutting, over harvest of habitat, and in some locations throughout its range, over-hunting (Marshall et al. 2003). It is still harvested in Washington and Oregon. For nesting, it uses mountain lakes surrounded by woodlands with snags (mostly aspen, but it will use Ponderosa Pine and

Douglas-Fir). Buffleheads are common in Oregon and Washington during winter, but are rare during the breeding season. Most breeding occurs in Alaska and Canada. In Oregon, buffleheads use a high preponderance of artificial nest boxes. Buffleheads eat animal matter, with common diet items including aquatic insects and larvae, physid snails, fish and sometimes herring eggs or salmon carrion. They also eat seeds of aquatic plants, such as smartweed, alkali bulrush, and sago pondweed (Marshall et al. 2003).

#### *Action Area Information*

Buffleheads have been documented on the CRNG as winter migrants and consistently at Haystack and Rimrock Springs Reservoirs (Roberts, A., personal communication, 2006). On the Crescent Ranger District buffleheads are commonly seen on Odell Lake, Crescent Lake, Davis Lake, and on the nearby Wickiup Reservoir nearly year-round or until freeze-up. Bufflehead have been observed year-round on large reservoirs, including Crane Prairie. They have also been observed on some of the high elevation lakes and ponds in the Oregon Cascades Recreation Area during the summer months. Nesting occurrence is unknown. Buffleheads have routinely been observed on many of the small lakes on the Sisters RD with the potential for breeding habitat to occur in the Meadow Lakes area and Round Lake.

### Harlequin Duck

Harlequin Ducks are an oceanic species that nest inland along swift flowing rivers and streams. They winter along rocky ocean coastlines. Harlequin ducks nest along fast-flowing rivers and mountain streams in the Cascade Range of Oregon and Washington. Nests are generally scooped depressions lined with down, and are located on exposed shelves of logs or root wads or on natural ledges on slopes or cliffs near water (Marshall et al. 2003). It is hunted in Washington and Oregon. Harlequin ducks forage heavily on caddisflies, and will also eat some mayflies and stoneflies (Marshall et al. 2003). They apparently eat fish only rarely.

#### *Action Area Information*

Harlequin ducks are not known or suspected to occur on the Ochoco National Forest. On the Deschutes, potential breeding habitat includes areas along the Deschutes and Little Deschutes Rivers, and perhaps along some creeks.

### Yellow Rail

The yellow rail breeds from central and eastern Canada south to New England and Great Lakes region. The Pacific Northwest populations are extremely limited and were thought to have disappeared early this century. Oddly, it is listed as a game species in Oregon, but is not present in fall.

Yellow rails inhabit freshwater marshes and wet meadows with a growth of sedges, usually surrounded by willows, and often with standing water up to a foot deep during the breeding season. Yellow rails begin nesting in Oregon by May. Nest is a cup covered with a canopy attached to emergent plants above water levels. Habitat includes native sedge, rush, reedgrass (*Calmagrostis* sp.), and tufted hairgrass (*Deschampsia* spp.) (Stern and Popper 2003).

It is very secretive, and little is known about its habits in Oregon. Rails have been mainly detected through its vocalizations during breeding season. Winter residence of Oregon populations of yellow rail is unknown, but the species will winter in and migrates through freshwater and brackish marshes, dense, deep grass, and grain fields (NatureServe 2003).

Yellow rails are reported to eat invertebrates, seeds of sedges and rushes, and freshwater snails (Stern and Popper 2003), but diet information for Oregon is not available.

#### *Action Area Information*

There is a small breeding population of yellow rails at Big Marsh on the Deschutes NF, Crescent District. There are about three acres of reed canarygrass proposed for treatment at Big Marsh, primarily in ditches that are part of a hydrologic restoration program. The majority of reed canarygrass infestation at Big Marsh is not proposed for treatment at this time. The infestations nearest the yellow rail nesting habitat are not scheduled for treatment. However, actually nesting locations of yellow rails varies annually based on available water in the marsh. Invasive plants will be treated with manual and cultural methods.

Since yellow rails do not nest in reed canarygrass (Kittrell, personal communication), reed canarygrass may be reducing available nesting habitat for yellow rails at Big Marsh.

### Upland Sandpiper

Upland sandpipers generally nest in extensive, open tracts of short grassland habitat, including native prairie, dry meadows, pastures, domestic hayfields, short-grass savanna, plowed fields, along highway rights-of-way and on airfields. Preferred habitat includes large areas of short grass for feeding and courtship with interspersed or adjacent taller grasses for nesting and brood cover. The species migrates along shores and mudflats, and winters in South America (NatureServe 2006).

They are one of Oregon's rarest breeding birds (the core breeding area in the U.S. is North Dakota and surrounding states) (Stern 2003). They are not found in Oregon away from breeding grounds. Insects are their primary food.

#### *Action Area Information*

Upland sandpipers are not known to occur within the action area on either forest or the CRNG, but are suspected to occur on the Ochoco. They occur on private land adjacent to the forest, and the forest has some potential habitat, but upland sandpipers have not been verified to occur on the Ochoco NF (Steele, D., personal communication, 2006).

### Greater Sage Grouse

Historically, around 220 million acres of sagebrush-steppe vegetation types existed in North America (McArthur and Ott 1996), making it one of the most widespread habitats in the country. Much of this habitat, however, has been lost or degraded over the last 100 years. For example, in the interior Columbia River Basin, total acreage in sagebrush steppe habitat has been reduced from about 40 million acres to 26 million acres, representing a loss of about 35 percent since the early 1900s (Hann et al. 1997). Most remaining sagebrush-steppe ecosystems in Oregon are on public lands managed by BLM.

Greater sage grouse (hereafter simply called sage grouse) have been extirpated in British Columbia and in five states (Arizona, New Mexico, Oklahoma, Kansas, and Nebraska), and is "at risk" in six states (Washington, California, Utah, Colorado, North Dakota, and South Dakota) and in the Canadian provinces of Alberta and Saskatchewan (U.S. Fish and Wildlife Service 2003a). In five states (Oregon, Nevada, Idaho, Wyoming, and Montana), long-term population declines have averaged 30 percent since 1950.

Specifically in Oregon, sage grouse were common to abundant in the non-forested areas east of the Cascades during much of the 19th century, but began to decline by the late 1890s (Crawford 1982). Populations recovered a little later, with birds being abundant in 1918 and early 1919, but a major die-off occurred in mid-1919 (Crawford 1982). By 1940, sage grouse occupied only half their historic range in Oregon, and numbers declined 60% between the late 1950s and the early 1980s (Crawford and Lutz 1985).

Prineville District BLM has local sage grouse information associated with the High Desert of Central Oregon (Hanf et al. 1994). This document describes seasonal use areas determined from analysis of radio telemetry data that was collected from 1988-1993. The telemetry study continued in 1994 and 1995.

On February 7, 2003, the FWS announced a 90-day finding on a petition to list the western sage grouse under the Endangered Species Act of 1973, as amended. The FWS found that the petition does not present substantial scientific or commercial information indicating that listing this subspecies may be warranted, on the basis that there is insufficient evidence to indicate that the western population of sage grouse is a valid subspecies or a Distinct Population Segment (U.S. Fish and Wildlife Service 2003a).

A Greater Sage grouse and Sagebrush Habitat Conservation Team, consisting of state and federal agencies, private landowners, conservation groups and academics, was established in 2001 to craft a comprehensive set of planning guidelines for sage grouse and sagebrush habitats in Oregon. Sage grouse and Sagebrush-Steppe Ecosystem Management Guidelines have been developed (USDI BLM et al. 2000). The primary goal of the guidelines is to maintain existing sagebrush-steppe habitats in order to sustain sage grouse populations and protect options for future management. Roland and Wisdom (2002) compiled known and needed information about sage grouse in Oregon.

#### *Habitat Requirements*

The sage grouse population in the High Desert of Central Oregon is thought to be non-migratory, but has been observed to move extensively between seasonal use areas, and may therefore require large areas of sagebrush habitat with sufficient suitable habitat between to provide connectivity (Hanf et al. 1994).

#### *Reproductive Season*

Sage grouse breed on sites called leks (strutting grounds) in March-April. The same lek sites tend to be used year after year. They are established in open areas surrounded by sagebrush, which is used for escape and protection from predators.

Habitats used by pre-laying hens are also part of the general breeding habitat. These areas provide forbs that are high in calcium, phosphorus, and protein, all of which are necessary for egg production. The condition and availability of these areas are thought to have a significant effect on reproductive success (Barnett and Crawford 1994).

Most sage grouse nests are located under sagebrush plants (Crawford et al. 2004; Schroeder et al. 1999; Wallestad and Pyrah 1974); however, nests have been found under other plant species (Connelly et al. 1991, Gregg 1991). Optimum sage grouse nesting habitat consists of a healthy sagebrush ecosystem complete with sagebrush plants and an herbaceous understory composed of grasses and forbs. Generally, the sagebrush stands contain plants 40 to 80 cm (16 to 32 in.) tall with a canopy cover ranging from 15 to 25 percent and an herbaceous understory of at least 15 percent grass canopy cover and 10 percent forb canopy cover that is at least 18 cm (7 in.) tall. Ideally, these vegetative conditions should be on 80 percent of the breeding habitat for any given population of sage grouse.

Sage grouse nesting and early brood-rearing occurs in April-June; this is a critical time for sage grouse.

Early brood-rearing generally occurs relatively close to nest sites; however, movements of individual broods may be highly variable. Brood rearing habitat also consists of sagebrush stands that are 40 to 80 cm (16 to 32 in.) tall with a canopy cover of 10 to 25 percent and an herbaceous understory of 15 percent grass canopy and 10 percent forb canopy. For brood rearing, however, this type of habitat need only be found on at least 40 percent of the area. Hens with broods may use relatively open sagebrush habitats having less canopy cover (about 14 percent) than optimum nesting habitat (Martin 1970, Wallestad 1971), but need an understory canopy cover of at least 15 percent of grasses and forbs

(Sveum et al. 1998). Hens with broods tend to select habitats having a wide diversity of plant species that tend to provide an equivalent diversity of insects that are important chick foods.

Late brood-rearing occurs June-October. Sage grouse broods use a variety of habitats from summer through fall. In June and July, as sagebrush habitats dry and herbaceous plants mature, hens usually move their broods to moister sites in or adjacent to sagebrush cover where more succulent vegetation is available (Connelly and Markham 1983; Connelly et al. 1988; Fischer et al. 1996). Examples of such habitats include low sagebrush (*Artemisia nova*; *A. arbuscula*) plant communities, wet meadows and riparian areas (Connelly et al. 1988; Connelly and Markham 1983; Martin 1970).

#### *Winter Habitats*

As fall progresses, sage grouse move towards their winter ranges and shift their diet primarily to sagebrush leaves and buds (Connelly et al. 1988, Connelly and Markham 1983, Patterson 1952, Wallestad 1975). The exact timing of this movement varies, depending on the sage grouse population, geographic area, overall weather conditions, and snow depth.

Sage grouse winter habitats, used in November-February, are relatively similar throughout most of their range. Because their winter diet consists almost exclusively of sagebrush (primarily leaves and buds), winter habitats must provide adequate amounts of sagebrush, and canopy heights must be sufficient so that leaves and buds are exposed at least 25 to 30 cm (10 to 12 in.) above snow level (Hupp and Braun 1989). If snow covers the sagebrush, the birds move to areas where sagebrush is exposed. Therefore, good winter habitat consists of sagebrush with 10 to 30 percent canopy cover on 80 percent of the wintering area.

Hanf et al. (1994) found that grouse in the Central Oregon study area congregated in large groups during the winter and used mountain big sagebrush and low sagebrush most frequently. During the winter of 1992-93, snow was on the ground for 3-4 months and accumulated up to a depth of 1.2 m. Sage grouse moved out of low sagebrush plant communities and into mountain big sagebrush plant communities where plants would still be accessible. Millican Valley was especially important to sage grouse during severe winters, as not as much snow accumulates there as in surrounding areas due to its lower elevation and rain shadowing by Horse Ridge. Twice as much snow accumulated in nearby Brothers (approx. 1.2m) during the winter of 1992-93 than in Millican Valley (40-55 cm).

#### *Threats to the Species*

Major threats to the species are habitat conversion and degradation. Numerous activities have adversely impacted, and continue to impact, the distribution and quality of sage grouse and their habitat. In addition, natural events and the human response to them could directly impact sage grouse and their habitat. Declines in sage grouse populations have been linked to agricultural conversion, rangeland conversion, livestock management, wildfire, prescribed fire, fire rehabilitation, structure and infrastructure development, juniper expansion, and invasions of exotic species (Blus et al. 1989; Braun 1987; Braun 1998; Connelly et al. 2000; Mack and Thompson l982; Pellant 1990; Peterson 1970; Quigley and Arbelbide 1997; Swensen et al. 1987; Valentine 1990; Wallestad 1975; Wisdom et al. 2002).

Cheatgrass (*Bromus tectorum*) invasion has particularly degraded sage grouse habitat by altering fire cycles in the sagebrush-steppe ecosystem and converting sagebrush habitat to rangeland dominated by an annual exotic grass (Connelly et al. 2000). The presence of cheatgrass fills in voids between shrubs and will carry frequent fires in the same areas. The frequent fires prohibit re-establishment of the big sagebrush and create cheatgrass monocultures that are unsuitable for sage grouse.

Additional threats include herbicide and insecticide use (Braun 1998; Connelly et al. 2000). Insecticide application to alfalfa fields in Idaho resulted in mortality to sage grouse that fed on contaminated insects (Blus et al. 1989). Herbicides were commonly used in sage grouse habitat until the early 1980s in order to reduce cover of sagebrush and increase livestock forage. The habitat alterations created areas unsuitable for sage grouse. Available literature on the effect of herbicide applications is limited to the effects of sagebrush reduction or removal (Braun 1998; Connelly et al. 2000; McCarthy and Kobriger 2005).

West Nile Virus is known to be lethal to sage grouse and Oregon Department of Fish and Wildlife (ODFW) reported the first mortalities to sage grouse in Oregon in August 2006. Currently, the disease seems to be affecting only those sage grouse around Burns Junction. ODFW plans further monitoring and blood samples of sage grouse in Oregon.

*Action Area Information*

Sage grouse were extirpated from the Crooked River National Grassland in the 1950s. Sage grouse occur on a few areas on the Ochoco National Forest. The use on the forest is limited to chicks and brooding females, there are no known leks. There are several leks on private land near the forest that serve as the source for the birds that occur on the forest. These leks are monitored annually and are generally stable in size (Steele, pers. comm., 2006). Sage grouse on the Deschutes NF are limited to the Bend/Fort Rock District. Sage grouse use in this area consists of nesting and brooding (Zalunardo, pers. comm., 2006).

Proposed treatments include treatment of non-native invasive plants only and will not treat native sagebrush or forb habitat. There are seven project area units containing or within 300 feet of potential sage grouse habitat. These are roadside treatments; some include treatments within forest or disturbed areas adjacent to roads. All units propose a combination of herbicide and manual treatments and three units also include some biological controls.

**American Peregrine Falcon**

Peregrine falcons are crow/raven-sized raptors that inhabit cliffs located within approximately 0.5 mile of riparian habitat. Peregrines nest on ledges clear of rock rubble, located approximately 40 - 80 percent of total cliff height. Peregrines are aerial predators who feed mostly on birds. Much of the prey consists of species the size of pigeons and doves; however avian prey ranges in size from hummingbirds to Aleutian Canada geese (Pagel, unpub. data).

Peregrines lay 2-4 eggs in March-May, and commence incubation after the clutch is complete. Eggshell thinning induced by the metabolite of DDT (DDE), affected populations in the Pacific Northwest and elsewhere, and residual levels of DDE continue to affect the reproductive success of peregrines. Reproductive failure at peregrine nests has been chronic in northern CA and OR at all nest sites since at least 1983 due to eggshell thinning.

Eggs hatch after an incubation period of 31-33 days. Fledging occurs when the young are between 37 and 45 days of age (56 days at the upper end). Juveniles continue to be fed and protected by the adults until they disperse, which can range from 3 weeks to 3 months (Davis unpub. data, Pagel unpub. data).

Adults (or subadults in some instances) at lower and medium elevation nest sites occupy the nesting territory for the remainder of the year until the next nesting season commences at the winter solstice. In extreme instances, the adult(s) temporarily abandon the territory due to cold temperatures and/or significant reduction of availability of avian prey. During this period, the peregrines will travel to coastal, or central valley areas of CA, OR, and WA (Pagel unpub. data).

Peregrine falcons can be disturbed by human activity during the nesting season (Pagel unpub.data). Disturbance can cause: nest sites and new territories to be abandoned; active nesting attempts to fail due to egg breakage; or divert adult attention from opportunities to forage and feed nestlings (Pagel unpub. data).

Peregrine falcons were delisted in 1999 and the FWS has committed to monitor populations nationwide five times at three-year intervals and report results. The FWS released in October 2006 the results from the first post-delisting monitoring effort conducted in 2003. This report found that there were 3,005 nesting pairs of peregrines in the United States, Canada, and Mexico, compared to 1,705 pairs at the time of delisting (U.S. Fish and Wildlife Service 2006).

Invasive plants do not directly affect peregrine falcons. Peregrine falcons in the Pacific Northwest are most affected by bioaccumulation of contaminants, and direct disturbance to their nesting at known or suspected nest sites; both which have caused numerous nesting failures during the previous 20 years of observation (Pagel unpub. data).

#### *Action Area Information*

There are no known peregrine falcon nests within the action area, but individual birds have been sighted. Forest wildlife sighting records list one peregrine report from Davis Lake during the fall however this may have been a migrant. Clowers (2004) reported seeing an adult peregrine hunting near Wickiup Dam during the late winter of 2003-2004 and 2 fledgling peregrines hunting near Reservoir Campground on Wickiup Reservoir in August 2004. Potential nesting habitat is present in the lava flow near Davis Lake, in the upper Little Deschutes River canyon, and on Maiden Peak. One survey for nesting peregrines was conducted on the Crescent RD in April 2005 on the lava flow near Davis Lake but no peregrines were observed. Peregrines have been sighted in the Tumalo Creek drainage, Benham Falls and possibly Pine Mountain. Surveys were conducted on the Bend Fort Rock District according to the Regional protocol in 2001 however, no peregrines were detected. One historic eyrie occurs near Benham Falls. Surveys were conducted on the Sisters RD near Castle Rocks with negative results. The CRNG conducted surveys for peregrine falcons in 1994 and the Ochoco NF conducted surveys in the 1980s; no peregrine nests were found.

### Gray Flycatcher

Gray flycatchers are uncommon in Oregon and Washington, but may be fairly common in specific locations (Marshall et al. 2003). They are locally fairly common in dry habitats in other areas of the western United States. In northern Washington, gray flycatchers inhabit dry open ponderosa pine stands with extensive bitterbrush and bunchgrass understories. Tree size ranges from small (6" diameter breast height) to large (40" diameter breast height). In central Oregon, they are commonly found in juniper, sage, and bunchgrass habitat. The common factor seems to be scattered vertical structure of evergreen trees over an extensive shrub and grass understory (savannah). They are migratory and spend winters in Arizona and Mexico, leaving breeding grounds by the end of September (Csuti et al. 2001). Gray flycatchers take insects on the wing and by foraging on the ground.

#### *Action Area Information*

Gray flycatchers have been documented on the CRNG and Ochoco National Forest. On the Grassland, surveys conducted in 2003 and 2004 found gray flycatchers nesting and foraging on the edge between juniper woodlands and openings with grass and shrubs (USFS 2004e).

### Tricolored Blackbird

Tricolor blackbirds are distributed from southern Oregon south through northern Baja, California. It is rare in Oregon, and prefers to breed in freshwater marshes with emergent vegetation (cattails) or in thickets of willows or other shrubs. In Oregon, it has bred in Himalayan blackberry growing in and around wetlands. It is often found breeding in the company of red-winged blackbirds; tricolor blackbirds breed in April after migrating to Oregon breeding grounds. The nest is made up of plant fibers attached to emergent vegetation or secured in a thicket of shrubs (Beedy and Hamilton 1999). This blackbird is colonial rather than territorial, defending only a few feet from the nest. After breeding season, it forms large flocks. Most of Oregon's tricolored blackbirds winter in California (Beedy and Hamilton 1999).

Tricolored blackbirds forage in pastures, lightly grazed rangelands, grain fields, and hay fields for insects, seeds and grass (Spencer 2003). Insect availability is an important factor in breeding colony location.

#### *Action Area Information*

Tricolored blackbirds are listed as “occasional” during fall, spring, and summer and “uncommon” during winter in the local brochure, “Common Birds of the Ochoco Region” (USDA 2001). There are no known sightings on the CRNG, although there are some known colonies within one half mile from the Grassland boundary in the Lone Pine area (Shunk 2003). Tricolored blackbirds generally are found in the Ochoco and CRNG area during migration. There is insufficient suitable breeding habitat to support nesting colonies (Steele, pers. comm. 2006).

Tricolored blackbirds are documented on the Deschutes NF, but sightings are extremely rare and there are no known breeding colonies. Potentially suitable habitat is present along the shoreline of Davis Lake, Wickiup Reservoir, Big Marsh, and along the Little Deschutes River. No formal surveys for this species have been conducted.

### Oregon Spotted Frog

The Oregon spotted frog once occurred from southwest British Columbia through western Washington and Oregon into northeastern California, but has been declining throughout its historic range. It is estimated to have been lost from >70% of its historic range (Hayes 1997, McAllister and Leonard 1997, Pearl and Hayes 2005). It currently occurs is found in three localities in British Columbia, four localities in Washington and approximately 24 localities in Oregon.

Hypothesized causes for the decline of the Oregon spotted frog include loss of habitat from altered hydrology due to agriculture, urbanization and water development; predation by exotic fish and amphibians, intensive livestock grazing; and physiological effects from changes in water chemistry (Hayes 1997, Watson et al. 2003, U.S. Fish and Wildlife Service 2004c, Pearl and Hayes 2005). Insecticide contamination (DDT and carbaryl) has also been implicated in decline of spotted frogs (Kirk 1988; Bridges and Semlitsch 2000). Introduced bullfrogs (*Rana catesbeiana*) and predatory fish have been implicated in the decline of native ranid frogs as well (Hayes and Jennings 1986, Hayes 1997, Pearl et al. 2004).

It has been suggested that invasive plants have negatively affected Oregon spotted frogs at some locations. For example, the Oregon spotted frog is no longer found where reed canarygrass has invaded several historical sites in the Willamette Valley and Puget Lowlands (Hayes 1997). In one study in Washington, transmittered spotted frogs used areas of reed canarygrass less than would be expected by its coverage (Watson et al. 2003). Observations in Oregon suggest spotted frog breeding may be more susceptible to desiccation in reed canarygrass-dominated microhabitats (C. Pearl, R. Roninger, personal communication, 2007).

The Oregon spotted frog is associated with relatively large wetland complexes. They are considered highly aquatic, and are found near vegetated edges of ponds or lakes, and also within the algae-grown overflow pools of streams (Blaustein et al. 1995; McAllister and Leonard 1997). This species is found near warmer wetland communities consisting of relatively un-shaded marshes, or ponds and streams with sedges, rushes, and grasses. Microhabitats where eggs are deposited are typically dry by mid- to late summer, range in depth from 2 to 14 in. during the breeding season, and are vegetated by low-growing emergent species such as grasses, sedges and rushes. After breeding, adults disperse into adjacent wetland and riparian habitats. Adults hibernate in streams, oxbows and springs.

The Oregon spotted frog exhibits strong fidelity to breeding sites and often deposits eggs in the same locations in successive years. It deposits egg masses in still, shallow waters atop submergent herbaceous vegetation or among clumps of herbaceous wetland plants. Oregon spotted frogs eat arthropods, earthworms and other invertebrate prey, as well as occasional vertebrate prey. They are apparently one of the few frog species that will prey on the larvae of western toads (*Bufo boreas*) (Pearl and Hayes 2002). Predators of the species include mink, river otter, raccoon, herons, bitterns, corvids, garter snakes, dragonfly larvae, and predacious diving beetles (McCallister and Leonard 1997).

Environmental stressors such as insecticides (Bridges and Semlitsch 2000, Bridges 1999), fertilizers (Marco et al. 1999), and heavy metals (Lefcort et al. 1998) may slow reactions or cause behavioral changes that make spotted frog tadpoles more vulnerable to predation. One study suggests that the herbicide formulation Roundup combined with stress from predator cues may be more lethal to some amphibian species than Roundup alone (Relyea 2005). However, this study did not report the effects from the aquatic formulations with contain glyphosate alone, so the effect reported could be due to the surfactant (polyethoxylated tallowamine) found in Roundup, rather than from the active ingredient glyphosate. Studies comparing toxicity of Roundup to aquatic formulations, which contain only glyphosate and water, demonstrate that the surfactant is responsible for the toxicity (Mann and Bidwell 1999, Perkins et al. 2000).

Other life history, habitat requirements, diet, predators, threats, causes of population decline, and population information can be found in U.S. Fish and Wildlife Service (2004c) and is incorporated by reference.

### *Action Area Information*

In the project area, the species can be found in areas of the Upper Deschutes Watershed including the Little Deschutes River, Crescent Creek, Long Prairie Creek, headwaters of the Deschutes River, Snowshoe Lakes, Crane Prairie Reservoir, Wickiup Reservoir, the Deschutes River between the reservoirs, Little Cultus Lake Marsh, Big Marsh and Big Marsh Creek, Odell Creek, and Davis Lake.

In 1994 Oregon spotted frog surveys were conducted on selected streams and marshes on the Crescent Ranger District (Hayes 1995). Oregon spotted frogs were confirmed in Big Marsh, Odell Creek and Ranger Creek. Greater than 300 frogs were counted in Big Marsh but only small populations (<10 individuals) on Odell Creek and Ranger Creek. Hayes (1995) stated spotted frog habitat was limited in Odell Creek and Ranger Creek because brook trout were present, stream temperatures were cold, and side channels were limited that offer warm shallow water habitat needed by frogs. In 2004 another inventory was conducted on Odell Creek and Ranger Creek to determine if Oregon spotted frogs were still present in these streams 10 years after the first survey. District wildlife personnel confirmed 2 sub-adult and 1 adult spotted frogs in Odell Creek between East Davis campground and the confluence of Odell Creek and Davis Lake. There were no observations of spotted frogs or egg masses in Ranger Creek in 2004. Two new small populations of spotted frog adults and egg masses were also confirmed in the Little Deschutes River near Highway 58 during inventories conducted in 2001 and 2003 (Branum, pers. comm. 2005). The greatest concentration of Oregon spotted frogs on the Crescent district occurs within Big Marsh. Inventories conducted in Big Marsh every year since 1997 with the exception of 2002. In the spring of 2006 counted over 1,600 egg masses. Big Marsh is the site of an active wetland restoration program.

Invasive plants such as reed canarygrass are capable of eliminating suitable habitat for the frog (Hayes 1997, Pearl and Hayes 2004, Cushman and Pearl 2007) and reed canarygrass poses a primary threat to spotted frog habitat from invasive plants within the project area (C. Pearl, personal communication).

Small populations of reed canarygrass throughout the Upper Deschutes watershed are recommended to be high priorities for management (C. Pearl, personal communication).

The Programmatic Biological Assessment (USDA Forest Service and USDI Bureau of Land Management 2006b) includes project design criteria (equivalent to PDF) for Columbia and Oregon spotted frogs. Most of the project design criteria discuss maintaining habitat features, such as hydrologic regime, required by the frogs. One project design criteria states, "Use of pesticides, herbicide, and similar potential contaminants are prohibited in and immediately adjacent to wetland habitat. Applications of these herbicides should be conservative when estimating drift to avoid any contamination." The application of this project design criteria from the programmatic BA must be qualified in regards to invasive plants. It is important to maintain suitable habitat by controlling invasive plants in spotted frog habitat. There is no mandated regulatory response required for deviating from the project design criteria in the Programmatic BA because spotted frogs are not federally listed or proposed. However, consultation with FWS biologists is being conducted for this project and the analysis for spotted frogs will be made available to FWS. Local biologists will be consulted prior to implementation of invasive plant treatments (spotted frog PDF).

There are 10 project area units that include or are within 100 feet of Oregon spotted frog habitat. Project area units are proposed to be treated with a combination of manual, cultural, mechanical, and herbicide methods. The project area units include lakeside and wetland areas as well as roadsides and one quarry. The lakeside and wetland treatments have the greatest potential to include areas where Oregon spotted frogs may be present.

### Columbia Spotted Frog

The Great Basin Distinct Population Segment (DPS) of the Columbia spotted frog is a federal candidate for listing. This DPS is found in Oregon, Idaho, and Nevada. One study estimated that Columbia spotted frogs are no longer found at almost 50% of historical localities in southeastern Oregon and northeastern Nevada (Wente et al. 2005). The Columbia spotted frog is considered FS sensitive and has been documented on the Malheur, Ochoco, Umatilla, and Wallowa-Whitman NFs. This species was once considered to be included in *Rana pretiosa*, with the Oregon spotted frog. Genetic data separated the two current species (Green et al. 1996). Threats to the species include mining, livestock grazing, road construction, agriculture, and direct predation by bullfrogs and non-native fishes (Reaser and Pilliod 2005; U.S. Fish and Wildlife Service 2004d).

Columbia spotted frogs are also highly aquatic and usually stay near permanent, quiet water. They occur along the grass and sedge margins of streams, lakes, ponds, springs, and marshes. Breeding habitats include a variety of relatively exposed, shallow-water (<60 cm), emergent wetlands such as sedge fens, riverine over-bank pools, beaver ponds, and the wetland fringes of ponds and small lakes. Vegetation in the breeding pools generally is dominated by herbaceous species such as grasses, sedges and rushes. After breeding, adults often disperse into adjacent wetland, riverine and lacustrine habitats. Columbia spotted frogs are capable of long movements, including across uplands (Bull and Hayes 2001). Columbia spotted frogs range from southeastern Alaska to central Nevada, east to Saskatchewan, Montana, western Wyoming, and north central Utah. In Washington, the species is known to occur at elevations ranging between 520 m (1720 ft.; near Rock Lake, Whitman Co.) to 950 meters (6400 ft.; at Hart's Pass, Whatcom Co.).

Other aspects of life history, habitat requirements, diet, predators, and causes of population decline are likely to be similar to those of the Oregon spotted frog.

#### *Action Area Information*

Columbia spotted frogs occur on the CRNG and Ochoco NF. The species is widespread within the upper Crooked River watershed and is found in the Ochoco and the Maury Mountains as well as in lower elevation ponds and streams including the upper Crooked River mainstem and tributaries of the Crooked River. It can also be found in stock ponds.

Invasive plants such as reed canarygrass are capable of eliminating suitable habitat for the frog (Hayes 1997, Pearl and Hayes 2004, Cushman and Pearl 2007) and reed canarygrass poses a primary threat to spotted frog habitat from invasive plants within the project area (C. Pearl, personal communication).

The discussion of the project design criteria in the Programmatic BA and its applicability to this project are as discussed above for the Oregon spotted frog.

There are 46 project area units that include or are within 100 feet of Columbia spotted frog habitat. Project area units are proposed to be treated with a combination of manual, cultural, mechanical, and herbicide methods. Project area units are primarily roadside treatments.

**Crater Lake Tightcoil Snail**

The Crater Lake Tightcoil is a Survey and Manage species of the NWFP that has been given Sensitive Species status on the Deschutes National Forest and is included on the Region 6 Sensitive Species list.

"The Crater Lake Tightcoil may be found in perennially wet situations in mature conifer forests, among rushes, mosses and other surface vegetation or under rocks and woody debris within 10 m of open water in wetlands, springs, seeps and riparian areas, generally in areas which remain under snow for long periods during the winter. Riparian habitats in the Eastern Oregon Cascades may be limited to the extent of permanent surface moisture, which is often less than 10 m. from open water" (Duncan et al. 2003).

Threats to the species include activities that compact soils, reduce litter and/or vegetative cover, or impact potential food sources (i.e. livestock grazing, heavy equipment use, off-road vehicles, and camping on occupied habitats). Fluctuations from removal of ground vegetation on ground temperature and humidity may be less extreme at higher elevations and on wetter sites, but no studies have been conducted to evaluate such a theory. These snails appear to occur on wetter sites than general forest conditions, so activities that would lower the water table or reduce soil moisture would degrade habitat (Burke et al. 1999).

Intense fire that burns through the litter and duff layers is devastating to most gastropods, and even light burns during seasons when these animals are active can be expected to have more serious impacts than burns during their dormant periods. Snowmobiling or skiing would impact these snails if snow, over their occupied habitats, is compacted losing its insulative properties and allowing the litter or ground to freeze (Burke et al. 1999).

Surveys were conducted using Version 2.0 protocol from the fall of 1998 through the fall of 2002. These surveys occurred both in and outside of riparian areas since little was known about the species. The new survey protocol (Version 3.0) was introduced in February of 2003, and subsequent survey efforts were modified to meet requirements of the new protocol. Version 3.0 states that surveys are required only in perennial wet areas (Duncan et al. 2003).

Most *Pristiloma* on the Deschutes NF (Sisters RD) have been located along perennial streams within 15 feet of the water's edge. Streams within the project area that are intermittent, lack of riparian vegetation, and have low moisture content in adjacent areas do not contain suitable habitat for mollusk species.

Due to the well draining pumice soils on the Crescent Ranger District, areas that retain permanent surface moisture are very narrow margins along the edge of springs, seeps, or streams. Ranger Creek, Odell Creek, Maklaks Creek, Crescent Creek, Little Deschutes River, Trapper Creek, Dell Springs, and the shorelines of Odell Lake, Crescent Lake, and Davis Lake provide permanent sources of water. At the present time there is only one confirmed population of Crater Lake Tightcoil snails on the

Crescent Ranger District. That population was located near the confluence of Princess Creek and Odell Lake in June 1999.

**Table 73.** Mollusk survey results.

| Project | Year | District | Known Sites |
|---|---|---|---|
| Bugs | 1998 | Sisters RD | No |
| Bugs | 1999 | Sisters RD | No |
| Beetle | 1999 | Sisters RD | No |
| Suttle Lake | 1999 | Sisters RD | No |
| Springtail | 1999 | Sisters RD | No |
| Lower Jack | 1999 | Sisters RD | No |
| First Creek Cottonwood | 2002 | Sisters RD | Yes |
| Bull Trout Rest. (Phase 1) | 2003 | Sisters RD | Yes |
| Bull Trout Rest. (Phase 2) | 2003 | Sisters RD | Yes |
| Seven Buttes | 1999 | Crescent RD | Yes |
| Seven Buttes | 2000 | Crescent RD | No |
| Big Marsh | 2000 | Crescent RD | No |
| Big Marsh | 2001 | Crescent RD | No |

Inventories for this species are incomplete; not all suitable habitat has been surveyed. Based on available data, riparian areas on the Sisters RD will be considered suitable habitat for the Crater Lake tightcoil. Current and future treatment projects can be expected to occur in suitable habitat.

Invasive plant species that tend to dry out sites more than native vegetation may degrade habitat. Invasive plants in riparian zones that do not alter soil moisture or the substrate preferred by these snails may not affect their habitat.

## Management Indicator Species

Management Indicator Species (MIS) are selected species whose welfare is believed to be an indicator of the welfare of other species using the same habitat or a species whose condition can be used to assess the impacts of management actions on a particular area (Thomas 1979). Table 74 includes those species that were identified as MIS for the Deschutes and Ochoco National Forests, and the Crooked River National Grassland (USFS 1990, and USFS 1989). Aquatic MIS are discussed in the aquatic species specialist's report.

Species identified as MIS were selected because their welfare could be used as an indicator of other species dependent upon similar habitat conditions. Indicator species can be used to assess the impacts of management actions on a wide range of other wildlife with similar habitat requirements.

MIS are discussed below. The bald eagle is sensitive to management in riparian areas. The northern spotted owl represents wildlife species associated with mature and older coniferous forests. The bald eagle and northern spotted owl have been discussed above under the section titled "Federally Listed Species." Peregrine falcon and wolverine have been discussed above under the section titled "Forest Service Sensitive Species."

**Table 74.** Deschutes and Ochoco National Forest Management Indicator Species.

| Common Name | Scientific Name | Deschutes | Ochoco | CRNG |
|---|---|---|---|---|
| **Birds** | | | | |
| Bald Eagle | *Haliaeetus leucocephalus* | X | | |
| Golden Eagle | *Aquila crysaetos* | X | | |
| Northern Goshawk | *Accipiter gentilis* | X | | |
| Cooper's Hawk | *Accipiter cooperii* | X | | |
| Sharp-shinned Hawk | *Accipiter striatus* | X | | |
| Red-tail Hawk | *Buteo jamaicensis* | X | | |
| Northern Spotted Owl | *Strix occendentalis caurina* | X | | |
| Great Gray Owl | *Strix nebulosa* | X | | |
| Peregrine Falcon | *Falco peregrinus anatum* | X | | |
| Osprey | *Pandion haliaetus* | X | | |
| Great Blue Heron | *Ardea herodias* | X | | |
| Pileated Woodpecker | *Dryocopus pileatus* | | X | |
| Northern Flicker | *Colaptes auratus* | | X | X |
| Primary Cavity Excavators | see below | X | X | |
| Waterfowl | see below | X | | |
| **Mammals** | | | | |
| American Marten | *Martes martes* | X | | |
| Deer and Elk | see below | X | | |
| Townsend's Big-eared Bat | *Corynorhinus townsendii* | X | | |
| Wolverine | *Gulo gulo* | X | | |

### Golden Eagle

Golden eagles inhabit open country with cliffs and are found in all counties east of the Cascade Range (Carey 2003). It also inhabits some areas within and west of the Cascades. Golden eagles forage primarily in open shrub habitat that provides food and cover for their prey. Prey items include lagomorphs, squirrels, woodrats, salmon and medium to large birds. Nests are primarily on cliffs and ledges, but some tree nests are also used. Golden eagles vary in response to disturbance near nest sites. Some eagles can become accustomed to significant recreation disturbance near nests, while others pairs may move away or abandon nests if disturbed (Carey 2003).

Golden eagles are relatively common within the project area. Many project area units include or are adjacent to suitable foraging habitat. Two project area units are near historic nest sites on the Deschutes NF. No project area units are in close proximity to currently known nest sites.

Invasive plants are not known to be specifically affecting golden eagle habitat.

### Northern Goshawk

The goshawk is associated with mature and late-successional forests. Suitable habitat includes foraging, nesting, and post-fledging family area habitat. All mature and late-successional habitats are considered potential nesting habitat and earlier forested seral stages are considered potential foraging habitat. Moist mixed conifer and moist ponderosa pine late-successional areas are preferred habitats, although forest structure appears to be the more limiting factor to goshawk habitat rather than stand composition (i.e. tree species). Preferred nest stands have a minimum of 40% canopy closure; and the nest sites within these stands have >60% canopy closure (Reynolds et al. 1991).

Goshawk prey varies by region and consists of a variety of small to large birds and chipmunks, squirrels and hares. Surveys have been conducted on the Deschutes NF and goshawk nest territories occur near Willamette Pass and Ringo Butte. Individual goshawks have been seen on Hamner Butte and Royce Mountain, but no nests were found. Additional goshawk sites include Black Pine spring, Merideth, Indian Ford, Jack Creek, Lower Bridge, and Six Creek.

Invasive plants are not affecting northern goshawk habitat.

### Cooper's and Sharp-shinned Hawks

These hawks often use dense cover in which to hunt and nest. Cooper's hawks tend to select nest sites in dense second growth of mixed conifer or ponderosa pine stands (Jackman and Scott 1975). Moore and Henney (1983) noted that this species would routinely utilize mistletoe brooms as nesting sites. Sharp-shinned hawks utilize thickets in mixed conifer and deciduous woods. Generally, nesting habitat has been grouped into 3 types by Reynolds (1976): young, even-aged conifer stands with single-layered canopies; mature, old-growth stands of mixed conifer with multi-layered canopies; and dense stands of aspen.

In Oregon, the diet of the sharp-shinned hawk is almost entirely small birds, but occasional small mammals are taken. Cooper's hawks eat more mammals than sharp-shinned hawks and prey on birds as well.

No formalized surveys have occurred for these two species in the project area, however, both have been documented on the Deschutes NF, with 25 locations for Cooper's hawks and 14 for sharp-shinned hawks. Documentations were gathered from sightings from surveys for other species or from casual observations. Known nest sites are rare, with a total of four for Cooper's hawk and one for sharp-shinned hawk. Invasive plant treatment sites in proximity to known sites for these hawks include treatment areas 11-26, 11-38, the Road 22 corridor and treatments along Pine Street in Sisters.

Invasive plants are not affecting habitat for these two hawks, although some of their prey could be adversely affected by large infestations.

### Red-tail Hawk

The red-tailed hawk is found throughout the state in every habitat and at every elevation, although they are scarce in dense forests (Marshall et al. 2003 p. 156). They are perch hunters (trees, utility poles, etc.) and inhabit mixed country of open areas interspersed with woods (agricultural areas, grasslands, woodlands, meadows). They roost in dense conifers and nest in large conifer snags often in the tallest tree on the edge of the timber (Jackman and Scott 1975). They feed mainly on small to medium prey including ground squirrels, cottontails, voles, pocket gophers, snakes (Marshall et al. 2003 p.157) but may also take larger mammals (skunks), birds, reptiles, and insects (Jackman and Scott 1975).

Past harvest activities had produced habitat conditions favorable for red-tailed hawks by clear-cutting stands adjacent to mature and late-seral stands. This provided open areas for foraging adjacent to potential roosting and nesting habitat. Numerous sightings have occurred throughout the project area although no formal surveys have been conducted.

Invasive plants are not affecting habitat for red-tailed hawks, but some of their prey could be adversely affected by large infestations.

### Great Gray Owl

This species was identified in the Northwest Forest Plan (NWFP) (USDA/USDI 1994b) as a protection buffer species requiring surveys due to an apparent range expansion resulting from opening up dense-canopied stands with shelterwood type harvest activities. A Regional survey protocol was developed in 1995 and was updated in January of 2004 (Version 3.0). An amendment to the NWFP occurred in 2001 which moved the great gray owl from a protection buffer species to a Category C species. This category contained uncommon species for which pre-disturbance surveys are practical.

Therefore, surveys are conducted at the project level prior to habitat disturbing activities. All known nest sites will be managed according to Management Recommendations; however these have not been established to date.

This species is associated with mature stands associated with meadows or like openings. Mixed conifer/lodgepole pine/mountain hemlock communities associated with meadows are considered the preferred habitat for this species. Recent studies in the Blue Mountains (Bull and Henjum 1990, Bull et al. 1988) have shown that owls will inhabit openings created by timber harvest activities, especially those that mimic natural gaps.

Great gray owls hunt from perches and can detect prey by sound alone which allows capture of prey beneath the snow. They utilize small prey, primarily pocket gophers and voles. Great gray owls forage in openings, along forest edges, or in open understory stands. Bull and Henjum (1990) found them utilizing forested stands with less than 59% canopy cover in eastern Oregon while Goggans and Platt (1992) found the birds using recent regeneration harvest units (0-10 years) on the west-slope of the Cascades until these sites became too dense. This habitat is ephemeral in nature but it may allow occupancy of habitat due to the proximity to suitable nesting habitat. Bryan and Forsman (1984) found that meadows where snow persisted beyond mid-April were not occupied. Snow conditions may not allow successful foraging due to the formation of a thick icy crust during this period. This finding may suggest that great gray owl habitat is more likely to be found in the mid to lower elevations of the project area (3,000-4,000 ft.).

Great gray owls do not build their own nests and are dependent on structures built by other species (i.e. ravens, red-tailed hawks, goshawk and Cooper's hawks) or existing substrate like broken top snags or mistletoe platforms. Great gray owls in this region show a high site fidelity to their nest site and exhibit only short seasonal movements. Bull and Henjum (1990) found that great grays prefer to nest in mature and old stands with a fairly open understory and a dense overstory. However, the availability of nest sites and suitable foraging habitat and their proximity to one another seem to dictate use by great grays.

Potential nesting habitat within the project area occurs in mature to old stands in close proximity to foraging habitat. Foraging habitat is widespread.

Great gray owl surveys have been conducted on the Deschutes NF. See Table 75 for more information on survey area and year. In addition, responses have been detected while conducting spotted owl surveys.

**Table 75.** Great gray owl survey areas, year surveys were conducted, and results.

| Survey Area | Years Surveyed | Results |
|---|---|---|
| Suttle | 1996 | None located |
| McCache | 1998, 1999 | None located |
| Metolius Basin | 2001, 2002 | One nest located |
| Black Butte (part of Metolius Basin) | 2002, 2003 | None located |
| Eyerly | 2003 | One auditory response |
| B&B Fire Recovery area | 2004 | Three new nests located, auditory responses detected at one known historic site, and a single detected at the other historic site. |
| Five Buttes | 1999, 2000, 2004, 2006 | None located |
| Davis Fire Recovery area | 2003, 2006 | None located |

Some species of invasive plants (e.g. Scotch broom, blackberry) may degrade foraging habitat for great gray owls and possibly adversely affect prey populations in specific meadows.

### Osprey

Osprey are specialized for catching fish. They nest near lakes and rivers in the tops of large snags or they may use artificial platforms if available. Their main prey is live fish – slow-moving species that swim near the surface. However, they may also take other vertebrate species (birds, reptiles, and small mammals) but this represents a very small proportion of their diet (Csuti et. al. 2001).

More than 40 nest sites are documented within the Deschutes NF, and upwards of fifteen historic nests were present along the Metolius River (district files). It is unknown how many nests are actually present or active each year as annual surveys are not conducted and nest sites frequently shift. Larger lakes with fish (Suttle, Dark, Blue, Scout, Round) and larger streams provide suitable habitat for ospreys for both nesting and foraging. Proposed invasive plant treatments are within ¼ mile of 13 nest sites along the Metolius River and potentially near nest sites at Odell Lake, Crescent Lake, Davis Lake and others.

Invasive plants are not affecting habitat for osprey.

### Great Blue Heron

The great blue heron is one of the most wide-ranging waterbirds in Oregon (Marshall et al. 2003). Highly adaptable, it is found along estuaries, streams, marshes and lakes throughout the state. Nest locations are determined by their proximity to suitable foraging habitat. Great blue herons nest in colonies within shrubs, trees and river channel markers where there is little disturbance (Marshall et al. 2003). Tree species they could utilize in the project area include ponderosa pine, Douglas fir, big-leaf maple, hemlock, and black cottonwood. While the average diameter of nest trees is 4.5 feet and the average height is 79 feet, they use a wide range of sizes from 1.5 to 6 feet in diameter and 43 to 120 feet tall (Marshall et al. 2003). They hunt shallow waters of lakes and streams, wet or dry meadows feeding on fish, amphibians, aquatic invertebrates, reptiles, mammals and birds. There is one active rookeries on the Deschutes NF on the western shore of Crane Prairie. Project area unit 11-77 is located near this rookery. There is an inactive rookery west of Davis Lake. Interestingly, this rookery became inactive in 2001 when a breeding pair of red-tailed hawks moved into the rookery. Great blue herons are still commonly seen at Davis Lake.

Invasive plants such as reed canarygrass could adversely affect foraging habitat for great blue herons when infestations get large enough to fill in ponds and wetlands. Whether this potential effect has actually occurred within the project area is unknown.

### Pileated Woodpecker

The Ochoco National Forest LRMP uses the pileated woodpecker as an indicator for moderate-sized areas (300 acres) of mature and old growth coniferous forest. The pileated woodpecker is the largest woodpecker species in the western United States and nests in cavities of large trees or snags. It is a denizen of mature forests, relying on large dead and decaying trees for foraging and nesting. A major food source for the pileated woodpecker includes carpenter ants found in decaying snags and logs (Bull et al. 2005). Pileateds also utilize roosts, primarily at night. These tend to be cavities in dead or hollow trees with hollow trees used more often (Bull, Holthausen, and Henjum 1990).

Pileated woodpeckers can act as a keystone habitat modifier by excavating large numbers of cavities that are depended upon by several other species, and by influencing ecosystem processes such as decay and nutrient cycling (Aubry and Raley 2002). Pileated woodpeckers will return to areas after timber harvesting (Ehrlich 1988), however, past management in the Pacific Northwest has lead to relatively few snags and down logs, especially of large diameters, remaining in many watersheds.

Pileated could occur near any treatment areas within or adjacent to suitable habitat. Invasive plants are not affecting habitat for pileated woodpeckers.

**Northern Flicker**

The western red-shafted group is distributed from Alaska to Mexico, and southern Canada to the western edge of Great Plains. The northern flicker is the most ubiquitous and unconventional woodpecker in Oregon (Simmons 2003). They use many habitats, but are most common in open forests and forest edges. Key habitat features for this species are down logs and snags. Northern flickers nest in large-diameter decaying snags. Their diet is primarily ants, crickets, beetles, berries, and seeds, obtained by foraging on the ground in open areas and on trees.

Invasive plants are not currently affecting habitat for northern flickers.

**Primary Cavity Excavators/Nesters**

A large number of species rely on cavities in trees for shelter and nesting. Primary cavity excavators for the Deschutes, Ochoco, and Grassland are represented by the following species:

| | | |
|---|---|---|
| Northern Flicker | Lewis' Woodpecker | Red-naped Sapsucker |
| Williamson's Sapsucker | Hairy Woodpecker | Downy Woodpecker |
| White-headed Woodpecker | Black-backed Woodpecker | Three-toed Woodpecker |
| White-breasted Nuthatch | Red-breasted Nuthatch | Pygmy Nuthatch |

Northern Flicker is discussed above. The following information is taken from Marshall et al. (2003).

*Lewis' woodpecker* – Distributed from southern BC and Alberta to central CA, AZ, NM, TX; a migrant in this part of its range; open woodland habitat; nest in cavities but seldom excavate their own; requires large snags in advanced state of decay to excavate nests; often nests in oak or cottonwood; opportunistic feeder eating insects in spring and summer and fruits and acorns in fall and winter; flycatchers or gleans insects; eats carpenter ants, bees, wasps, mayflies, beetles and grasshoppers; burned ponderosa pine forests provide highly productive habitat (Wisdom et al. 2002).

*Red-naped sapsucker* – Distributed from southwestern Canada to eastern CA, NV, AZ, NM, TX; riparian habitats and aspen, and some mixed conifer; forages largely in riparian; excavates cavities in aspens, larch, pine, Doug-fir; eats sap, cambium, and insects attracted to sap; forages in trees.

*Williamson's sapsucker* – Distributed from British Columbia south to Mexico from the east Cascades to the Rocky Mountains; breeds in mid- to high-elevation mature or old-growth conifer forests with fairly open canopy; prefers ponderosa pine in Oregon; prefers larger trees for nesting but will utilize a range of snag sizes; weak cavity excavator needing soft wood; diet consist of conifer tree sap, cambium, and insects; forages on trunk and limbs.

*Downy woodpecker* – Distributed from Alaska to CA, Newfoundland to Florida; deciduous and mixed forests; nests in snags; main diet is scale insects (Coccids), beetles, and ants; forages primarily in trees, but some in shrubs.

*Hairy woodpecker* – Distributed from Alaska to Panama, Newfoundland to Bahamas; mixed conifer and ponderosa pine and adjacent deciduous stands; nests in snags with light to moderate decay; main diet is beetles, and ants; forages on mature and old-growth conifers but also deciduous trees during breeding.

*White-headed woodpecker* – Distributed from British Columbia to southern California, east to Idaho and Nevada; occurs mainly in open ponderosa pine or mixed-conifer forests dominated by ponderosa pine; usually in old-growth or in stands with old-growth components; excavate cavities in snags and also stumps, logs, and dead tops of live trees; diet varies seasonally and includes pine seeds, invertebrates, and sap; it is the only woodpecker species to rely heavily on seeds of ponderosa pine for food; forages primarily on branches and trunk and some cones and also occasionally on the ground. A long-term study of white-headed woodpeckers included sites on the Deschutes NF. The study found they were associated with higher densities of large trees.

*Three-toed woodpecker* – Holarctic distribution; in North America it is found from Alaska to AZ and NM; lodgepole pine, fir/hemlock, Douglas-fir/mixed conifer at higher elevations; nest in cavities, eats bark beetles and larvae, forages in trees.

*Black-backed woodpecker* – Distributed from Alaska to CA, Canada to South Dakota, and elsewhere in northern and eastern U.S.; conifer forest with snags, especially recently burned or bark-beetle killed forests; nest in live (heart rot) or dead trees; can use smaller trees for nest cavities; main diet is larvae of wood-boring beetles gathered from under bark of trees.

*Northern flicker* – Western red-shafted group is distributed from Alaska to Mexico, southern Canada to western edge of Great Plains; many habitats, most common in open forests and forest edges; nests in large-diameter decaying snags; diet primarily ants, crickets, beetles, berries, seeds; forages on the ground in open areas and on trees.

*Red-breasted nuthatch* – Distributed from Alaska to CA, Canada to Appalachians; breeds mostly in old-growth and mature conifer; nests in snags or dead limbs; forage along trunk and branches of conifers, sometimes deciduous; eats weevils, ants, leafbugs, barkbeetles; outside of breeding season, conifer seeds are important food.

*White-breasted nuthatch* – Distributed from across Canada to Florida and CA except in Great Basin, Great Plains, and Sonoran Desert; various woodlands, especially ponderosa pine; use woodpecker cavities for nesting and roosting; forage mainly on large tree limbs and trunks; eats beetles, weevils, sunflower seeds and suet.

*Pygmy nuthatch* – Distributed from British Columbia south to Mexico and east to Nebraska; resident of mature and old-growth ponderosa pine forests; nests in snags or dead portions of live trees; utilized natural cavities or those created by other woodpeckers, but does not excavate its own cavities; forages over all tree surfaces from trunks to outer- and top-most needles and cones; limited foraging may occur on ground; eats beetles, weevils, wasps, ants, true bugs, and butterfly and moth larvae; sunflower seeds and suet.

Invasive plants are not affecting habitat for primary cavity excavators or nesters.

**Waterfowl**

Open lakes, ponds, streams, rivers, and wet/dry meadows provide foraging habitat for most waterfowl species. Some species utilize large snags for nesting, while others utilize open grassy areas near the water’s edge. Most waterfowl diets consist primarily of vegetation although some animal matter (caddisflies, crustaceans, and mollusks) may be consumed (Csuti et. al 2001 pp. 66, 84-87, 89, 96, 99-102).

Many waterfowl species have been documented in the project area, including mallard, common merganser, hooded merganser, wood duck, green-winged teal, blue-winged teal, ring-necked duck, northern pintails, cinnamon teal, northern shovler, widgeon, scaup, Barrow’s goldeneye, common goldeneye, common loon, western grebe, and Canada goose. Potential habitat exists along major streams, lakes and some meadow areas. Much of the suitable meadow habitat occurs on private land. No formal surveys have occurred for most waterfowl species to date.

Invasive plants such as reed canarygrass can adversely affect nesting and foraging habitat for some species of waterfowl. Whether this potential effect has occurred within the project area or not is unknown.

**American Marten**

The American marten (aka pine marten, *Martes americana*) represents species that inhabit mature coniferous forest habitats. American martens occur in forests containing snags and down logs, which provide suitable denning sites. The pine marten is most closely associated with heavily forested east and north-facing slopes that contain numerous down logs (Ruggiero et al. 1994). They tend to avoid areas that lack overhead protection and the young are born in nests within hollow trees, stumps, or logs. Martens do not tolerate concentrated human use or habitat modification (Maser et al. 1981).

American martens spend a great deal of time in trees and can even leap from branch to branch between trees. They eat a variety of small mammals, particularly squirrels, as well as voles, mice, pika, and rabbits. Invasive plants are not impacting habitat for the pine marten.

Surveys on the Deschutes NF were conducted in the winters of 1997/1998 (Dec. through March) and 1999 (Feb. through April) according to the protocol outlined in Ruggiero et al. (1994). These consisted of Trailmaster baited camera set-ups located along the Mt. Jefferson wilderness boundary. Marten were found during these surveys.

Invasive plants are not affecting habitat for American marten.

### Townsend's Big-eared Bat

The Townsend's big-eared bat is a large bat with unusually long ears. This bat occurs from southern British Columbia and the western U.S. to southeastern U.S. and southern Mexico. Townsend's big-eared bats inhabit a wide variety of habitats from old-growth forests to extreme desert. It roosts in caves, mines, rock crevices, buildings, and bridges, but is primarily cave-dependant. One young is born from April to July (Maser et al. 1981). This bat feeds primarily on moths, but will also eat beetles, true bugs, and flies. It captures prey in flight or by gleaning from foliage (Csuti et al. 2001). Big-eared bats hibernate in winter and are not known to migrate long distances. These bats are very intolerant of human disturbance at either winter hibernacula or summer roosts (Csuti et al. 2001). Significant declines in total number of animals and average colony size have been documented. Pierson (1988) found one-third of historic roost sites no longer being used.

#### *Action Area Information*

The Sisters Ranger District conducted three surveys for bat species in 1996-1998. Surveys inventoried First Creek, Canyon Creek, and the Metolius winter range area near Fly Creek. Results confirmed presence of Townsend's big-eared bats on the District. No proposed project area units are associated with the known locations of these bats, although bats could forage along the Metolius River.

Townsend's big-eared bats are present on Bend/Fort Rock RD as well and occur in several caves, some of which are important nursery sites and some are hibernacula. None of these caves are near proposed project area units for invasive plant treatment. One known day roost occurs on the Grassland near Round butte. Additional suitable habitat in the form of bridges is present at many locations in the project area.

Invasive plants are not adversely affecting habitat for Townsend's big-eared bat.

### Rocky Mountain Elk and Mule Deer

These important game animals occur throughout the project area, and both species use a combination of habitats comprised of cover and forage areas that are not too fragmented by road systems. Deer and elk eat a wide variety of plants including grasses, forbs, aspen, and woody shrub species. In general, elk eat primarily grasses while deer eat more browse species. Both summer and winter range habitat are present on the Deschutes and Ochoco NFs. Meadows provide important foraging areas, especially in the spring and early summer.

Deer habitat on the DES is categorized as summer, transitional, and winter habitat. Bitterbrush provides critical food source in the winter. Winter range occurs on eastern border of the forest. Invasive plants and treatment sites are located in known winter range, but occur almost exclusively along roads.

Invasive plants on the forest are present in important foraging areas and if infestations expanded, the quality and quantity of available forage could be reduced.

## Survey and Manage Species

Species that were covered under Survey and Manage as of March 21, 2004 (prior to the 2004 ROD) are once again included in the Survey and Manage program. The inclusion of some of these species in the Region's Sensitive Species Program remains in effect.

The Deschutes NF has two survey and manage species: the great gray owl and the Crater Lake tightcoil snail. The great gray owl is identified as a Category C species which were species considered uncommon and where pre-disturbance surveys are practical. It is discussed under the section titled Management Indicator Species. The status of the great gray owl has not changed during subsequent reviews. The Crater Lake Tightcoil was included in the Sensitive Species update, while the great gray owl was not but is still considered a management indicator species in the Deschutes LRMP.

## Birds of Conservation Concern

In January 2001, President Clinton issued an executive order on migratory birds directing federal agencies to avoid or minimize the negative impact of their actions on migratory birds, and to take active steps to protect birds and their habitat. Within two years, federal agencies were required to develop a Memorandum of Understanding (MOU) with the U.S. Fish and Wildlife Service to conserve migratory birds including taking steps to restore and enhance habitat, prevent or abate pollution affecting birds, and incorporating migratory bird conservation into agency planning processes whenever possible. Toward meeting this end the U.S. Fish and Wildlife Service (2002) developed the Birds of Conservation Concern.

The "Birds of Conservation Concern 2002" (BCC) identifies species, subspecies, and populations of all migratory non-game birds that without additional conservation actions are likely to become candidates for listing under the Endangered Species Act of 1973. While all of the bird species included in the BCC are priorities for conservation action, the list makes no finding with regard to whether they warrant consideration for ESA listing.

Bird Conservations Regions (BCRs) were developed based on similar geographic parameters. The project area includes BCR 9, Great Basin and BCR 10, Northern Rockies. BCR 10 only adds three additional species that are not already included in BCR 9 – mountain plover, pygmy nuthatch, and McCown's longspur. The following table displays the BCR species for the Deschutes and Ochoco NFs and the CRNG, preferred habitat and whether suitable habitat is present in the project area.

**Table 76.** Species included in Bird Conservation Region's 9 and 10.

| Bird Species | Preferred Habitat | Habitat in Project Area |
|---|---|---|
| Swainson's Hawk | Open lands with scattered trees | Yes |
| Ferruginous Hawk | Elevated nest sites in open country | No |
| Golden Eagle | Elevated nest sites in open country | Yes |
| Peregrine Falcon | Cliffs | Yes |
| Prairie Falcon | Cliffs in open country | Yes |
| Greater Sage Grouse | Sagebrush dominated rangelands | Yes |
| Yellow Rail | Dense sedge marshes | Yes |
| American Golden-Plover | Burned meadows/mudflats | No |
| Snowy Plover | Dry sandy beaches, alkaline flats and salt pans | No |
| American Avocet | Wet meadows | Yes |
| Solitary Sandpiper | Meadow/Marsh/Bogs | Yes |

| Bird Species | Preferred Habitat | Habitat in Project Area |
|---|---|---|
| Whimbrel | Marsh/Mudflats | No |
| Long-billed Curlew | Grasslands | Yes |
| Marbled Godwit | Marsh/Wet Meadows | Yes |
| Sanderling | Sandbars and beaches | No |
| Wilson's Phalarope | Marsh/Meadows | Yes |
| Yellow-billed Cuckoo | Dense riparian/cottonwoods | No |
| Flammulated Owl | Ponderosa pine forests | Yes |
| Burrowing Owl | Non-forested grasslands | Yes |
| Black Swift | Cliffs associated with waterfalls | No |
| Lewis's Woodpecker | Ponderosa pine forests | Yes |
| Williamson's Sapsucker | Ponderosa pine forests | Yes |
| White-headed Woodpecker | Ponderosa pine forests | Yes |
| Loggerhead Shrike | Open country with scattered trees/shrubs | Yes |
| Gray Vireo | Pine/juniper woodland/sagebrush scrubland | No |
| Virginia's Warbler | Mountain Mahogany groves | No |
| Brewer's Sparrow | Sagebrush clearings in coniferous forests/bitterbrush | Yes |
| Sage Sparrow | Sagebrush | Yes |
| Tricolored Blackbird | Cattails or tules | Yes |
| Mountain plover | high plateaus of Rocky Mountains | No |
| Pygmy nuthatch | mature ponderosa pine | Yes |
| McCown's longspur | dry sparse prairies | No |

The golden eagle, peregrine falcon, sage grouse, yellow rail, Lewis's woodpecker, Williamson's sapsucker, white-headed woodpecker, pygmy nuthatch, and tricolored blackbird have been covered in previous sections of this report. The following species do not occur in the project area and will not be discussed further: ferruginous hawk, yellow-billed cuckoo, black swift, gray vireo, Virginia's warbler, McCown's longspur, whimbrel, sanderling, snowy plover, American golden-plover, mountain plover (Ridgley et al. 2003).

The following species may occur near project area units based on their range, known occurrences, or presence of potentially suitable habitat in the project area. The following information is taken from Marshall et al. (2003).

*Swainson's hawk* – In Oregon, Swainson's hawks breed in the bunchgrass prairies or near irrigated fields east of the Cascades. They nest in trees, which need not be tall. Primary prey items during breeding season include various small mammals.

*Prairie falcon* – Prairie falcons breed in Oregon east of the Cascades wherever cliffs and outcrops provide opportunity for nesting; mostly rimrock country. Grasslands are preferred habitat; they are less productive in sagebrush. The need low, sparse vegetation for hunting. Prey most often consists of small mammals, usually ground squirrels, but will also prey on birds, especially in winter.

*American avocet* – Breeding areas of this striking bird occur in south-central and southeastern Oregon. They are rare during winter in Oregon. They occur in shallow wetlands and need freshwater to breed. Nest sites are along shorelines and in adjacent uplands with sparse or no vegetation. Avocets feed on aquatic and terrestrial invertebrates, but may also utilize seeds and vegetable matter.

*Solitary sandpiper* – This unsociable shorebird is an uncommon to rare migrant throughout Oregon. It prefers freshwater areas such as muddy ponds, livestock wallows, and high elevation lakes. Unlike other shorebirds, it may be found in partially wooded habitats. Their diet consists of insects, spiders, amphibians, worms, snails, and small fish.

*Long-billed curlew* – The largest North American shorebird, it breeds in Oregon east of the Cascades in open grassland areas. Curlews avoid habitat with trees, dense sagebrush, and tall, dense grasses. The nest is a shallow depression in the ground. Prey items include invertebrates like grasshoppers and beetles, bird eggs, and small vertebrates including nestlings.

*Marbled godwit* – It is an irregular spring and fall migrant in Oregon, including eastern Oregon. It breeds in Alaska, Canada, and the Great Plains. This wader forages along the coast and wet margins of large reservoirs during migration. They eat aquatic invertebrates such as worms, clams, and crabs.

*Wilson's phalarope* – This phalarope is a common breeder east of the Cascades in marshes and migrates elsewhere for the winter. It nests in bulrushes or dense grass in wet meadows, marshes, sloughs, and even roadside ditches. Flies, true bugs, beetles, crustaceans, and seed of aquatic plants are dietary items.

*Flammulated owl* – This owl breeds in open forest in all eleven contiguous western states. In Oregon, it breeds primarily on the eastern slope of the Cascades and in the Blue Mountains. It is a cavity nester. Diet is primarily crickets but may also take moths and beetles.

*Burrowing owl* – This unique owl lives and nests in burrows underground in open grassland and shrub-steppe habitat. Burrowing owls prefer habitat with substantial amounts of bare ground, which improves detectability of prey. They prey on small mammals and large ground-dwelling arthropods. These owls were present on the CRNG until 1992 but have not been seen since then (Zalunardo, pers. comm. 2006).

*Loggerhead shrike* – Oregon breeding areas for loggerhead shrike include open habitats east of the Cascades. It is not found in forested landscapes or high-elevation sites. Shrikes require elevated perches for hunting and singing, open areas for hunting, and scattered shrubs or small trees for nesting. They feed on insects primarily, but eat small vertebrates also, especially in winter.

*Brewer's sparrow* – The most abundant bird breeding in the sagebrush expanse of the intermountain West is the Brewer's sparrow. In Oregon, it occurs east of the Cascades and breeds in sagebrush communities, particularly Great Basin shrub-steppe. The diet consists of small insects gleaned from foliage and bark of sagebrush. It may also eat seeds from the ground or insects from other plants or trees.

*Sage sparrow* – This sparrow breeds in southeastern and central Oregon in areas with big sage. They leave Oregon in the winter. It is almost a sagebrush obligate, but can be found in some other dry shrub communities. The nest is placed in the densest portion of a tall bush. Sage sparrows forage on the ground for insects and seeds.

## Landbirds

The Forest Service has prepared a Landbird Strategic Plan (January 2000) to maintain, restore, and protect habitats necessary to sustain healthy migratory and resident bird populations to achieve biological objectives. The primary purpose of the strategic plan is to provide guidance for the Landbird Conservation Program and to focus efforts in a common direction. On a more local level, individuals from multiple agencies and organizations within the Oregon-Washington Chapter of Partners in Flight participated in developing publications for conserving landbirds in this region. The "Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington" was published in June 2000 (Altman 2000a). This plan covers mid to high elevation forest types along the eastern slope of the Cascades and identifies primary management needs for birds in this forest zone. The principal issues affecting bird populations listed in this plan include habitat loss, alteration, and fragmentation resulting from timber harvesting; and habitat alteration from changes in historic fire regimes and large-scale grazing by livestock.

The remainder of the project area is covered in two other plans titled “Conservation Strategy for Landbirds in the Columbia Plateau In Oregon and Washington” (Altman and Holmes 2000), which discusses riparian, sage-steppe, and juniper habitats; and, “Conservation Strategy of Landbirds in the Northern Rocky Mountains of Eastern Oregon and Washington” (Altman 2000b). The principal issues affecting bird populations in the Columbia Plateau include habitat loss and fragmentation resulting from conversion to agriculture; and habitat degradation and alteration from livestock grazing, invasion of exotic vegetation, and alteration of historic fire regimes. The principal conservation issue affecting bird population in the Rocky Mountain plan are fire suppression and timber harvesting.

All three plans identify invasion by exotic plants as an important issue adversely affecting landbird populations. The Columbia Plateau plan states, “One of the most severe impacts in shrub-steppe has been the increased spread of exotic plants” (Altman and Holmes 2000).

These strategies identify groups of focal species and their associated habitat attributes that can be used to identify desired landscapes. Many of the focal species identified in the above plans are found on the Deschutes and/or Ochoco National Forests and the Crooked River National Grassland. These plans are intended to help facilitate land management planning for healthy populations of native landbirds. They focus on landscape-scale management, with emphasis on habitat structure.

The following tables list the priority habitat features and associated focal species for conservation from the respective plans. Relevant conservation strategies from the respective plans are included after the habitat tables for each zone. *Conservation strategies for habitats or species that are not relevant to invasive plant treatments are not included.* The effects of the proposed alternatives on the habitat features and consistency with relevant conservation strategies is discussed in the Environmental Consequences section.

### *East Slope Cascades (Altman 2000a)*

**Table 77.** Forest Habitats

| Habitat | Habitat Feature | Focal Species for Central Oregon |
|---|---|---|
| Ponderosa Pine | Large patches of old forest with large snags | White-headed woodpecker |
| | Large trees | Pygmy nuthatch |
| | Open understory with regenerating pines | Chipping sparrow |
| | Patches of burned old forest | Lewis’ woodpecker |
| Mixed Conifer (Late-Successional) | Large trees | Brown creeper |
| | Large snags | Williamson’s sapsucker |
| | Interspersion grassy openings and dense thickets | Flammulated owl |
| | Multi-layered/dense canopy | Hermit thrush |
| | Edges and openings created by wildfire | Olive-sided flycatcher |
| Lodgepole Pine | Old growth | Black-backed woodpecker |
| Meadows | Wet/dry | Sandhill Crane |
| Aspen | Large trees with regeneration | Red-naped sapsucker |
| Subalpine fir | Patchy presence | Blue Grouse |

***Conservation Strategies for Ponderosa Pine***

*Pesticides/Herbicides*: Use of insecticides can reduce the insect food base for many bird species. Use of herbicides can reduce cover and indirectly affect the insect food base.

- Use Integrated Pest Management practices or non-spraying in low human use areas (e.g., mosquito spraying).
- Encourage biological controls rather than herbicide controls wherever possible.
- Applications should be done by hand if practical to target appropriate species (e.g. noxious weeds).
- Applications on lands adjacent to riparian areas should avoid environmental conditions where the riparian zone may be threatened.

Lewis' Woodpecker: Eliminate or minimize pesticide spraying within territories of nesting pairs, which may reduce insect prey base.

***Conservation Strategies for Mixed Conifer***

*Pesticides/Herbicides*: Use of insecticides can reduce the insect food base for many bird species. Use of herbicides can reduce cover and indirectly affect the insect food base.

- Use Integrated Pest Management practices or non-spraying in low human use areas (e.g., mosquito spraying).
- Encourage biological controls rather than herbicide controls wherever possible.
- Applications should be done by hand if practical to target appropriate species (e.g. noxious weeds).
- Applications on lands adjacent to riparian areas should avoid environmental conditions where the riparian zone may be threatened.

Flammulated Owl: Avoid insect control spraying near known nest areas or suitable habitat.

### *Columbia Plateau (Altman and Holmes 2000)*

**Table 78.** Shrub Steppe Habitats

| Habitat | Habitat Feature | Focal Species for High Lava Plains |
|---|---|---|
| Steppe | Native bunchgrass cover | Grasshopper Sparrow |
| Steppe-Shrubland | Interspersion of tall shrubs and openings | Loggerhead Shrike |
| | Burrows | Burrowing Owl |
| | Deciduous trees and shrubs | Sharp-tailed Grouse |
| Sagebrush | Large areas of sagebrush with diverse understory of native grasses and forbs | Sage Grouse |
| | Large unfragmented patches | Sage Sparrow |
| | Sagebrush cover | Brewer's Sparrow |
| | Sagebrush height | Sage Thrasher |
| Shrublands | Ecotonal edges of herb, shrub, and tree habitats | Lark Sparrow |
| | Upland sparsely vegetated desert scrub | Black-throated Sparrow (BR and OW only) |
| Juniper-Steppe | Scattered mature juniper trees (savannah) | Ferrunginous Hawk |

***Conservation Strategies for Shrub-Steppe***
*Insecticides/Herbicides*: use of insecticides can reduce the insect food base for many bird species. Use of herbicides can reduce cover and indirectly affect the insect food base.

- Minimize or discontinue use of pesticides wherever possible.
- Practice procedures in Integrated Pest Management for reduced destruction of non-target insects.
- Encourage biological controls rather than herbicide controls wherever possible.
- Treatments should be followed by restoration activities.
- Limit the application of herbicides to invasive non-native species, and use in conjunction with habitat enhancement projects which include long-term solutions to control future infestations.

***Conservation Strategies for Steppe***
Grasshopper Sparrow: Where treatments are occurring in grasslands (e.g. burning, mowing, herbicide applications) leave adjacent untreated areas to maintain a population of associated birds until treated areas become suitable.

Loggerhead Shrike: Avoid insecticide spraying during the breeding season in shrike nesting habitat.

***Conservation Strategies for Shrublands***
Lark Sparrow: Use exotic weed control and replant with native perennials to restore degraded habitat.

**Table 79.** Riparian Habitats

| Habitat | Habitat Features | Focal Species for High Lava Plains |
|---|---|---|
| Woodland | Large snags (cottonwood) | Lewis' Woodpecker |
| | Large canopy trees | Bullock's Oriole |
| | Subcanopy foliage | Yellow Warbler |
| | Dense shrub layer | Yellow-breasted Chat |
| | Large structurally diverse patches | Yellow-billed Cuckoo |
| Shrub | Shrub density | Willow Flycatcher |
| | Shrub-herbaceous interspersion | Lazuli Bunting |

***Conservation Strategies for Riparian***
*Pesticides/Herbicides*: Use of insecticides can reduce the insect food base for many bird species. Use of herbicides can reduce cover and indirectly affect the insect food base.

- Use Integrated Pest Management practices or non-spraying in low human use areas (e.g., mosquito spraying).
- Encourage biological controls rather than herbicide controls wherever possible.
- Applications should be done by hand if practical to target appropriate species (e.g. noxious weeds).
- Applications on lands adjacent to riparian areas should avoid environmental conditions where the riparian zone may be threatened.
- Limit the application of fertilizers, pesticides, and herbicides in the riparian zone to invasive non-native species (e.g. reed canary grass) in conjunction with habitat enhancement projects which include long-term solutions such as planting trees and shrubs to eventually shade-out future infestations.

Lewis' Woodpecker: Eliminate or minimize pesticide spraying within territories of nesting pairs, which may reduce insect prey base.

Bullock's Oriole: Use mechanical or other means to remove invasive plants in the understory that inhibit growth and development of young (recruitment) trees.

Yellow Warbler: Eliminate willow cutting and herbicide spraying in riparian zone (Taylor and Littlefield 1986).

Yellow-breasted Chat: Eliminate willow cutting and herbicide spraying in riparian zone (Taylor and Littlefield 1986).

Willow Flycatcher: Eliminate willow cutting and herbicide spraying in riparian zone (Taylor and Littlefield 1986).
Where herbicide control of riparian exotic shrubs and trees (e.g. Russian olive) is occurring within known nesting habitat, consider the following actions:

- Conduct treatment outside the breeding season.
- Treat patches on a staggered rotation to allow some habitat to remain for breeding; treat remaining patches when treated patches approach habitat suitability.
- Let treated areas decompose naturally without mechanical assistance to maintain structure and allow for continued use.
- Use mechanical removal in smaller areas of treated patches to assist in recolonization by desired species through planting/seedlings.

Lazuli Bunting: Eliminate willow cutting and herbicide spraying in riparian zone (Taylor and Littlefield 1986).
Where herbicide control of riparian exotic shrubs and trees (e.g. Russian olive) is occurring within known nesting habitat, consider the following actions:

- Conduct treatment outside the breeding season.
- Treat patches on a staggered rotation to allow some habitat to remain for breeding; treat remaining patches when treated patches approach habitat suitability.
- Let treated areas decompose naturally without mechanical assistance to maintain structure and allow for continued use.

Use mechanical removal in smaller areas of treated patches to assist in recolonization by desired species through planting/seedlings.

**Table 80.** Unique Habitats

| Habitat | Habitat Features | Focal Species for High Lava Plains |
|---|---|---|
| Aspen | Large trees and snags with regeneration | Red-naped Sapsucker |
| Agricultural Fields | Mesic Conditions | Bobolink (GB and OW only) |
| Cliffs and Rimrock | Undeveloped foraging areas | Prairie Falcon |
| Mountain Mahogany | Large diameter trees with regeneration | Virginia's Warbler |

***Conservation Strategies for Unique Habitats***
Prairie falcon: Agricultural pesticide use may be adversely affecting prey populations. Habitat alteration in foraging areas may affect prey base.

### *Northern Rocky Mountains (Altman 2000b)*

**Table 81.** Dry Forests

| Habitat | Habitat Feature | Focal Species for the Blue Mountains |
|---|---|---|
| Dry Forests (ponderosa pine and ponderosa pine/Douglas-fir) | Large patches of old forest with large trees and snags | White-headed Woodpecker |
| | Old forest with interspersion of grassy openings and dense thickets | Flammulated Owl |
| | Open understory with regenerating pines | Chipping Sparrow |
| | Patches of burned old forest | Lewis' Woodpecker |
| Mesic Mixed Conifer (Late-Successional) | Large snags | Vaux's Swift |
| | Overstory canopy closure | Townsend's Warbler |
| | Structurally diverse; multi-layered | Varied Thrush |
| | Dense shrub layer in forest openings or understory | MacGillivray's Warbler |
| | Edges and openings created by wildfire | Olive-sided Flycatcher |

***Conservation Strategies for Dry Forest***

*Pesticides/Herbicides*: Use of insecticides can reduce the insect food base for many bird species. Use of herbicides can reduce cover and indirectly affect the insect food base.

- Use Integrated Pest Management practices or non-spraying in low human use areas (e.g., mosquito spraying).
- Encourage biological controls rather than herbicide controls wherever possible.
- Applications should be done by hand if practical to target appropriate species (e.g. noxious weeds).
- Applications on lands adjacent to riparian areas should avoid environmental conditions where the riparian zone may be threatened.

<u>Flammulated Owl</u>: Avoid insect control spraying near known nest areas or suitable habitat.

<u>Lewis' Woodpecker</u>: Eliminate or minimize pesticide spraying within territories of nesting pairs, which may reduce insect prey base.

***Conservation Strategies for Mesic Mixed Conifer***

*Pesticides/Herbicides*: Use of insecticides can reduce the insect food base for many bird species. Use of herbicides can reduce cover and indirectly affect the insect food base.

- Use Integrated Pest Management practices or non-spraying in low human use areas (e.g., mosquito spraying).
- Encourage biological controls rather than herbicide controls wherever possible.
- Applications should be done by hand if practical to target appropriate species (e.g. noxious weeds).
- Applications on lands adjacent to riparian areas should avoid environmental conditions where the riparian zone may be threatened.

<u>Vaux's Swifts</u>: Avoid use of pesticides near retained snags.

**Table 82.** Riparian

| Habitat | Habitat Features | Focal Species for the Blue Mountains |
|---|---|---|
| Riparian Woodland | Large snags | Lewis' Woodpecker |
| | Canopy foliage and structure | Red-eyed Vireo |
| | Understory foliage and structure | Veery |
| Riparian Shrub | Willow/alder shrub patches | Willow Flycatcher |

***Conservation Strategies for Riparian***

*Pesticides/Herbicides*: Use of insecticides can reduce the insect food base for many bird species. Use of herbicides can reduce cover and indirectly affect the insect food base.

- Use Integrated Pest Management practices or non-spraying in low human use areas (e.g., mosquito spraying).
- Encourage biological controls rather than herbicide controls wherever possible.
- Applications should be done by hand if practical to target appropriate species (e.g. noxious weeds).
- Applications on lands adjacent to riparian areas should avoid environmental conditions where the riparian zone may be threatened.
- Limit the application of fertilizers, pesticides, and herbicides in the riparian zone to invasive non-native species (e.g. reed canary grass) in conjunction with habitat enhancement projects which include long-term solutions such as planting trees and shrubs to eventually shade-out future infestations.

Lewis' Woodpecker: Eliminate or minimize pesticide spraying within territories of nesting pairs, which may reduce insect prey base.

Veery: Eliminate willow cutting and herbicide spraying in riparian zone (Taylor and Littlefield 1986).

Willow Flycatcher: Eliminate willow cutting and herbicide spraying in riparian zone (Taylor and Littlefield 1986).

Where herbicide control of riparian exotic shrubs and trees (e.g. Russian olive) is occurring within known nesting habitat, consider the following actions:

- Conduct treatment outside the breeding season.
- Treat patches on a staggered rotation to allow some habitat to remain for breeding; treat remaining patches when treated patches approach habitat suitability.
- Let treated areas decompose naturally without mechanical assistance to maintain structure and allow for continued use.
- Use mechanical removal in smaller areas of treated patches to assist in recolonization by desired species through planting/seedlings.

**Table 83.** Unique Habitats

| Habitat/Feature | Focal Species for the Blue Mountains |
|---|---|
| Subalpine Forest | Hermit Thrush |
| Montane Meadows | Upland Sandpiper |
| Steppe Shrublands | Vesper Sparrow |
| Aspen | Red-naped Sapsucker |
| Alpine | Gray-crowned Rosy Finch |

No relevant conservation strategies listed.

**Amphibian Decline**

Many species of amphibians in many parts of the world have experienced alarming population declines in the past two decades. International task forces have been formed and scientists have researched causes. A number of studies have documented declines, even in relatively undisturbed habitats (Drost and Fellers 1996, Lips 1998, 1999), while other studies have found some populations to be stable (Pechmann et al. 1991). However, detecting actual population declines in amphibian populations is difficult due to the extreme annual variation in populations caused by environmental factors, such as drought (Pechmann et al. 1991, Reed and Blaustein 1995).

Potential causes of amphibian declines investigated include habitat loss, non-native predators (e.g. Drost and Fellers 1996, Knapp and Matthews 2000), and disease (Muths et al. 2003, Berger et al. 1998, Berger et al. 1999), pesticides (Bridges and Semlitsch 2000, Hayes et al. 2006), climate change (Blaustein et al. 2001, Crump 2005), and ultraviolet radiation (Starnes et al. 2000, Adams et al. 2001), among others. Results of studies are variable and some populations are in decline while others are not. There is no “smoking gun” at the global scale and all the causes are implicated to some degree (Halliday 2005).

Hayes et al. (2002, 2006) found that exposure to the herbicide Atrazine caused hermaphroditism ad testicular oocytes in African clawed frogs and wild leopard frogs and suggested that this could be concern in regard to amphibian declines. Population level effects to amphibians form Atrazine exposure are unclear as wild leopard frogs were abundant at collection sites for the Hayes et al. study (2003).

Herbicides proposed for use in the project area have little potential to adversely affect amphibians and contribute to amphibian decline because of either their low toxicity to amphibians or the very low exposures likely to occur. Low exposures are due to either the application rates and physical properties of the herbicides, or use restrictions (PDFs) required for all alternatives. Relyea (2005a,b) has demonstrated that glyphosate with POEA surfactant is lethal to amphibians, but his studies mimicked aerial applications or illegal use directly in water, and conducted exposures in the absence of soil. Because glyphosate binds tightly and quickly to soil, realistic field applications would result in much lower exposures. The influence of soil on the movement of glyphosate into water is dramatically demonstrated by Ramwell et al. (2002), which showed that even dust on an asphalt road with concrete curb reduced expected concentrations in rainwater runoff.

The use of herbicides as proposed in the action alternatives will not contribute to amphibian decline and therefore this issue is not discussed further in this document.

## Management Direction

Recent amendments to the Deschutes and Ochoco Forest Plans occurred as a result of the Pacific Northwest Region Invasive Plant Program Record of Decision (USFS 2005b). One standard added to the Forest Plans requires the use of project design features to minimize or eliminate adverse effects to federally listed species. The project design features listed in Chapter 2.4 (particularly PDFs 75 to 80) fulfill this requirement and will minimize or eliminate adverse effects to bald eagles, spotted owls, and Canada lynx. These design features are part of the proposed action and are mandatory in order to stay within the scope of this effects analysis. Additional design features also listed in Chapter 2.4 will minimize adverse effects to FS Sensitive Species, MIS, and other “species of local interest.”

Refer to the discussion of Oregon and Columbia spotted frogs above for information regarding project design criteria for these two species in the Forests’ Programmatic BA.

## 3.9.2 ENVIRONMENTAL CONSEQUENCES

The following section is a general overview of the potential impacts to federally listed wildlife from all control methods included in the proposed action. For all methods, project design features could be used to mitigate the majority of these impacts.

### Effects Analysis Methods

The herbicides considered for use under the Proposed Action, and the typical and highest application rates used for the analysis are found in Table 12, Chapter 2. Characteristics for each herbicide are found in the R6 FEIS (USFS 2005a) and in Appendix D of this FEIS.

### Herbicide Risk Assessments

Because herbicides have the potential to adversely affect the environment, the U.S. Environmental Protection Agency (EPA) must register all herbicides prior to their sale, distribution, or use in the United States. In order to register herbicides for outdoor use, the EPA requires the manufacturers to conduct a safety evaluation on wildlife including toxicity testing on representative species of birds, mammals, freshwater fish, aquatic invertebrates, and terrestrial and aquatic plants. An ecological risk assessment uses the data collected to evaluate the likelihood that adverse ecological effects may occur as a result of herbicide use.

The Forest Service conducts its own risk assessments, focusing specifically on the type of herbicide uses in forestry applications. The FS contracts with Syracuse Environmental Research Associates, Inc. (SERA) to conduct human health and ecological risk assessments for herbicides that may be proposed for use on National Forest System lands. The information contained in this FEIS and the Biological Assessment relies on these risk assessments. All toxicity data, exposure scenarios, and assessments of risk are based upon information in the FS/SERA risk assessments unless otherwise noted. FS/SERA risk assessments use peer-reviewed articles from the open scientific literature and current EPA documents, including Confidential Business Information. Specific methods used in preparing the FS/SERA risk assessments are described in SERA, 2001-Preparation. The risk assessments and associated documentation are available in total in the administrative record for the EIS. Estimates of risk are not absolute; rather, they are relative and based on assumptions contained in generic “worst case” scenarios. Risk assessments have inherent limitations; these are discussed later in this chapter.

### Herbicide Analysis

The risk assessments prepared by SERA (2001, 2003, 2004) contain the detailed analysis of the potential effects of each herbicide. Portions of the risk assessments pertaining to terrestrial wildlife are summarized in USDA Forest Service (2005d, Appendix B). This summary contains a detailed description of factors influencing exposure and dose, use of surrogate species for toxicity data, field studies, and analysis results for each individual herbicide. Refer to this summary, found in Appendix B, for more information on analysis methods used to determine the potential effects to listed species.

Toxicity data found in the risk assessments, exposure scenarios, and project worksheets were used to derive quantitative estimates of dose for worst-case situations. The worksheets used in the analysis may be found in the project record for the EIS.

When enough data was available for a particular type of animal, an exposure scenario was developed, and a quantitative estimate of dose received by the animal type in the scenario was calculated (SERA 2007). The quantitative estimates of dose were compared to available toxicity data to determine potential adverse impacts. We used the most sensitive response (i.e. a sub-lethal effect that occurred at the lowest dose) from the most sensitive species to determine the “toxicity indices” for each herbicide[15]. Adverse affects to wildlife health such as lethargy, weight loss, nausea, and fluid loss due to diarrhea or vomiting, can affect their ability to compete for food, locate and/or capture food, avoid or fight off predators, or reproduce. The following analysis relies on these types of effects, when sufficient data exists, rather than directly lethal doses, to determine the potential for doses to cause an "adverse effect" to wildlife.

The estimated dose (from the scenarios) was divided by the "toxicity index" and the result is known as the Hazard Quotient. When the Hazard Quotient is less than 1.0, the dose is les than the toxicity index. Potential effects from doses calculated to be below the toxicity indices are discountable. When a calculated dose was greater than the toxicity index, we stated that there was a potential for adverse effects. This very protective approach constitutes a "worst-case" analysis for potential effects of herbicides.

Whenever sufficient data were available to determine the dose that resulted in no observable adverse effects (NOAEL), the NOAEL was used as the toxicity index. If data were not sufficient to determine a NOAEL, other endpoints of toxicity were used, such as the lowest-adverse-effect level (LOAEL), or the dose that was lethal to 50 percent of the test population (LD50). When a LOAEL or LD50 was used as the toxicity index, standard EPA methods for applying an uncertainty factor to the toxicity index to determine a level of concern were used. The standard EPA method for listed terrestrial species is to take 0.1 of the LD50 (EPA/OPP 2004), which is the protocol used in this analysis when a NOAEL is not available.

### Herbicide Mixtures

A Standard in the Deschutes-Ochoco and Grassland Land Management Plans limits mixtures to three herbicides or fewer and requires the use of a dose addition analysis at the project scale to determine if a particular mixture may be used. Under specified conditions, dose addition analysis is believed to provide a reasonable estimate of the cumulative toxicity of chemical mixtures. The hazard index (HI) method of assessing dose addition is relatively simple and straightforward. The approach is used or recommended by a number of agencies, including EPA, National Academy of Sciences, National Research Council, and Occupational Health and Safety Administration (ATSDR 2004).

The individual herbicides in each mixture are analyzed to determine estimated dose, which is then divided by the respective "toxicity index" to produce a hazard quotient (HQ). When the HQ is less than 1.0, then the dose is less than the toxicity index. The HI is calculated by adding all the HQ's for the herbicides in the mixture. This is known as dose addition. If the HI is < 1.0, then an acceptable level of mixture toxicity risk is assumed to be present. A HI would be calculated at the project level to assess potential effects to listed species in a project area.

Dose addition is considered most appropriate for mixtures with components that affect the same endpoint by the same mode of action, and are believed to behave similarly with respect to uptake, metabolism, distribution, and elimination (Choudhury et al. 2000). The precise toxic mechanism(s) in birds and mammals are not known for all of the 10 herbicides contained in the proposed action. But in terrestrial wildlife, effects to the kidney and liver are typical endpoints.

Dose addition analysis is also a reasonable assumption when analyzing mixtures of chemicals with different or unknown toxicity mechanisms, when expected doses will be below known toxic levels (ATSDR, 2004). This is also supported by data from Feron et al. (1995, as cited in EPA Choudhury et al., 2000), which showed interaction when mixture chemical components were present in

[15] For example, the most sensitive response to picloram in mammals is weight loss in rabbits. We used the dose of picloram that did not cause weight loss in rabbits as the toxicity index. This dose was reported in scientific literature or toxicity studies as the no-observable-adverse-effect-level (NOAEL).

concentrations at or near their respective LOAELs. No interaction was observed between chemical components when present at concentrations 1/10 or 1/3 or their respective LOAELs.

The dose addition analysis described in this document is believed to produce conservative estimates of mixture toxicity for several reasons. First, the assumption of dose addition in itself is conservative; the dose addition protocol assumes an additive response for all chemicals in the mixture, when in fact some chemicals may produce independent, non-additive responses. For example, the EPA description of dose addition analysis in Choudhury et al. (2000) states that separate dose addition analyses should be performed for each affected organ. This protocol utilizes one HI that includes all herbicides, regardless of toxicity site, potentially resulting in a higher HI value than if mixture components were analyzed in smaller groups by affected organ.

Also, by requiring the HI for the mixture to be less than 1.0, the Hazard Quotients of each component in the mixture must be below known toxic levels and will meet the criteria cited in ATSDR (2004) and Choudhury et al. (2000).

The primary sources of uncertainty in utilizing dose addition analysis in the proposed manner are the lack of mixture analysis studies utilizing more than two chemicals. The risk of adverse effects, with respect to the lack of information on mixtures involving more than two chemicals, increases with the number of mixture components. In an effort to minimize these risks, the proposed action states the mixtures will contain no more than three active herbicide ingredients.

### Uncertainty and Data Gaps

Generally, active ingredients have been tested on only a limited number of species and mostly under laboratory conditions. While laboratory experiments can be used to determine acute toxicity and effects to reproduction, cancer rates, birth defect rates, and other effects that must be considered, laboratory experiments do not account for wildlife in their natural environments. Environmental stressors can increase the adverse effects of contaminants, but the degree to which these effects may occur for various herbicides is largely unknown. Various wildlife species may also be more or less sensitive to a particular herbicide than laboratory animals. This leads to uncertainty in the risk assessment analysis. Additional discussion of incomplete and unavailable information can be found in the EIS. In response to this uncertainty, the effects analysis has relied upon data from the most sensitive effect from the most sensitive species and has used the maximum exposure estimates from exposure calculations to determine potential for risk.

### The Use of Surrogate Species

Most toxicity testing utilizes surrogate species. Surrogate species serve as a substitute for the species of interest, because all species of interest could not be tested. Surrogate species are typically organisms that are easily tested using standardized methods, are readily available, and inexpensive. The physiological requirements for some organisms prohibit their use in toxicity testing because these requirements cannot be met within the test system. Rare or federally listed species are not used for a variety of reasons, including legal restrictions and having only a limited numbers of individuals available. On the rare occasions when data can be obtained from federally listed species, the limited conditions under which they are taken may bias the results (e.g. see Wiemeyer et al., 1993).

Even when desired species are available (e.g. salmon), researchers may choose a surrogate, like zebrafish (Danio rerio)(aka zebra danio), because test results are more easily discerned with the surrogate, and reproductive capacity allows testing of large numbers of individuals, among other reasons (Scholz et al. 2005).

However, caution should to be taken when addressing ecological risk and the use of surrogates when analyzing those ecological risks. Some herbicides demonstrate more variation than others in effects among different species, and very limited numbers of species have been tested.

Because of the variation of responses among species, and the uncertainty with regard to how accurately a surrogate species may represent other wildlife, the FS/SERA risk assessments use the most sensitive endpoint from the most sensitive species tested as the toxicity index for all wildlife. This does not alleviate concerns over interspecies variations in response.

### Doses and Responses

The likelihood that an animal will experience adverse effects from an herbicide depends on: (1) the inherent toxicity of the chemical, (2) the amount of chemical to which an animal is exposed, (3) the amount of chemical actually received by the animal (dose), and (4) the inherent sensitivity of the animal to the chemical.

The amount of chemical to which an animal may be exposed is influenced by several factors, such as the presence of fur or feathers, environmental conditions, and foliar interception of spray. When an animal is exposed to a chemical, only a portion of the chemical applied or ingested is actually absorbed or taken in by the animal (the dose). Various absorption rates for wildlife are not available, so direct spray scenarios assume 100 percent absorption for this analysis.

In this analysis, only the highest ranges of exposure assumptions are included, although a more complete range of possible values is included in the FS/SERA risk assessments and in all worksheets attached to Appendix B. For example, for a given herbicide, residues of the herbicide on vegetation that are reported in the literature will vary between studies and by vegetation type. A range of residue rates is used in the FS/SERA risk assessment worksheets, but only the highest reported rates are used in the data reported here. Only the highest values are used here to reduce length and complexity of this document and also to present a reasonable “worst-case” exposure analysis. It should be noted, however, that reporting only the upper estimates of exposure assumptions could distort the risk (by potentially over stating it) and does not adequately encompass the uncertainties involved (Durkin, pers. comm.).

### Non-herbicide Treatment Effects

The effects of other methods of invasive plant treatment to listed wildlife were evaluated by consulting peer-reviewed literature, previous Biological Opinions, and species experts, as well as using professional judgment and common sense.

## General Effects of Invasive Plant Treatment

Wildlife species may be adversely affected by invasive plant treatment methods. All treatment methods have the potential to disturb, temporarily displace, or directly harm various wildlife species. Successful control of invasive plant infestations provides long-term benefits by restoring and preventing further loss of native habitat. Treatment of larger infestations may create more disturbances for longer periods than small infestations, but the specific amount and duration is largely dependant upon specific treatment method. Several techniques can create bare ground, which may reduce cover and expose certain species to increased predation. Large tracts of bare ground can alter migration and dispersal of some species (Semlitsch 2000). The likelihood of these effects depends on the size and distribution of bare ground created.

The effects of the invasive plant treatment are also relative to the size and locations of existing and future invasive plant infestations. Treatments of infestations along disturbed roadsides are not likely to substantially affect terrestrial wildlife populations, since this vegetation type does not provide essential habitat for native wildlife species, and it consists of long, narrow areas spread over large distances. Adverse effects to individuals using the roadside vegetation at the time of treatment could occur.

Treatments of moderate-sized infestations may pose the greatest risk to native wildlife. In moderately infested areas, enough native habitats may remain to support some native wildlife, and the infestation may be large enough to require more intensive and extensive treatment techniques. Very large infestations and monocultures of invasive plants do not support native wildlife populations and the presence of native wildlife in these areas is greatly reduced in comparison to native habitat.

## Manual

Manual treatments can result in disturbance caused by human presence. The degree of threat and effect from manual treatments depends on the number of workers present and the size of the area being treated. Because manual techniques are slower than mechanical or herbicide methods, the duration of disturbance, caused by the presence of people, may be longer in the treatment area.

### Mechanical

Mechanical treatments may generate loud noises that could flush birds from a nest or interfere with feeding of nestlings. Noise generated by mechanical equipment varies, with large chainsaws generating noise levels that could disrupt nesting or feeding when conducted in proximity to nests. Other equipment, like string trimmers, mowers, herbicide spray rigs, or heavy equipment, may generate less noise than large chainsaws.

### Biological

Biological control methods will not directly affect native wildlife species, however, recent studies have found that native rodents may take advantage of the food source provided by biological control agents (Pearson et al., 2000). Biological control methods that reduce invasive plant populations, increase native plant populations, and provide a supplemental food source are indirectly beneficial to wildlife. Any biological control agents that affected native plant species could adversely affect wildlife. No biological control agents are known to directly or indirectly affect bald eagles, northern spotted owls or their habitats.

### Prescribed Fire

The potential effects to wildlife from prescribed fire, depend on the size, intensity, duration, and season of the burn. For invasive plant treatment, fire is used primarily when there are homogenous stands of invasive plants and fire is needed to remove biomass, reduce seed production, or reduce the seed bank on the surface of the soil. Prescribed fire is useful as a prelude to control with other methods because fire can increase germination of and access to invasive plants. The heat from the fire can destroy bird nests, or kill small mammals and reptiles that cannot escape the burn. Smoke may affect some species of birds, but effects from smoke have generally only been reported for very large wildfires where heavy smoke was present for almost one month (Tilghman and Paton 1988). If the prescribed fire kills trees, nesting or foraging habitat may be reduce for some animals but may be increased for snag and cavity-dependent animals. Predatory birds often hunt in recently burned areas because of increased visibility of and access to prey.

## Site Restoration/Revegetation

Reseeding or revegetation to increase competition with invasive plants can cause short-term disturbance to wildlife similar to manual or mechanical treatments, depending on specific methods used. If native or non-native, non-invasive forage species are used in restoration or competitive plantings, increased food and native habitat could benefit wildlife. Restoration activities have the potential to restore important wildlife habitat faster than natural or passive revegetation.

## Effects of Herbicides

Herbicides vary in their environmental activity and physical form. Some may be oil- or water-soluble molecules dissolved in liquids, or attached to granules for dry application to soil surface. Herbicides may move from their location of application through leaching (dissolved in water as it moves through soil), volatilization (moving through air as a dissolved gas), or adsorption (attached by molecular electrical charges to soil particles that are moved by wind or water).

In soil and water, herbicides may persist or decompose by sunlight, microorganisms, or other environmental factors. Soil properties, rainfall patterns, slope, and vegetative cover greatly influence the likelihood that an herbicide will move off-site, once applied.

In combination with other site and biological factors, these characteristics influence both the probability of meeting site-specific goals for invasive plant control, and the potential of impacting non-target components of the environment.

The effects from the use of any herbicide depends on the toxic properties (hazards) of that herbicide, the level of exposure to that herbicide at any given time, and the duration of that exposure. Risk to wildlife can be reduced by choosing herbicides with lower potential for toxic effects when exposure may occur. Exposure of wildlife to herbicides can be greatly reduced or increased depending on site-specific implementation techniques and timing used in herbicide application projects. Exposure can be reduced by such methods as streamside buffer zones, timing applications to avoid sensitive seasons, varying application methods used, and combining herbicide treatments with non-herbicide treatments to reduce overall use. These project design features, or criteria, are typically used in current projects and the expectation is that they will continue to be used to reduce potential exposures to wildlife. A Standard in the Land Management Plans requires the use of project design criteria to reduce effects to listed and proposed species.

The hazards associated with each herbicide active and inert ingredients, impurity or metabolite, were determined by a thorough review of available toxicological studies. For a background discussion of all toxicological tests and endpoints considered in Forest Service Risk Assessments, refer to SERA, 2001.

Herbicides are not pure compounds and they contain the active ingredient, impurities, adjuvants, inert ingredients, and may also contain surfactants. The effects of inert ingredients, adjuvants, impurities, and surfactants to wildlife are discussed first, followed by a discussion of the effects of the active ingredients.

### Inerts, Adjuvants and Impurities

Inert compounds are those that are intentionally added to a formulation, but have no herbicidal activity and do not affect the herbicidal activity. Inerts are added to the formulation to facilitate its handling, stability, or mixing. Impurities are inadvertent contaminants in the herbicide, usually present as a result of the manufacturing process. Adjuvants are compounds added to the formulation to improve its performance. They can either enhance the activity of an herbicide's active ingredient (activator adjuvant) or offset any problems associated with its application (special purpose or utility modifiers). Surfactants are one type of adjuvant that makes the herbicide more effective by increasing absorption into the plant, for example.

Inerts and adjuvants, including surfactants, are not under the same registration guidelines as are pesticides. The EPA classifies these compounds into four lists based on the available toxicity information. If the compounds are not classified as toxic, then all information on them is considered proprietary and the manufacturer need not disclose their identity. Therefore, inerts and adjuvants generally do not have the same amount of research conducted on their effects, especially to wildlife species, compared to active ingredients.

**Impurities and Metabolites**

All herbicides likely contain impurities as a result of the synthesis or production process. The toxic effects of impurities are addressed in toxicity tests using the technical grade product, which would contain the impurities.

Hexachlorobenzene is an impurity in the technical grade products of clopyralid and picloram. Hexachlorobenzene is a ubiquitous and persistent chemical in the environment, as it is used or present in a wide variety of manufacturing processes. It has been shown to cause tumors in mice, rats and hamsters, and EPA has classified it as a probable human carcinogen (SERA, 2003 Picloram). The amount of hexachlorobenzene released into the environment from Forest Service use of picloram and clopyralid is inconsequential in comparison to existing background levels and the annual release from manufacturing processes (SERA, 2003 Picloram). The use of picloram and clopyralid in remote forest locations could constitute the primary source of localized contamination. The projected amounts of hexachlorobenzene released during invasive plant treatments is calculated to be well below the level that poses a risk to cancer in mammals.

POEA surfactant used in Roundup and Roundup Pro contain 1,4-dioxane as an impurity, which has been classified by EPA as a probable human carcinogen. Based on current toxicity data and an analysis by Borrecco and Neisess (1991), the potential effects of 1,4-dioxane are encompassed by the available toxicity data on the Roundup formulation (SERA, 2003 Glyphosate). Borrecco and Neisess (1991) also demonstrated that the upper limit of risk of cancer from this impurity was less than one in a million.

Triclopyr contains an impurity, 2- butoxyethanol (aka EGBE), that is a major industrial chemical used in a wide variety of industrial and commercial applications. It is known to cause fragile red blood cells in rodents (Borrecco and Neisess 1991). EPA has classified EGBE as moderately toxic. Borrecco and Neisess (1991) found that potential doses of EGBE to mammals were less than 0.001 of the lowest LD50 and did not substantially increase risk over the risk identified for triclopyr, even under worst-case scenarios. Data on toxicity of EGBE to birds was lacking, but the authors conclude that comparative sensitivities between birds and mammals, and the extremely low doses indicated a low risk to birds.

Similar to impurities, the potential health effects of herbicide metabolites are often accounted for in the available toxicity studies, assuming that the toxicological effects of metabolism within the test animal species would be similar to those in other animals. The potential toxic effects of environmental metabolites (those formed as a result of processes outside of the body) may not be accounted for by laboratory toxicity studies.

TCP (3,5,6-trichloro-2-pyridinol) is an environmental metabolite of triclopyr. It is substantially more toxic to fish than either triclopyr acid or triclopyr TEA, and is similar to the toxicity of triclopyr BEE (SERA, 2003 Triclopyr). For fish, the risk characterization for TCP was considered quantitatively, using available toxicity data. SERA (2003, Triclopyr) found that worst-case exposures of fish to TCP did not exceed levels of concern when triclopyr is applied at the typical application rate. However, at higher application rates, the level of concern is substantially exceeded and adverse effects to fish are plausible (using worst-case exposure assumptions) from this metabolite.

In mammals, TCP has about the same toxicity as triclopyr. No quantitative estimate of exposure to mammals or birds was calculated in the SERA risk assessment, due to the lack of appropriate data. However, since TCP is as toxic as triclopyr, the risk characterization for triclopyr could be applied to TCP.

Site-specific analysis is necessary to further evaluate the risk of toxic effects from TCP. The Proposed Action restricts use of triclopyr to specific application methods, such as spot spray or cut stump applications. Since the worst-case exposure estimates were done using either an accidental spill of

200 gallons of triclopyr, or a broadcast spray of triclopyr to a 10-acre area, it does not appear plausible for the resulting estimates of TCP concentration to occur given the restrictions contained in the Proposed Action. Exposure of mammals or birds to TCP would also be minimal.

**Inert Ingredients**

An inert ingredient in an herbicide is any ingredient that does not kill plants. Surfactants are a special type of inert ingredient discussed in a following section.

The EPA has categorized approximately 1,200 inert ingredients into four lists. Lists 1 and 2 contain inert ingredients of known or suspected toxicological concern. List 4 contains non-toxic substances such as corn oil, honey and water. List 3 includes substances for which EPA has insufficient information to classify as either hazardous (List 1 and 2) or non-toxic (List 4).

None of the inert ingredients included on EPA's List 2, 3, or 4 need to be disclosed on the herbicide label, despite evidence that some compounds on these lists may cause adverse effects to laboratory animals and humans (Anonymous 1999; Cox 1999; Knight 1997; Knight and Cox 1998; Marquardt et al., 1998). EPA's own website (http://www.epa.gov/opprd001/inerts/) states, "Since neither federal law nor the regulations define the term "inert" on the basis of toxicity, hazard or risk to humans, non-target species, or the environment, it should not be assumed that all inert ingredients are non-toxic." Northwest Coalition for Alternatives to Pesticides (NCAP) obtained the identity of many inert ingredients through a Freedom of Information Act request; the list of inerts they obtained can be found at http://www.pesticide.org/FOIA/

Use of formulations containing inert ingredients on List 3 and 4 is preferred for invasive plant treatment under current Forest Service policy. A Standard in the Land Management Plans requires review of inert ingredients in a risk assessment prior to formulations being approved for use on FS projects.

Most information about inert ingredients that is submitted to EPA for pesticide registration is classified as "Confidential Business Information" (CBI). CBI is not generally released or available for public review. SERA risk assessors obtained clearance to review the identity and data on inerts in the CBI files, as well as used publicly available data, when preparing herbicide risk assessments. However, even when the inert ingredients can be identified, toxicity data on the ingredient may be lacking. This leads to substantial uncertainty in the assessment of hazard or risk posed by the inert ingredients. This is particularly true for wildlife species, as there is very little data regarding the effects to most wildlife species from inert ingredients contained in the 10 herbicides considered in the Proposed Action.

FS/SERA Risk Assessments analyze the effects of inert ingredients and full formulations by the process described below:

- Compare acute toxicity data between the formulated products (includes inert ingredients) and their active ingredients alone;
- Disclose whether or not the formulated products have undergone chronic toxicity testing; and
- Identify, with the help of EPA and the herbicide registrants, ingredients of known toxicological concern in the formulated products and assess the risks of those ingredients.

Researchers who have studied the relationships between acute and chronic toxicity have found that relationships do exist and acute toxicity data can be used to give an indication of overall toxicity (Zeise, et al., 1984). The court in *NCAP v. Lyng*, 844 F.2d 598 (9th Cir 1988) decided that this method of analysis provided sufficient information for a decision maker to make a reasoned decision. *In SRCC v. Robertson*, Civ.No. S-91-217 (E.D. Cal., June 12, 1992) and again in *CATs v. Dombeck*, Civ. S-00-2016 (E.D. Cal., Aug 31, 2001) the district court upheld the adequacy of the methodology described above for disclosure of inert ingredients and additives.

Available information for the inerts contained in the proposed herbicides are as follows:

*Chlorsulfuron* – The identity of inerts used in chlorsulfuron are confidential, but SERA reviewed them for preparation of the risk assessment (SERA, 2004 Chlorsulfuron). EPA has not classified any of the inerts as toxic. These inert ingredients do not affect the assessment of risk

*Clopyralid* – Identified inerts include monoethanolamine and isopropyl alcohol, both approved food additives. These inert ingredients do not impact the assessment of risk

*Glyphosate* – There are at least 35 glyphosate formulations that are registered for forestry applications (SERA, 2003 Glyphosate) with a variety of inert ingredients. SERA obtained clearance to access confidential business information (i.e. the identity of proprietary ingredients) and used this information in the preparation of the risk assessment. Surfactants (discussed below) were the only additives identified that impact risk (SERA, 2003 Glyphosate).

*Imazapic* - The identity of inerts used in imazapic formulations are confidential, but SERA reviewed them for preparation of the risk assessment (SERA, 2004 Imazapic). None of the inerts are classified by EPA as toxic.

*Imazapyr* – The NCAP website (http://www.pesticide.org/FOIA/picloram.html) identifies only glacial acetic acid as an inert ingredient. Isopropanolamine is also present, and it is classified as a List 3 inert.

*Metsulfuron methyl* - The identity of inerts used in metulfuron methyl formulstions are confidential, but SERA reviewed them for preparation of the risk assessment (SERA, 2004 Metsulfuron methyl). None of the inerts are classified by EPA as toxic.

*Picloram* formulations, Tordon K and Tordon 22K contain the following inerts: potassium hydroxide, ethoxylated cetyl ether, alkyl phenol glycol ether, and emulsified silicone oil (NCAP website; http://www.pesticide.org/FOIA/picloram.html). Potassium hydroxide is an approved food additive. The other compounds are all on EPA’s List 4B, inerts of minimal concern. They may also contain the surfactant polyglycol 26-2, which is on EPA’s List 3: Inerts of Unknown Toxicity, discussed in the following section. The toxicity data on the formulations encompasses toxic risk from the inerts. Inerts in picloram formulations do not appear to pose a unique toxic risk to wildlife (SERA, 2003 Picloram).

*Sethoxydim* - The formulation Poast contains 74 percent petroleum solvent that includes naphthalene. The EPA has placed this naphthalene on List 2 (“agents that are potentially toxic and a high priority for testing”). Petroleum solvents and naphthalene depress the central nervous system and cause other signs of neurotoxicity (SERA, 2001). Poast has also been reported to cause skin and eye irritation. There is no information suggesting that the petroleum solvent has a substantial impact on the toxicity of sethoxydim to experimental animals, with the important and notable exception of aquatic animals (SERA, 2001). Poast is much more toxic to aquatic species than sethoxydim.

*Sulfometuron methyl* - The identity of inerts used in Oust are confidential, but SERA reviewed them for preparation of the risk assessment (SERA, 2004 Sulfometuron methyl). None of the inerts are classified by EPA as toxic. Based on comparison of the toxicities of the active ingredient and the formulation, there is no reason to suspect that Oust contains other ingredients that substantially affect the potential risk to wildlife.

*Triclopyr* - Formulations contain ethanol (Garlon 3A) or kerosene (Garlon 4), which are known to be neurotoxic. However, the toxicity of these compounds is less than that of triclopyr, so the amount of ethanol and kerosene in these formulations is not toxicologically significant (SERA, 2003 Triclopyr) for wildlife.

The amount of inert ingredients in the formulations is generally not known, so exposure and dose estimates cannot be calculated. Use of formulations containing toxic inert ingredients may increase the risk of toxic effects to wildlife above that, or in addition to, the risk discussed for the active ingredient.

**Surfactants**

Surfactants, or surface-acting agents, facilitate and enhance the absorbing, emulsifying, dispersing, spreading, sticking, wetting, or penetrating properties of herbicides. There is a fair amount of research on the effects of surfactants to terrestrial and aquatic organisms because they are widely used in detergents, cosmetics, shampoos and other products designed for human exposure.

The following information is taken from “Analysis of Issues Surrounding the Use of Spray Adjuvants With Herbicides” (USDA FS, 2003) and “Human and Ecological Risk Assessment of Nonylphenol Polyethoxylate-based (NPE) Surfactants in Forest Service Herbicide Applications” (USDA FS, 2003). Refer to these documents for more complete discussions.

Some glyphosate formulations contain polyethoxylated tallow amine (POEA) surfactant, which is substantially more toxic to aquatic species than glyphosate or other surfactants that may be used with glyphosate (SERA, 2003 Glyphosate). In the SERA risk assessment, the toxicity of glyphosate is characterized based on the use of a surfactant, either in the formulation or added as an adjuvant in a tank mixture (SERA, 2003 Glyphosate).

Polyglycol 26-2, used in picloram, will impact mitochondrial function in vitro, but information is insufficient to evaluate risks to wildlife in vivo from field applications at plausible levels of exposure (SERA, 2003 Picloram).

The primary active ingredient in many of the non-ionic surfactants used by the Forest Service is a component known as NonylPhenol polyEthoxylate (NPE). NPE is found in these commercial surfactants at rates varying from 20 to 80 percent. NPE is formed through the combination of ethylene oxide with nonylphenol (NP), and may contain small amounts of un-reacted NP. Nonylphenol is a material recognized as hazardous by the U.S. EPA (currently on U.S. EPA’s inerts List 1). Both NP and NPE exhibit estrogen-like properties, although they are much weaker than the natural estrogen, estradiol.

Data is insufficient or lacking on the toxic effects of NP or NPE to birds and terrestrial invertebrates. NPE and NP are slightly toxic to practically non-toxic to mammals.

NP and NPE are weakly estrogenic in aquatic and terrestrial organisms (1000 to 100,000 times weaker than natural estrogen). NP and NPE are not toxic to soil microbes. NP is highly toxic to many aquatic organisms at low concentrations (currently on U.S. EPA’s Inert List 1).

The use of NPE-based surfactants in any of the 12 herbicides considered in this EIS could result in toxic effects to some mammals at typical and high application rates (USDA FS, 2003). The exposure scenarios and calculated doses used in the analysis represent worst-case scenarios and are not entirely plausible. Wildlife at most risk from adverse effects of NPE surfactants, at the typical application rate, include small mammals that may be directly sprayed, and large mammals consuming contaminated vegetation. At the highest application rate, small mammals that may be directly sprayed, and large or small mammals consuming contaminated vegetation may be at risk of adverse effects. No chronic exposures result in plausible risk to mammals.

NP and NPE have been studied for effects to aquatic organisms. NP is more toxic than NP9E, by one to three orders of magnitude (USDA FS, 2003). The toxicities of the intermediate breakdown products, NPEC and others, are intermediate between NP and NPE. In the aquatic environment, the breakdown products NP1EC and NP2EC are likely to be present also. These two metabolites are known to affect vitellogenin (a precursor for egg yolk) production in male fish, but NP, which is a more potent estrogenic compound, did not cause vitellogenin increases in male Xenopus laevis, or leopard frogs (Selcer et al., 2001; cited in USDA FS, 2003).

Mann and Bidwell (2000, 2001) tested several Australian frogs and Xenopus for effects to NP8E. They found that Xenopus was the most sensitive to toxic effects, with an LC50 of 3.9 ppm (3.9 mg/L). Similar to studies with herbicides, the LC50 values for the frogs are comparable to those for fish (USDA FS, 2003). NP8E inhibited growth at concentrations as low as 1 ppm (Mann and Bidwell, 2000, 2001). Mild narcosis of tadpoles can occur at EC50 values as low as 2.3 ppm, and reduced dissolved oxygen content in the water lowered the EC50 values by about half as compared to normal oxygen levels. The tadpoles recovered from the narcosis. Malformations in Xenopus occurred at EC50 values between 2.8 and 4.6 mg/L.

NP may cause tail resorption with a 14-day NOEC of 25 ppb for Xenopus laevis (Fort and Stover 1997; cited in USDA FS, 2003). NP also increased the percentage of female Xenopus developing from tadpoles exposed to 22 ppb for 12 weeks, but did not produce this effect at 2.2 ppb.

During operational use of NPE surfactant, ambient levels of NP9E (including a small percentage of NP, NP1EC, and NP2EC) could average 12.5 ppb (range 3.1 to 31.2 ppb). The duration of these exposures from Forest Service use would generally be much shorter than those used in laboratory experiments, due to transport by flowing streams, dilution, and environmental degradation. These levels are not likely to adversely affect amphibians found in the Pacific Northwest for normal operations. However, overspray or accidental spills could produce concentrations of NP9E that could adversely affect amphibians, particularly in small stagnant ponds.

## Endocrine disruption

Recent information has highlighted the potential for certain synthetic and natural chemicals to affect endocrine glands, hormones, and hormone receptors (endocrine system). The endocrine system helps control metabolism, body composition, growth and development, reproduction, and many other physiological regulators. An endocrine disrupter is a substance that may exert effects to the body by affecting the availability of a hormone to its target tissue(s) and/or affecting the response of target tissues to the hormone (SERA, 2002). Estrogen is a prominent hormone in animal systems and substances that mimic estrogen or stimulate similar responses in target tissues are referred to as "estrogenic."

Scientists have expressed concern regarding estrogenic effects of synthetic chemicals since before the 1970's. The EPA (1997) reports effects of endocrine disruption in animals that "include abnormal thyroid function and development in fish and birds; decreased fertility in shellfish, fish, birds, and mammals; decreased hatching success in fish, birds, and reptiles; demasculinization and feminization of fish, birds, reptiles, and mammals; defeminization and masculinization of gastropods, fish, and birds; decreased offspring survival; and alteration of immune and behavioral function in birds and mammals."

Some of the more noted endocrine glands include gonads, adrenal, pancreas, thyroid and pituitary. Alteration in endocrine function may affect reproductive output (i.e. feminization, masculinization), and therefore, could affect population numbers of affected species.

Many of the known endocrine disrupting contaminants have been banned or are regulated (e.g. DDT/DDE, PCB, TCDD). Some endocrine disrupting compounds are persistent and are still found within the living tissue of wildlife; their decomposition half-life is lengthy, they bioaccumulate, and are present in the environment at high background levels. A local example is the high level of DDT/DDE and PCB that are found within peregrine falcons in the Pacific Northwest (Pagel, unpub. data). Research has suggested that embryonic exposure to endocrine disrupters may cause permanent health effects to adult animals. Some of these effects may include altered blood hormone levels, reduced fecundity, reproductive behavioral alterations, reduced immune function, masculinization and feminization, undescended testicles, increased cancer rates, altered bone density and structure, and malformed fallopian female reproductive tract (Kubiak et al., 1989; Colborn et al. 1993; White et al., 1994; Fry, 1995; LeBlanc, 1995). Examples of wildlife species that have been adversely affected by endocrine disrupters include wood ducks in Arkansas, wasting and embryonic deformities of Great Lakes piscivorous birds, reproductive abnormalities of snapping turtles, gulls, trout and salmonids, alligators, mink, and Florida panther (Bishop et al., 1991; Colborn, 1991; Facemire et al., 1995; Fox et al., 1978, 1991 (a, b), Fry and Toone, 1981; Fry et al. 1987; Gilbertson et al., 1991; Guillette et al., 1994, 1995; Kubiak et al., 1989; Mac and Edsall, 1991, 1993; Leatherland, 1993; Peakall and Fox, 1987; and Wren, 1991).

Recently, evidence of endocrine disruption in African clawed frogs and leopard frogs have been attributed to the herbicide Atrazine from field and laboratory exposures (Hayes 2002a, 2002b , 2003, 2006).

Of the herbicides analyzed for this EIS, only NPE surfactants have been identified as potentially having estrogenic effects (USGS 1998; Bakke 2003). Triclopyr and glyphosate have been evaluated for endocrine disrupting effects, and the weight of evidence indicates that these herbicides cause no specific toxic effects on endocrine function (SERA, 2002).

### Synergistic Effects

Certain chemicals may cause synergistic effects in the presence of other chemicals: that is, the total effect of two chemicals may be greater than that suggested by the sum of the effects from the individual components (USEPA, 2000). However, information regarding the existence or potential for synergistic effects from the herbicides discussed in this document is very limited.

Some of the herbicides analyzed for the EIS (e.g. picloram) have been investigated for possible synergistic effects but the study designs were insufficient for the assessment of toxicologic interactions (SERA, Picloram, p.3-35). Some studies of some chemicals (not necessarily herbicides) have noted statistically significant interactions (both synergistic and antagonistic) (Durkin, pers. com.). Even with excellent data, the complexity of the experimental designs necessary to properly assess interactions, and the uncertainties regarding the dose-response relationship for interactions, make the quantitative use of interaction data in risk assessments infeasible (ATSDR 2004, U.S. EPA 2000b).

U.S. EPA (2000b) did state that for exposures at low doses, with low risk for each component in the chemical mixture, that the likelihood of significant interaction (e.g. synergistic effects) is usually considered to be low. Likewise, a report by ATSDR (2004) cited several studies using rats that found no synergistic effects for mixtures of four, eight and nine chemicals at low (sub-toxic) doses. However, some studies have found different results for some chemicals, the study of synergist effects is extremely complicated, and there can be substantial uncertainty in the risk characterization for chemical mixtures (ATSDR, 2004; USEPA, 2000).

### Effects of Active Ingredients in Herbicides

The most sensitive effect from the most sensitive species tested was used to determine the toxicity indices for each herbicide. Quantitative estimates of dose from each exposure scenario were compared to the corresponding toxicity index to determine the potential for adverse effect. Doses below the toxicity indices resulted in a discountable effects.

Table 84 lists the toxicity indices used to assess risk to birds and Table 85 the toxicity indices for mammals.

**Table 84.** Toxicity indices for birds used in the effects analysis. Indices represent the most sensitive endpoint from the most sensitive species for which adequate data are available.

| Herbicide | Duration | Endpoint | Dose | Species | Effects Noted at LOAEL |
|---|---|---|---|---|---|
| Chlorsulfuron | Acute | NOAEL | 1686 mg/kg | Quail | No significant effects at highest dose |
| | Chronic | NOAEL | 140 mg/kg/day | Quail | No significant effects at highest dose |
| Clopyralid | Acute | NOAEL | 670 mg/kg | Mallard & Quail | No signs of toxicity reported, LOAEL not determined |
| | Chronic[1] | NOAEL | 15 mg/kg/day | Rat | Thickening of gastric epithelium at 150 mg/kg/day |
| Glyphosate | Acute | NOAEL | 562 mg/kg | Mallard & Quail | No effects at highest dose |
| | Chronic | NOAEL | 100 mg/kg | Mallard & Quail | No effects on reproduction at highest dose |
| Imazapic | Acute | NOAEL | 1100 mg/kg | Quail | No effects at highest dose |
| | Chronic | NOAEL | 113 mg/kg/day | Quail | Decreased weight gain in chicks at 170 mg/kg/day |
| Imazapyr | Acute | NOAEL | 674 mg/kg | Quail | No effects at highest dose |
| | Chronic | NOAEL | 200 mg/kg/day | Mallard & Quail | No effects at highest dose |
| Metsulfuron methyl | Acute | NOAEL | 1043 mg/kg | Quail | No significant effects at highest dose |
| | Chronic | NOAEL | 120 mg/kg/day | Mallard & Quail | No significant effects at highest dose |
| Picloram | Acute | NOAEL | 1500 mg/kg | Chicken & pheasant | No effect to reproduction. LOAEL not reported |
| | Chronic[2] | NOAEL | 7 mg/kg/day | Dog | Increased liver weight at 35 mg/kg/day |
| Sethoxydim | Acute | NOAEL | >500 mg/kg | Mallard & Quail | No or low mortality at highest doses tested. LOAEL not available. |
| | Chronic | LOAEL[3] | 10 mg/kg/day | Mallard | Decreased number of normal hatchlings at 10 mg/kg/day |
| Sulfometuron methyl | Acute | NOAEL | 312 mg/kg | Mallard | Decreased weight gain at 625 mg/kg/day |
| | Chronic[4] | NOAEL | 2 mg/kg/day | Rat | Effects on blood and bile ducts at 20 mg/kg/day |
| Triclopyr BEE[5] | Acute | $LD_{50}$ | 388 mg/kg | Quail | 50% mortality at 388 mg/kg |
| | Chronic | NOAEL | 10 mg/kg/day | Mallard & quail | Decreased survival of offspring, reduced eggshell thickness at 20 mg/kg/day |
| Triclopyr TEA | Acute | $LD_{50}$ | 535 mg/kg | Quail | 50% mortality at 535 mg/kg |
| | Chronic | NOAEL | 10 | Mallard & | Decreased survival of |

| | | | | | |
|---|---|---|---|---|---|
| | | | mg/kg/day | Quail | offspring, reduced eggshell thickness at 20 mg/kg/day |
| NPE Surfactants[7] | Acute | NOAEL | 10 mg/kg | Rat | Slight reduction of polysaccharides in liver at 50 mg/kg/day |
| | Chronic | NOAEL | 10 mg/kg/day | Rat | Increased weights of liver, kidneys, ovaries, and decreased live pups at 50 mg/kg/day |

1 Chronic toxicity studies in birds are not available, so the value from mammal studies is used.
2 Chronic toxicity studies in birds are not available, so the value from mammal studies is used.
3 Based on one study in which a NOAEL was not determined, so the LOAEL is used.
4 Birds may be somewhat less sensitive than mammals, but data are limited, so the lower value from mammal studies is used.
5 Unlike in mammals, the toxicities of triclopyr BEE and triclopyr TEA are different for birds, so the indices of the two forms of triclopyr are presented separately
7 Data on birds is not available in published literature so data from mammals is used.
Source: SERA 1998, 2001, 2003, 2004; USFS 2003c

**Table 85.** Toxicity indices for mammals used in the effects analysis. Indices represent the most sensitive endpoint from the most sensitive species for which adequate data are available.

| Herbicide | Duration | Endpoint | Dose | Species | Effect Noted at LOAEL |
|---|---|---|---|---|---|
| Chlorsulfuron | Acute | NOAEL | 75 mg/kg | Rabbit | Decreased weight gain at 200 mg/kg |
| | Chronic | NOAEL | 5 mg/kg/day | Rat | Weight changes at 25 mg/kg/day |
| Clopyralid | Acute | NOAEL | 75 mg/kg | Rat | Decreased weight gain at 250 mg/kg |
| | Chronic | NOAEL | 15 mg/kg/day | Rat | Thickening of gastric epithelium at 150 mg/kg/day |
| Dicamba | Acute | NOAEL | 45 mg/kg | Rat | Decreased pup growth at 120 mg/kg |
| | Chronic | NOAEL | 45 mg/kg/day | Rat | Decreased pup growth at 120 mg/kg |
| Glyphosate | Acute | NOAEL | 175 mg/kg | Rabbit | Diarrhea at 350 mg/kg |
| | Chronic | NOAEL | 175 mg/kg/day | Rabbit | Diarrhea at 350 mg/kg |
| Imazapic | Acute | NOAEL | 350 mg/kg | Rabbit | Decreased body weight at 500 mg/kg |
| | Chronic | NOAEL[1] | 45 mg/kg | Dog | Microscopic muscle effects at 137 mg/kg |
| Imazapyr | Acute | NOAEL | 250 mg/kg | Dog | No effects at highest doses tested |
| | Chronic | NOAEL | 250 mg/kg/day | Dog | No effects at highest doses tested |
| Metsulfuron methyl | Acute | NOAEL[2] | 25 mg/kg | Rat | Decreased weight gain at 500 mg/kg |
| | Chronic | NOAEL | 25 mg/kg/day | Rat | Decreased weight gain at 125 mg/kg |
| Picloram | Acute | NOAEL | 34 mg/kg | Rabbit | Decreased weight gain at 172 mg/kg |
| | Chronic | NOAEL | 7 mg/kg | Dog | Increased liver weight at 35 mg/kg[4] |
| Sethoxydim | Acute | NOAEL | 160 mg/kg[4] | Rabbit | Reduced number of viable fetuses, some dam mortality at 480 mg/kg |
| | Chronic | NOAEL | 9 mg/kg/day | Dog | Mild anemia at 18 mg/kg/day |
| Sulfometuron methyl | Acute | NOAEL | 87 mg/kg | Rat | Decreased body weight at 433 mg/kg |
| | Chronic | NOAEL | 2 mg/kg/day | Rat | Effects on blood and bile ducts at 20 mg/kg/day |
| Triclopyr[5] | Acute | NOAEL | 100 mg/kg | Rat | Malformed fetuses at 300 mg/kg |
| | Chronic[6] | NOAEL | 0.5 mg/kg/day | Dog | Effect on kidney at 2.5 mg/kg/day |
| NPE Surfactants | Acute | NOAEL | 10 mg/kg | Rat | Slight reduction of polysaccharides in liver at 50 mg/kg/day |
| | Chronic | NOAEL | 10 mg/kg/day | Rat | Increased weights of liver, kidneys, ovaries, and decreased live pups at 50 mg/kg/day |

1 Imazapic – NOAEL calculated from a LOAEL of 137 mg/kg/day and application of a safety factor of 3 to extrapolate from a LOAEL to a NOAEL.
2 The acute NOAEL of 24 mg/kg is very close to the chronic NOAEL, so chronic value is used for acute exposures as well.
3 USEPA/OPP 1998
4 Source of the value used by EPA (180 mg/kg) is not well documented, so the lower value of 160 mg/kg from a rabbit study is used as the toxicity index for this analysis.
5 Triclopyr BEE and TEA have equal toxicities to mammals (SERA 2003 Triclopyr).
6 Value taken from Quast et al. 1976 as cited in SERA 2003 Triclopyr. This represents an extremely conservative approach, explained in more detail in the write up on triclopyr later in this document.
Source: SERA 2001, 2003, 2004 and USFS 2003c.

## Summary

Effects of invasive plant treatment methods to wildlife were evaluated and discussed in detail in the R6 2005 FEIS and its Appendix P, the corresponding Biological Assessment (USFS 2005d), project files, and SERA risk assessments (2001, 2003, 2004). These documents indicate that disturbance from manual and mechanical treatment pose greater risks to terrestrial wildlife species of local interest than herbicide use.

For spotted owls, loud and sudden noises above background or ambient levels (those above 92 dB) can cause disturbance that might flush a bird off the nest or abort a feeding attempt. Vehicles used to spray roadside vegetation with herbicides do not make noise above 92 dB, based on recent field measurements, so no “injury” or “harassment” from noise will occur. Other mechanical devices proposed for use on invasive plants include brushing machines, mowers, chainsaws, and string trimmers. These tools have the potential to create noise above background levels that may disturb owls if used close to nests during the early nesting season. Bald eagles could be disturbed by these same tools, as well as human presence, but eagles are quite variable in their responses to activity and noise in the vicinity of their nests or roosts.

Small species that lack rapid mobility (e.g. amphibians, mollusks) are vulnerable to crushing or injury from people or equipment. The mechanical treatments proposed are primarily the use of string trimmers (weed whacking), with two areas identified for roadside mowing/brushing and two areas for discing. The potential for this effect can often be minimized by the seasonal timing of treatments. This is discussed in more detail in the following sections.

Prescribed fire may remove habitat for some animals but improve it for others. Fire could kill small species that are unable to escape the burn. Burns involving large acreages are more likely to result in mortality or habitat loss than burns involving small acreages. The prescribed burns proposed in this document for invasive plant control are unlikely to have adverse effects, including mortality, to wildlife because the burns are in very small patches and areas dominated by houndstongue, which does not provide suitable habitat for any TES, MIS or any other species of local interest.

Invasive plant treatments will not alter native habitat structure or composition for terrestrial wildlife species, including MIS, or bird species included in Birds of Conservation Concern (U.S. Fish and Wildlife Service 2002) or the Partners in Flight strategy for landbirds (Altman 2000). In some cases, removal of invasive plants could cause a very localized decrease in the amount of vegetative cover provided. Due to the patchy nature of the invasive plant infestations, the amount of cover lost would be so small that it is not measurable in a meaningful manner. Unlike other management activities, such as grazing or timber harvest, invasive plant treatments do not reduce habitat available to native wildlife. Likewise, prey availability would not be reduced because invasive plants are located in relatively small patches, or along narrow road corridors, within and adjacent to the much larger natural habitats in which the prey reside.

Risk from herbicide exposure was determined using data and methods outlined in the SERA risk assessments. Tables 8 and 9 in the Biological Assessment (USFS 2005d, pp. 138-140) list the toxicity indices used as the thresholds for potential adverse effects to mammals and birds (respectively) from each herbicide. A quantitative estimate of dose using a “worst case” scenario was compared to these toxicity indices. The toxicity indices are used as a potential effect threshold; doses below the thresholds indicated no plausible adverse effect. The toxicity indices used for each species group were the most sensitive effect endpoint from the most sensitive species from available data. There is insufficient data on species-specific responses to herbicides for free-ranging wildlife, so wildlife species were placed into groups based on taxa type (e.g. bird, mammal), body size, and diet (e.g. insect-eater, fish-eater, plant-eater). Quantitative estimates of dose for each animal grouping for each herbicide are contained in the project file worksheets.

Data is very limited or lacking on potential adverse effects of herbicides to mollusks and amphibians. There is some data to suggest that amphibians may be as sensitive to herbicides as fish (Berrill et al. 1994; Berrill et al. 1997; Perkins et al. 2000), so for this analysis, herbicides that pose potential risk to federally listed fish (as determined by the quantitative estimates from exposure scenarios) will also be considered to pose a risk to amphibians. Glyphosate, picloram, and sethoxydim were identified as posing potential risks to fish in the aquatic species BA (USFS 2005d). Sulfometuron methyl was specifically tested on amphibians and it may cause malformations, but only at very high application rates. Triclopyr used in a broadcast spray scenario may pose a risk to fish and amphibians, but a Standard in the Forest Plan restricts triclopyr to selective application methods only, almost eliminating the opportunity for exposure.

Relyea (2005) found no effect to three species of aquatic snails from the glyphosate formulation Roundup. Only glyphosate and picloram have been tested on a terrestrial mollusk; the brown garden snail (*Helix aspersa*). Neither glyphosate nor picloram appeared to pose a risk to the snail (see USFS 2005d, Appendix B).

Under "worst case" scenarios, mammals and birds that eat insects or grass may be harmed by some herbicides and surfactants. Amphibians also appear to be at higher risk of adverse effects due to their permeable skin and aquatic or semi-aquatic life history.

The SERA and Bakke risk assessments and the R6 2005 FEIS indicated that for typical application rates, triclopyr and NPE surfactants produced doses that exceeded toxicity indices for birds and mammals. NPE surfactant exceeded the toxicity index for direct spray of a small mammal, large mammal and large bird that consumed contaminated vegetation (acute), and small mammal and small bird that consume contaminated insects.

The "worst case" exposure scenarios do not account for factors such as timing and method of application, animal behavior and feeding strategies, seasonal presence or absence within a treatment area, and/or implementation of Project Design Criteria. Therefore, risk is overestimated when compared to actual applications proposed in this EIS.

Nonetheless, caution in the design and implementation of the project is warranted. In many cases, insufficient data is available to allow for a quantitative risk assessment. For instance, there is no quantitative scenario for a predatory bird that eats primarily other birds, such as the peregrine falcon, so the "fish-eating bird" scenario was used as a surrogate. This scenario likely overestimates the dose to the peregrine falcon because the hypothetical fish consumed are from a pond contaminated by a large spill of herbicide. These hypothetical fish likely have higher concentrations of herbicide in their bodies (and thus a higher dose to the predatory bird) than would a small bird that incidentally ingested herbicide before it was preyed upon. Also, data was insufficient to assess risk of chronic exposures for a large grass-eating bird from NPE exposure, or insect-eating birds and mammals for several herbicides.

The limited spatial extent of infestations, which are limited primarily to disturbed roadsides (see Section 2.5), and the limits placed on herbicide applications will reduce exposure of wildlife to herbicides. Standards 19 and 20 adopted in the R6 2005 ROD require that adverse effects to wildlife species of local interest from invasive plant treatments be minimized or eliminated through project design and implementation. In addition, Standard 16 restricts broadcast use of triclopyr, which eliminates plausible exposure scenarios. All action alternatives must be designed to comply with these standards.

To account for uncertainty, the Project Design Features (PDF) place restrictions on how and where herbicides are applied. For example, PDFs eliminate broadcast herbicide treatments near perennial streams; minimize disturbance to certain habitats during certain times of the year; and prohibit the use of certain surfactants in some habitats. These Forest Plan Standards and Project Design Features ensure that no alternative adversely affects federally listed species, results in a trend toward listing of any sensitive species, nor adversely impacts the habitat of Management Indicator Species, landbirds, or Birds of Conservation Concern.

## Alternative 1 - No Action

There are existing NEPA documents that allow treatment of some invasive plants with manual and herbicide methods on the Forests and Grassland. Approximately 275 acres per year are treated with herbicide and 1,265 acres per year are treated manually. Only the herbicides glyphosate, dicamba, and picloram are approved for use. Environmental analysis for these existing projects concluded that there would be no adverse effects to any federal listed, Forest Service Sensitive, or MIS.

Project design features listed in this document are consistent with those required in the existing NEPA documents, or, the project sites in the existing NEPA documents do not include potential habitat for the wildlife discussed below.

Under the No Action alternative, the sites analyzed in these previous NEPA documents would be the only areas treated for invasive plants. The remaining infestations would go untreated and would likely expand. Habitat for a variety of wildlife, including some of the FS sensitive species, would likely degrade to a point that it becomes unsuitable. Infestations that become so well-established that future treatment is cost-prohibitive can result in a permanent loss of wildlife habitat (Asher 2000).

Habitat loss via invasive plant infestation has been reported to occur in Oregon spotted frog habitat that is invaded by reed canarygrass (McAllister and Leonard 1997, Watson et al. 2003)). Currently, the Deschutes and Ochoco National Forest have a Programmatic Biological Assessment that prohibits use of herbicides in and immediately adjacent to wetland habitat for Columbia and Oregon spotted frogs. Further loss of Oregon and Columbia spotted frog habitat, as well as other amphibian habitat, can be expected to occur in the project area for this alternative due to lack of proposed treatments, and prohibition on effective treatments, in their habitat.

Reed canarygrass infestations at Big Marsh may be reducing available nesting habitat for yellow rails, and if the infestation spreads to preferred nesting sites, yellow rail populations could be affected. Conclusive data supporting this hypothesis has not been collected.

Continued loss of habitat for sage grouse as well as pygmy rabbit can be expected with expansion of invasive plants (Connelly et al. 2000, Weiss and Verts 1984). Some decrease in available foraging habitat for elk and other big game is possible (Rice et al. 1997). The spread of wetland invasive plants will likely reduce waterfowl nesting habitat (Blossey 1999). Spread of burdock could result in additional instances of direct mortality to bats and hummingbirds.

With only 1,540 acres of proposed treatment within 14,546 acres of mapped infestations, at projected rates of spread (10-15% annually on western federal lands; Asher and Dewey 2005), this alternative could result in a substantial loss of habitat over time for several wildlife species.

### Effects of Alternatives 2 and 3

The two action alternatives both utilize manual, mechanical, cultural, biological, prescribed fire, and herbicide tools and methods for invasive plant treatment. Alternative 2 permits a wider variety of treatments in Riparian Reserves (RR) and Riparian Habitat Conservation Areas (RHCAs). Alternative 3 restricts the types of herbicides permitted within RR and RHCAs. A 300-foot buffer would be applied to all perennial streams, lakes, ponds, and reservoirs and to all fish-bearing streams. Inside the 300-foot buffer, there would be no broadcast spraying of herbicides permitted, no use of triclopyr, picloram, or sethoxydim at all, and no herbicide application within the channel of dry intermittent streams. Also, no herbicide application would occur within 10 feet of perennial or fish-bearing waters when water is present. Machinery or equipment that could cause substantial sedimentation would not be permitted within the buffers. Otherwise, the Proposed Action and Alternative 3 permit the same amount and types of invasive plant treatments. Effects to some wildlife species are not different between the alternatives because adverse effects from herbicide exposure are not plausible, required project design features avoid or minimize adverse effects from manual and mechanical techniques, or the wildlife species are not present within project area units or likely to be present in future areas treated under EDRR.

The project design features listed for bald eagles, spotted owls, and other species, apply to all alternatives (including the No Action). Because the project design features are required, and because they are effective at eliminating adverse effects from disturbance to these species, none of the action alternatives will result in adverse effects to these species from disturbance.

For bald eagles, which feed upon fish, adverse effects from herbicide or NPE surfactant exposure are not plausible because even if they fed on contaminated fish for a lifetime, the estimated dose for herbicide or NPE does not exceed a threshold of concern for potential effects (i.e. the toxicity index) (project file worksheets). For spotted owls, no herbicide or NPE dose from feeding on prey that had been directly sprayed exceeded the toxicity index for typical application rates (project file worksheets). In addition, exposure of spotted owl prey to herbicide, and the consumption of contaminated prey by spotted owls are not plausible because of the life history and habitat of the prey. The owl's arboreal and nocturnal prey, which does not feed upon invasive plants, has almost no opportunity to become exposed to herbicide or NPE surfactants.

Therefore, no invasive plant treatments in any alternative results in adverse effects to spotted owl or bald eagle. The following discussion contains the details of the analysis and rational for this conclusion.

Other federally listed species do not occur within the project area and therefore will not be impacted, regardless of alternative.

## Federally Listed Species

### Effects to Northern Spotted Owl

#### *Disturbance*

Invasive plant treatments may disturb spotted owls during the nesting season. Direct effects from invasive plant treatment include disturbance caused by noise, people, vehicles and equipment. The potential for visual disturbance to cause harassment of spotted owls is low. Noise-generating activities above ambient levels could potentially cause enough disturbance to result in harassment of northern spotted owls during the breeding season. Noise or visual stimuli may interrupt or preclude essential nesting and feeding behaviors, cause flushing from the nest or missed feedings of young (USDA/USDI 2006b).

Projects that generate noise or activity above ambient levels and occur within the 1/4 mile, from an active spotted owl nest may cause harassment effects (USDA/USDI 2006b). Some equipment used to treat invasive plants could create noise above ambient levels, depending upon site-specific conditions. Engines used to pump herbicide and other liquids through nozzles for roadside spraying operations, normally in the back of a pick up truck, may generate noise levels that could disturb spotted owls. Because noise levels of this type of equipment were not known, two diesel pump engines used for roadside spraying were evaluated for noise level. Two separate readings of different pump engines using different decibel meters produced readings of 72-75 decibels within 10 yards, dropping to 64-67 decibels at 35 yards (observations in the project file). The threshold for noticeable noise is 70 decibels and the threshold for disturbance causing "injury" or disruption is 92 decibels (U.S. Fish and Wildlife Service 2003). Vehicles used to spray roadside vegetation with herbicides do not make noise above 92 dB, based on the measurements taken, so no effect to the northern spotted owl from noise disturbance will occur. Within 10 yards of a nest or unsurveyed suitable habitat, roadside spraying could create a brief noise of notice to spotted owls (e.g. slightly above 70 dB), but not loud enough to create disturbance (U.S. Fish and Wildlife Service 2003, project file data). County Weed Coordinators also reported that the noise of diesel pump engines measured for this analysis was greater than the noise of gasoline-powered pump engines used by some operators (D. Sherwin, pers. comm. 2005, D. Durfey, pers. comm. 2005). The gasoline-powered pump engines will be quieter than the diesel pump engines that we measured.

There are no spotted owls on the Ochoco National Forest or Crooked River National Grassland. On Deschutes National Forest system lands, there are 1,367 acres of suitable nesting, roosting, and foraging habitat within proposed project area units, only a portion of which is likely to be suitable for nesting. There are 18 core areas for spotted owls within proposed project area units. However these treatment areas do not propose mowing or brushing. Mowing and brushing uses machinery that can create louder noise, so treatment areas with these methods was considered a potential disturbance effect for owls.

Treatment areas that may use brushing or mowing include 543 acres of suitable habitat for spotted owls. The mandatory PDF for spotted owls requires that these methods, or others that generate sufficient noise (greater than 92 dB), be conducted farther away than 35 yards for heavy equipment or motorized hand tools, and 65 yards for chainsaws, or outside the breeding season. This PDF has been included in several Biological Opinions throughout the region and has been found to be effective at minimizing effects to spotted owls because it minimizes or eliminates the source of disturbance near nests or suitable habitat.

Therefore, noise from mechanical and manual methods to control invasive plants, including equipment used to spray roadside vegetation, “may affect, but is not likely to adversely affect” spotted owls.

#### *Biological Control*

No biological control agent that is currently present in the project area is adversely affecting northern spotted owls or their habitat. Future biological control agents used for invasive plant control are not likely to target or inadvertently affect habitat or pretty of northern spotted owls, because they would not affect forest trees nor influence prey availability.

#### *Prescribed fire*

Burning of 14.3 acres of houndstongue in the Dry Paulina Creek watershed will have no effect on spotted owls because no spotted owl nests occur on the Ochoco national Forest.

#### *Effects of Herbicides*

Exposure scenarios used to analyze potential effects from herbicides are discussed in the USFS 2005d, Appendix B, p. 461. None of the herbicides proposed for use in this EIS nor NPE surfactants, applied at typical application rates, pose a risk to northern spotted owls.

Spotted owls are not likely to be directly sprayed, or encounter vegetation that has been directly sprayed, because no aerial applications are proposed. No ground applications of herbicide would reach the upper canopies of mature trees where the owls nest and forage.

Spotted owls on the Deschutes NF prey primarily on northern flying squirrels. Western red-back voles, bushy-tailed woodrat, and other small mammals are secondary prey items. These prey items are nocturnal and hide under cover during the day. Flying squirrels are chiefly arboreal. Red-backed voles and flying squirrels feed primarily on fungi and lichen. Other voles, mice and woodrats eat primarily vegetation and seeds. While it is not plausible for the arboreal owls or their primary prey to be exposed to herbicides used within the owl’s activity centers, some of their other prey, like mice and woodrats, could be exposed to treated vegetation. Prey are unlikely to be directly sprayed because they are largely nocturnal, hide under cover during the day, and would likely flee areas with human activity. However, a worst-case exposure scenario for the spotted owl was conducted using consumption of prey that had been directly sprayed, with the assumption that 100 percent of the herbicide is absorbed by the prey, and the prey is ingested immediately by the owl. Direct spray of the prey is used because that scenario results in a higher dose to the prey and owl than would ingesting a prey item that had consumed treated vegetation.

The following interpretations of the exposure scenario results are made with the reservation that toxicity data was generated from laboratory animals which may not accurately represent potential effects to free-ranging wildlife.

At typical application rates, the estimated acute doses from the exposure scenarios are all less than the reported NOAELs (no-observable adverse effect level) for all herbicides and NPE. The estimated dose from an NPE-based surfactant applied at the highest rate did exceed the NOAEL. Project design feature number 37 limits use of NPE-based surfactants to the typical application rate, so exposures exceeding the NOAEL will not occur. Chronic doses in this scenario are highly unlikely to occur because it is very unlikely that even one prey item could be directly sprayed and then immediately consumed, let alone a long-term diet of contaminated prey. Therefore, there is no basis for asserting or predicting that adverse effects to spotted owls from NPE or the herbicides considered in this EIS are plausible.

#### *Critical Habitat*

Invasive plant treatments do not remove or modify any of the primary constituent elements that define critical habitat. The action alternatives will have "no effect" to critical habitat for the northern spotted owl.

### Summary of Effects to Northern Spotted Owl

Disturbance by humans and vehicles during project implementation is the primary adverse effect that is plausible for northern spotted owls. Project design features for activities conducted within or adjacent to occupied or un-surveyed suitable habitat will minimize adverse effects from disturbance. There are no invasive plant locations or species that cannot be adequately treated using the project design features. If new sites found under the Early Detection/Rapid Response approach could not be adequately treated with the project design feature, it would be considered outside the scope of the EIS and the corresponding consultation. New NEPA analysis and consultation would be conducted.

Conducting invasive plant treatments "may affect, but are not likely to adversely affect" the northern spotted owl. This determination is based on:

- The project design feature required for northern spotted owl sites or potential habitat will eliminate adverse effects from disturbance.
- Spotted owls do not occur on the forest where prescribed burning is proposed and will not be affected.
- Exposure of spotted owls or their prey to herbicides is not plausible because:
    - Spotted owls and the majority of their prey are arboreal and/or nocturnal, and not likely to be exposed to herbicides.
- Even if an owl immediately consumed a prey item that had been directly sprayed, the resulting dose would be below those known to cause any adverse effects in birds.
- Invasive plant treatment projects conducted according to the project design feature will not affect critical habitat for the northern spotted owl. This determination is based on:
    - No primary constituent elements are affected by invasive plant treatments.

**Cumulative Effects**

There are no direct or indirect effects to northern spotted owls likely, so there are no effects to accumulate. Effects from the action alternatives will not accumulate with other existing or foreseeable future effects; therefore there will be no cumulative effects to northern spotted owls.

### Summary of Effects Determinations – Federally Listed Species

**Table 86.** Effects Determinations on Federally Listed Species (All Alternatives)

| Species | Status | Effects Determinations |
|---|---|---|
| Bald eagle | Delisted | See Sensitive Species section |
| Northern spotted owl | Threatened | May Affect, Not Likely to Adversely Affect |
| Canada lynx | Threatened | No Effect |

## Direct and Indirect Effects on Regional Forester Sensitive Species

Under all alternatives, two primary effects on sensitive wildlife species are plausible: 1) disturbance and trampling from machinery or people treating invasive plants; and 2) risk from herbicide contact, particularly to species for which data is not sufficient to allow quantitative estimates of risk. Alternative 3 reduces the likelihood of exposure to herbicides for species that reside within Riparian Reserves or Riparian Habitat Conservation Areas, but it increases the likelihood of disturbance and/or trampling. This replaces potential effects from herbicide treatment methods with effects from non-herbicide treatment methods. When analysis was conducted by alternative, results indicated that effect determinations for each species were the same for all action alternatives.

Sensitive species' habitat would be protected in all alternatives because invasive plant treatments do not remove suitable habitat for any species, and the majority of the treatments will occur along highly disturbed roadsides which do not provide suitable habitat in most cases. Some species on the Forests and Grassland have suitable habitat along roads, although in small amounts relative to the amount of suitable habitat that is not within a road corridor.

No indirect effects (those occurring later in time) are likely for wildlife species analyzed in this report. Invasive plant species do not provide habitat for sensitive species nor do they forage substantially on invasive plants or upon insects on or around them[16]. Control of invasive plants will not reduce their available habitat or food nor affect any life history attributes. Herbicides proposed in this EIS do not store in body fat, so they are rapidly eliminated from the body even if exposure does occur. They do not bioaccumulate so no effects are likely to occur much later in time.

### Effects to Bald Eagle

*Manual, Mechanical, and Cultural Methods*

Potential effects of invasive plant treatment methods on bald eagles are associated with disturbance that may occur during the nesting season. Direct effects from invasive plant treatment include disturbance caused by noise, people and vehicles. Human and vehicle presence can disturb bald eagles during the breeding season, causing the birds to leave nests, or stay away from the nest long enough to

[16] Deer mice have been found to feed extensively on the larvae of biocontrol insects in spotted knapweed (Pearson et al. 2000, Pearson and Callaway 2006). Deer mice are not a sensitive species and no other species have been reported to heavily utilize invasive plants or insects upon invasive plants.

have detrimental effects to eggs or young (U.S. Fish and Wildlife Service, 1986). Effects from mechanical methods (e.g. tractors, bulldozers, chainsaws, or string trimmers) may be more likely to occur, and occur at greater distances from the project site, because machinery creates louder noise.

The critical period in Oregon and Washington when human activities could disturb occupied nests extends from January 1 to August 31 (U.S. Fish and Wildlife Service 1981). Bald eagles are sensitive to human disturbance during this time, particularly within sight distance of nest sites. Disturbance near winter roost sites is not likely to occur because invasive plant treatments generally do not occur during the winter. Invasive plant treatments in the project area will avoid conducting the project in proximity to an occupied nest during these time-frames.

Projects conducted at anytime that are more than 1/4 mile, or ½ mile line of sight, from eagle use areas, and which do not result in the modification of use areas or the eagles' food resource, and noise is below ambient levels, will have no effect on bald eagles. Activities that occur within 1/4 mile, or ½ mile line of sight, from eagle use areas and produce noise above ambient levels, and do not result in degradation of use areas or the eagles' food resource, but implement the limited operating period in the project design feature (January 1 to August 31 for nesting and rearing, and November 1 to April 30 for winter roosting and foraging), are not likely to adversely affect bald eagle.

Invasive plant treatments will not result in the removal of bald eagle nest or roost trees, or suitable habitat, because invasive plants do not provide habitat. Projects could occur within suitable habitat, but would comply with the above PDF, therefore invasive plant treatment projects proposed may affect but will not adversely affect bald eagles.

### *Prescribed Fire*

Both action alternatives propose burning 14.3 acres of houndstongue in four discrete spots in the Dry Paulina Creek watershed (Figure 8). Burning will take place in spring. No bald eagle nests occur in this area, so the prescribed burning will have no effect on bald eagles.

### *Herbicides*

Exposure scenarios used to analyze potential effects from herbicides are discussed in USFS 2005d, Appendix B, p. 461. None of the herbicides proposed for use in this EIS nor NPE surfactants, applied at typical application rates, pose a risk to bald eagles.

Bald eagles are not likely to be directly sprayed, or encounter vegetation that has been directly sprayed, because no aerial application is proposed. No ground applications of herbicide would reach the upper canopies of mature trees where bald eagles nest. The potential for the herbicides to adversely affect bald eagles was determined using quantitative estimates of exposure from worst-case scenarios. The dose estimates for fish-eating birds were calculated using herbicide or NPE concentrations in fish that have been contaminated by an accidental spill of 200 gallons into a small pond. Assumptions used include no dissipation of herbicide, bioconcentration is in equilibrium with water, contaminant level in whole fish is used, and upper estimate assumes 15 percent of body weight eaten/day. For chronic exposures, we used a scenario where the bird consumes fish from water contaminated by an accidental spill over a lifetime. All estimated doses used in effects analysis were the upper levels reported in the Forest Service/SERA risk assessments.

The following interpretations of the exposure scenario results are made with the reservation that toxicity data was generated from laboratory animals which may not accurately represent potential effects to free-ranging wildlife.

The results of these exposure scenarios indicate that no herbicide or NPE surfactant poses any plausible risk to birds from eating contaminated fish. All expected doses to fish-eating birds for all herbicides and NPE are well below any known no-observable-adverse-effect-level (NOAEL) (see USFS 2005d, Appendix B).

The weight of evidence suggests that adverse effects to bald eagles from NPE or the herbicides included in the action alternatives are not plausible.

**Summary of Effects to Bald Eagle**

There are 27 bald eagle locations within 0.5 mile, and 17 locations within 0.25 mile, of proposed treatment areas on the Deschutes and Ochoco National Forests. Disturbance by humans and vehicles during project implementation is the primary adverse effect that is plausible for bald eagles. The project design features required for bald eagles, which imposes a seasonal restriction on activities near or within line-of-sight of nesting or roosting eagles, will eliminate adverse effects from disturbance.

Conducting invasive plant treatments would have "no impact" to bald eagles. This conclusion is based on:

- The project design features required for areas near or within line-of-sight of bald eagle sites will minimize adverse effects from disturbance.
- Proposed prescribed burning will have no effect on bald eagles because they are not in or near the treatment area.

Adverse effects to bald eagles from herbicide exposure are not plausible because:

- Even if they fed, for a lifetime, upon fresh-water fish that had been contaminated by an accidental spill of herbicide, they would not receive a dose that exceeds any known NOAEL.
- Proposed treatments, and treatments under EDRR, do not have the potential to create herbicide exposure above that which was quantified for the accidental spill scenario.

**Cumulative Effects to Bald Eagle**

There are no direct or indirect effects to bald eagles likely, so there are no effects to accumulate. Effects from the action alternatives will not accumulate with other existing or foreseeable future effects, therefore there will be no cumulative effects to bald eagles.

### California Wolverine

Wolverines occur in remote areas of the Deschutes and Ochoco National Forests. No treatment areas are located in likely wolverine habitat and short duration, low intensity invasive plant treatments are unlikely to disturb wolverines. Therefore, “no impact” to California wolverine will occur for all action alternatives.

### Pacific Fisher

There are no known resident populations of fisher on the Forests or Grassland. Only one transient individual has been documented within the action area. Proposed project area units that would be treated within suitable fisher habitat would consist of roadside treatments and those within previously harvested areas. These areas are subject to more disturbance and are not the typical habitat in which fishers are found. Areas infested with invasive plants do not provide habitat for Pacific fishers. It is highly unlikely that any proposed treatments would occur in the vicinity of individual fishers, therefore the proposed treatments in all alternatives will have “no impact” on the Pacific fisher.

### Pygmy Rabbit

Pygmy rabbits are not associated with riparian areas, so the differences in alternatives will not produce any differences in potential effects to the pygmy rabbit. Two treatment areas on the CRNG contain pygmy rabbit habitat. Neither of the infestations proposed for treatment is located in a burrow area, so crushing of burrows or rabbits will not occur. Both areas propose herbicide use (clopyralid) applied as a spot spray.  Site 75-54 is within a previously burned area, so if rabbits were present on the CRNG in this general area, they would not utilize the treatment site due to lack of cover and forage.  There is no likely exposure to herbicide that would occur.  The other site, 75-44, has been surveyed and there is no indication of occupancy by pygmy rabbits, so no herbicide exposure would occur on this site.

There is potential pygmy rabbit habitat elsewhere on the Deschutes and Ochoco NFs where herbicide may be used.  Potential effects to rabbits from herbicide exposure was conducted using a worst case exposure scenario for a small mammal that consumed contaminated vegetation for an entire day (acute exposure) or for 90-days (chronic exposure) (see Appendix P of the R6 2005 FEIS).  The dose the small mammal received from consuming contaminated vegetation was compared to doses identified at the "no-observable-adverse-effect-level" (NOAEL) from toxicity studies.  Dose to the small mammal was calculated for both application rates that are typical in Forest Service invasive plant treatments and at the highest reported use rates.  No chronic doses exceed the NOAEL for any of the herbicides available for use in the proposed project.  The estimated dose from an NPE-based surfactant also did not exceed the NOAEL in chronic exposure scenarios.

For acute exposures, no herbicide available for use exceeded the NOAEL at either typical or highest application rates.  The estimated dose from an NPE-based surfactant did exceed the NOAEL, but only at the highest application rate.  Project design feature number 37 limits use of NPE-based surfactants to the typical application rate, so exposures exceeding the NOAEL will not occur.

The herbicides available for use in the proposed action, or in Alternative 3 do not bioaccumulate nor do they biomagnify up the food chain.  These herbicides do not store in body fat and are rapidly excreted in urine from mammals, often within hours of consumption (see Appendix B of USDA Forest Service 2005d).  No additive doses are likely because herbicide is excreted before another exposure is likely to occur.  No doses exceeding that which was estimated are probable.

Available data indicates that there is no likely negative effect to pygmy rabbits from exposure to herbicides proposed for use in Alternatives 2 or 3.  Exposure to NPE-based surfactants is limited to typical application rates, so no doses exceeding the NOAEL will occur and no adverse effects are likely.

There are no known project area units currently occupied by pygmy rabbits and several surveys of suitable habitat have been conducted.  Suitable burrow sites have been identified and in most cases protected by exclosures.  There is only one treatment proposed in burrow habitat.  Future projects under EDRR could also occur in suitable burrow habitat. The pygmy rabbit PDFs restrict treatments in burrow habitat to only one or two individuals, to minimize the possibility of collapsing burrows.  If pygmy rabbits did occur within treatment areas, no exposure to herbicide is likely to cause an adverse effect.  Potential adverse effects from NPE-based surfactants are avoided by a pygmy rabbit PDF prohibiting use of NPE in breeding or foraging areas.

The proposed prescribed fire treatment does not occur in pygmy rabbit habitat and will not affect pygmy rabbits.  Fire can adversely affect pygmy rabbit habitat, so future prescribed burns for invasive plant control would have to be evaluated for potential effect to pygmy rabbits or their habitat.

Invasive plant treatments will improve existing habitat, help protect sagebrush habitat from adverse modification due to future spread of invasive plants, possibly reduce likelihood of habitat loss from fires.  Neither the likelihood of disturbance or exposure to herbicides differs between alternatives.  Therefore, treatments proposed "may impact, but are not likely to lead to a trend toward federal listing" for pygmy rabbits regardless of alternative chosen.

### Greater Sage Grouse

Sage grouse are not associated with riparian areas, so the differences in alternatives will not produce any differences in potential effects to the sage grouse. Invasive plants are well-documented to degrade sage grouse habitat and invasive plant treatments are recommended in sage grouse and sagebrush management publications.

#### *Disturbance*

Sage grouse are sensitive to disturbance in breeding habitat (leks and other areas used in the spring). PDFs for sage grouse prohibit activities within 0.3 mile of leks during the dawn and dusk periods and within breeding habitat from February 15 to June 30. These PDFs will effectively avoid disturbance to breeding sage grouse. Invasive plant treatments are not conducted during the winter, so disturbance to wintering sage grouse will not occur.

#### *Prescribed fire*

Both action alternatives propose burning 14.3 acres of houndstongue in four discreet spots in the Dry Paulina Creek watershed. Burning will take place in spring. This general area receives incidental use by an occasional sage grouse in late summer (August/September) (M. Feiger, pers. comm. 2007). Use of the area appears to be foraging by individual males, females without broods, nor will it include native habitat, so the proposed prescribe fire treatment will have no effect on sage grouse. Future prescribed fire projects would need to be evaluated for potential effect to sage grouse or their habitat.

#### *Herbicide*

Sage grouse are large vegetation-eating birds, so a worst-case scenario was used that estimated herbicide exposure for a large bird eating contaminated vegetation. At typical and highest application rates and acute exposures, only NPE surfactants exceeded toxicity thresholds (see Appendix P of R6 2005 FEIS). Data on toxicity of NPE to birds is lacking, so a toxicity threshold for mammals were used in the analysis (see Bakke 2003). The estimated dose to a four-kg bird exclusively consuming vegetation sprayed with NPE-based surfactant for one entire day exceeded the dose that created a slight reduction in polysaccharides in the liver of rats. Whether this type of effect could be expected in birds is unknown.

One paper (APERC 2000, cited in Bakke 2003) stated that no behavioral changes or mortality to quail occurred when they were fed up to 5,000 ppm of NPE for five days. The authors concluded that the lethal dose ($LC_{50}$) for quail was greater than 5,000 ppm, which is at the higher range or well above the reported range of $LC_{50}$ values for mammals. However, with only one study on birds available, data is insufficient to state whether or not birds are less susceptible to NPE than are mammals.

Using the limited data available, including toxicity thresholds from mammal data, it appears that some adverse effects from consuming contaminated vegetation are plausible from NPE surfactants.

No herbicides at the typical application rate in the exposure scenario analysis produced exposures that exceeded the toxicity thresholds for birds. Triclopyr cannot be broadcast sprayed due to a standard added to the forest LRMP by the R6 2005 ROD, and would not be spot sprayed on sagebrush (their primary food), so exposures of concern are not likely.

Sage grouse chicks depend heavily upon insects, so estimates of dose for small birds consuming contaminated insects were also used. At typical application rates, NPE surfactants exceeded toxicity thresholds. Data on NPE is limited for birds as discussed above. Triclopyr cannot be broadcast sprayed, so contamination of a substantial amount of insects within a foraging area is unlikely. Also, triclopyr is used on invasive woody vegetation, like blackberries and Scotch broom, neither of which are present in sage grouse habitat and if they were, sage grouse would be unlikely to forage for insects exclusively on or near these plants. Exposures of concern for triclopyr are not likely.

At highest application rates, glyphosate, in addition to NPE, exceeded the toxicity threshold for small birds eating contaminated insects. The estimated dose somewhat exceeded the dose of glyphosate that caused weight loss in zebra finches (Evans and Batty 1986 as cited in SERA Glyphosate 2003). Glyphosate is not sprayed at the highest rate analyzed, as previously discussed, because it hampers effectiveness and wastes money.

Chronic exposures were also evaluated for herbicides. There are no long-term residue rates on vegetation for NPE, nor any exposure data on birds, so a quantitative estimate for chronic exposures is not available for NPE. There are no long-term residue rates for herbicides on insects, so quantitative estimates are not available for small birds consuming contaminated insects. The estimated dose of glyphosate applied at the highest application rate exceeded the chronic NOAEL for effects to reproduction. In order to receive this dose, sage grouse would have to consume nothing but contaminated vegetation for 90 days. This scenario seems highly unlikely given that only patches of invasive plants would be treated, sage grouse do not feed extensively on invasive plant species if at all, and sage grouse are unlikely to feed exclusively within treated patches for three months. Also, glyphosate is not sprayed at the highest application rates because it is effective at much lower rates and use of higher rates wastes money, very high rates can hinder translocation to the roots where the desired effect takes place, and glyphosate is rarely used in dry habitat because it is non-selective.

**Table 87.** Summary of exposure scenario results showing the herbicides and NPE, scenario, and application rates that produce risk to sage grouse. Symbol meanings are as follows: -- estimated dose below the NOAEL; ★ estimated dose exceeds the NOAEL at both typical and highest application rates; ◆ estimated dose exceeds the NOAEL at only the highest application rates. N/A – data not available

| Animal/diet | Glyphosate | NPE |
|---|---|---|
| **ACUTE EXPOSURE (1-day)** | | |
| Large bird / contaminated vegetation | -- | ★ |
| Small bird / contaminated insects | ◆ | ★ |
| **CHRONIC EXPOSURE (90-DAYS)** | | |
| Large bird / contaminated vegetation | ◆ | N/A |

The majority of treatments within or adjacent to suitable habitat for sage grouse occurs along road shoulders. Brooding sage grouse will utilize road shoulder habitat, especially ditches, in search of green vegetation and insects (Steele, D., pers. comm. 2006). Proposed roadside treatments involve spraying the patch of invasive plants with truck-mounted nozzles or with hand-held sprayers. If sage grouse were to forage within patches treated solutions containing NPE-based surfactants at typical application rates, exposures of concern could result. Glyphosate is not likely to be used at high application rates in sage grouse habitat as explained above. A sage grouse PDF prohibits use of NPE-based surfactants within areas where sage grouse may forage. Therefore, no herbicide or surfactant use is likely to result in adverse effects to sage grouse.

The PDFs effectively minimize risk to sage grouse from disturbance or exposure to herbicides or surfactant. Invasive plant treatments will improve existing habitat, help protect sagebrush habitat from adverse modification due to future spread of invasive plants, possibly reduce likelihood of habitat loss from fires. Therefore, invasive plant treatments “may impact, but are not likely to lead to a trend toward federal listing” for sage grouse, regardless of alternative.

### Horned and Red-necked Grebe

These species are not usually present during the breeding season when most invasive plant treatments would occur. Risk from herbicide exposure is evaluated using a "fish-eating bird" scenario. A quantitative estimate of dose was calculated for a bird eating contaminated fish for one day (acute) and for a lifetime (chronic). The fish are from a pond (1000 $m^2$ by 1 m deep) that has been contaminated by a spill of 200 gallons of herbicide. No herbicide or NPE exceeded a dose of concern for any exposure (acute or chronic) at any application rate (typical or highest). Based on available data, adverse effects to fish-eating birds from the herbicides in this analysis are not likely.

There are seven project area units that intersect potential grebe habitat at Wickiup Reservoir and Davis Lake. Mechanical treatments are proposed in three of these units. Only the use of string trimmers is included in the mechanical treatments proposed. The mechanical treatments proposed would not differ between alternatives and no herbicide or NPE has the potential for plausible adverse effects, so there would be no difference in effects to these grebes between alternatives. Grebes do not nest in invasive plants targeted for treatment and are not likely to be present during treatment. Therefore, invasive plant treatment projects will have "no impact" on horned or red-necked grebes regardless of alternative.

### Bufflehead

Buffleheads are rare in Oregon during the breeding season. Since they nest in tree cavities, their nesting habitat will not be affected by invasive plant treatments – no native trees will be treated or removed. Because they rarely breed in Oregon, invasive plant treatments are unlikely to disturb any breeding bufflehead.

These ducks eat aquatic invertebrates and fish, so risk from herbicide exposure is evaluated using a "fish-eating bird" scenario. A quantitative estimate of dose was calculated for a bird eating contaminated fish for one day (acute) and for a lifetime (chronic). The fish are from a pond (1000 $m^2$ by 1 m deep) that has been contaminated by a spill of 200 gallons of herbicide. No herbicide or NPE-based surfactant exceeded a dose of concern for any exposure (acute or chronic) at any application rate (typical or highest). Based on available data, adverse effects to fish-eating birds from the herbicides in this analysis are not likely.

The differences between the alternatives do not result in a difference in potential effects because neither disturbance nor herbicide exposure from invasive plant treatments are likely to have any effects to bufflehead. Therefore, invasive plant treatment projects will have "no impact" on bufflehead regardless of alternative.

### Harlequin Duck

Harlequin ducks nest along fast-flowing rivers and mountain streams in the Cascade Range. Invasive plant treatments along fast-flowing sections of river and mountain streams are likely to be rare for a variety of reasons. Infestations of invasive plants are less likely along swift sections and higher gradient streams than in slower river bottom habitat. It is more difficult for seeds and propagules of invasive plants to become established in swift water. If invasive plants become established along some swift water areas, they may not be treated because terrain and swift water limit access to the infestation. However, some invasive plant infestations will be treated in potential harlequin duck habitat with moderate flow (e.g. Metolius River).

Disturbance to nesting ducks could occur along the shore from people treating invasive plants either manually, with string trimmers (weed whackers), or with herbicides. Manual and mechanical treatments are likely to cause more disturbance and of longer duration than treatments with herbicide. However, most herbicide treatment projects involve a component of manual or mechanical treatment, so there would be some disturbance regardless of the technique used. Duration of disturbance from any method is expected to be a maximum of three to four hours in a single day and only occurring once during the nesting season.

Risk from herbicide exposure would be the same as that discussed above for bufflehead. While harlequin ducks only rarely eat fish, there is not sufficient data to quantitatively estimate dose from consuming contaminated insects. Because harlequin ducks are found along swift water, any herbicide that inadvertently entered the water would be rapidly diluted and moved downstream. This would greatly reduce exposure of this duck and its prey to herbicide. The fish-eating bird scenario seems an appropriate "worst case scenario" to use as a surrogate for analysis. Results from this scenario indicate that no herbicide or NPE-base surfactant poses a risk of adverse effects to harlequin ducks.

Differences in potential effects between the alternatives would be minor and based on the degree and duration of disturbance from increased manual and mechanical treatment activities presumed for Alternative 3. However, because some disturbance will still occur with herbicide treatment and herbicide treatments often include manual or mechanical treatments as well, potential differences in effects are not substantial enough to differentiate between alternatives.

The magnitude and duration of any disturbance or herbicide exposure is low level and short term. Therefore, treatments proposed "may impact, but are not likely to lead to a trend toward federal listing" for harlequin ducks.

**Yellow Rail**

There is a breeding population of yellow rails at Big Marsh and there are about three acres of invasive plants that are proposed for treatment with manual, mechanical (string trimmer), and herbicide methods. The target species for treatment is reed canarygrass that will be treated primarily in ditches that are part of a hydrologic restoration program.

The reed canarygrass that will be treated is not in the main part of the marsh used by the rails. Yellow rails also do not utilize the non-native reed canarygrass so they are unlikely to be directly harmed by its treatment or removal. Future treatments of the main reed canarygrass infestation near yellow rail habitat are unlikely because the infestation is so large it is not currently feasible or cost effective to treat. Breeding yellow rails could be disturbed by treatment activity nearby. This potential effect could occur regardless of alternative chosen. Data is insufficient to distinguish between alternatives the likelihood or magnitude of this potential effect. Because yellow rail locations vary annually with surface water availability, a PDF for all alternatives requires a local biologist to review the site prior to implementation to determine the location of the yellow rails relative to planned treatments.

Risk of effects from herbicide exposure is evaluated using the insectivorous bird scenario. A quantitative estimate of dose was calculated for a small bird feeding on insects (or any other small item) contaminated by direct spray of herbicide. The bird is assumed to feed exclusively on contaminated insects for the entire day's diet. There is no chronic dose estimate because there is no data on long-term herbicide residue on insects. The herbicide triclopyr cannot be broadcast sprayed and it is unlikely that an entire day's diet of insects could be contaminated by spot spray or hand/selective applications, so quantitative estimates are not made for triclopyr.

At typical application rates, no herbicide exceeded a dose of concern for insectivorous birds. At highest application rates, glyphosate did exceed a dose of concern. Because glyphosate is one of the few herbicides that can be used in a wetland situation, it is likely to be used on the reed canarygrass in Big Marsh. However, glyphosate is not applied in a foliar spray at the highest rate analyzed because excessively high rate burns the vegetation and interferes with translocation, making the treatment ineffective, and it is a waste of treatment funds. Contamination of an entire day's diet of invertebrates seems unlikely for the following reasons: 1) yellow rails are not known to forage within areas dominated by invasive reed canarygrass, 2) the presence and movement of applicators is likely to scare off some invertebrates, making them less likely to be sprayed; and, 3) the infestation proposed for treatment is not immediately adjacent to the habitat used by the yellow rails.

NPE-based surfactants exceeded the dose of concern for insectivorous birds at both typical and highest application rates. However, PDFs for all alternatives restrict the application rate of NPE to 0.5 lb a.i./acre and prohibit spraying of NPE within habitat for the yellow rails. These PDFs eliminate plausible exposures of concern so no doses of concern to yellow rails will occur.

Invasive plant treatment projects "may impact, but are not likely to lead to a trend toward federal listing" for the yellow rail, regardless of alternative, for the following reasons:

- Yellow rails are unlikely to be immediately adjacent to the portion of Big Marsh scheduled for treatment
- PDFs require biologist verification of yellow rail locations relative to treatment location
- PDFs restrict broadcast spraying and application rate of glyphosate and NPE in yellow rail habitat.

**Upland Sandpiper**

Upland sandpipers nest in open, short-grass habitat and are extremely rare breeders in Oregon. The Ochoco NF has some suitable habitat. The cryptic nests of upland sandpipers are susceptible to crushing or trampling by people or vehicles. If upland sandpipers were nesting in areas where invasive plant treatments occurred, eggs or nestlings could be trampled, regardless of the treatment technique used. Data is not sufficient to distinguish in a meaningful way the magnitude or duration of disturbance or trampling between alternatives. Invasive plant infestations do not provide suitable habitat for nesting upland sandpipers. Due to the low likelihood of this sandpiper being present in the treatment sites, actual risk to the birds is very low.

Upland sandpipers eat insects so the risk from herbicide and NPE-based surfactants is as discussed above for sage grouse. Glyphosate is not broadcast sprayed at high application rates and NPE is limited to typical application rate by a PDF. Ingesting insects contaminated with NPE-based surfactant applied at typical rates could exceed a level of concern. However, the sandpiper's would have to eat contaminated insects exclusively and it is unlikely that this would happen. Due to the low likelihood of this sandpiper being present in the treatment sites, actual risk of herbicide exposure to the birds is very low.

Upland sandpipers are not known to nest or forage in stands of invasive plants that are likely to be treated. Due to their very low likelihood of being present within treatment areas, the proposed treatments will have "no impact" on upland sandpipers regardless of alternative.

**American Peregrine Falcon**

Peregrine falcons are not dependant upon riparian areas and do not forage exclusively within them, so the differences in alternatives will not produce any differences in potential effects to the peregrine falcon. There are no known peregrine falcon nests in the action area, but some individuals have been seen.

There is no quantitative scenario for a predatory bird that eats primarily other birds, such as the peregrine falcon, so the "fish-eating bird" scenario and the "mammal-eating bird" were used as surrogate scenarios. The fish eating bird scenario likely overestimates the dose to the peregrine falcon because the hypothetical fish consumed are from a pond contaminated by a large spill of herbicide. These hypothetical fish likely have higher concentrations of herbicide in their bodies (and thus a higher dose to the predatory bird) than would a small bird that incidentally ingested herbicide before it was preyed upon. Also, the small mammal in the "mammal-eating bird scenario" is directly sprayed.

It would be practically impossible to directly spray a bird that a peregrine falcon would then immediately prey upon. Herbicide analysis indicates that no herbicide dose exceeded the toxicity indices for fish-eating or mammal-eating birds even at highest application rates in the “worst-case” scenarios.

The dose from NPE-based surfactant exceeded the level of concern, but only at the highest application rate. A PDF in all alternatives limits NPE to 0.5 lb a.i./acre or less only so this dose will not occur.

In reality, a peregrine falcon feeding on a bird would not receive a high dose from its prey (as estimated by the scenarios) because the herbicides proposed in this EIS are rapidly excreted from animals and do not bioaccumulate. In the fish scenario, the fish are still within the contaminated water and therefore have some herbicide in their tissues. In the mammal prey scenario the prey has been directly sprayed and is covered with herbicide. So, if birds were exposed to herbicides and then subsequently preyed upon and consumed by peregrine falcons, the amount of herbicide that the peregrine would be exposed to is likely less than that modeled in the “worst case” scenarios using contaminated fish or small mammals.

No current nest sites for peregrine falcon occur within 1.5 miles of any proposed treatment area, the mandatory PDFs will avoid disturbance, and no herbicide or NPE dose exceeded the toxicity indices for fish-eating birds even in a “worst case” scenario, so there would be “no impact” to peregrine falcons for all action alternatives.

### Gray Flycatcher

Gray flycatchers are not associated with riparian areas, so the differences in alternatives will not produce any differences in potential effects to the gray flycatcher.

Gray flycatchers nest in trees and are not susceptible to the short-term disturbance created by invasive plant treatments. Gray flycatchers are insectivorous birds and could be exposed to herbicides by consuming contaminated insects. Most of the insects consumed by gray flycatchers are unlikely to become contaminated with herbicides because they inhabit tree canopies, are not necessarily associated with invasive plant species, and foliage would intercept most herbicide applied. Herbicide exposure to insectivorous birds was estimated as described above for sage grouse. Only glyphosate applied at a high application rate and NPE-based surfactant at high and typical rates resulted in a dose that exceeded the NOAEL. Glyphosate is not sprayed at high application rates as described above for sage grouse. A PDF in all alternatives limits NPE application 0.5 lb a.i./acre or less so doses of concern would not occur. Substantial numbers of insect prey are not likely to be sprayed during ground spraying treatments (no aerial treatment is proposed). Gray flycatchers are unlikely to forage exclusively on insects contaminated with NPE applied at typical rates, so doses of concern are unlikely.

The proposed prescribed burning of 14.3 acres on the Ochoco will have “no impact” on gray flycatchers because they do not nest or forage in houndstongue. The burn will not pose any risk to their nests. In addition, the small size of the burn, which will occur in four discreet patches, is insufficient to significantly alter their habitat in the project area. Therefore, invasive plant treatments will have “no impact” on gray flycatchers.

### Tricolored Blackbird

Tricolored blackbirds nest in wetland areas, primarily in native emergent vegetation, but have also been reported to use blackberries in Oregon. Birds nesting in cattails or other native vegetation are unlikely to be disturbed by invasive plant treatments. If birds were nesting in blackberries that are the target of treatment with manual, mechanical, or herbicide methods, they would be vulnerable to disturbance that could destroy the nests.

The potential effects would be the same regardless of alternative chosen. This potential effect is unlikely within the project area as there are no known breeding sites on the Deschutes or Ochoco NFs or the Grassland.

Risk of herbicide or NPE exposure is the same as discussed above for yellow rail. Blackbirds forage in areas beyond the 10-foot no-herbicide buffer around perennial lakes and ponds specified in Alternative 3, so there is little or no difference between alternatives in likelihood of exposure to, or effects from, herbicide. A PDF in all alternatives restricts spraying of NPE to 0.5 lb a.i./acre so doses of concern will not occur.

Invasive plant treatments are will have “no impact” on tricolored blackbirds because they are not present in treatment areas and the PDF restricting the application rate of NPE eliminates the potential for NPE exposures of concern.

### Oregon and Columbia Spotted Frogs

The habitat and life histories of these two frogs are similar so their risk of effects from disturbance or herbicide is similar. Columbia spotted frog has a larger distribution within the project area so there is a larger overlap between proposed and future treatments and their habitat. Columbia spotted frogs utilize terrestrial habitat more than Oregon spotted frogs and so are somewhat more susceptible to disturbance or inadvertent trampling.

#### *Disturbance*

Adult frogs, eggs, and larvae are not likely to be disturbed by invasive plant treatments during the breeding season because they are restricted to aquatic habitat. After breeding however, adults, particularly Columbia spotted frogs, will disperse into adjacent wetland and riparian habitats. Adults and juveniles would be susceptible to trampling from invasive plant treatment activities in wetland and riparian habitat utilized by frogs. The probability that this would actually occur is low because the frogs are less likely to inhabit areas infested with invasive plants. This potential effect would occur in all alternatives, but might be slightly more likely in Alternative 3 due to increased use of manual and mechanical techniques.

#### *Prescribed Fire*

Both action alternatives propose burning 14.3 acres of houndstongue in four discreet spots in the Dry Paulina Creek watershed, treatment areas 72-37 and 72-15. Oregon spotted frogs are not present, but Columbia spotted frog habitat is present in the general area. The prescribed burning of houndstongue sites will take place in spring when the frogs are located in aquatic habitat. While Columbia spotted frogs have been reported to move between aquatic habitats, these movements have been documented to occur after the breeding season (Bull and Hayes 2001) so no effects to dispersing frogs will occur. Spotted frogs will move prior to breeding, to locate females and suitable breeding sites. However, the burn areas do not provide quality habitat so the Columbia spotted frogs are not likely to be affected by the burn, but harm to an isolated individual frog that happened to be in the small burn patches cannot be ruled out. The burn will not involve any aquatic habitat and will not burn any suitable breeding or feeding habitat. The prescribed burn has a low probability of harming individual frogs, but will not affect the local population level or degrade habitat.

#### *Summary of Herbicide Effects to Amphibians*

There are 41 project areas within 100 feet of spotted frog habitat that propose use of herbicides. Almost all of these project areas are roads in which small patches of invasive plants along the road shoulder would be sprayed. The spatial distribution of the invasive plants along roads is widely scattered and infestations are not dense. Small patches over very large areas would be treated, resulting in a very low probability of exposure to individual frogs or contamination of breeding ponds or streams.

Data on herbicide effects to amphibians is limited. Appendix B of the Invasive Plant BA (USFS 2005d) summarized available data on the effects of herbicides to amphibians and this discussion is incorporated by reference. As stated previously ("Introduction and Methods"), where data was lacking, toxicity data on fish was used as a surrogate for toxicity to amphibians, based on studies comparing data available for both groups of species (Berrill et al. 1994; Berrill et al. 1997; Perkins et al. 2000). For glyphosate and sulfometuron methyl there was sufficient data to do a quantitative evaluation of exposure and risk.

Results of the analysis indicate that the following herbicides pose a low risk of mortality to amphibians: chlorsulfuron, clopyralid, imazapic, imazapyr, metsulfuron methyl, and picloram. Data is insufficient to evaluate risk of sub-lethal effects. The Poast® formulation of sethoxydim is much more toxic to aquatic species than is technical grade sethoxydim. However, use of Poast® is unlikely to result in concentrations in the water that would result in toxic effects to aquatic species (SERA 2001). There is a substantial limitation to this risk characterization because there are no chronic toxicity studies on aquatic animals available for either sethoxydim or Poast®. However, for the types of herbicide applications proposed in this analysis, the R6 Invasive Plant BA (USFS 2005d) demonstrated that chronic exposures of concern to aquatic species are not possible.

Formulations of glyphosate that contain POEA surfactant are much more toxic to aquatic organisms than aquatic-labeled formulations, which do not contain POEA. The concentration in water for a "worst case scenario" (see fisheries effects analysis) was compared to toxicity data on both versions of glyphosate. At typical application rate, concentrations in the water for acute and chronic exposures were well below any reported $LC_{50}$ for either version of glyphosate, with the exception of one study by Smith (2001). The Smith study is not consistent with other reported studies on glyphosate and so was not used to establish the threshold of concern for aquatic species in the Glyphosate Risk Assessment (SERA 2003 Glyphosate).

Relyea (2005) reported a synergistic effect with predatory cues and glyphosate with POEA for one of six amphibian species tested. The effect occurred in wood frogs (*Rana sylvatica*) but not leopard frogs (*R. pipiens*), green frogs (*R. clamitans*), bullfrogs (*R.catesbeiana*), American toads (*Bufo americanus*) or gray tree frogs (*Hyla versicolor*). The stress from the presence of predatory cues caused glyphosate with POEA to be twice as lethal to wood frogs. Relyea did not report, or did not study, this effect for glyphosate without POEA and states that the POEA surfactant is the likely cause for the high toxicity. The lack of comparison with glyphosate without POEA hampers the usefulness of the study in terms of facilitating conclusions about herbicides and potential synergistic effects from environmental stressors. It cannot be demonstrated that the effect noted by Relyea was due to the herbicide at all.

At the high application rate, concentrations of glyphosate with POEA surfactant exceeded lethal levels and mortality to amphibians could occur. The version of glyphosate without POEA (i.e. the aquatic-labeled formulations) did not exceed 0.1 of the lethal dose (SERA 2003 Glyphosate). Based on available data, this dose does not appear to pose a risk of adverse effects to amphibians.

Sufficient data are available on the toxicity of sulfometuron methyl to allow quantitative estimates of exposure and risk. Data is limited to that generated by studies on *Xenopus* (African clawed frogs), but other studies have indicated that *Xenopus* are a sensitive indicator for effects to amphibians (Mann and Bidwell 2000, Perkins et al. 2000). Results from the "worst case scenario" for aquatic species indication that all estimated exposures were far below acute and chronic "no-observable-effect-concentration" (NOEC) values. Sulfometuron methyl has been reported to cause malformations in amphibians, but only at doses that far exceeded those estimated from the worst case scenario.

Triclopyr comes in two forms; triclopyr BEE and triclopyr TEA. Triclopyr BEE is much more toxic to aquatic organisms than is triclopyr TEA. Triclopyr cannot be broadcast sprayed, regardless of alternative, because of a standard added to the LRMP by the R6 2005 ROD. At typical application rates, neither version is likely to result in adverse effects to amphibians, using a sub-lethal effect for tadpole responsiveness as a threshold of concern. At the highest application rate analyzed, tadpole responsiveness could be reduced. However, the highest application rate analyzed exceeds that which is legally permitted on the herbicide label, so this rate could not be applied. Also, the concentrations of concern are not likely to occur from applications in the proposed action due to the restriction on broadcast spraying.

Triclopyr also has an environmental metabolite known as TCP (3,5,6-trichloro-2-pyridinol). TCP is about as acutely toxic to aquatic species as triclopyr BEE (SERA 2003 Triclopyr). Adverse effects to aquatic species (based on data from fish) from TCP are likely only if triclopyr is applied at the highest application rates. These rates are highly unlikely to be realized given the prohibition on broadcast spraying of triclopyr.

NPE-based surfactants are known to cause adverse effects, including estrogenic effects, to aquatic organisms. A quantitative risk assessment for NPE was conducted by Bakke (2003), which included risks to aquatic organisms. Estimated concentrations from the operational scenario analyzed (10 acres of broadcast spray immediately adjacent to water) produced exposures 15-30 times lower than the level of concern from all NPE related compounds. Bakke also analyzed a scenario in which a small pond or stagnant stream reach is oversprayed directly, with no foliar interception. In this case, levels of NPE related compounds could reach those that pose a risk of toxic effect.

In summary, adverse effects to amphibians are only likely from glyphosate with POEA and triclopyr applied at high rates, or NPE sprayed directly on stagnant water. As discussed, the high application rates of triclopyr and glyphosate will not be used and triclopyr cannot be broadcast sprayed at all, so concentrations in water that pose risks to amphibians are highly unlikely. The spotted frog PDF prohibits spraying of NPE-based surfactants within 100 feet of occupied or suitable spotted frog habitat, so an inadvertent overspray of standing water is not possible.

In addition, other PDFs required in all alternatives minimize the amount and type of herbicide to which spotted frogs could be exposed by restricting application methods and buffer distances. Minimum buffer widths for each alternative (Tables 15 and 16) are listed for each herbicide. These buffer widths restrict the use of herbicides along streams, ponds, and lakes and in wetlands. Glyphosate with POEA cannot be broadcast sprayed within 300 feet, or spot sprayed within 100 feet, of lake/wetland habitat in Alternative 2, and cannot be used at all within 300 feet of lake/wetland habitat in Alternative 3. Both of these options make it highly unlikely that this version of glyphosate would reach the water bodies and create concentrations of concern. It is not possible to differentiate potential effects between alternatives because adverse effects in either alternative are unlikely.

Triclopyr TEA cannot be used within 15 feet of water and triclopyr BEE cannot be used within 50 feet of water in Alternative 2. Triclopyr BEE cannot be used at all and triclopyr TEA cannot be spot-sprayed within 15 feet of water in Alternative 3. These restrictions also make it highly unlikely that concentrations of triclopyr in water would reach levels of concern. It is not possible to differentiate potential effects between alternatives because adverse effects in either alternative are unlikely.

Adult spotted frogs could also be dermally exposed to herbicides as they move through treated vegetation or soil, although this would be unlikely because spotted frogs are highly aquatic. There is insufficient data to quantify dose received from dermal exposure to contaminated vegetation or soil, but it is likely to be much less than if the frog was in contaminated water and could easily absorb the solution through its skin. Our assumption for analysis is that risk from exposure to contaminated water adequately encompasses risk from all types of herbicide exposure for amphibians.

### *Relation to Programmatic BA Project Design Criteria*

The Programmatic BA (USDA Forest Service 2006) contains a project design criteria (equivalent to a PDF) that prohibits the use of herbicides in and adjacent to spotted frog habitat. The project design criteria for the Programmatic BA set implementation requirements that, if followed, would result in no impact, or no adverse impact, on the these species. The proposed action and alternatives discussed in this document do have the potential for adversely impacting spotted frogs, so communication with the U.S. Fish and Wildlife Service has been initiated and new project design features for invasive plant treatment projects have been developed. This process was anticipated to occur and is mentioned in the Letter of Concurrence received from the USFWS, dated August 24, 2006.

### *Summary of potential effects to spotted frogs*

There is a low likelihood of disturbance to spotted frog eggs, larvae or adults during invasive plant treatments, although some disturbance could occur to adults moving overland. Some individuals Columbia spotted frogs could possibly be harmed during the prescribed burn, but the probability of this actually occurring is very low because the burn sites are not suitable spotted frog habitat. Due to the relatively low toxicity of most herbicides proposed, the low concentrations in water that would occur under normal operations (i.e. low exposures), and the Forest Plan standards and PDFs that restrict herbicide and NPE use in or near spotted frog habitat, adverse effects from herbicide exposure are unlikely. Treatment of reed canarygrass in spotted frog habitat would provide beneficial effects to frog breeding and habitat maintenance. Therefore, invasive plant treatments “may impact, but are not likely to lead to a trend toward federal listing” for Oregon and Columbia spotted frogs.

#### Crater Lake tightcoil snail

This snail likely occurs in project area units located within riparian or wetland habitat on the Sisters RD. Manual and herbicide treatments are proposed within suitable habitat (e.g. Metolius River ribbongrass control). These snails are among wetland vegetation and under rocks and woody debris. At least some individuals may be subject to trampling during treatment of ribbongrass or reed canarygrass infestations. They have not been specifically reported from this vegetation, but it is assumed they could use it. Trampling could occur for any treatment method under any alternative. The impact of trampling would be limited to a few individuals immediately on or in the vegetation to be removed. Other snails in the population would be under cover of rocks and woody debris, and in adjacent native riparian and wetland habitat, and would not be subject to trampling or disturbance from invasive plant treatments.

There is limited data on herbicide effects to terrestrial snails. Relyea (2005) found no effect to three species of aquatic snails from the glyphosate formulation Roundup. Data on terrestrial snails are limited to studies with glyphosate and picloram on the brown garden snail (*Helix aspersa*) (SERA 2003 Glyphosate, SERA 2003 Picloram). No studies showed adverse effects to the snails. It appears unlikely that herbicides are likely to pose serious toxic risk to terrestrial snails, but this conclusion of risk is made with the reservation that data is extremely limited.

Invasive plant treatments “may impact, but are not likely to lead to a trend toward federal listing” for the Crater Lake tightcoil because potential impacts are limited to a few individuals that may be on or in riparian or wetland invasive plants targeted for treatment.

This species is also included in the Survey and Manage program, so appropriate pre-disturbance surveys would be conducted prior to implementing invasive plant treatments in appropriate habitat, if the project meets the survey criteria.

**Table 88.** Summary of Effects to Forest Service Sensitive Species

| Species | Determination | Reason |
|---|---|---|
| Bald eagle | no impact | PDFs minimize potential for disturbance; herbicide effects highly unlikely |
| California wolverine | no impact | not present in treatment areas |
| Pacific fisher | no impact | not present in treatment areas |
| Pygmy rabbit | MINL* | may not be present in treatment area, PDFs minimize potential effects, treatments improve habitat |
| Greater sage grouse | MINL | PDFs minimize potential effects, invasive plant treatments important for habitat improvement |
| Horned and red-necked grebes | no impact | not likely present during treatment, herbicide effects or disturbance unlikely |
| Bufflehead | no impact | not likely present in treatment areas; herbicide effects or disturbance unlikely |
| Harlequin duck | MINL | may be present in only a few treatment areas, potential disturbance is short term and low magnitude, herbicide effect unlikely |
| Yellow rail | MINL | PDFs minimize potential for effects; herbicide effect unlikely |
| Upland sandpiper | no impact | not present in treatment areas |
| American peregrine falcon | no impact | PDFs eliminate disturbance or NPE exposure; no known nests in treatment areas |
| Gray flycatcher | no impact | prey unlikely to contaminated, not susceptible to disturbance from short-duration, low magnitude invasive plant treatments |
| Tricolored blackbird | no impact | not present in treatment areas |
| Oregon spotted frog | MINL | low likelihood of disturbance, adverse effects from herbicide unlikely, PDFs minimize potential for effects |
| Columbia spotted frog | MINL | low likelihood of disturbance, adverse effects from herbicide unlikely, PDFs minimize potential for effects |
| Crater Lake tightcoil | MINL | some individuals may be trampled, suitable habitat will be maintained, herbicide effects unlikely |

*MINL = may impact, but not likely to lead to a trend toward federal listing.

### Cumulative Effects to Forest Service Sensitive Species

Cumulative impacts are those impacts on the environment which results from the incremental impact of each action when added to other past, present, and reasonably foreseeable future actions.

There will be no cumulative effects to the following sensitive species because the proposed invasive plant treatments, including alternatives, do not create any effects that would cumulate with current effects: California wolverine, Pacific fisher, horned and red-necked grebes, bufflehead, upland sandpiper, American peregrine falcon, gray flycatcher, and tricolored blackbird.

Invasive plant treatments involve relatively small, well-defined spatial areas. Most treatments are confined to patches infested with invasive plants while leaving interspersed native vegetation intact. Native wildlife habitat is not removed, modified, or degraded, nor are any hydrologic regimes affected. Treatments occur one to three times during a season, generally from late spring to mid-fall. Treatments are low intensity and of small magnitude and generally short duration (one day or less). Given the spatial and temporal scale of invasive plant treatments, potential for cumulative effects is low.

Cumulative effects to pygmy rabbits are unlikely because there are no known populations within the project area and most potential population sites are protected by exclosures. There is a very low potential for disturbance from invasive plant treatments to add to disturbance caused by grazing or other land management activities. But, the disturbance level from invasive plant treatments is very low and unlikely to add significantly to current disturbance levels. There is no potential for cumulative effects from herbicide exposure because pygmy rabbits on National Forest system land would not be exposed to additional herbicide use other than invasive plant treatments, and the herbicides proposed for use do not bioaccumulate or biomagnify. There are no significant cumulative effects to pygmy rabbits.

For sage grouse, there is limited potential for disturbance from invasive plant treatments to add to disturbance from other land management activities. The potential for disturbance is greatly limited by the PDF for sage grouse. As such, there will be no significant cumulative effect from disturbance. Cumulative exposure of sage grouse to herbicides could only occur for birds that move between National Forest System lands and other ownerships (invasive plant treatments are the only herbicide use proposed within the project area). Because the herbicides proposed for use in this project are rapidly excreted, do not bioaccumulate or biomagnify, and pose low risk to the grouse, even if exposures occurred from multiple ownerships, they are unlikely to result in any cumulative toxic effect to the sage grouse. There are no significant cumulative effects to sage grouse.

Harlequin ducks and yellow rails could be disturbed by recreational activity as well as other activities occurring in riparian areas. Invasive plant treatments could add to the disturbance, but are such low magnitude, short duration, and low intensity that no significant cumulative effect is likely to occur. In addition, the PDF for yellow rails also limits the amount of disturbance that could occur from invasive plant treatments. Cumulative exposure of harlequin ducks and yellow rails to herbicides could only occur for birds that move between National Forest System lands and other ownerships. Because the herbicides proposed for use in this project are rapidly excreted, do not bioaccumulate or biomagnify, and pose low risk to the birds, even if exposures occurred from multiple ownerships, they are unlikely to result in any cumulative toxic effect to these birds. There are no significant cumulative effects to harlequin ducks or yellow rails.

Oregon and Columbia spotted frogs might be disturbed or harmed if they were within or traveling through invasive plants targeted for treatment. Likelihood of this occurring is low because they are very aquatic and not likely to be within patches of upland invasive plants. Other activities, such as grazing, road maintenance, or recreation could also create some disturbance. Invasive plant treatments could add to the disturbance, but are such low magnitude, short duration, and low intensity that no significant cumulative effect is likely to occur. Herbicides proposed for use have a low likelihood of causing effects to spotted frogs due to their low toxicity and PDFs limiting exposure. Spotted frogs that may be exposed to very low levels of herbicide within the project area are not likely to be exposed to herbicide use from some other source because the frogs are somewhat limited in their movements. Because the herbicides proposed for use in this project are rapidly excreted (even by aquatic organisms), do not bioaccumulate or biomagnify, and pose low risk to spotted frogs, significant cumulative effects from herbicide exposure are unlikely. Spotted frogs are at risk from exposure to more toxic compounds like insecticides, but these compounds are not proposed for use on the National Forest System lands where invasive plant treatments would occur. There are no significant cumulative effects to Oregon or Columbia spotted frogs.

Some individuals of Crater Lake tightcoil snail could be trampled during invasive plant treatments. Trampling could also occur from recreational use or similar activities in riparian areas. The magnitude and extent of trampling from invasive plant treatments is very low and restricted to a few individuals present within or immediately adjacent to invasive plant species. In addition, because Crater Lake tightcoil is a Survey and Manage Species, pre-disturbance surveys are required. As such, trampling from invasive plant treatments are unlikely to add significantly to trampling or disturbance from other activities. There is currently no evidence that the herbicides proposed for use will have adverse effects on terrestrial snails, so there are no herbicide effects to add to other past, present, or future effects. There are no significant cumulative effects to Crater Lake tightcoil snail.

## Direct and Indirect Effects to Management Indicator Species

Effects to bald eagle, northern spotted owl, peregrine falcon, and wolverine were previously discussed. Effects to MIS from herbicide exposure were evaluated by placing the species into groups based on taxa type, body size, and diet. Exposure scenarios for various groupings were used to quantitatively estimate dose and characterize risk. Scenarios are discussed in detail in Appendix P of the R6 2005 FEIS and this information is incorporated by reference. The following scenarios were used for the following species:

- *Predatory bird consuming a contaminated small mammal*: golden eagle, northern goshawk, Cooper's hawk, sharp-shinned hawk, red-tail hawk, great gray owl.
- *Predatory bird consuming contaminated fish*: osprey, great blue heron, waterfowl.
- *Herbivorous bird consuming contaminated vegetation*: waterfowl
- *Large mammal consuming contaminated vegetation*: deer and elk
- *Carnivore consuming contaminated small mammal*: American (pine) marten
- *Insectivorous mammal*: Townsend's big-eared bat

Effects to pileated woodpeckers, northern flicker, and primary cavity excavators are included below.

### Pileated Woodpeckers, Primary Cavity Excavators

Species that forage and nest in trees are not likely to be exposed to herbicides because no trees will be treated and no aerial application, which could create drift over large trees, is proposed. Lewis' woodpecker and northern flicker are the only cavity excavators that may feed on the ground or low shrubs for a substantial portion of their diet. They may encounter contaminated insects. No herbicides except triclopyr (which cannot be broadcast sprayed) are a concern at typical application rates. NPE may exceed toxicity index at typical and highest application rates given the worst case scenario of feeding exclusively on contaminated insects. Given the varied diet and movement of these birds, they are unlikely to forage exclusively within one patch of treated invasive plants and actual doses exceeding levels of concern are unlikely. None of these species are susceptible to the low magnitude, extent, and duration of disturbance caused by treating patches of invasive plants, which occur mostly along roadsides. Invasive plant treatments will not cause adverse effects to these species. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no appreciable difference in effects between alternatives.

### Effects to MIS Raptors

Effects from herbicide exposure are the same as those previously discussed for the northern spotted owl. The estimated dose from an NPE-based surfactant applied at the highest rate did exceed the NOAEL. Project design feature number 12 limits use of NPE-based surfactants to the typical application rate, so exposures exceeding the NOAEL will not occur. Also, the probability is very low that any raptors would consume a prey item directly sprayed with NPE and no herbicide posed a risk of adverse effects to predatory birds. Only sites treated with heavy equipment or other mechanical methods are likely to cause enough noise to disturb these nesting raptors, and mechanical treatments are proposed only for 23 project area units. Of these sites, 21 propose use of string trimmers and 2 propose use of a disc. Eighteen of the sites are located along roads or recreational areas where existing ambient disturbance occurs regularly. For treatment sites where noise from the treatments would exceed ambient levels of disturbance, effects from disturbance would be avoided by adhering to the PDF for nesting raptors and herons that lists seasonal restrictions for nesting raptors. Invasive plant treatments will not cause adverse effects to these species. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no appreciable difference in effects between alternatives.

**Effects to Great Gray Owl**

No herbicides or NPE-based surfactants applied at typical application rates pose a risk to predatory birds consuming small mammals that may have been directly sprayed. At the highest application rates, only NPE-based surfactants exceeded a level of concern. A PDF for all alternatives restricts NPE to application rates of 0.5 a.i/acre (less than the "typical rate" analyzed) or less, so doses of concern will not occur. For treatment sites where noise from the treatments would exceed ambient levels of disturbance, effects from disturbance would be avoided by adhering to the PDF that lists seasonal restrictions for nesting raptors. In addition, great gray owl is a Survey and Manage species for which pre-disturbance surveys are required. Conducting the pre-disturbance surveys to document presence and the PDF which restricts seasons for disturbance causing activities will eliminate potential effects from disturbance. Invasive plant treatments will not cause adverse effects to this species. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no appreciable difference in effects between alternatives.

**Effects to Osprey and Great Blue Heron**

Effects from herbicide exposure are the same as those previously discussed for the bald eagle. Potential for disturbance is the same as discussed for MIS raptors. Effects from disturbance would be avoided by adhering to the PDF that lists seasonal restrictions for nesting raptors and the great blue heron. Invasive plant treatments will not cause adverse effects to these species. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no appreciable difference in effects between alternatives.

**Effects to MIS Waterfowl**

For acute exposures, no herbicide resulted in a dose that exceeded a level of concern for birds consuming contaminated vegetation. NPE exceeded the level of concern only at the highest application rate, but a PDF restricts the use of NPE to 0.5 lb a.i./acre (less than the 'typical rate analyzed), so exposures of concern will not occur. For chronic exposures, glyphosate, sethoxydim, and sulfometuron methyl exceed the level of concern, but only at the highest application rates. Waterfowl would have to feed exclusively on treated vegetation for 90 days to receive the chronic dose of concern. Given foraging movements of the birds and the nature of invasive plant treatments proposed (small patches scattered over larger areas), this scenario is highly unlikely. The R6 Invasive Plant BA (USFS 2005d) demonstrated that chronic exposure in water are not possible with the types of applications proposed. Waterfowl are highly unlikely to receive a dose of triclopyr that would exceed a level of concern due to restrictions on use of triclopyr. High application rates of glyphosate are not sprayed because it reduces effectiveness and wastes money. Tables 15 and 16 in the FEIS list the buffers for all herbicides. Sethoxydim cannot be broadcast sprayed within 100 feet of water in Alternative 2 and not at all in Alternative 3. Sulfometuron methyl cannot be broadcast sprayed within 50 feet of water in Alternative 2 and not at all in Alternative 3. These buffers and restrictions make it highly unlikely that waterfowl could feed exclusively on treated vegetation over a 90 day period, which is what would have to occur in order to receive the chronic dose of concern. In addition, these waterfowl species do not feed extensively, if at all, on invasive plants, so the likelihood of any exposure is very low.

Disturbance to nesting waterfowl could occur for treatments with any method, but will be short term, low intensity, and limited in extent (usually less than one acre). No adverse effects from this low level of disturbance will occur.

Invasive plant treatments will not cause adverse effects to MIS waterfowl. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no appreciable difference in effects between alternatives.

### Effects to Deer and Elk

The grazing and browsing habits of elk and deer make it possible for them to consume vegetation that has been sprayed with herbicide. Quantitative estimates of risk using "worst-case" scenarios found that none of the herbicides considered for use, at typical application rates, would result in a dose that exceeds the toxicity indices in either acute or chronic scenarios. The dose for NPE surfactant exceeds the toxicity index only in an acute scenario. The deer or elk would have to consume an entire day's diet of contaminated grass in order to receive this dose. No broadcast spraying is proposed over large areas in which deer or elk would forage. Spot spraying and roadside boom spraying of invasive plants are not likely to expose deer or elk to harmful levels of herbicide or NPE because they are unlikely to forage exclusively on treated invasive plants, which are not their preferred forage. Also, the patchy nature of the applications makes it unlikely that the deer or elk would forage exclusively on the scattered treated patches.

Invasive plant treatments can create some disturbance, but the level of disturbance would be short term, low intensity, and limited extent. The level of disturbance will not create negative effects for these very mobile and wide-ranging species. Invasive plant treatments will have no negative effect on deer or elk. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no appreciable difference in effects between alternatives.

Treatment of invasive plants in meadows and along roadsides in meadow habitat could beneficially affect deer and elk by preserving native forage species and maintaining the long-term suitability of the habitat. Invasive plants can reduce the ability of an area to support deer and elk (Rice et al. 1997).

### Effects to American Marten

No herbicide or NPE exceeded a level of concern for carnivores eating contaminated small mammals. Invasive plant infestations are unlikely to occur in marten habitat except along disturbed roadsides, so disturbance to martens from treatment is not likely to occur. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no appreciable difference in effects between alternatives.

### Effects to Townsend's Big-eared Bat

Currently known sites are not near invasive plant treatment areas and are in mining shacks, caves, or rock crevices in canyon rims. This bat may have roosts on bridges within or near treatment areas. Traffic along the roads and the bridges used for roosting was well-established when the bats colonized the bridges. Roadside treatments typically consist of a boom or nozzle spray attached to a pick-up truck, or a person with a backpack sprayer conducting spot sprays of plants. Both treatment methods only take a couple minutes to conduct, do not generate noise much beyond the background noise of the road and bridge use, and do not occur in close proximity to the bats themselves. Therefore, the likelihood of disturbing roosting bats during treatment of roadside invasive plants is remote.

The bats forage over large areas catching insects (primarily moths) in flight or by gleaning from vegetation. The small amount of acreage proposed for treatment, scattered in small patches, make it unlikely that the bats would forage within treatment areas and on insects that have been inadvertently sprayed by herbicides and NPE surfactant. If contaminated insects were ingested, only NPE surfactants resulted in a dose that exceeds the toxicity index. In order to receive this dose, the bat would have to consume nothing but contaminated insects for an entire nights feeding. Given the bats foraging habits, it is unlikely that bats would be exposed to this level of NPE. In addition, because the bats roost in crevices well above ground level during the day, it is not plausible that they could be directly exposed to spray of herbicides or NPE.

Data is lacking on risk from chronic exposure to contaminated insects. It is highly unlikely that bats would be exposed chronically to contaminated insects given the small acreages treated and the relatively large areas in which bats forage. The bats are not likely to forage exclusively within treated areas over a 90-day period (the chronic exposure) so there does not appear to be a plausible risk from chronic exposure.

Invasive plant treatments will not cause adverse effects to Townsend's big-eared bat. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no appreciable difference in effects between alternatives.

**Cumulative Effects to MIS**

None of the MIS are significantly affected by invasive plant treatments. Even effects to individuals have a very low probability of occurring. In many cases, there will be no effect at all to MIS. Therefore, the effects from invasive plant treatments will not add to past, present, or future effects to create significant cumulative effects.

## Effects to Survey and Manage Species

There are only two Survey and Manage Species, located only on the Deschutes NF: the great gray owl and Crater Lake tightcoil snail. The Crater Lake tightcoil is discussed under the section titled "Direct and Indirect Effects to Forest Service Sensitive Species" and the great gray owl is discussed in the section titled "Direct and Indirect Effects to Management Indicator Species." Cumulative effects are discussed in the respective sections. Pre-disturbance surveys are required for both of these species. There are two survey seasons for the great gray owl and two survey periods for the Crater Lake tightcoil.

Invasive plant treatments will cause no negative effects to populations of these species. Some individual snails could be trampled during treatments, but the majority of the population in native riparian and wetland habitat would be protected.

## Effects to Birds of Conservation Concern

The short-term (one day or less), low magnitude, and limited extent (usually 1 acre or less scattered over larger areas) of disturbance that will occur with invasive plant treatments will not cause negative effects to populations of birds in this category. In addition, several of the raptors in this category are further protected from disturbance by the PDF for nesting raptors and great blue heron.

Effects to golden eagle, peregrine falcon, sage grouse, yellow rail, Lewis's woodpecker, Williamson's sapsucker, white-headed woodpecker, tricolored blackbird, and pygmy nuthatch have been discussed previously. Similar to the discussion for MIS, risk of herbicide exposure to these species was evaluated by placing them into groups based on diet.

*Predatory bird consuming small mammal*: Swainson's hawk, flammulated owl, burrowing owl, and prairie falcon. Risks are the same as those discussed for MIS raptors.

*Insectivorous bird*: American avocet, solitary sandpiper, long-billed curlew, marbled godwit, Wilson's phalarope, and loggerhead shrike. Risks are the same as those previously discussed for the gray flycatcher and upland sandpiper.

**Brewer's Sparrow and Sage Sparrow**

There is no quantitative exposure scenario for birds that eat primarily seeds, but the scenario for birds that eat contaminated vegetation can be used as a reasonable surrogate. Herbicide residue rates on grass are high compared to other vegetation and the caloric content of grass is low compared to seeds (Kenaga 1973; EPA 1993, p. 3-5). This means that birds would ingest more vegetation and receive a higher dose of herbicide than expected for seed eaters. Therefore, the risks to sparrows from herbicide exposure are the same as those discussed previously for MIS waterfowl.

Invasive plant treatments will have no negative effect on Birds of Conservation Concern. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no appreciable difference in effects between alternatives. Control of invasive plants will protect and improve important habitat for many of the birds included in this category.

## Effects to Landbirds or their Habitat

The Forest Service has prepared a Landbird Strategic Plan (January 2000) to maintain, restore, and protect habitats necessary to sustain healthy migratory and resident bird populations to achieve biological objectives. The conservation strategies that cover the project area all mention the adverse impacts of exotic plants to landbird habitat. Therefore, invasive plant treatments are consistent with management direction provided in the conservation strategies.

Some of the conservation strategies for priority habitats and focal species mention pesticides, including herbicides. One concern listed is the effect of insecticides on insect prey base. Insecticide use is not part of this action and is not likely to occur within invasive plant treatment areas. The herbicides in this proposal are not toxic to insects, although data is limited (USFS 2005d, SERA 2001, 2003, 2004). However, herbicides target physiological systems found primarily or exclusively in plants and have a low potential for effects to insects.

For herbicide use or noxious weeds, conservation strategies recommend that herbicides be applied by hand if practical. Most herbicide applications considered will be done by hand (selective methods, back pack, or hose and wand attached to a vehicle-mounted tank). No aerial application is proposed. Some broadcast applications will be applied under Alternative 2, but those would be roadside patches and other patches in relatively flat terrain. There would be less spraying in riparian habitat in Alternative 3, but treatments in both alternatives avoid native vegetation and any difference in effect between the two alternatives is so small it cannot be meaningfully measured. The use of herbicides to target invasive plants will not reduce cover needed by focal species because the invasive plants are not extensively used by native birds. One exception may be Himalayan blackberry.

The conservation strategy for riparian habitat states that herbicide use should be limited to invasive non-native species (e.g. reed canarygrass) to enhance habitat. This is consistent with the herbicide uses proposed in the alternatives.

Recommendations for yellow warbler and yellow-breasted chat include elimination of willow cutting and herbicide spraying in riparian zones, and Taylor and Littlefield (1986) is cited for this recommendation. However, Taylor and Littlefield (1986) discuss the purposeful treatment of native willows to increase cattle forage. The proposed invasive plant treatments in both action alternatives contain buffers that restrict spraying of herbicides in riparian zones, and willows are not the target of invasive plant treatments, so no habitat for these species will be removed or degraded.

In conclusion, none of the proposed invasive plant treatments will negatively affect the habitat features provided by native vegetation and may serve to improve the quality of these habitat features for the focal species identified; none of the herbicides proposed for use will substantially affect any insect prey populations; and none of the herbicides or surfactants proposed for use pose a toxic risk to focal species of birds. The treatment of invasive plants is consistent with management recommendation contained in the various conservation strategies that cover the project area.

Invasive plant treatments will not have negative effects on focal species or priority habitats included in the Landbird Strategy. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no appreciable difference in effects between alternatives.

**Cumulative Effects to Landbirds and Birds of Conservation Concern**

None of the bird species or their habitats are significantly affected by invasive plant treatments. Even effects to individuals have a very low probability of occurring. In many cases, there will be no effect at all to the birds or their native habitats. Therefore, the effects from invasive plant treatments will not add to past, present, or future effects to create significant cumulative effects.

# 3.10 Economic Analysis

## 3.10.1 Introduction

Concerns about project cost, financial efficiency, and jobs were expressed during scoping. The Forest Service in Oregon and Washington is spending about 4.8 million dollars annually to treat approximately 25,000 acres of invasive plants in the Pacific Northwest Region. From 2003 to 2005 the Deschutes and Ochoco National Forests and Crooked River National Grassland have had an average annual combined budget for invasive plant management of about $224,500 (Cheney, pers. comm. 2006). The treatments proposed by the Forest Service are likely to be funded through a variety of mechanisms and partnerships including county, state, federal, and private sources.

Costs used in the analysis are assumptions for the purpose of comparing alternatives; they are estimates and in some cases may not reflect the most current costs to accomplish control methods. Refer to the R6 Invasive Plant Program FEIS for more information on unit costs (page 4-94).

### Economic Impact of Invasive Plants

Invasive plants (noxious weeds) have an enormous impact on Oregon's economy and natural resources. In 1999, Oregon Department of Agriculture (ODA) partnered with Oregon State University (OSU) to study the economic impacts of 21 of the 99 invasive plants listed in Oregon as noxious. Existing populations of these 21 species presently reduce Oregon's total personal income by about 83 million dollars, the equivalent of 3,329 jobs lost to Oregon's economy from the production foregone by the presence of these invasive plants. The continued expansion of these species could further reduce Oregon's personal income by another 54 million dollars. The value of Oregon's resources is reduced by approximately one billion dollars because of these weeds (The Research Group 2000). Of the 21 invasive plants highlighted for economic evaluation by ODA and OSU, several are present in the Forests and Grassland and are targets of this proposal: yellow starthistle, spotted knapweed, diffuse knapweed, Russian knapweed, leafy spurge, Scotch thistle, orange hawkweed, tansy ragwort, Scotch broom, gorse, purple loosestrife, and whitetop.

## 3.10.2 Treatment and Project Costs

Non-herbicide methods can be more costly than herbicide applications (USFS 2005a, p. 4-94), and treatment costs are a factor in the amount of acreage that can be completed. Most of the cost associated with invasive plant treatment is in labor. Hand pulling and hand application of herbicides have the highest labor costs. It is the combination of different methods, however, that is often most effective. The availability of volunteer labor could offset the costs associated with manual treatment as long as the commitment and availability of volunteers matched the treatment requirements. Cultural and biological methods are not included in this assessment because they account for such a small portion of the treatments proposed.[17]

[17] Biological control is about $70 per acre and cultural methods average around $50 per acre according to the R6 Invasive Plant FEIS, page 4-94.

**Table 89.** Cost of Treatment by Method

| Method | Cost Per Acre | Wage cost as Percent of Total |
|---|---|---|
| Manual | $340 | 100 |
| Herbicide - Broadcast | $100 | 24 |
| Herbicide - Spot, hand | $250 | 85 |
| Mechanical | $100 | 40 |
| Active Restoration | $500 | 50 |

Variables that affect the actual cost of treating an invasive plant site include such things as whether or not return visits are required and for how long, the amount of acres that requires re-treating, whether the objective is to control/eradicate or to contain (containment objective will likely have fewer net acres treated)[18], and the reduced amount of herbicides used in subsequent treatments. When figuring project costs, it was assumed that:

- All acres are previously untreated.
- Where the treatment involves herbicides, the herbicides application will occur in the first year and will be 100% herbicide, even though prescriptions may include some manual or mechanical treatment during or before herbicide application.
- Broadcast will be the application method on roads and spot or hand application will be the method employed everywhere else that broadcast is allowed.
- Non-herbicide treatments that are combined with herbicide treatments are assumed to start occurring in the second year of treatment (as populations become more manageable, more of the treatment becomes manual).
- Acres are of the mapped invasive plant sites in GIS (and therefore larger than actual infested acres varying by the density of the infestation).

Based on Table 5, Page 29, about 95% of the first year's treatment would be herbicide application, and 5% manual. Sites that are classified as a road site type were used to estimate the proportion of broadcast treatment vs. spot or hand application (although roadsides sites are not necessarily treated by broadcast spraying).

**Table 90.** Estimated Cost of Treating all Acres in First Year.

| | Proposed Action | Alternative 3 |
|---|---|---|
| Cost for First Year's Treatments (all acres) | manual - $240,040<br>herb (spot/hand) - $968,750<br>herb (broadcast) - $996,500<br>------------------------------------<br>$2,205,290 | manual - $255,340<br>herb (spot/hand) - $1,472,750<br>herb (broadcast) - $790,400<br>------------------------------------<br>$2,518,490 |

The difference in cost for the action alternatives is small and is based on the area within 10 feet of water switching from hand application of herbicide to manual pulling as well as the areas within 300 feet of water switching from broadcast application of herbicides to hand/spot application. Alternative 3 also restricts certain herbicides within 300 feet of streams, which could also affect cost, particularly if no effective herbicide were allowed and the treatment became manual. The cost of Alternative 2 would be less than Alternative 3. The costs associated with Alternative 1 would be based on the remaining work to be done on the sites approved for treatment in earlier NEPA documents. Because

[18] For example, medusahead sites on the Grassland are very large, but the containment strategy involves treating the perimeter and along roadways.

herbicide use on these sites has declined as treatment has been effective, costs will become more associated with manual work (see, for example, Table 27).

Costs of active restoration will vary by site. It is estimated that active restoration will cost on average $500 per acre. Of the known sites, 9 are currently expected to require active restoration (Appendix A, Table A-3). If the currently infested acres of these project area units were actively restored, the cost could reach $131,000. Additional active restoration may be deemed necessary, based on post-treatment monitoring.

**Table 91.** Pattern of herbicide to non-herbicide over time alternatives 2 and 3, if all 1,892 sites were treated beginning in 2007. Based on analysis done by the Olympic National Forest (USFS 2006).

| Year | Percent Herbicide Use | Percent Non-Herbicide Use |
|---|---|---|
| 2007 | 95% | 4% |
| 2008 | 75% | 25% |
| 2009 | 50% | 50% |
| 2010 | 0% | 100% |

For the Proposed Action, assuming a constant budget of $250,000 per year[19], about 10% of the infested sites could be effectively treated in the first year. As prioritization takes place across the Forests and Grassland to make the best use of the budget, high priority sites would be most likely to be effectively treated, but other infestations would continue to spread until they could be effectively treated. Cost of treating existing infestations would continue to increase.

**Early Detection / Rapid Response**

The intent of the EDRR strategy is to treat new invasive plant sites while they are small and more easily controlled. Smaller populations can be treated manually (depending on the species), so the costs associated with EDRR may be more related to the labor involved in inventory, processing, and implementing manual treatments. If new invasive plant populations are detected, the costs for treatment would generally be the same as for the inventoried sites. However, because early detection means that new sites can be treated while small, the quick treatment of newly discovered could mean less are treated and fewer return visits.

**Cumulative Effects**

There are costs associated with implementing the prevention standards of the 2005 Record of Decision (USFS 2005a, pp 4-98 to 4-103). Local prevention guidelines will also have some cost associated with them. Use of funds for these purposes and for invasive plant treatment can impact the amount of money available to other programs.

With the implementation of prevention standards and guidelines, invasive plant spread is anticipated to slow (USFS 2005b, p. 9). The cost, therefore, incurred with detecting and responding to new invasive plant sites is expected to go down over time. Implementing effective treatments on existing invasive plant sites will also reduce the sources of spread and therefore the cost associated with treating new sites.

## 3.10.3 Jobs Associated with Invasive Plant Treatment

Some members of the public felt that job creation is a valuable indirect effect of invasive plant treatment. They expressed that manual treatments are more likely to involve manual labor than other

[19] The figure of $250,000 was used as an annual budget, which is based on a slight increase over the average received by the Forests and Grassland for invasive plant treatments for years 2003, 2004, and 2005.

treatment methods, and thus should be favored. Indeed, nearly all of the costs associated with manual treatments involve labor costs and an invasive plant program with a greater proportion of this treatment method compared to other methods would require more manpower and therefore more money.

The R6 FEIS compared alternatives that involved more or less manual treatments and found that the larger the percentage of treatments done by manual methods, the fewer acres that could be treated for a given amount of money (USFS 2005a, p. 4-97). The Regional Forester's selected alternative for invasive plant management in the Region provided a balance between cost-effectiveness and risk of adverse effects (USFS 2005b, p. 9).

The Forests have been employing Youth Conservation Corps (YCC), youth-at-risk programs (e.g. COSTEP), and county corrections crews for manual work on invasive plants. Additional work that would be beyond the capacity of these resources would result in short-term employment opportunities. Also, assuming full funding, the most ambitious treatment scenarios in either alternative would result in short-term employment opportunities (for all treatment methods). Employment opportunities would diminish over time as the invasive plants are eradicated, controlled, contained, or suppressed and treated sites are restored.

It is estimated that a hand crew of 10 people can complete work on one acre in one day on a heavily infested knapweed site (USFS 1998a).

Wages are estimated as 80 percent of labor cost (assuming the other 20 percent applies to taxes and benefits). Wages are assumed to average $160 per worker day; actual wages range widely for machine operators, herbicide applicators, and hand laborers (USFS 2006c).

**Table 92.** Assumptions for Worker Days per Treatment Area.

| Treatment Method | Total Cost per Acre | Wage Cost as % of Total | Worker Day per Treatment Acre |
|---|---|---|---|
| Herbicide-Broadcast | 100 | 24 | .23 |
| Herbicide-Spot/Hand | 250 | 85 | 1.6 |
| Mechanical | 100 | 40 | .3 |
| Manual | 340 | 100 | 3 |
| Restoration | 500 | 50 | 1.18 |

**Table 93.** Number of Jobs for First Year of Most Ambitious Treatment Scenario (all acres treated in first year).

| Alternative | Total Acres | Total Worker Days | Number of Jobs Assuming 6 Month Season |
|---|---|---|---|
| **No Action** | 1,595* | 3,858 | 32 |
| **Alt. 2** | 14,546 | 10,610 | 88 |
| **Alt. 3** | 14,546 | 13,497 | 112 |

*Average annual treatment under current NEPA, from Table 3, page 25.

Future years' job numbers would decline rapidly after the first year of the most ambitious scenario, because less treatment would be needed in following years. However, restoration work would remain. Jobs associated with restoration in these subsequent years amount to about 6 additional jobs per 6-month year.

Alternative 3 would involve more labor because of a heavier reliance on manual treatment and/or hand application of herbicide near water, which are more labor-intensive methods, but the difference would be slight considering the entire project area.

**Cumulative Effects**

This job level is not significant to the economy of the counties surrounding the Deschutes or Ochoco National Forest, although the most ambitious treatment scenario may require the help of workers from outside the local area.

Government officials estimate that invasive plant control occurs on over 1,250,000 acres in Oregon and Washington, and more than 90 percent of this control is through the use of herbicides (based on informal discussions with state and county agriculture and weed personnel). These data suggest that the broader regional treatment program resembles the Proposed Action. If this is true, then invasive plant control in the region creates roughly 8,038 jobs annually (applying the average of one $20,000 job equivalent for every 138.3 acres treated). (USFS 2005a).

# 3.11 Range Resources & Grazing Management

## 3.11.1 Affected Environment

### Introduction

Together, the Crooked River National Grassland and the Deschutes and Ochoco National Forests (Forests) administer 109 grazing allotments, of which 73 are active, 23 are vacant, and 13 are closed to permitted livestock grazing. There are currently weed populations mapped on 78 of these including on 16 of the vacant allotments, and on 7 of the closed allotments. The Crooked River National Grassland administers 25 grazing allotments, of which 19 are active, 1 is vacant, and 5 allotments are closed to permitted livestock grazing. There are currently weed populations mapped on 17 of these, 2 of which are closed allotments with the remainder being active. See Tables 94-96 below. The Deschutes National Forest administers 34 grazing allotments, of which 7 are active, 20 are vacant, and 7 are closed to permitted livestock grazing. There are currently weed populations mapped on 28 of these, including on 16 of the vacant allotments, and 6 of the closed allotments. The Ochoco National Forest administers 50 grazing allotments, of which 47 are active, 2 are vacant, and one is closed to permitted livestock grazing. There are currently weed populations mapped on 36 of these, including on the two vacant allotments, and on the closed allotment.

Invasive species are not present on all allotments, nor are they present on only active allotments. On the Deschutes National Forest in particular, many allotments have been vacant for several decades or more and yet invasive species are present on many of these. In no way are invasive species confined uniquely to grazing allotments, as these plants are commonly present where no allotments exist. This is especially evident when considering the Deschutes National Forest where invasive plants are common on the Bend, Crescent, and Sisters Ranger Districts where grazing is not occurring.

The presence of invasive plants is relatively recent in the context of the presence of human activity in the Central Oregon Region. Historical grazing in one form or another likely occurred over much of the planning area, but recent grazing activities are much more defined and concentrated on managed allotments. There is likely little connection to historic grazing use and the more recent problem of invasive plant introduction on areas not grazed except historically or in recent times on allotments that have been vacant for decades.

Because invasive plants exist on some allotments and not others, are present in both active and vacant allotments, species variability is high across the three administrative units, multiple vectors for spread are common and varied, connections between disturbance zones of influence such as forest transportation roads, gravel pits, wildfire impacted areas is relatively high, and because an association of infested areas to adjacent non-Forest Service owned lands is relatively common, it is difficult to determine how much current grazing activities are contributing to the spread of invasives. The vast majority of weed sites are associated with roads, which is an indication that disturbed areas subject to vehicle use are high risk environments and that vehicle use is a major vector. Refer to Chapter 3.3 for more discussion on mechanisms of invasion and spread. Proper grazing management and best management practices are designed to sustain or improve the health of vegetation communities.

Domestic livestock grazing on the Forests currently is not suspected of being a major contributor to the spread of noxious weed infestations within affected range allotments at this time. The overall trends for these plants indicate that human activity along roads, trails, and recreation areas, along with disturbance at rock quarries and special-use sites such as microwave sites, and the movement of seed or other vegetative propagates by water along riparian corridors, are the main transportation vectors at this time. This human activity can include the hauling of livestock on trailers and the hauling of livestock water on trucks that could contribute to the spread of invasive plants if the vehicle comes from an infested area or drives through an infested area. Grazing permittees are not allowed to feed weed-infested hay to their livestock on National Forest System lands, which could be a potential source of new infestations. Oregon Department of Agriculture has developed procedures for a weed-free forage certification program (http://oregon.gov/ODA/PLANT/WEEDS/weedfreeforageprogram.shtml). In Deschutes County at least one field of hay has been certified by the county vegetation manager (Cheney, pers. comm. 2006).

Domestic livestock along with native ungulates and other small mammals are considered to be an important vector for *Cynoglossum officinale* (houndstongue) within the Ochoco National Forest. This is not the case on the Deschutes or Crooked River National Grassland as this species is currently not present on allotments within these two land management areas. It is not presently known to what extent livestock are spreading this plant on the Ochoco National Forest. Research undertaken by Clerck-Floate, 1997 found that cattle are major dispersers of houndstongue on rangelands. One European study of this species found that the largest animals responsible for burr dispersal were rabbits and there were doubts as to their efficacy as dispersers. Wildlife, such as deer and elk, also may contribute to houndstongue seed dispersal; although it is suspected that their role as dispersers is minor relative to that of cattle (Clerck-Floate 1997).

Because of existing population levels of houndstongue within the Roba Allotment located on the Paulina Ranger District, weed managers there are proposing to implement a three year rest from cattle grazing in at least one of the allotment pastures. While the pasture is rested, weed control methods will be applied to control this invasive species and upon measured success, grazing will resume. The Snowshoe Allotment located on the Lookout Mountain Ranger District has high population levels of houndstongue and similar measures may be taken if they prove effective on the Roba Allotment.

Invasive plant species vary in their susceptibility to be spread by various livestock classes; it also depends on the time of year grazing occurs. For example, grazing spotted knapweed by cattle prior to seed head opening and pollination likely has no potential for the spread of the plant as the seeds are not fertile. The seeds of spotted knapweed are much less likely to “cling” to cattle than are the seeds of Houndstongue plants and so the risk is much different for spread of invasive by cattle for each species. On the Sisters Ranger District spotted knapweeds appears to be able to leave the disturbed sites along roads and commonly enter native upland plant communities that are not subject to any grazing. This is uncommon if not non-existent on the Fort Rock District where native flora has so far proved quite resistant to spotted knapweed regardless of whether grazing is occurring.

Certain invasive plant species are known to be toxic to various classes of permitted livestock. Canada thistle has the potential to concentrate nitrates and cause nitrate poisoning in ruminants. In addition, the application of the herbicide 2,4-D has been shown to increase the nitrate content of plants and the palatability of the plants, increasing the potential for poisoning. Field bindweed contains tropane alkaloids and may also accumulate toxic levels of nitrate. It is most likely to cause poisoning in animals when it becomes the predominant plant available for the animals to eat. Russian knapweed and yellow starthistle both produce a unique poisoning of horses that is generally fatal. Black henbane is a member of the nightshade family (Solanaceae) and has the potential to cause poisoning, but because it is unpalatable, it is rarely eaten. Poison hemlock is toxic to a wide variety of animals including man, birds, wildlife, cattle, sheep, goats, and horses. The poison can be transmitted through the milk of animals that have eaten poison hemlock. Leafy spurge can cause excessive salivation and diarrhea in cattle. It does not appear to affect sheep and goats (Knight & Walter 2001).

**Table 94.** Grazing Allotments with Known Invasive Plant Populations on the Crooked River National Grassland.

| Allotment Name Status: active | Invasive Plant Species | Total gross acres* |
|---|---|---|
| Blanchard | whitetop, medusahead, diffuse knapweed | 5.2 |
| Boyce | whitetop, spotted knapweed, diffuse knapweed, bull thistle, field bindweed | 1.6 |
| Cyrus | whitetop, spotted knapweed, bull thistle, field bindweed, spotted knapweed, Dalmation toadflax | 16.1 |
| East Winter | medusahead | 468.1 |
| Fox | medusahead | 3.1 |
| Grizzly | whitetop, spotted knapweed, diffuse knapweed, Canada thistle, bull thistle, field bindweed, St. Johnswort, medusahead | 2,113.4 |
| Haystack | Russian knapweed, spotted knapweed, diffuse knapweed, bull thistle, Scotch thistle | 237.1 |
| Holmes-Williams | spotted knapweed, diffuse knapweed | 97.6 |
| Juniper Butte | diffuse knapweed | 26.0 |
| Lone Pine | spotted knapweed, diffuse knapweed, St. Johnswort, medusahead, spotted knapweed, Canada thistle | 1,714 |
| Lower Desert | spotted knapweed, diffuse knapweed, medusahead | 272.7 |
| North | spotted knapweed, medusahead, Scotch thistle | 355.2 |
| Round Butte | medusahead | 5.2 |
| Rush | Russian knapweed, whitetop, spotted knapweed, diffuse knapweed, bull thistle, field bindweed, medusahead | 103.1 |
| Steer | whitetop, spotted knapweed, diffuse knapweed, bull thistle, field bindweed | 0.9 |
| | **Total gross acres active allotments** | **5,419.3** |
| **Status: closed** | | |
| Clevenger | N/A | 0 |
| Goldmine/Falls | N/A | 0 |
| Peninsula | N/A | 0 |
| Whychus Creek | spotted knapweed, diffuse knapweed, medusahead, St. Johnswort | 545.9 |
| | **Total gross acres closed allotments** | **545.9** |
| **Status: vacant** | | |
| Canadian Bench | N/A | 0 |

*Gross invasive plant acres: reflects the number of acres with infestations as "mapped" in our corporate GIS system. Polygons reflect mapped infestations and the entire area within a polygon is part of the numeric result, but it may or may not contain invasive plants throughout the entire mapped area.

**Table 95.** Grazing Allotments with Known Invasive Plant Populations on the Deschutes National Forest

| Allotment Name Status: active | Invasive Weed Species | Total gross acres |
|---|---|---|
| Cinder Hill {Cinder Cone} | spotted knapweed, bull thistle, Russian thistle, Dalmation toadflax | 2.5 |
| Holzman (Special use) | spotted knapweed, diffuse knapweed, Scotch broom, Dalmation toadflax | 7.9 |
| Indian Ford* | spotted knapweed, diffuse knapweed | 3.8 |
| Pine Mountain | spotted knapweed, Canada thistle, bull thistle, Dalmation toadflax, Russian thistle, | 188.5 |
| Quartz Mountain | spotted knapweed, diffuse knapweed, Canada | 4.3 |

| | | |
|---|---|---|
| | thistle | |
| Sand Springs | spotted knapweed, Canada thistle, bull thistle | 9.4 |
| | **Total gross acres active allotments** | **216.4** |
| **Status: closed** | | |
| Abbot | spotted knapweed, Canada thistle, bull thistle, leafy spurge | 17.0 |
| Big Marsh | spotted knapweed, diffuse knapweed, reed canarygrass | 827.3 |
| Glaze Meadow | spotted knapweed, diffuse knapweed, St. Johnswort, bull thistle, Dalmation toadflax | 115.7 |
| Little Deschutes | | 0 |
| Ryan Ranch | spotted knapweed, bull thistle, reed canarygrass, Dalmation toadflax | 10.7 |
| Tethrow Meadow | quackgrass, Scotch thistle | 17.6 |
| Crater Buttes | Scotch broom | 1.0 |
| | **Total gross acres closed allotments** | **988.3** |
| **Status: vacant** | | |
| Big Hole | spotted knapweed | 100.2 |
| Cache Mountain | spotted knapweed, diffuse knapweed, Canada thistle, St. Johnswort, bull thistle, knapweed, Dalmation toadflax, tansy ragwort, Russian thistle | 473.1 |
| Coyote {Bessie} | spotted knapweed, diffuse knapweed, bull thistle, Dalmation toadflax, Russian thistle | 126.6 |
| Crescent Butte | spotted knapweed, diffuse knapweed, Canada thistle, St. Johnswort, bull thistle | 26.9 |
| Crescent Creek | spotted knapweed, diffuse knapweed, Canada thistle, pepper weed, St. Johnswort, bull thistle, reed canarygrass, Dalmation toadflax, tansy ragwort, butter and eggs, Russian thistle | 253.3 |
| Davis Lake | spotted knapweed, diffuse knapweed, St. Johnswort, bull thistle, Canada thistle, Scotch broom, butter and eggs, reed canarygrass | 1,325.0 |
| Fremont Siding | spotted knapweed, diffuse knapweed, bull thistle, St. Johnswort | 58.9 |
| Fuelbreaks | spotted knapweed, diffuse knapweed, Canada thistle, knapweed, St. Johnswort, bull thistle, Scotch broom, Dalmation toadflax, tansy ragwort, medusahead | 1,521.7 |
| Garrison Butte | spotted knapweed, diffuse knapweed, bull thistle, St. Johnswort | 104.3 |
| Gilchrist | N/A | 0 |
| Hole-in-the-ground | spotted knapweed | 225.7 |
| Mowich | spotted knapweed, diffuse knapweed, bull thistle, St. Johnswort, field bindweed, kochia, butter and eggs, Canada thistle | 114.6 |
| Sand Flat | diffuse knapweed, bull thistle, yellow sweet clover | 5.4 |
| Spring Butte | spotted knapweed, bull thistle | 123.1 |
| Whychus Creek | diffuse knapweed, spotted knapweed, knapweed | 138.1 |
| | **Total gross acres vacant allotments** | **4,597.9** |

* Weed population is currently outside allotment between the fence and the adjacent roads.

**Table 96.** Grazing Allotments with Known Invasive Plant Populations on the Ochoco National Forest.

| Allotment Name Status: active | Invasive Weed Species | Total gross acres |
|---|---|---|
| Badger | musk thistle, spotted knapweed, medusahead | 23 |
| Bear Creek | spotted knapweed, diffuse knapweed, Canada thistle, houndstongue, St. Johnswort, sulphur cinquefoil, medusahead | 2.8 |
| Big Summit | spotted knapweed, diffuse knapweed, Canada thistle, bull thistle, Scotch thistle, Mediterranean sage, butter and eggs | 1.2 |
| Burn | spotted knapweed, diffuse knapweed, Canada thistle, houndstongue, teasel, St. Johnswort, medusahead | 1.2 |
| Canyon Creek | whitetop, spotted knapweed, diffuse knapweed, Canada thistle teasel, butter and eggs | 2.5 |
| Crystal Springs | Russian knapweed, spotted knapweed, diffuse knapweed, Canada thistle, houndstongue, Mediterranean sage, medusahead | 13.5 |
| Deep Creek | Russian knapweed, spotted knapweed, diffuse knapweed, Canada thistle, field bindweed, houndstongue, Scotch broom, St. Johnswort, Dalmation toadflax, sulphur cinquefoil | 59.4 |
| Double Cabin | whitetop, spotted knapweed, diffuse knapweed, Canada thistle, St. Johnswort, sulphur cinquefoil | 3.0 |
| Dry Corner | sulphur cinquefoil | 0.1 |
| East Maury | whitetop, spotted knapweed, diffuse knapweed, Canada thistle, Dalmation toadflax, Scotch thistle | 4.0 |
| Elkhorn | spotted knapweed, Sonoma ceanothis, Canada thistle, houndstongue, medusahead | 33.6 |
| Fox Canyon | spotted knapweed, diffuse knapweed, bull thistle | 1.3 |
| Gray Prairie | whitetop, St. Johnswort | 2.3 |
| Happy | spotted knapweed, diffuse knapweed, Canada thistle, houndstongue, teasel | 25.5 |
| Heisler | medusahead | 0.9 |
| Klootchman | Russian knapweed, whitetop, spotted knapweed, diffuse knapweed, Canada thistle, Scotch thistle, sulphur cinquefoil, medusahead | 3.3 |
| Little Summit | spotted knapweed, diffuse knapweed, Canada thistle, St. Johnswort | 1.1 |
| Lost Horse | spotted knapweed, whitetop, medusahead | 0.3 |
| Marks Creek | spotted knapweed, Canada thistle, houndstongue, teasel, leafy spurge, Scotch thistle, medusahead | 3.5 |
| Mill Creek | whitetop, spotted knapweed, diffuse knapweed, field bindweed, Canada thistle, houndstongue, Scotch broom, St. Johnswort, Scotch thistle, sulphur cinquefoil, medusahead, teasel | 15.6 |
| Pisgah | houndstongue | 0.1 |
| Pringle | whitetop, St. Johnswort | 42.2 |
| Reservoir | spotted knapweed, Canada thistle, houndstongue, St. Johnswort, Scotch thistle | 3.3 |
| Roba | whitetop, diffuse knapweed, Canada thistle, houndstongue, teasel, sulphur cinquefoil, medusahead | 869.2 |

| | | |
|---|---|---|
| Sherwood | whitetop, Canada thistle | 0.4 |
| Shotgun | whitetop, diffuse knapweed, Canada thistle, bull thistle, teasel | 37.1 |
| Snowshoe | spotted knapweed, diffuse knapweed, houndstongue, field bindweed, medusahead | 16.0 |
| Sunflower | Russian knapweed, whitetop, spotted knapweed, diffuse knapweed, Canada thistle, leafy spurge, St. Johnswort, sulphur cinquefoil | 12.9 |
| Trout Creek | spotted knapweed, diffuse knapweed, Canada thistle, field bindweed, Scotch broom, teasel, St. Johnswort, sulphur cinquefoil, medusahead | 11.8 |
| West Maury | spotted knapweed, Canada thistle, Mediterranean sage | 20.9 |
| Wildcat | spotted knapweed, diffuse knapweed, houndstongue, Scotch broom, St. Johnswort, medusahead | 4.8 |
| Wind Creek | whitetop, spotted knapweed, Canada thistle, teasel, sulphur cinquefoil, medusahead | 23.3 |
| Wolf Creek | whitetop, diffuse knapweed, spotted knapweed, Canada thistle, houndstongue, St. Johnswort, Dalmation toadflax, reed canarygrass, sulphur cinquefoil, Mediterranean sage, medusahead | 36.7 |
| | **Total gross acres active allotments** | **1,276.8** |
| **Status: closed** | | |
| Allen Creek | whitetop, spotted knapweed | 0.4 |
| | **Total gross acres closed allotments** | **0.4** |
| | | |
| Bearskull/Cotton | yellow star-thistle, diffuse knapweed, spotted knapweed, Canada thistle, bull thistle, houndstongue, teasel, St. Johnswort, Scotch thistle, Himalayan blackberry | 19.6 |
| Rock Creek | diffuse knapweed, Canada thistle | 2.1 |
| | **Total gross acres vacant allotments** | **21.7** |

In reviewing the tables above, the Grizzly, Whychus Creek, Lone Pine, East Winter and the Lower Desert allotments of the Crooked River Grassland (Grassland), the Big Marsh, Cache Mountain, Davis Lake, and the Fuelbreaks Allotments of the Deschutes NF and the Roba allotment of the Ochoco NF have relatively large infestations (500 acres or more). These are moderate to large allotments, some of which have permitted livestock grazing and others that do not. Three of the five Grassland allotments are active and two are closed, while all of the Deschutes Allotments are vacant or in the case of Big Marsh, closed. The Roba allotment on the Ochoco NF is active.

The Ochoco National Forest also administers the Big Summit Wild Horse Management Area. Wild horses currently occupy the designated horse area. The wild horse area in its entirety is comprised of the Canyon Creek and Reservoir Sheep allotments and its exterior boundary is shared where these two allotments do not share a common boundary. There are currently weed populations mapped on the occupied area, see Table 97 below. There are 3.5 acres of infestation within the Reservoir allotment and 1.7 acres of infestation within the Canyon Creek allotment. As mentioned previously, certain weed species, such as Russian knapweed and yellow star-thistle, are known to be toxic to horses, which could be a concern if they were to become widespread within the area.

**Table 97.** Occupied Wild Horse Territories with Known Invasive Plant Populations on the Ochoco National Forest

| Wild Horse Area Name | Invasive Weed Species | Total Gross acres |
|---|---|---|
| Big Summit | spotted knapweed, Canada thistle, houndstongue, teasel, St. Johnswort, Scotch thistle | 5.2 |

Domestic livestock have been used as a tool to manage noxious weeds on the Deschutes National Forest, but on a very limited basis. A combination of sheep and goats was used on the Sisters Ranger District to treat infestations of *Centaurea biebersteinii* (Spotted knapweed) that were occurring after a large wildfire (Eyerly) that burned large areas west of Lake Billy Chinook. Sheep and goats were also used at the Bend Pine Nursery to treat noxious weeds. The current project proposes no grazing for invasive species control.

**Considering Prevention in Grazing Management**

The Pacific Northwest Region Invasive Plant Program Record of Decision (ROD) (USFS 2005b) recognized that invasive plants lead to many adverse environmental effects, including a reduction in forage for livestock. The ROD directed that prevention of invasive plant introduction, establishment and spread will be addressed in grazing allotment management plans. The 2005 ROD selected 23 prevention and treatment standards which will affect range management actions (see Chapter 1).

Annual Operating Instructions/plans include measures to manage weeds such as: while permittee is on Forest Service Lands that the permittee is required to follow these guidelines when using public grazing allotments: 1) the permittee would prevent the spread of noxious weeds from private land or other lands from which he/she derives a benefit; 2) a quarantine would be imposed on livestock exposed to noxious weeds for nine days prior to release onto Forest Service Allotments; 3) vehicles which have come in contact with noxious weeds would have their under carriage washed prior to use of public lands; 4) and the permittee is encouraged to use certified weed free feeds and/or selective grazing of non-infested pastures prior to turn-out.

Allotments or a specific grouping of allotments are generally unique in such ways as the presence of above ground water, the specific type of invasive species present, the aspect and slope of the landforms in the area, climate, etc. For these reasons the management direction including management for prevention and control of invasive species often is specific to each allotment or grouping of allotments and is generally addressed by allotment; but will contain generic measures such as those listed above.

In Range Annual Operating Plans of permittees:

- Strongly consider excluding livestock (by timing or otherwise) from high priority invasive plant sites where the animals are likely to cause a spread of weeds off site.
- Hay or straw used on DNF be invasive plant-free if at all possible (As of 3/06, weed-free hay is not available and the State of Oregon does not have a program for certified weed-free hay). However, Oregon State University Extension Service and Central Oregon hay growers are working together to initiate a voluntary weed-free certification trial program.)
- Require that permittees take precautions to prevent transport of invasive plants from public or private lands, by either transport vehicles or livestock, when operating on DNF.
- Livestock grazed at known invasive plant sites on public or private lands be fed weed free hay or pellets for 10 days prior to entry to DNF.

## 3.11.2 Environmental Consequences

### Summary of Effects

Implementing the No Action Alternative would not be beneficial to the livestock grazing programs on the three administrative areas as the presence of invasive species would increase. The current condition for the project area shows a trend for increasing invasive species on all administrative units and this trend is recognized regionally as the 2005 R6 FEIS species that invasive plants spread at a rate of 8-12 percent annually. Current management is having some success, but has not been able to reverse or nullify the trend of increasing invasive plants.

Implementing Alternative 2 or 3 would result in beneficial impacts on 77 grazing allotments (active, vacant, and closed) and one wild horse territory. In general, the public lands in the project area are not currently at a level of infestation where noxious weeds are displacing grazing opportunities except in very small localized situations. The one exception is on the Paulina Ranger District of the Ochoco National Forest where livestock grazing in portions of the Roba Allotment will be stayed for several years while management of houndstongue populations is implemented. Over the long term, control measures taken now will avoid more significant impacts in the future.

Of concern with Alternative 3 are the riparian reserves project area units (PAU) and new starts within these riparian reserves where treatment with herbicides will be restricted. Alternative 3 is expected to reduce invasive plants in PAUs but it will not be as effective as Alternative 2 and some invasive riparian species will persist.

Implementing these alternatives includes the use of herbicides listed in Chapter 2, Table 12. Some herbicides have use restrictions associated with domestic livestock that will need to be followed on public rangelands as listed in Appendix D to this FEIS.

**ALTERNATIVE 1 – NO ACTION**

### Direct and Indirect Effects

The direct and indirect effects are evaluated based upon the physical boundaries of the 109 allotments within the project area over the period of time which implementation of the decision occurs and until such time as the decision is modified or superceded by another decision.

Invasive plants are currently damaging the ecological integrity of lands within and outside these administrative units. Despite management direction introduced to all Land and Resource Management Plans in Region 6 by the *Record of Decision (ROD) for Managing Competing and Unwanted Vegetation* (1988 ROD), and the 1989 Mediated Agreement, invasive plants continue to increase and occupy previously uninfested areas. IAs the current conditions of the project area change and as invasive plants continue to spread as they have done so in the last decade or more, management activities such as livestock grazing will be affected. Livestock and their human managers have the potential to spread invasive plants. As populations of invasive species become larger and more widespread and as changes in ecosystems become more obvious to the public, there will be more pressure to manage public lands more intensely and that will likely include restrictions on vectors such as livestock and livestock operations to slow the spread of invasive plants.

Current management of invasive plants within the project area has had some success with existing invasive sites and in treating new starts that are found. Under current management, the ability to treat invasive plants is limited by existing environmental documents completed in 1998. Management of existing sites is currently limited by treatment method and often excludes the use of herbicides. In addition, under existing treatment options, the choice of herbicides that can be used is much more restrictive than that which would be allowed under Alternative 2. New sites can not be treated with herbicides.

Without more aggressive treatment than is currently occurring, invasive plants would likely continue to displace palatable native vegetation and reduce forage on affected grazing allotments and the wild horse territory in small and localized areas. Loss of native plant communities may continue to occur as invasive plants occupy and out-compete native species. Once invasive plants begin to dominate these communities, a loss of species diversity, composition, and ecosystem function could occur. Invasive plants would continue to spread into areas that are not currently infested, such as recently burned areas, as witnessed in the 18 Fire on the Bend / Fort Rock Ranger District on the Deschutes National Forest, and areas of new disturbance, such as gas pipeline corridors on the Bend / Fort Rock Ranger District. Once invasive plants become established, these areas would likely serve as seed source for other areas of the Forest and nearby non-National Forest System lands.

Species such as Canada thistle and field bindweed that can be toxic to livestock and to wild horses would continue to increase under the current treatment programs and could start to affect wild horses and livestock.

The desired future condition of the project area is to "retain healthy native plant communities that are diverse and resilient, and restore ecosystems that are being damaged. Provide high quality habitat for native organisms throughout the Forests and Grassland, and assure that invasive plants do not jeopardize the ability of these administrative units to provide goods and services communities expect. This alternative would not meet the desired future condition as stated.

## ALTERNATIVE 2 – PROPOSED ACTION

### Direct and Indirect Effects

The direct and indirect effects are evaluated based upon the physical boundaries of the 109 allotments within the project area over the period of time which implementation of the decision occurs and until such time as the decision is modified or superceded by another decision.

The expected effect of invasive plant treatments on the 77 affected grazing allotments and the one wild horse territory would be the retention and in some cases increases in density and vigor of native and desired vegetation within project area units.

Specific treatment of existing invasive plant sites by livestock is not a proposed activity because of the existing conditions within the project area including the particular species of invasive plants that are currently present, size of current infestations, specific location or configuration of current sites (i.e., along road corridors) and the type of sites we have. The use of livestock may become a more important management for rapidly responding situations such as wildfires associated with new infestations or the rapid expansion of an existing population.

There may be some direct effects to existing permittees and allotment(s) management such as timing and duration of grazing, pattern of use, requirements to use only weed-free feed, and the potential of quarantine periods if these activities are implemented on active allotments, but these impacts should be manageable. Operators would experience a loss of grazing opportunity and may indirectly experience a loss of production if reasonable alternatives for livestock production are not found. A number of factors including drought, market conditions (livestock prices), supply and demand could cumulatively cause a hardship on a permittee(s) if non-use is implemented.

Some herbicides have use restrictions in regards to livestock grazing and/or slaughtering post herbicide treatment and subsequent exposure (see Appendix D). A key element to the implementation of herbicides where livestock may be present will be proper coordination and notification of permittees and rangeland managers. Timely notification and coordination should occur during annual operating instruction/plan meetings and by posting/signing areas to be treated prior to and after treatment (ROD).

Local producers who were contacted in regards to growing "chemical free beef" have raised no concerns in using herbicides to treat invasive plants. Their interest is more in growing beef free of growth hormones as they have stated that they are not concerned with herbicides (Byron Cheney, Doc Hatfield (Oregon Natural Beef Cooperative), pers. comm., 2005).

Under the proposed action it is acknowledged that more herbicides would be available in the environment during implementation as a potential hazard to livestock and livestock managers. The potential for a spill to occur during herbicide operations would be greater than under the no action alternative based on the additional number of acres that would be treated. If label directions are followed and handling methods are implemented, this is expected to be of no concern to livestock and livestock managers (also see Human Health, Section 3.8).

The Proposed Action Alternative will allow invasive plant treatments across approximately 52,000 acres within the Deschutes and Ochoco National Forests and Crooked River National Grassland. Under this Forest Service Proposed Action for Deschutes and Ochoco National Forests and Crooked River National Grassland, approximately 14,500 weed site acres would be treated. Control of invasive plants and in addition, eradication at some locations, would allow grazing activities to remain much as they are under current conditions and would meet the desired future condition within the project area. A key part of this effort would be early detection and response for any new infestations.

Some restrictions, such as those proposed for the Roba Allotment on the Paulina District for several years of non-use while invasive plants are being treated, may still occur within the project area in order to treat existing heavy or difficult infestations. This would have a direct effect on permittees and their operation should such measures be implemented. This project is not specifically proposing any such actions.

Compared to the Alternative 1 (No Action), the impacts to permittees would potentially be much less, especially if considered over time as invasive species would continue to expand and displace native vegetation and degrade ecosystem health. If Alternative 2 is fully (budget dependent) implemented including EDRR then the increase in invasive plants will be greatly reduced and the impacts to permittees from invasive plants would be expected to be from 2 to 6 percent (personal experience). As invasive plant sites are controlled, eradicated, suppressed, and contained and as new starts are located and managed (EDRR); the positive cumulative effect will be to improve rangeland conditions.

**Project Design Features**

1. Permittees will be made aware of annual treatment actions at the permittee annual operating plan meetings and/or if requested, notified in advance of spray dates (treatment standard #23).
2. Apply herbicides within 100 feet of permanent water sources used for livestock watering such as water troughs associated with spring developments, reservoirs, trick tanks and other sources developed for range use and listed as a range improvement(s) when other methods are not available or feasible. Use wick, wipe, or similar low application methods when herbicides are applied. If herbicides are not to be applied, invasive plants will be treated using other methods. Temporary watering developments such as watersets, will have no restrictions except when in use and as needed to follow guidelines established in Grazing Restriction Table, Appendix D.

## ALTERNATIVE 3

This alternative proposes to meet the same objectives as stated in the Proposed Action, but intends a more cautious approach with herbicides in riparian areas. Specific herbicides would not be allowed for use, and treatment methods to apply herbicides would be limited. Mechanical treatment methods that may cause significantly increased sediment would not be allowed in this alternative.

The potential for exposure of livestock and livestock managers will be slightly decreased as fewer herbicides will be used within the treatment area. It is expected that invasive plants will continue to increase over time in riparian areas and this will reduce available forage due to displacement of native vegetation and reduced ecosystem health.

Both the action alternatives and the No Action Alternative require incorporation of invasive plant prevention practices in annual operating instructions/plans and allotment management plans. Since invasive plants are already considered to some degree in many grazing management plans, the effect of this standard is mainly for Regional consistency.

The effects on livestock grazing levels and permittees under action alternatives 2 and 3 could include, but are not limited to:

- Changes in livestock movement patterns that require additional labor or may reduce outputs for certain allotments.
- Alterations to season of use (length, turn-on, turn-off, etc.) and intensity of use that could reduce outputs.
- Resting of pastures resulting in reduction of livestock use and output.
- Active restoration of native plant communities, which requires allotment resting for one to two seasons and could reduce livestock use and output. In some cases fencing can be used to mitigate impacts.
- Delayed reintroduction of livestock following wildfires resulting in reduced livestock use and outputs over time.

Ultimately, invasive plant prevention practices may result in some reduction to livestock grazing, but prevention of invasive plants is only one consideration; multiple factors including range condition, stream protection, and endangered species management will also influence allotment management.

An actual reduction in Animal Unit Month (AUMs) attributed to invasive plant management cannot be quantified at the project scale due to unavailable data, unknown introductions of actual species of invasive plants, unknown location of new introductions, variability between allotments, and the ongoing process of Allotment Management Plan revision.

For example, *Cynoglossum officinale* is often associated with riparian areas and livestock are known to be a vector. If this species is present in a riparian area within an allotment and is not abated and expands, then measures to restrict livestock use such as fencing or non-use may be necessary that could impact portions of or whole allotments. At an average cost of $6,000 (personal knowledge) per mile of new fence, this option will be variable depending on the size of the existing population of invasive plants and thus the amount of fencing needed. Restricting the use of portions of allotments, whole allotments, or multiple allotments will have quite different impacts to the project area as a whole. For example, the loss of one pasture in a seven pasture allotment for one season might be quite manageable; while losing a whole allotment would mean that the livestock operator would have no where for his livestock to go the entire grazing season which is typically for four months. Multiple allotments would mean more than one operator would be impacted.

The implementation of EDRR will be limited in riparian areas by the amount of herbicide, type of herbicide and the application method that could be applied within this zone. The concern will be effectiveness of treatment within the riparian areas and is correlated to overall success in meeting management goals. An estimate of impacts to permittees within the project area will be a reduction of 2 to 10 percent available grazing area over the next decade based on an expectation that invasive plants will increase in riparian areas as much as 8 percent. Livestock frequent riparian areas to obtain water and to acquire what is often preferred forage depending on the season of use and the surrounding rangeland conditions. Livestock can not be excluded from all riparian areas and even though this resource area may comprise a small portion of a given pasture, if livestock are to be excluded from a riparian area infested with invasive plants, then they must be excluded from the entire pasture. A small invasive plant site can impact a large portion of an allotment and thus can have measurable impacts to the livestock operator.

## Cumulative Effects – All Alternatives

The cumulative effects are evaluated based upon dependent resources within and outside of the project area in relation to existing and dependent permittees and land owners over the period of time in which implementation of the decision occurs and until such time as the decision is modified or superceded by another decision. Permittees and in some instances adjacent private land owners may be effected by decisions made on public lands that change management practices and opportunities.

Cumulative impacts relative to grazing resources include past, present, and future grazing by domestic livestock on the affected allotments, which has the potential to reduce native forage, reduce vegetative diversity, and provide for the introduction and/or spread of invasive plants. Additional impacts would be associated with recreation and land use on roads and trails within the affected allotments. Future use of area roads and trails, as well as uncontrolled off road use, would likely result in the introduction and/or spread of weeds. The effect of prolonged drought may include an increase in plant species which are drought tolerant and have a competitive edge during periods of drought over other vegetation. This could include both native and non-native species.

Preventing and Managing Invasive Plants Final Environmental Impact Statement for the Pacific Northwest Region (USFS 2005a; www.fs.fed.us/r6/invasiveplant-eis) noted that some members of the public suggested that grazing be ended on National Forest System lands in the Pacific Northwest: *"A number of comments received during the scoping process suggested that the Forest Service consider prohibiting major land-use activities on National Forests in the Region, such as OHV use, logging, livestock grazing, and access for all motorized traffic. The Proposed Action and Alternative 3 do include standards that place restrictions on some or all of these activities. Eliminating these multiple-use activities is outside the scope of this Proposed Action and inconsistent with current laws governing the management of National Forest System lands."* The action being considered in this EIS is whether to treat invasive plants and if so to what degree. It is likely that grazing will continue to occur on National Forest System lands, although the level of use may change in relation to the situation with invasives. If invasive species continue to increase as they have over the last decade or longer, then this will in time reduce grazing opportunities; for example, by reducing the amount and/or availability of quality forage, decreasing the length of the season of use, and restricting the timing of grazing.

As invasive populations and introductions are continually increasing throughout the region, the time that it takes to implement actions and obtain control of invasive plants is a critical factor in the cumulative effect of the action alternatives for the project. The longer it takes to implement the action alternatives, the larger the problem will become and the more difficult it will be to control and manage the infestations. This in turn will increase the risk that grazing actions will be affected.

Under all alternatives, present and reasonably foreseeable future action will continue to cause ground disturbance across the project area that could result in the introduction and spread of invasive plants. Forest Plan standards require that prevention be considered in all land management planning. Positive cumulative effects could occur as Forest Service efforts are combined with other federal, state, county, and private landowner efforts, reducing the rate of spread on a regional level. Proposed actions on National Forest System lands would complement these efforts.

The authorized number of AUMs has been decreasing for the past decade, with some allotment closures and with slight decreases during drought years. Thus, factors other than invasive plant management would continue to influence grazing levels regardless of the alternative selected in this EIS. Invasive Plant management and other land management practices may positively influence forage quantity or quality and result in beneficial impacts to grazing.

**Table 98.** Cumulative Effects on Grazing and Range Management within the Project Area

| Alternative | Effects on Grazing and Range Management |
|---|---|
| **Alternative 1 No Action** | Direct effects to allowed use over time as infested areas will increase and forage plants will be reduced through displacement and reduced ecosystem health. Livestock use will be reduced to prevent the further spread of invasive plants. Anticipated to occur with grazing NEPA over time as conditions change in the project area. |
| **Alternative 2** | Some limitations on livestock grazing, presently on the Roba Allotment. As implementation of the proposed action occurs, it is expected that increased retention of desirable species, vegetation density, and plant vigor of desired native vegetation will increase and/or improve. |
| **Alternative 3** | Same as the Proposed Action. Restricted treatment options in riparian areas are expected to reduce effectiveness of treatment and therefore have a greater impact on grazing management over time. |

The Bessie Allotment on the Bend-Ft. Rock District may be grazed starting in 2007 by sheep and goats with the purpose of managing vegetation in road rights-of-way and utility corridors. The sheep and goat grazing may also provide an additional benefit of reducing the existing invasive plants (by reducing seed production) in those areas, which occur in Project Area Units 11-02 and 11-28.

Implementation of Alternative 2 with appropriate environmental protection would not result in irreversible or irretrievable loss of range resources. Implementing Alternative 1 (No Action) and Alternative 3 would likely result in eventual irreversible impacts on grazing resources as invasive plants would continue to spread and invade in and around the proposed treatment areas.

# 3.12 Heritage Resources

This section of the EIS provides desired condition, existing condition, evaluates the effects of the alternatives, and describes the mitigation or monitoring that is recommended.

**Management Direction**

Management direction for cultural resources is found in the Deschutes National Forest Land and Resource Management Plan (LRMP), the Ochoco National Forest LRMP, the Crooked River Grassland LRMP, in the Forest Service Manual section 2360, in federal regulations 36 CFR 64 and 36 CFR 800, and in various federal laws including the National Historic Preservation Act of 1966 (as amended), the National Environmental Policy Act, and the National Forest Management Act (NHPA). In general, the existing management direction asks the Forest to consider the effects on cultural resources when considering projects that fall within the Forest's jurisdiction. Further direction indicates that the Forest will determine what cultural resources are present on the forest, evaluate each resource for eligibility to the National Register of Historic Places (Register) and protect or mitigate effects to resources that are eligible.

Relevant Deschutes National Forest Management Plan Standards and guides include:

CR-2 which states that cultural resource properties located during inventory will be evaluated for eligibility to the Register.

CR-3 states that in concert with inventories and evaluations the Forest will develop thematic Register nominations and management plans for various classes of cultural resources.

CR-4 indicates that project level inventories or the intent to conduct such shall be documented through environmental analysis for the project.

Ochoco National Forest and Crooked River National Grassland Management Plan standards and guides are not separated the same way but are consistent with those on the Deschutes and include conducting inventories prior to ground disturbing projects, evaluating resources located for eligibility to the National Register, and determining effects of projects in consultation with the Oregon State Historic Preservation Office (SHPO).

**Desired Condition**

The desired condition is not clearly stated in the Deschutes Forest Plan but can be derived from the implied goals of the Standards and Guides and the Monitoring Plans. It would be desired to know the location and extent of all cultural resources, have evaluated each one for eligibility to the Register, and have developed management plans for eligible properties that would provide protection or mitigate effects that will occur to the resource.

The desired condition in the Ochoco LRMP is more clearly stated. The plan calls for obtaining extensive knowledge about the historic and prehistoric resources on the Forest and tribal use resources to include site types, distribution, and management plans for heritage resources. This would facilitate efficient and precise resource management. Emphasis of management would be less on additional inventory and more on thematic evaluations and increased interpretation and management of facilities to enhance heritage resources.

The Crooked River National Grassland has a desired condition that includes a greater emphasis on enhancement and interpretation of heritage resources and greater use by Native American groups for native food gathering and religious practices. Native Americans would be more involved in the management of heritage resources and the Grassland in general.

## 3.12.1 Existing Condition

Numerous previous projects have been inventoried for cultural resources within the current project analysis area. Some of them were conducted and documented sufficiently to be used as adequate survey. As this decision will include treatment of locations not yet identified (EDRR), no complete numbers of past projects or acres surveyed can be determined.

Through these past and present surveys, many heritage sites have been located and recorded. Sites are defined by having 10 or more artifacts or the presence of features such as a cave, rock art, fire pit remains, structure, etc. Isolates are defined as not having any features and locating less than 10 artifacts.

Various tribal use plants are known in the project area (see Table 65). The Warm Springs, Paiute, and Wasco Tribes from The Confederated Tribes of the Warm Springs Reservation of Oregon, The Klamath Tribes, and the Burns Paiute are the known tribes with historic associations to this area. The project area is within lands ceded to the Federal Government by treaty. Only the tribes of the Warm Springs Reservation retain land use rights on the ceded lands under the Treaty with the Tribes of Middle Oregon of 1855.

## 3.12.2 Environmental Consequences

### Direct, Indirect, and Cumulative Effects – Action Alternatives

Under this project, only burning and disking or subsoiling are proposed treatments with a potential to affect historic properties and potential historic properties. Other types of treatments proposed of applying herbicides, hand pulling, and reduction of stalks by using a weed whacker or mower have little or no potential to affect historic properties or potential historic properties. Herbicides sprayed directly on features or artifacts would cause no loss of data or disturbance. Only two identified units have the potential to affect historic properties because the treatment methods involve burning and disking. Potential locations under the early detection/rapid response program that would require the same treatment methods would also have the potential to affect historic properties. Any added treatment locations or changes in treatment methods will require Section 106 (NHPA) compliance measures including consultation with the State Historic Preservation Office (SHPO). Effects to humans related to the cultural use of plants are discussed in Chapter 3.8.

Under this project, treatments with potential to affect historic properties or potential historic properties were inventoried and found to not contain any significant or unevaluated historic properties. The project will not impact any significant historic or prehistoric sites or locations with undetermined significance resulting in no direct or indirect effects. Since there will be no direct or indirect effects, no cumulative effects will occur.

#### Project Design Features and Monitoring

Treatment areas 72-15 and 72-37 will include both burning and discing of the soils. Field surveys found no eligible or unevaluated sites of historic or prehistoric nature are present and no avoidance measures are needed. EDRR locations added over time will also need to avoid any disturbances in similar cases if they occur. Post treatment monitoring can verify that avoidance measures were followed and were effective. Annual review of any proposed treatment changes or proposed treatment of newly identified invasive plant locations can determine what avoidance measures, if any, are needed under this project each year.

As part of annual implementation planning and public notification, treatments in the vicinity of tribal use plants will require consultation with the relevant tribal government and resource specialists. Herbicide use or burning of locations at the same time of traditional gathering or use of that plant will be avoided.  Otherwise, treatments that may reduce competing invasive plants and may enhance the tribal use plant will be coordinated with tribal government and resource specialists.

# 3.13 Recreation and Scenery

Central Oregon has a history of being uniquely situated to "preserve and provide interpretation of unique geological and cultural areas for education, scientific and public enjoyment purposes" (Deschutes National Forest, 1990 Forest Plan LRMP, 4-90). Recreation and scenic resources, including the tourism industry, are increasingly being touted as a mainstay of the local economy within Central Oregon. Winter and summer recreation expenditures have long added an element of stability to the otherwise volatile wood products-based economy of the past (Deschutes National Forest, 1990 Forest Plan LRMP, 2-2).

**Landscape Character Description**

The Central Oregon landscape encompassing the Deschutes and Ochoco National Forests and the Crooked River National Grassland is well known for its open park-like stands of large yellow-bark ponderosa pine, spectacular snow-capped mountain peaks, open grassy meadows, crystal clear lakes and streams, abundant fish and wildlife species, wondrous and unusual geological landforms, spectacular scenery, and world class outdoor recreation opportunities. All these elements contribute to a reputation that the Oregon high desert landscape is a world class destination that brings in over 5 million visitors each year. The area's popularity is expected to continue to grow and expand in the future.

**Management Direction & Desired Future Condition**

The Deschutes and Ochoco National Forest Land and Resource Management Plans (LRMP) allocated numerous management areas, each with a different role in providing goods and services, as well as perpetuating forest ecosystems (Deschutes National Forest, 1990 Forest Plan, 4-1, M11-M14, M9; and Ochoco National Forest, 1989 Forest Plan, 4-22, 4-26, MA-F26). Similarly, the Crooked River National Grassland also established management areas to provide similar goods and services benefiting the general public.

Desired future condition statement: In Central Oregon, healthy native plant communities remain diverse and resilient, and damaged ecosystems are being restored. High quality habitat is providing for native organisms throughout the area. Invasive plants do not jeopardize the ability of the Forests to provide goods and services to communities.

The Landscape Character goal for the analysis area is to achieve a natural appearing landscape, such as open park-like stands, where management directions, the desired future conditions, and social and ecological framework are met (Forest Plan, Deschutes LRMP MA-9, MA-19 - MA-28, and Ochoco NF MA-F26).

The Recreation Objective is to provide a wide variety of quality outdoor recreation opportunities and experience within a forest environment where the localized settings may be modified to accommodate large numbers of visitors. The recreation setting and opportunities provided include the Recreation Opportunity Spectrum (ROS) categories of Rural and Roaded Natural (Deschutes National Forest LRMP, MA-11). Provide safe, healthful, and aesthetic facilities for people to utilize while they are pursuing a wide variety of recreational experiences within a relatively natural outdoor setting (Ochoco National Forest LRMP, MA-F13).

The Scenic Quality Objective states that scenic quality within the analysis area would have a natural-appearing character where various line, form, color, and texture elements are found within the landscape. Human alterations, in general, would be subordinate and conform to natural appearing landscape characteristics. Character trees, snags and small openings, to highlight special features within the landscape, are desirable and encouraged. Where biologically feasible, diversity in vegetation species, age, and size classes is encouraged (Deschutes NF LRMP MA-9, Ochoco NF LRMP MA-F26).

**Recreation Opportunity and experience**

Central Oregon has numerous recreation sites, including dispersed and developed campgrounds, trails and trailheads, fish and wildlife viewing platform, viewpoints and vista points, boating facilities, and others. These allocations also include Intensive Recreation and Special Interest Areas.

In general, the recreation sites on the Forests have been designated as either Rural or Roaded Natural (ROS Classes), specifically along access and travel route, such as road, trail, and river corridors. Further direction regarding ROS classes can be found in the USDA Forest Service ROS Users Guide.

**Recreation Allocations**

Numerous recreation sites and associated administrative facilities on the Forests have been strategically placed along travel routes and/or a water ways to take full advantage of the area's incredible scenic beauty or recreation opportunities. Many of these recreation site and facility are very popular destinations in Central Oregon, throughout the year. Outdoor recreation activities are very popular here, and include driving for pleasure, off road vehicle use, camping, hiking, biking, horse back riding, snow shoeing, skiing, bird and wildlife viewing, hunting, boating, and fishing. Such diverse recreation, from dispersed and primitive traditional sites to well-developed and refined facilities, attract over five million visitors to the Oregon high desert area each year.

**Scenic Views Allocations**

The outstanding and remarkable scenery of Central Oregon is well known. The existing Forest Plan direction on recreation management and scenic quality is the basis for this analysis. Further direction regarding scenery management is in Forest Service Manual 2380 (Landscape Management) and Landscape Aesthetics: A Handbook for Scenery Management. (USFS 1995d)

The Forest Service implementing regulations also establish a variety of Scenic Quality Standards for scenic views allocation areas (Management Area 9). These include:

- Natural-appearing landscape with high scenic integrity level (Retention);
- Slightly altered landscape with medium scenic integrity level (Partial Retention);
- Altered landscape with low scenic integrity level (Modification).

Primary and secondary access and travel routes, along with trails and waterway corridors, are within the scenic allocation area under the Deschutes and Ochoco National Forests and the Crooked River Grassland management plans. Two primary distance zones fall within the analysis area as viewed from the scenic corridor; including: Foreground (0-0.5 mile) and Middleground beyond the Foreground up to 5.0 miles.

**Recreational Experience**

High quality recreation experience, diverse landscape, and remarkable scenery uniquely complement one another within the Central Oregon landscape. The area has provided exceptional recreation opportunities, setting, and experiential levels to generations of people who have recognized its truly unique ecological quality and diversity of landscape character.

Recreation in Central Oregon is more than just camping, fishing, and hiking. People choose a specific setting and/or an experiential level for each of these activities in order to realize a desired set of experiences they come to expect. For instance, camping in a large undeveloped setting with difficult access and few facilities offers a visitor a sense of solitude, challenge, and self-reliance. In contrast, camping in a setting having easy access and with more facilities offers more comfort, security, and social interaction opportunities.

The end product of recreation management is the experience people have. The key to provide most experience opportunities is the setting and how it is managed. Many desired experiences, by way of such proper and effective recreation management, are translated into "setting indicators" as access, remoteness, naturalness, facilities/site management, social encounters, visitor impacts, and visitor management (USDA Forest Service ROS Users Guide, USFS 1990b).

**Aesthetic Experience**

"Scenic attractiveness is the primary indicator of the intrinsic scenic beauty of a landscape and the positive responses it evokes in people. It helps determine landscapes that are important for scenic beauty, based on commonly held perceptions of the beauty of landform, vegetation pattern, composition, surface water characteristics, land use patterns, and cultural features." (USFS 1995d)

Scenic attractiveness is ordinarily very stable. However, in rare circumstances, scenic attractiveness may change because of natural disasters or human alteration of the landscape. Change may increase the potential for a "typical or common" landscape to become "distinctive."

Along travel routes and waterways within Central Oregon, natural disturbances such as past wildfires, insect and disease infestation, wind damage, and invasive plant infestation are evident. As a result, the Central Oregon landscape is characterized by a mosaic of disturbed conditions caused by these natural and human-caused processes.

The scenic quality within the project area is based generally on people's perception, including emotional and/or physical attachment to the landscape from a sensory perspective (such as sight, sound, feel, taste, and touch) and cultural value (such as attitudes and beliefs).

## 3.13.1 Affected Environment

The existing condition described in this document includes "positive attributes" and "negative deviations" from the valued landscape character and recreational experience level. Deviations from the valued landscape character and recreation experience are often caused by human or management activities. These may include changes from construction of facilities, increase in human interaction that socially affect quiet places or private areas, and naturally caused disturbance events, such as wildfire, insect and disease, invasive plant infestations, and flooding or erosion.

**Recreation and Scenic Condition Summary**

The recreation and scenic condition within the analysis area may not meet the expectations and preferences of many visitors or users in its current condition. An overall decline in forest health in addition to recent wildfires, invasive plant infestation, and other disturbances, affects recreation experience and scenic characteristics of the area the most.

**Positive Attributes**

Today, the diverse landscapes, cultures, experiences, and distinctive places of the Deschutes and Ochoco National Forests, along with that of the Crooked River National Grassland, encompass just over 2.5 million acres of Central Oregon. These public land areas offer a wide variety of recreational opportunities and experiences. Some of the most popular activities, which draw millions of visitors to Central Oregon each year include boating, day use sites, dispersed and developed camping, fishing, white water rafting, guides and outfitters, rental and summer home, rock hounding, summer and winter trails, wildlife viewing, outdoor photography, winter recreation, destination resorts, scenic drives, and the rapidly growing and highly popular Off Highway Vehicle (OHV) use. Coupled with natural scenery that offers travelers views of snow-capped mountains, grassy meadows, forests, gushing springs, lakes, rivers -filled with trout, geology, and numerous wildlife species, the area has attracted countless visitors for decades.

**Negative Deviations**

In Central Oregon, natural and man-made forest disturbance processes are especially visible and accessible to the forest visitor along major travel corridors, including roads, trails, and waterways. Access roads, utility corridors, recreation facilities development, timber harvest activities, insects and diseases infestation, wildfires, and the spread of invasive plants have all contributed to the alteration of natural landscape character and recreational experience.

With relative ease of access by vehicles, including OHVs, mountain bikes, horses, and hikers, the spread of invasive plants have been slowly taking a foothold, particularly along the majority of Central Oregon's road, trail, and river corridors. Slowly and surely, this "quiet invasion" is altering natural landscapes and affecting recreational experience level on the Deschutes and Ochoco National Forests and the Crooked River National Grassland.

**Invasive Plants Infestations**

For the purposes of this analysis, areas within the scenic corridors and developed recreation sites have been classified into three categories. These include: Low, moderate, and high level of invasive plants infestation. The low infestation areas are considered as low concern for scenery and recreation experience; the moderate infestation areas are considered as moderate concern; and the high infestation areas are considered as high concern.

In general, invasive plants do not affect scenic corridors and developed recreation sites within low use or low impact settings. Results of a spot field survey of low to moderate use developed sites and scenic corridors in higher elevation, show that areas above 5,000 feet have little to no infestation of invasive plants. On the other hand, invasive plants are greatly affecting developed recreation sites and scenic corridors in high-use areas and at lower elevations (generally below 5,000 feet above sea level).

Infestation levels for developed recreation sites, visually sensitive access and travel routes, including waterways, are classified as low, moderate, and high. Since dispersed sites are so numerous and within the low use/low intensity area, the infestation level of invasive plants, if any, is expected to be low, especially in traditional higher-elevation sites. The following three tables list scenic corridors on the Forests and Grassland with their level of infestation.

**Table 99.** Deschutes National Forest. Based on GIS inventory invasive plant data and limited field checking. The invasive plant affected areas includes proximity to developed recreation sites along travel routes, allocated scenic and waterway corridors.

| Scenic Corridors | Level of Infestation |
|---|---|
| Skyliner (Road 4601) | Moderate |
| Highway 46 (Cascade Lakes National Scenic Byway) | Moderate |
| Upper Deschutes River Wild and Scenic River | Low to moderate |
| Little Deschutes River | Low |
| Road 40 | Low to moderate |
| Road 41 | Low |
| Road 42 | Low to moderate |
| Road 43 | Low |
| Road 44 | Low |

| | |
|---|---|
| Road 45 | Low |
| Highway 97 | Low to moderate |
| Highway 58 | Low |
| Road 61 | Low |
| Road 18 (China Hat Road) | Low to moderate |
| Road 18 (China Hat Road) | Low to moderate |
| Road 9720 (Lava Cast Forest) | Low |
| Road 21 (Paulina Creek) | Low to moderate |
| Road 22 | Low |
| Highway 31 | Low to moderate |
| Road 14 (Metolius Wild and Scenic River) | Low to moderate |
| Highway 20 (Santiam Pass Highway) | Low to moderate |
| Highway 242 (Mckenzie National Scenic Byway) | Low |
| Road 11 | Moderate |
| Road 12 (Metolius Basin) | Moderate to high |
| Road 15 | Low |
| Road 16 | Low |

**Table 100.** Ochoco National Forest (Lookout Mountain Ranger District and Paulina Ranger District).

| Scenic Corridor | Level of Infestation |
|---|---|
| Road 12 | Moderate to high |
| Road 16 | Low to moderate |
| Road 17 | Low to moderate |
| Road 22 | Moderate to high |
| Highway 26 | Low to moderate |
| Road 2630 | Low to moderate |
| Road 27 | Moderate to high |
| Road 33 | Low |
| Road 38 | Low to moderate |
| Road 42 | High |
| Road 58 | Low to moderate |
| North Fork Crooked River National Wild and Scenic River | Low to moderate |

**Table 101.** Crooked River National Grassland

| Scenic Corridor | Level of Infestation |
|---|---|
| Highway 97 | Low |
| Highway 26 | Low to moderate |
| Road 64 | Low to moderate |
| Lake Billy Chinook | Low |
| Lower Deschutes Wild and Scenic River | Low |
| Lower Crooked Wild and Scenic River | Low |

## 3.13.2 Environmental Consequences

### Direct and Indirect Effects of Alternatives on Recreation and Scenic Resources

The effect on recreation and scenic resources resulting from implementation of the alternatives is described for the short-term and long-term (generally within the life span of the proposed treatment). It is assumed the effects described would be most prominent to the visiting public within the immediate area of recreation sites, administrative facilities, and travel corridors where invasive plant treatment activities are being proposed.

### Alternative 1- No Action

Only those invasive plant sites already approved for treatment under existing NEPA would continue to be treated under Alternative 1. Some sites along scenic corridors such as the Cascade Lakes Scenic Byway will continue to be treated.

Under this alternative, the area's landscape character, scenic quality, scenic integrity level would remain essentially unchanged during the short-term period. There would be no direct effect on recreation opportunity spectrum classes (experience levels) or users/visitors. Indirectly, however, the effect from this alternative would likely result in the continued expansion of invasive plants all over areas of concern, specifically along access, travel, and river corridors where new sites have become established since the noxious weed EAs were written in 1998. Invasive plants are expected to be dispersed by both human and natural vectors. Such vectors include: vehicles, people, and animals traveling along roads, trails, and waterways that can spread invasive plants to high value areas. Similarly, wind and flowing water can quickly carry seeds considerable distances along all access, travel, and river corridors.

The long-term effect on scenic quality, scenic integrity level, landscape character, and recreation experience levels would be altered as the rate of spread of invasive plant species follows successional pathways, which is currently estimated to be approximately 8% per year. Under this alternative, the desired future condition for recreation and scenic resources may not meet public expectations, goals, or objectives under the Forest Plan.

### Alternatives 2

**Effect on Scenic Resources**

Aesthetic considerations expressed in the current Handbook for Scenery Management (pages 23, 24- Purpose and Scope) suggest ecological process, function, structure and composition of the landscape that is consistent with the elimination of invasive plants for the promotion of long-term ecological health.

Under this alternative, the treatment of invasive plants, primarily low lying vine, grass, and shrub forms, along access and travel corridors (including within immediate foreground of the landscape) would likely only create minimal short-term negative effects on scenic resources for about one to two growing seasons. Long-term benefits of restoring ecological balance to the landscape and promoting positive and natural landscape character is expected to out weigh the short-term negative effects on scenic resources.

This alternative is expected to fully meet desired future scenic condition, specifically for travel routes and scenic corridors proposed to be treated.

**Effect on Recreation Resources**

Under this alternative, the effect(s) on recreation resources, specifically on the recreating public and human health, brought on by the proposed treatment activities is a concern. The effect on recreation resources, including human health concerns and the conflict of the proposed treatment activities with recreation users, is expected to occur at certain developed and dispersed recreation sites, administrative sites, special uses sites, and at cultural and special forest product collection areas.

The project area units overlap the following recreation areas/sites:

**Deschutes National Forest**

- Skyliner (Road 4601): Tumalo Falls Trailhead and Day Use, Skyliner Lodge, and Skyliner Snopark.
- Highway 46 (Cascade Lakes National Scenic Byway): Arlie's Rock Photo Point (North Portal), Virginia Meissner Snow Park, Wanoga Snow Park, Vista Butte Snow Park, and Dutchman Flat Snow Park,
- Upper Deschutes River Wild and Scenic River (Road 41): Meadow Day Use, Lava Island Falls Trailhead, Lava Island Day Use, Dillon Trailhead, Dillon Falls Day Use, Slough Camp Trailhead, Slough Camp Day Use, Benham Falls Day Use, and Benham Falls Trailhead.
- Road 42: Fall River Campground, South Twin Lake Campground, Brown Mountain campground, and Brown Crossing Campground.
- Highway 97: Lava Lands Visitor Information Center and Lava River Cave Trailhead.
- Highway 58: Crescent Lake Snow Park, Simax Beach Day Use, Simax Beach Campground, and Simax Beach Group Site.
- Road 21 (Paulina Creek): Road 21/Hwy 97 Information Station, Ogden Trailhead, Ogden Group Campground, Ten Mile Snow Park, Road 21 Overlook, Paulina Lake Campground, and Paulina Lake Visitor Center.
- Road 14 (Metolius Wild and Scenic River): Camp Sherman Fish Viewing Station and Candle Creek Campground.
- Highway 20 (Santiam Pass Highway): East Portal Information Station, Camp Sherman/Metolius Information Station, Suttle Lake Information Station, Indian Ford Campground, Black Butte Trailhead, Shuttle Lake Water Ski Area, Blue Bay Campground, Mt. Washington Viewpoint, and Corbett Snopark.
- Highway 242 (McKenzie National Scenic Byway): Windy Point Viewpoint and Dee Wrights Observatory.
- Road 11: Perry South Campground.
- Road 12 (Metolius Basin): Jack Lake Campground and Jack Lake Trailhead.
- Road 16: Tam McArthur Rim Trailhead and Three Creek Lake Campground.

**Ochoco National Forest**

- Road 12: Wildwood Campground.
- Highway 26: Bandit Spring Trailhead.
- Road 27: North Potlid Trailhead and Scotty Creek Trailhead.
- Road 33: Steins Pillar Trailhead, Stein Pillar Information Station, and Wildcat Campground.
- Road 42: Lookout Mtn. Trailhead.
- Road 2630: Keeton trailhead and Fry Trailhead.
- Road 38: South Apple Trailhead, West Black Canyon Trailhead, and North Payten Trailhead.

**Crooked River National Grassland**

- Highway 97: Haystack Campground

- Highway 26: Rimrock Springs Trailhead, Rimrock Springs Wildlife Management Area, and Gray Butte Trailhead.

Under this alternative, the recreating public would have more potential for temporary contact with contaminated vegetation within the above listed recreation areas/sites than the general public traveling along road and river corridors. When inventoried invasive plant sites within these Project Area Units are treated--with implementation of the recommended Project Design Features (such as public notification)--the overall effect(s) on recreation resources is expected to be minimal, limited, short-term, and localized only to the project area units. If recreation sites need to be closed for implementation, there would be an impact to visitors who would be displaced for a short period of time, but closures would prevent people from being exposed to herbicides.

Manual treatments would require more people and time to accomplish than herbicide treatments, and therefore manual treatments have the potential to impact the recreating public more. Solarization by tarping will be an unnatural intrusion on the landscape; however, they will be small in scale and would take place in areas not frequented by recreationists. Although the herbicides being used as part of the treatment process have a short life span and are considered relatively safe to use, there is still a perception of risk, so people encountering forest workers may have a negative experience. Public notification will serve to educate as well as notify the public of what to expect if treatments will occur in recreation sites.

The long-term effect on scenic quality, scenic integrity level, landscape character, and recreation experience levels would improve as the rate of spread of invasive plant species is either reduced or eliminated from the current level, which follows successional pathways and is currently estimated to be approximately 8% to 10% per year, nationally.

### Alternative 3

This alternative proposes to meet the same objectives as stated for the proposed action, but intends minimal impact from herbicides in riparian areas. Specific herbicides would not be allowed for use, and treatment methods to apply herbicides would be limited within a 300 foot buffer.

Under this alternative, similarly to Alternative 2, the effect on scenic and recreation resources is expected be minimal, limited, localized, and short-term. Where visual degradation from control measures is a concern, revegetation with native plants should occur within six months following treatment. Along the Metolius, fishing and recreating public would be exposed to herbicides in areas of ribbongrass treatment. This alternative would reduce the amount of exposure because there would be no use of herbicide within 10 feet of the water.

The long-term effect on scenic quality, scenic integrity level, landscape character, and recreation experience levels would improve as the rate of spread of invasive plant species is either reduced or eliminated from the current level.

### Cumulative Effect all Alternatives

Because the effect(s) of the proposed invasive plant treatments on recreation and scenic resources, are considered to be minimal, limited, localized, and short-term, there is very low chance the effects would accumulate with effects brought on by past treatment activities (see Chapter 3.1).

# 3.14 Congressionally-Designated Areas and Other Areas of Special Interest

## 3.14.1 Wilderness

In Wilderness, motorized travel is prohibited and the ground disturbances and vectors of invasive plant spread associated with motorized vehicle use are greatly diminished. However, both natural and human caused ground disturbances and vectors of invasive plant seed spread still exist. Invasive plants adversely affect wilderness values because they disrupt natural processes.

According to the R6 Invasive Plant Program FEIS, invasive plant inventories show that Wilderness areas in Region Six have not yet been highly infiltrated by invasive plants, but that invasive plants are gradually finding their way into Wilderness, and have been identified mostly along trails and more heavily used zones (USFS 2005a, page 3-70). This holds true for the Ochoco National Forests as well, where there are currently only two project area units – both at trail or trailhead. Eight Wilderness areas occur on the two Forests: Mt. Jefferson, Mt. Washington, Three Sisters, Diamond Peak, Mt. Thielsen, Mill Creek, Bridge Creek, and Black Canyon. Current inventories show few occurrences of invasive plants in Wilderness (Table 102).

**Table 102.** Project Area Units Located within Wilderness, Deschutes & Ochoco National Forests

| Wilderness Area | Project Area Units overlapping Wilderness | Treatment Methods |
|---|---|---|
| Mill Creek Wilderness, Ochoco NF | 71-57 (trail) | Manual |
| Black Canyon Wilderness, Ochoco NF | 72-52 (trail)<br>72-53 (trailhead) | Manual |

Three project area units are located within Wilderness areas: #71-57 in the Mill Creek Wilderness, and #72-52 & 72-53 in the Black Canyon Wilderness, both on the Ochoco National Forest. Unit 71-57 contains five small patches of diffuse and spotted knapweed that occupy approximately ½ acre in total along a hiking trail. The sites in the Black Canyon Wilderness are also located along a trail. Hand pulling is the proposed method of treatment for these areas.

Project area units are also located adjacent to Wilderness, primarily along roads. For example, the Cascade Lakes Highway (Hwy 46, unit 11-07) parallels the Three Sisters Wilderness for several miles on the west side of the Deschutes NF; a railroad right-of-way and Road 60 (a recreation access road) border the Diamond Peak Wilderness. These routes involve large mapped sites of several invasive species (units 12-06, 12-16) where proposed treatment would involve herbicide and manual methods. Project Area Unit #15-06 runs along State Highway 242 between the Three Sisters Wilderness and Mt. Jefferson Wilderness Areas. Spotted and diffuse knapweeds are proposed for herbicide/manual treatment at these locations.

### Consequences of No Action

Invasive plants have adverse effects to Wilderness values because they disrupt natural processes. The no action alternative would not allow for any treatment within the Wilderness as listed in Table 102 above; and it would not allow for control of most of the sites near Wilderness (except those identified in early NEPA documents such as along Cascade Lakes Hwy), where there is a possibility of spread.

Without the ability to quickly respond to new infestations in and near Wilderness the invasive plants could continue to spread and impact Wilderness values. Visitors' experience may be diminished if they are aware of the invasive plants. Where herbicide treatments have been on-going near the Wilderness, such as along Cascade Lakes Highway, and it has not affected Wilderness values.

**Effects of Both Action Alternatives**

Controlling invasive plants will benefit Wilderness by keeping existing populations from spreading further into the Wilderness areas and by eradicating existing infestations. Natural conditions will be preserved.

Treatments may affect Wilderness values because human intervention will be necessary. It will be short-term (during the time that manual treatments are occurring). Wilderness visitors may notice the effects of invasive plant treatments, but only manual control is proposed, so it would be very minimal. A visitor's sense of solitude may be affected if they came upon an invasive plant worker. Under EDRR, any newly detected sites within Wilderness that would require more than manual treatment for effective control would need to be further analysis for effects to wilderness values.

**Cumulative Effects**

The amount of treatment that will occur in Wilderness is very minute compared to the size of the Wilderness. If the manual treatments were to occur along the trail at the same time as any trail work, there may be an additive effect to a person's wilderness experience because they could encounter more people than ordinary.

Since January 2007, pelletized feed or certified weed-free feed is required in all Wilderness areas and Wilderness trailheads. This Forest Plan standard will benefit Wilderness as the introduction of new sites can be checked through this prevention effort. Combined with the eradication efforts on existing sites, and early detection/rapid response to new sites, there will be a beneficial cumulative effect of keeping Wilderness free of invasive plants.

## 3.14.2 Oregon Cascades Recreation Area

The goals of the Oregon Cascades Recreation Area (OCRA) is "To conserve, protect, and manage in a substantially undeveloped condition the unique values associated with the Oregon Cascade Recreation Area. To feature dispersed recreation opportunities and wildlife, fish, and scenic resources…including nesting habitat for spotted owls." (USFS 1990, p 4-146). Project activities are in a portion of the OCRA that is also a Wild and Scenic River corridor (Big Marsh Creek).

Invasive species sites occur in the OCRA, in project area unit 12-05. Reed canary grass has been established in Big Marsh since the area was used for grazing in the 1940s. Spotted and diffuse knapweeds, Canada thistle, and bull thistle also occur within this project unit.

**Effects of Both Alternatives**

Treatment for the invasive plants in this area includes focusing on controlling reed canarygrass in the disturbed ditches along the edges of the marsh where hydrologic restoration activities have been occurring. Treatments will consist of solarization of patches of the invasive plant by covering with black plastic; then revegetating with local native plants. Treatment is the same under both alternatives. Effects to the OCRA will be beneficial by favoring native vegetation and will further the objectives of the management area. Water quality, botanical and wildlife resources are discussed in other sections of this chapter.

**Cumulative Effects**

Invasive plant treatment will positively affect ongoing efforts to restore the natural hydrology and enhance habitat for TES plants and wildlife in the area. Reed canarygrass in other areas of the marsh may be controlled by rising water through the restoration activities that are ongoing; treating the ditches through this project will complement those effects. Revegetation with native plants in areas of bare soil (caused through the hydrologic restoration activities) will also have a positive additive effect to the efforts to suppress reed canarygrass and prevent introduction of invasive plants.

## 3.14.3 Wild and Scenic Rivers

Several rivers on the Forests and Grasslands are partially or completely within the National Wild and Scenic River System, as designated by Congress, or have been identified as eligible to be included. The intent of the 1968 Wild and Scenic Rivers Act is to maintain the free-flowing character of the designated rivers and to protect their "outstandingly remarkable values." Outstandingly remarkable values (ORV) are values or opportunities in a river corridor which are directly related to the river and which are rare, unique, or exemplary from a regional or national perspective. The ORVs for the wild and scenic rivers on the Forests and Grassland are identified in Table 104. Table 103 lists the river where project area units are overlapping the corridor or adjacent to the corridor as well as the types of treatments that would occur.

**Table 103.** Project Area Units within or Partially within Designated and Eligible Wild and Scenic River Corridors.

| River Segment | Project Area Units | Treatment Methods | Site Types |
|---|---|---|---|
| Upper Deschutes River* | 11-38, 11-23, 11-80, 11-57, 11-11, 11-10, 11-50, 11-62, 11-67, 11-68, 11-69, 11-70, 11-71 | Chemical/manual<br>Manual/mechanical<br>Manual<br>Mechanical/manual/cultural | Dispersed camping<br>Trail and day use<br>Meadow<br>Road-stream<br>Road-forest |
| Crooked River | 75-10 | Chemical<br>Chemical/manual | Quarry |
| North Fork Crooked River | 71-01, 71-08, 71-25, 72-03, 72-67, 72-68 | Chemical/manual<br>Manual<br>chemical<br>Biological | Quarry<br>Road<br>Stream |
| Metolius River* | 15-12, 15-17, 15-18, 15-19, 15-21, 15-32, | Chemical/manual/cultural<br>Chemical/manual/biological<br>Chemical/manual<br>Manual<br>mechanical | Road<br>Stream |
| Whychus Creek | 15-03 | manual | Road |
| Little Deschutes River* | N/A | N/A | N/A |
| Crescent Creek | 12-03, 12-04, 12-07 | Chemical/manual<br>manual | Road |
| Big Marsh Creek* | 12-05 | Manual/chemical<br>Cultural/chemical<br>manual | Wetland |
| Jack Creek (Eligible) | 15-10, 15-16, 15-21, | Manual<br>Chemical/manual<br>Chemical/manual/biological<br>mechanical | Road |
| Deschutes River (Eligible) | 11-07, 11-09, 11-35, | Chemical/manual<br>Mechanical/manual/cultural | Road<br>Lake |
| Fall River (Eligible) | 11-10 | Chemical/manual<br>Manual | Road |

| | | | |
|---|---|---|---|
| | | Mechanical/manual/cultural | |
| Browns Creek (Eligible) | 11-10 | Chemical/manual<br>Manual<br>Mechanical/manual/cultural | Road-forest |
| Paulina Creek (Eligible) | 11-03, 11-33 | Chemical/manual<br>Manual<br>Mechanical/manual/cultural | Road-forest<br>Lake |

*Management Plans have been completed for these rivers. See http://www.fs.fed.us/r6/centraloregon/projects/planning/major-plans/index.shtml

**Table 104.** Outstandingly Remarkable Values for the Wild and Scenic Rivers on the Deschutes & Ochoco NFs and CRNG.

| ORV | Upper Deschutes | Crooked | N. Fork Crooked | Metolius | Whychus Cr.* | Little Deschutes | Crescent Cr. | Big Marsh Cr. |
|---|---|---|---|---|---|---|---|---|
| Vegetation or Ecology | X | | X | X | | X | X | X |
| Scenery | X | X | X | X | X | X | X | X |
| Geology/Hydrology | X | | | X | X | X | | X |
| Fisheries/Fish Habitat | X | | | X | X | | | |
| Wildlife | X | | | X | | | | X |
| Recreation | X | X | | X | | | | |
| Cultural | X | | | X** | X | | | |

* Resource Assessment is in Draft
** Historic and prehistoric values, and traditional uses

## Direct, Indirect, and Cumulative Effects

### Consequences of No Action

Many of the invasive plant sites within the Wild and Scenic corridors occur along roads that serve as major access routes to recreation areas. Previous NEPA documents determined there would be no significant impact to the ORVs of the Wild and Scenic Rivers from the treatments authorized in 1998. Unless identified in the previous NEPA documents listed on page 24, these sites would not receive adequate treatment, leaving them to spread, which could impact Wild and Scenic River values by degrading scenery and vegetation, affecting fish and wildlife habitat, and impacting recreationists. Unchecked spread of the invasive ribbongrass on the banks and islands of the Metolius may eventually lead to channel changes that could negatively affect the character of the stream.

### Effects of Alternatives 2 and 3

With the implementation of both action alternatives, control would be accomplished within 31 project area units overlapping Wild and Scenic corridors and in nine units overlapping the eligible rivers. These project area units can each include several invasive plant sites, and the majority of the sites occur along roadways.

A common outstandingly-remarkable value (ORV) for the rivers is scenery. Invasive plant treatments can temporarily affect scenery if large numbers of target plants are clumped together and are seen when dead or dying and turning brown. Also, manual treatments could cause visible ground disturbance. However; these effects will not be noticed the following growing season when the residual live, green native vegetation dominates the view. These treatments would contribute to maintaining native plant communities which in many instances have been identified as an ORV.

Controlling invasive plants in these corridors would be beneficial to vegetation, but would have negligible effects to other outstandingly remarkable values (see 3.4 Native Vegetation, 3.6 Water Quality; 3.7 Fisheries. Project design features (PDFs) are incorporated to ensure protection of water quality, fisheries, and non-target plants and wildlife. Alternative 3 provides more restrictions on chemicals that can be used and by what method within proximity to water. Neither alternative would impact the free-flow character of the streams.

**Cumulative Effects**

Throughout the timeframe of this project, approximately 0-15 years, other actions may occur in the Wild and Scenic corridors. Scenic integrity of the corridors will not be further reduced by invasive plant treatments. Treatments, even if they were to occur simultaneously with other activities, would not affect the free-lowing nature of the rivers or the ORVs.

## 3.14.4 Research Natural Areas

Natural processes are to be allowed to continue in Research Natural Areas (RNAs) for research purposes and education. Any management within RNAs is directed at maintaining the natural conditions of the areas.

**Table 105.** Research Natural Areas with Project Area Units Overlapping or Adjacent.

| Research Natural Area | Project Area Units | Site Type | Treatment Methods | Native Plant Communities Potentially at Risk |
|---|---|---|---|---|
| Headwaters Cultus River RNA | 11-07 (adjacent) | Road | Chemical/manual | Engelmann spruce bottomlands<br>Lodgepole/blueberry/forb wetlands<br>Lodgepole/bitterbrush/sedge<br>Ponderosa/bitterbrush/needlegrass |
| Katsuck Butte RNA | 11-07 (adjacent) | Road | Chemical/manual | Mtn. hemlock/grouse huckleberry<br>lodgepole pine/grouse huckleberry |
| Cache Mtn. RNA | 15-30 (adjacent) | Road | Chemical/manual<br>Manual<br>Mechanical<br>Chemical/manual/biological | 6 plants communities ranging from moist meadows through mixed conifer |
| Metolius RNA | 15-19 (adjacent) | Road | Chemical/manual<br>Manual<br>Manual/biological | |
| Ochoco Divide RNA | 71-16, 71-32 | Road | Chemical/manual | Grand fir<br>Ponderosa pine |
| Grassland Island RNA | 75-47 | General Forest | Manual | Sagebrush/steppe |

### Direct, Indirect, and Cumulative Effects

**Consequences of No Action**

Invasive plant species are degrading the natural conditions of RNAs where they have been invaded. The No Action Alternative does not provide an effective means of controlling these infestations and would allow three sites known to occur within an RNA to go untreated. Those sites would continue to spread and may invade RNAs that currently have no known invasive plant sites. Unit 15-19 involves a heavily-infested major access road into the Metolius River area. Without treatment, the six species that are currently known along the road could continue to expand throughout the area, and potentially into the Metolius RNA which currently has no known invasive plant sites within the RNA. Table 105 shows the native plant communities at risk to invasion by invasive species.

**Effects of Alternatives 2 and 3**

Treatment of invasive plants is consistent with the direction for RNAs: it is necessary for maintaining the natural conditions of the area. Four project area units are located adjacent to RNAs that currently do not have known invasive plant sites. Effective control will reduce the likelihood that invasive plants could become established in the RNAs. Use of herbicides in the Ochoco Divide RNA will would allow successful treatment within a shorter timeframe and prevent the invasives from spreading throughout the RNA. Invasive plant sites occur along roadsides, except for the Island RNA on the Crooked River National Grassland, which is a peninsula of Forest Service land overlooking Lake Billy Chinook. A high-priority species, medusahead, has been inventoried in this RNA. Partnerships with Bureau of Land Management and the Native Plant Society have worked together on hand-pulling which is currently considered effective at controlling this site; continuation of this treatment is proposed in both action alternatives.

There would be no difference between the effects of the two action alternatives within the RNAs. Aside from the benefit of controlling invasives, there would be no direct, indirect, or cumulative effects from the treatments to the RNA values.

## 3.14.5 Newberry National Volcanic Monument

Designated by Congress in 1990, the Newberry National Volcanic Monument covers approximately 50,000 acres of the Deschutes National Forest. It was established "in order to preserve and protect for present and future generations Newberry's remarkable geologic landforms – and to provide for the conservation, protection, interpretation, and enhancement of its ecological, botanical, scientific, scenic, recreational, cultural, and fish and wildlife resources. (Public Law 101-522)." (USFS 1994b, p 1).

**Table 106.** Project Area Units within or Partially within Newberry National Volcanic Monument

| Project Area Units | Site Type | Treatment Methods |
|---|---|---|
| 11-01 | Road-forest; major transportation vector bisecting monument | Chemical/manual |
| 11-03 | Road and sno-park | Chemical/manual |
| 11-33 | Lake; high-use recreation | Mechanical/manual/cultural |
| 11-38 | General Forest | manual |

**Consequences of No Action**

Because current inventory shows invasive plant sites along roads and in high-use recreation areas, there is a strong probability that the sites will spread within the project area units along the roads and also be spread from the high-use sites to other areas of the Forest. Invasive plant sites approved for treatment under the earlier NEPA documents do not adequately address all of the existing sites.

**Effects of Alternatives 2 and 3**

Invasive plant sites within the Monument that occur along the roadside will be treated with herbicides. Other locations will receive manual and mechanical treatment methods. As with other designated areas, the values for which the Monument is established will benefit from the control and reduction of invasive plants. Resources that are to be protected within the boundaries, such as botanical resources, will benefit from the invasive plant treatments because native vegetation will be restored.

Based on the location of currently mapped infestations, it is likely that future control of invasive plants will be required along the roads in the Monument.

## 3.14.6 Inventoried Roadless Areas

Inventoried Roadless Areas (IRAs) occur across both Forests and are mapped in the Final Environmental Impact Statement for the Roadless Area Conservation Final Rule and can be found at http://roadless.fs.fed.us/states/or/desc.pdf. Inventoried roadless areas are National Forest System lands typically exceeding 5,000 acres that meet the minimum criteria for wilderness consideration under the Wilderness Act of 1964. There are approximately 198,000 acres of IRA across the Deschutes and Ochoco NFs and Grassland.

**Table 107.** Project Area Units that overlap Inventoried Roadless Areas

| Inventoried Roadless Area | Project Area Units | Project Area Unit Description | Treatment Methods* |
|---|---|---|---|
| Bearwallows | 15-03 | Road plus adjacent disturbed area; spotted and diffuse knapweed spreading along road. | Manual |
| Bend Watershed | 11-17 | Floodplain; Tumalo Creek stream restoration area. Mapped weed site does not currently enter IRA | Chemical/Manual |
| Maiden Peak | 12-01 | Plantation at edge of IRA | Manual w/ selective chemical as needed for expansion |
| West-South Bachelor | 11-39 | Reed canarygrass at Lava Lake. | Mechanical, manual, chemical, cultural |
| Mt. Jefferson | 15-05, 15-02 | Roads and adjacent disturbed areas; including Highway 20. Six inventoried species; knapweed expanding | Chemical, manual, biological |
| Metolius Breaks | 15-12 | Road plus adjacent; only known medusahead on Deschutes NF. | Chemical, manual, cultural, biological |
| South Paulina | 11-38, 11-03 | Road & forest; Newberry National Volcanic Monument | Manual, Chemical |
| North Paulina | 11-43 | | Chemical, manual |
| Deschutes/Steelhead Canyon | 75-43, 75-56, 75-42 | Road, General Forest, Stream. Large sites and adjacent private land. | Chemical, manual |
| Green Mountain | 71-48 | Road-forest | Chemical, manual, biological |
| Lookout Mountain | 71-11, 71-18 | Road | Chemical, manual |
| Rock Creek | 72-49, 72-70 | Road, road-plus | Chemical, manual, biological, chemical, manual |
| Cottonwood Creek | 72-48 | Blackberry on trail. Only known site. | Chemical |

*In combination or alone, depending on species.

### Direct, Indirect, and Cumulative Effects

**Effects of No Action**

Invasive plants are known to occur in several IRAs (see Table 107). Some sites were addressed in previous NEPA documents. Where not already covered, without effective treatment, these sites are likely to expand and provide for expansion to other areas (see Section 3.3 Treatment Effectiveness). The Cottonwood Creek IRA has the only known site of Himalayan blackberry. It is a high-priority site with an objective of eradication. The canes of the Himalayan blackberry can grow up to lengths of 7 meters in a single season (Mazzu 2005); where these canes root new daughter plants can develop. Without treatment it could spread rapidly.

No Action provides no mechanism for responding quickly to newly discovered invasives. Areas that are currently uninfested but near invasive plant sites are at risk from them expanding.

**Effects of Alternatives 2 and 3**

Most project area units that are near or overlap the IRAs occur along road corridors that run parallel to the boundaries. Treatments along roads, trails, and adjacent disturbed areas make it less likely that the sites will expand into the IRAs. Controlling invasive plants improves habitat for TES species and native plants in general (see Native Vegetation, Chapter 3.4).

Alternative 2 would control Himalayan blackberry along Cottonwood Creek because it would allow the preferred herbicide to be used within 300 feet of the water (triclopyr, which is selective, spot or hand application only). Alternative 3 would allow the 2nd choice alternative to be used, but it is not selective (glyphosate).

The Early-Detection/Rapid Response (EDRR) strategy will allow early treatment of new infestations while they are small and will help prevent establishment and spread of invasive plants into uninfested areas.

Values associated with IRAs such as natural-appearing landscapes, good water and habitat, and protection of cultural resources will benefit from the control of invasive plants. Precautionary measures to protect fish, wildlife, and non-target plants are built into the alternatives (see Chapter 2.4).

Invasive plant treatments will have no cumulative effect on IRAs, but may offset negative impacts of weed invasion.

### 3.14.7 Experimental Forest

**No Action and Alternatives 2 and 3**

Burgess Road (Hwy 43) crosses the Pringle Falls Experimental Forest on the Deschutes National Forest. The road accesses recreation sites along the Deschutes River, including a section of privately-owned land. Spotted knapweed and Dalmatian toadflax have been inventoried along this road. Project Area Unit 11-11 incorporates the known weed sites and the rest of the road to account for incomplete inventory and potential spread along the road corridor. Proposed treatments will have no effect on the values for which the Experimental Forest was designated (to conduct research activities for silvicultural practices on lodgepole and ponderosa pine). Recent road closures may have a beneficial effect of reducing invasive plant spread into the Experimental Forest; however, high recreation use still poses a risk of introduction of new species.

## Summary Designated Areas

A prevailing theme in the goals and objectives for these designated and special areas is the desire to maintain natural conditions. Invasive plant treatments are consistent with this. Many of these areas are at risk of losing habitat to invasives (see for example, Section 3.4 on sensitive plants that are currently threatened by invasive plant infestations). The short-term and minor impacts from treatment to the values of these areas are compared to the potential long-term and more negative impacts of the invasive plants. Both action alternatives will help to protect native plant communities in unique areas by aggressively treating invasive plant populations in those areas or along roads and trails leading to them. Alternative 2 treats has more herbicide options available and therefore would allow more areas to be treated faster and more effectively thereby protecting the native plant communities in unique management areas, because there are more tools and methods available to treat invasive plant populations. The two action alternatives provide a mechanism for treating new invasive plant sites that if left untreated could expand into specially designated areas. The response to and treatment of new or currently undetected invasive plant populations in Congressionally-designated or areas of special interest is expected to have the same minor short-term effects and the same long-term positive effects as described earlier for known sites.

## 3.15 Forest Plan Amendments

Alternatives 2 and 3 in this Draft EIS propose an amendment to the Ochoco National Forest Land and Resource Management Plan (Forest Plan). The proposed amendment is a minor change to two of the standards and guidelines in the Forest Plan.[20] The purpose of the amendments is to reconcile the Ochoco Forest Plan with recent standards and guidelines established in the 2005 Invasive Plant Program Record of Decision (USFS 2005b). The proposed changes are described in Table 14. These amendments if approved would be effective at the time of the decision and would apply to the respective management areas throughout the Forest and Crooked River National Grassland.

The regulations for forest planning under the National Forest Management Act (36 CFR Part 219, as of July 1999) provide procedures for the Responsible Officials to amend a Forest Plan.

The regulations state: "If the change resulting from the amendment is determined not to be significant for the purposes of the planning process, the Forest Supervisor may implement the amendment following appropriate public notification and satisfactory completion of NEPA procedures" (36 CFR 219.10(f)). Additional guidance on amending Forest Plans is provided in the Forest Service Manual 1900-Planning. Section 1926.51 describes non-significant amendments as:

1. Actions that do not significantly alter the multiple-use goals and objectives for long-term land and resource management;
2. Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long –term land and resource management;
3. Minor changes in standards and guidelines; and/or
4. Opportunities for additional projects or activities that will contribute to achievement of the management prescriptions.

The proposal to amend the Forest Plan was described in a notice mailed to the public in March of 2006. The proposed amendment does not propose changes in management area boundaries or prescriptions, but does represent minor changes in standards and guidelines and provides for additional management practices that could contribute to achieving management prescriptions.

The proposed minor changes to the standards and guidelines would not alter any of the multiple use goals or objectives outlined in the Forest Plan for the Ochoco NF or Crooked River NG. To the extent that invasive plants may adversely affect the multiple use goals of these management areas, however, allowing for the appropriate use of herbicides to treat invasive plant populations in these areas could contribute to achieving multiple use goals.

The minor change to forest and grassland-wide standards do not change the overall intent of the standards. The standards as written could mean that methods other than herbicides need to be tried first on a weed site before herbicides could be used. In other words, they would be used only as a last resort when other methods fail. That would contradict the Regional Forester's direction in the R6 2005 Record of Decision for the Invasive Plant Program (USFS 2005b). The Record of Decision established that only allowing herbicides to be used as a method of last resort is inconsistent with integrated weed management principles (ROD page 27). The amendment makes the Ochoco Forest Plan consistent with this most recent direction.

[20] The two standards were incorporated into the Ochoco Forest Plan through amendment in 1995 (Ochoco National Forest and Crooked River NG Weed Environmental Assessment and Decision Notice).

# 3.16 Other Disclosures

## Smoke Management and Clean Air Act

Treatments within Project Area Units 72-15 and 72-37, totaling approximately 14 acres, will include the use of controlled burning prior to herbicide application (see Figure 8, p. 248). The use of fire is intended to clear away dense standing old houndstongue and seed beds in dense stands of houndstongue to facilitate herbicide application. The fuel on site is primarily herbaceous (houndstongue, mullein, bull thistle, grass, and bare ground). Very few planted trees occur in the locations to be burned. These areas would likely be burned in the spring when soil and fuel moisture are appropriate. Burning will occur once in a season, for no more than two seasons.

The Oregon Department of Environmental Quality (ODEQ) is responsible for assuring compliance with the Clean Air Act. In 1994, the Forest Service, in cooperation with the ODEQ, the Oregon Dept. of Forestry, and the Bureau of Land Management, signed a Memorandum of Understanding (MOU) to establish a framework for implementing an air quality program in Northeast Oregon. The MOU includes a prescribed fire emission limit of 15,000 tons of PM 10 per year for the national forests of the Blue Mountains (which includes the Ochoco). PM10 are particulate matter that measure ten microns in diameter or less, and are small enough to enter the human respiratory system.

Burning would be conducted under the State of Oregon Smoke Management System to track smoke produced and would be coordinated through Oregon Department of Forestry. Controlled burning would be conducted under favorable smoke dispersal conditions and would be avoided during inversion conditions, which would increase the potential for smoke pooling in valleys and drainages.

Smoke from the burning operations would not affect any Class I Wilderness or urban Special Protection Zones because of where Project Area Unit 72-15 and 72-27 are located. The nearest Class I wilderness is the Strawberry Mountain Wilderness, nearly 45 miles to the east. The nearest special protection zone is Bend, approximately 75 miles to the west, into the prevailing winds. Prescribed fire operations are not expected to contribute significantly to smoke pooling in the Paulina Valley. Impact from smoke could affect widely scattered individual dwellings in the Paulina Valley, and would be short-term.

## Energy Requirements and Conservation Potential

There are no unusual energy requirements associated with this project. No unusual equipment would be used. Fossil fuels would be used in a prudent manner.

## Irreversible or Irretrievable Use of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time, such as the temporary loss of timber productivity in forested areas that are kept clear for use as a powerline right-of-way or road.

No irreversible or irretrievable uses of resources are associated with this invasive plant treatment project. This project restores native vegetation in areas where non-native plants have been introduced. Herbicide treatments in accordance with the alternatives would have relatively short-lived impacts; effects on non-target species would be minimized; such effects would not be permanent.

## Effects on Long-term Productivity

Positive effects on site productivity would be expected as native vegetation is restored. None of the herbicides under consideration for use has been shown to have a notable effect on soil productivity.

## Prime Farmlands, Rangelands, Forestlands

No prime farmland, rangeland, or forestlands exist in the project area; therefore, there would be no effects to these. Under the No Action alternative, continued spread and incidence of invasive plants on National Forest System lands could impact adjacent private lands which could be considered prime farmland or rangeland. Alternative 2 would be the most effective because of reduced costs and more herbicide options available and therefore it would better reduce the potential of invasive plants to spread to adjacent private lands from National Forest System lands (also see discussion in Chapter 3.3, Treatment Effectiveness).

## Floodplains and Wetlands (Executive Orders 11988 & 11990)

Proposed invasive plant treatments within the riparian areas and wetlands are discussed in Chapter sections 3.6 and 3.7.

The proposed treatments would be implemented using the standards from the Invasive Plant ROD (USFS 2005b) and Project Design Features (Chapter section 2.4). The project does not involve any construction or improvements to occur in wetlands; no destruction or modification of wetlands will take place. No occupancy, development, or modification of floodplains is proposed. No adverse impacts associated with construction, developments, or improvements will occur from any alternative.

## Consistency with Forest Service Policies and Plans

The action alternatives are consistent with all Forest Service policies and existing plans, except where Forest Plan Amendments are described in Chapter 2 (Table 14). Refer to Appendix C for applicable standards and guidelines from Forest Plans. Project implementation will comply with pesticide use reporting as required by Oregon State law and Forest Service manual direction.

## Conflicts with Other Plans or Policies

NEPA directs “to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with … other environmental review lands and executive orders.” 40 CFR 1502.25(a). Based on information received during scoping and informal consultation meetings, none of the alternatives would conflict with existing plans or policies of other jurisdictions. Refer to Chapter 2 for the description of a non-significant Forest Plan Amendment that will align two standards and guidelines of the Ochoco Forest Plan with the new direction provided with the R6 ROD (USFS 2005b).

A recent lawsuit, Washington Toxics Coalition et al. v. EPA, regarding the lack of Endangered Species Act consultation on allowable public use of certain herbicides, was resolved by requiring certain buffers near streams. Herbicide use on federal land was exempt from the buffer zone requirement because such use already “implements safeguards routinely required” by the regulatory agencies.

## Adverse Effects that cannot be Avoided

Most issues have been resolved through development of and adherence to Project Design Features that minimize or eliminate the potential for adverse effects. However, some adverse effects are inherent to invasive plant treatments and cannot be avoided. These include:

- Common non-target plants are likely to be killed by treatments in close proximity. This is most likely to occur with broadcast spraying of herbicides. The adverse effects of the invasive plants themselves outweigh the potential for adverse effects to non-target species. See Sections 3.4 for a discussion of expected effects (beneficial and negative) to non-target vegetation.
- Invasive plant treatment will incur a cost to the government. Ultimately the taxpayers will be responsible for most costs of treatment. Section 3.10 provides estimates of project cost.
- Herbicide toxicity exceeding thresholds of concern are unlikely but possible given an accidental herbicide spill or unpredictable weather event.
- Although effects of herbicide treatments on the soil resource are minimized (because of compliance with standards and guidelines and local project design features), and overall effects of herbicide application on the soil resource are not expected to be significant at the Forest scale, some adverse effects have been shown to be unavoidable. These include primarily localized effects on soil microorganisms and soil productivity as a result of the toxicity and persistence of herbicides, and changes to soil disturbance and/or cover levels as a result of manual and herbicide treatment methods. See Section 3.5 for information on effects to soils.

# Chapter 4

## Consultation & Coordination

# Chapter 4 Consultation and Coordination

**Chapter 4 Changes Between Draft and Final**

- Consultation information has been updated
- Information about the public comment period has been added.
- The Responsible Officials have been updated.
- Response to Comments has been added as Appendix I.

## 4.1 Consultation with other Agencies

### 4.1.2 Consultation with U.S. Fish and Wildlife Service and National Marine Fisheries Service (NOAA Fisheries)

Informal consultation was conducted with USFWS for northern spotted owl and Canada lynx. Based on the effects analysis prepared for the project, the project is not likely to adversely affect spotted owls and will have no effect on Canada lynx (see Chapter 3.9). Therefore, formal consultation is not required for these species.

Informal consultation was conducted with USFWS for bull trout. The Level I team was presented the proposed action and affected environment; conversations with the Level One Team has continued throughout the analysis stages. Informal consultation was conducted with NOAA fisheries on listed anadromous fish species and their habitat that occur within or near the proposed invasive plant treatment areas. For those watersheds where listed fish and their habitat occur, formal consultation with USFWS and NOAA is expected to begin in November 2007. A Record of Decision for those areas will not be signed until a Biological Opinion is received.

### 4.1.3 Consultation with Oregon State Historic Preservation Office (SHPO)

The National Historic Preservation Act of 1966 requires consideration be given to the potential effect of federal undertakings on historic properties. This includes historic and prehistoric cultural resource sites, structures, and objects. The guidelines for assessing effects and for consultation are provided in 36 CFR 800. To implement these guidelines, the Pacific Northwest Region (Region 6) and the USDA Forest Service signed an agreement in 2004 with the Oregon SHPO and the Advisory Council on Historic Preservation. In accordance with the agreement, areas of potential effect were inventoried and project design features were developed to avoid impacts to any historic properties or potential historic properties. A no effect determination has been made for the proposed action (Alternative 2) and for Alternative 3 and documentation has been submitted to the Oregon SHPO for their review.

Any additional locations identified for treatment under the early detection/rapid response protocols will include review of potential effects to historic properties and compliance with the provisions of the National Historic Preservation Act as specified in the agreement with the Oregon SHPO and the Advisory Council on Historic Preservation.

### 4.1.4 Consultation with Tribal Governments

Potentially affected Tribes were first notified of the proposed action on September 23, 2005, by letters addressed to each of the following Tribes: Burns Paiute, Klamath, Confederated Tribes of the Warm Springs. The Tribes also received the January 2006 mailing of the alternative descriptions.

Several phone calls were made to Natural Resource Directors, and Cultural and Heritage Directors of the Tribes. The Tribes expressed concerns about the use of herbicides in areas of plant collecting and requested that notification and signing be used. These measures are incorporated into the action alternatives (PDFs and the implementation planning process (Appendix F)).

The Forest Service offered to provide electronic maps to the Burns Paiute, Klamath and Confederated Tribes of the Warm Springs (CTWS). The CTWS and Klamath Tribes accepted this offer; the Burns Paiute were provided paper maps.

A meeting was held with Confederated Tribes of the Warm Springs in May 2006. This meeting did not result in identification of any new significant issues related to the proposed action. The natural resource managers expressed support for treatment of invasive plants.

### 4.1.5 Consultation with State and County Noxious Weed Departments

Because the county weed departments and Oregon Department of Agriculture (ODA) conduct invasive plant treatments in and around the Forests and Grassland, they are experts in the selection and application of herbicides. Representatives of the ODA and Deschutes and Crook County noxious weed departments have been consulted on technical aspects of the project. These departments were invited to review the Project Design Features and the list of preferred herbicides for invasive species. They have also participated in field review of invasive plant sites, including discussions of herbicide application techniques and implementation of project design features.

## 4.2 Preparers and Contributors

This Draft EIS document was prepared by the USDA Forest Service, Deschutes and Ochoco National Forests, and Crooked River National Grassland. A Forest Service Interdisciplinary Team developed analysis, prepared the FEIS document, and provided technical review of analysis and documentation. This Chapter identifies the coordinators, resources specialists and others who participated in the overall preparation of the Draft and Final EIS for Invasive Plants Treatment, and includes the index for the document and the project glossary. A distribution list of agencies and people who requested a copy of the DEIS is also in this chapter.

### RESPONSIBLE OFFICIALS

**John Allen - Forest Supervisor, Deschutes National Forest**

**Jeff Walter – Forest Supervisor, Ochoco National Forest**

### ID TEAM MEMBERS

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Experience: Sixteen years experience with the Forest Service in planning, and GIS.

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Experience: Twenty five years experience with the Forest Service in NEPA, silviculture, herbicides and their risk assessments

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Experience: Twenty-four combined years Forest Service and BLM in Recreation Management, Range Management, Fire Management, Special Uses, and Timber Management.

**Janice Schultz – Writer/Editor, USDA Forest Service, TEAMS Planning Enterprise**
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Experience: Twenty-five years experience with the Forest Service in silviculture, recreation, public information and writing.

**James E. Seymour – Hydrologist, USDA Forest Service, Ochoco National Forest, Lookout Mountain Ranger District**

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Experience: Twenty five years experience with the Forest Service in hydrology, planning, and water quality monitoring

**Peter Sussmann - Soil Scientist, USDA Forest Service, Deschutes/Ochoco National Forests**

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**Ranachith (Ronnie)Yimsut - Landscape Architect, USDA Forest Service, Deschutes-National Forest, Bend Fort Rock Ranger District**

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Experience: Sixteen years experience with the Forest Service; Two years university instructor, trainer, and public facilitator on civil rights issues.

**Donald Zettel - Archaeologist, USDA Forest Service, Deschutes NF, Sisters RD**

Contribution: Heritage Resources Report, SHPO compliance report
Education: BA in Anthropology, UCLA, 1985, graduate work, University of Montana, 1986 and 87.
Experience: 19 years experience as archaeologist with Forest Service at Deschutes NF, Bighorn NF, and Black Hills NF, and two years as seasonal archaeology technician at Beaverhead NF.

## TECHNICAL ADVISORS

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**Charmane Powers –** District Botanist/Ecologist and Weed Coordinator, USDA Forest Service, Deschutes National Forest, Bend/Ft. Rock Ranger District

**Kev Alexanian** – Crook County Weed Management Specialist, Prineville, Oregon

**Dave Langland** –Oregon Department of Agriculture Weed Specialist, Redmond, Oregon

# 4.3 Distribution of the Environmental Impact Statement

This Draft Environmental Impact Statement has been distributed in the form of a hard copy or compact disc to individuals who responded throughout the development of this project and is also available at the National Forests Website (http://www.fs.fed.us/r6/invasiveplant-eis/site-specific/DES/). In addition, copies have been sent to federal agencies, federally-recognized tribes, state and local governments. Where agencies or individuals requested only www access to the DEIS, a letter informing them when and where the document is available has been sent. Comments received and the Forest Service responses are included in Appendix H.

## Received DEIS or Notified of DEIS Availability

### Federal Agencies

U.S. Dept. of the Interior National Park Service
U.S. Dept. of the Interior Bureau of Land Management
U.S. Dept. of the Interior Fish and Wildlife Service
U.S. Dept. of the Interior Office of Environmental Policy and Compliance
U.S. Dept. of Agriculture Forest Service
  Pacific Northwest Region
  Mt. Hood National Forest
  Willamette National Forest
  Pacific Northwest Research Station, Blue Mountains Pest Mgmt. Service Center
U.S. Dept. of Agriculture APHIS PPD/EAD
U.S. Dept. of Agriculture, National Agricultural Library
U.S. Army Engr. Northwestern Division
U.S. Dept. of Energy, Office of NEPA Policy and Compliance
National Marine Fisheries Service
Environmental Protection Agency
Natural Resources Conservation Service
Advisory Council on Historic Preservation
Northwest Power Planning Council
U.S. Coast Guard, Marine Environmental and Protection Division
Federal Aviation Administration
Federal Highway Administration

### American Indian Tribes

Burns Paiute Tribe
Confederated Tribes of the Warm Springs Reservation
The Klamath Tribe

### Oregon State Government Agencies

Oregon Dept. of Agriculture
Oregon Dept. of Geology and Mineral Industries
Oregon Dept. of Forestry

Oregon Dept. of Environmental Quality
Oregon Dept. of Fish and Wildlife

**County/Local Government Agencies**
Crescent Water Association
Crook County
Crook County Natural Resources
Crook County Parks and Rec.
Grant County Soil and Water
Deschutes County CDD
Deschutes County Weed Board
Deschutes County Road Dept.
Klamath County Weed Control
Sisters-Camp Sherman Rural Fire District

**Businesses**
Bill Gowen, Mt. Bachelor Academy
Richard and Audrie Bedortha, Bedortha Ranches, Inc.
Tim McIsaac, Gutierrez Cattle Company
Robert Marheine , Portland General Electric
Ken Speakman, Grant Western Lumber Co.
John Morgan, Ochoco Lumber Company
Loy Helmly, Black Butte Ranch

**Individuals**
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Robert Ervin
Bill and Gloria Gibbs
Mark Dohrmann
Tyler Groo
Charles and Helen McDonald
Allen Greendale
James Baird
Eunice and Dean Richardson
Greg Bedortha
Loy Helmly
Charles Hedges
Brenda Pace
Al and Sharon Sahonchik
Bob and June Hill
Jim and Janet Crates
David Kruse
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Warren Pavlat
Violet Johnson
Stan Kunzman
Kathryn Venator
William Padgham
Bruce Kassab
Peter Schay
Dave Molony
Michele Penner
Kent Gill
Jerry Asher

**Organizations**
Blue Mountain Biodiversity Project

Central Oregon Audubon Society
Deschutes Basin Land Trust
Sunriver Homeowners Assoc.
Sierra Club, Juniper Group
Oregon Wild
Northwest Coalition for Alternative to Pesticides
Crooked River Weed Management
Clean Air Committee
Friends of Metolius
Western Society of Weed Science
Rocky Mtn. Elk Foundation

**Paper of Record: The Bulletin, Bend, Oregon**

# Index

# PROJECT GLOSSARY

**Active ingredient (a.i.)** - In any pesticide product, the component (a chemical or biological substance) that kills or otherwise controls the target pests. Pesticides are regulated primarily on the basis of active ingredients. The remaining ingredients are called "inerts".

**Acute effect -** An adverse effect on any living organism in which severe symptoms develop rapidly and often subside after the exposure stops.

**Acute exposure -** A single exposure or multiple brief exposures occurring within a short time (e.g., 24 hours or less in humans). The classification of multiple brief exposures as "acute" is dependant on the life span of the organism.

**Acute toxicity -** Any harmful effect produced in an organism through an acute exposure to one or more chemicals.

**Adaptation -** Changes in an organism's physiological structure or function or habits that allow it to survive in new surroundings.

**Adapted -** "How well plants are physiologically suited for high survival, good growth, and resistance to pests and diseases in a particular environment" (Northern Region Native Plant Handbook, 1995).

**Additive effect -** A situation in which the combined effects of exposure to two chemicals simultaneously is equal to the sum of the effect of exposure to each chemical given alone. The effect most commonly observed when an organism is exposed to two chemicals together is an additive effect.

**Adaptive management -** A continuing process of action-based planning, monitoring, researching, evaluating, and adjusting with the objective of improving implementation and achieving the goals of the standards and guidelines (USDA, USDI 1994a).

**Adjuvant(s) -** Chemicals that are added to pesticide products to enhance the toxicity of the active ingredient or to make the active ingredient easier to handle or mix.

**Administratively Withdrawn Areas -** Areas removed from the suitable timber base through agency direction and land management plans.

**Absorption –** The assimilation of gas, vapor, or dissolved matter by the volume of a gas, liquid, or solid material.

**Adsorption[21] -** The tendency of one chemical to adhere to another material such as soil. The assimilation of gas, vapor, or dissolved mater by the surface of a soil colloid or organic matter through an ionic bond.

**Aerobic -** Life or processes that require, or are not destroyed by, the presence of oxygen. (See also, *anaerobic*).

**Affected Environment -** Existing biological, physical, social, and economic conditions of an area subject to change, both directly and indirectly, as the result of a proposed human action.

**Agent -** Any substance, force, radiation, organism, or influence that affects the body. The effects may be beneficial or injurious.

[21] The following describes a general distinction between adsorption and absorption for herbicides: Adsorption refers to the tendency for the herbicide to be bound to soil colloids and held in place (affecting mobility and degradation rates), while absorption refers to the ability for plant roots to take up the herbicide on site.

**Alien Species -** "With respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem" (Executive Order 13112, 2/3/99).

**Allelopathy -** The suppression of growth of one plant species due to the release of toxic substances by another plant.

**Alluvial -** Relating to clay, silt, sand, gravel, or similar detrital material deposited by flowing water. Alluvial deposits may occur after a heavy rain storm.

**Ambient -** Usual or surrounding conditions.

**Amphibian -** Any of a class of cold-blooded vertebrates (including frogs, toads, or salamanders) intermediate in many characteristics between fishes and reptiles and having gilled aquatic larvae and air-breathing adults.

**Anadromous -** Fish that spend their adult life in the sea but swim upriver to fresh water spawning grounds to reproduce.

**Anaerobic -** Life or process that occurs in, or is not destroyed by, the absence of oxygen.

**Anastimozing –** A channel that splits into several channels that rejoin irregularly.

**Anions -** Negatively charged ions in solution e.g., hydroxyl or OH– ion.

**Annual -** A plant that endures for not more than a year.  A plant which completes its entire life cycle from germinating seedling to seed production and death within a year. (Dayton, 1950)

**Anoxia -** Literally, "without oxygen". A deficiency of oxygen reaching the tissues of the body especially of such severity as to result in permanent damage.

**Aqueous -** Describes a water-based solution or suspension.

**Aquifer -** An underground geological formation, or group of formations, containing usable amounts of groundwater that can supply wells and springs.

**Arid -** A terrestrial region lacking moisture, or a climate in which the rainfall is not sufficient to support the growth of most vegetation.

**ATSDR -** Agency for Toxic Substances and Disease Registry; federal agency within the Public Health Service charged with carrying out the health-related analyses under CERCLA and SARA.

**Background level -** In pollution, the level of pollutants commonly present in ambient media (air, water, soil).

**Bacteria -** Microscopic living organisms that can aid in pollution control by metabolizing organic matter in soil, water, or other environmental media. Some bacteria can also cause human, animal and plant health problems.

**Basal application -** In pesticides, the spreading of a chemical on stems or trunks of plants just above the soil line.

**Base -** Substances that (usually) liberate OH anions when dissolved in water and weaken a strong acid.

**Benchmark -** A dose associated with a defined effect level or designated as a no effect level.

**Benthic region -** The bottom layer of a body of water.

**Benthos -** The plants and animals that inhabit the bottom of a water body.

**Best management practices (BMP) -** A practice or combination of practices determined by a state or an agency to be the most effective and practical means (technological, economic, and institutional) of controlling point and non-point source pollutants at levels compatible with environmental quality.

**Bioaccumulation -** The increase in concentration of a substance in living organisms as they take in contaminated air, water, or food because the substance is very slowly metabolized or excreted.

**Bioassay –** (1) To measure the effect of a substance, factor, or condition using living organisms. (2) A test to determine the toxicity of an agent to an organism.

**Bioconcentration -** The accumulation of a chemical in tissues of a fish or other aquatic organism to levels greater than in the surrounding water.

**Bioconcentration factor (BCF) -** The concentration of a compound in an aquatic organism divided by the concentration in the ambient water of the organism.

**Biodegradability -** Susceptibility of a substance to decomposition by microorganisms; specifically, the rate at which compounds may be chemically broken down by bacteria and/or natural environmental factors.

**Biodiversity or biological diversity -** "The diversity of living things (species) and of life patterns and processes (ecosystem structures and functions). Includes genetic diversity, ecosystem diversity, landscape and regional diversity, and biosphere diversity" (USDA Forest Service. "An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins", Vol. II, 1997).

**Biological Control -** The use of nonnative agents including invertebrate parasites and predators (usually insects, mites, and nematodes), and plant pathogens to reduce populations of nonnative, invasive plants.

**Biological Magnification -** The process whereby certain substances such as pesticides or heavy metals increase in concentration as they move up the food chain.

**Biologically sensitive -** A term used to identify a group of individuals who, because of their developmental stage or some other biological condition, are more susceptible than the general population to a chemical or biological agent in the environment.

**Biomass -** The amount of living matter.

**Biota or Bio**me - All living organisms of a region or system.

**Body Burden -** The amount of a chemical stored in the body at a given time, especially a potential toxin in the body as the result of exposure.

**Broadcast application -** In pesticides, to spread a chemical over a broad area.

**Bryophytes -** Plants of the phylum *Bryophyta*, including mosses, liverworts, and hornworts; characterized by the lack of true roots, stems, and leaves (USDA, USDI 1994a).

**Candidate Species -** Those plant and animal species that, in the opinion of the Fish and Wildlife Service (FWS) or NOAA Fisheries, may qualify for listing as endangered or threatened. The FWS recognizes two categories of candidates. Category 1 candidates are taxa for which the FWS has on file sufficient information to support proposals for listing. Category 2 candidates are taxa for which information available to the FWS indicates that proposing to list is possibly appropriate, but for which sufficient data are not currently available to support proposed rules.

**Capillary Fringe -** The zone above the water table within which the soil or rock is saturated by water under less than atmospheric pressure.

**Carcinogen -** A chemical capable of inducing cancer.

**Carrier -** a non-pesticidal substance added to a commercial pesticide formulation to make it easier to handle or apply.

**CAS Registration number** - An assigned number used to identify a chemical. CAS stands for Chemical Abstracts Service, an organization that indexes information published in Chemical Abstracts by the American Chemical Society and that provides index guides to help locate information about particular substances in the abstracts. Sequentially assigned CAS numbers identify specific chemicals. The numbers have no chemical significance. The CAS number is a concise, unique means of chemical identification.

**Cation** - Positively charged ions in a solution.

**Chemical Control -** The use of naturally derived or synthetic chemicals called herbicides to eliminate or control the growth of invasive plants.

**Chronic exposure -** Exposures that extend over the average lifetime or for a significant fraction of the lifetime of the species (for a rat, chronic exposure is typically about 2 years). Chronic exposure studies are used to evaluate the carcinogenic potential of chemicals and other long-term health effects.

**Chronic RfD -** An estimate of a lifetime daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects. Chronic RfDs (reference doses) are specifically developed to be protective for long-term exposure to a compound (7 years to lifetime).

**Chronic toxicity -** The ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous exposure sometimes lasting for the entire life of the exposed organism.

**Code of Federal Regulations (CFR) -** Document that codifies all rules of the executive departments and agencies of the federal government. It is divided into fifty volumes, known as titles. Title 40 of the CFR (referenced as 40 CFR) lists all environmental regulations, including regulations for EPA pesticide programs (40 CFR Parts 150-189).

**Colluvium -** soil material or rock fragments moved downslope by gravitational forces.

**Congressionally Reserved Areas -** Areas that require Congressional enactment for their establishment, such as National Parks, Wild and Scenic Rivers, National Recreation Areas, National Monuments, and Wilderness. Also referred to as Congressional Reserves (USDA, USDI 1994). Includes similar areas established by Executive Order such as National Monuments.

**Conifer -** An order of the Gymnospermae, comprising a wide range of trees and a few shrubs, mostly evergreens that bear cones and have needle-shaped or scalelike leaves; Conifer timber is commercially identified as softwood.

**Connected actions -** Exposure to other chemical and biological agents in addition to exposure to a specific pesticide formulation in a field application to control pest organisms.

**Contaminants -** For chemicals, impurities present in a commercial grade chemical. For biological agents, other agents that may be present in a commercial product.

**Control -** Means, as appropriate, eradicating, suppressing, reducing, or managing invasive species populations, preventing spread of invasive species from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of invasive species and to prevent further invasions (Executive Order 13112, 2/3/99).

**Cultural Control -** The establishment or maintenance of competitive vegetation, use of fertilizing, mulching, prescribed burning, or grazing animals to control or eliminate invasive plants.

**Cumulative Effect -** The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions—regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time (40 CFR 1508.7).

**Cumulative exposures -** Exposures resulting from one or more activities that are repeated over a period of time.

**Detritus -** Loose fragments, particles, or grains formed by the disintegration of rocks or organic matter.

**Dicot –** A plant with two seed leaves.

**Disturbance -** An effect of a planned human management activity, or unplanned native or exotic agent or event, that changes the state of a landscape element, landscape pattern, or regional composition" (USDA Forest Service. "An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins", Vol. II, 1997).

**Dosage/Dose -** 1. The actual quantity of a chemical administered to an organism or to which it is exposed. 2. The amount of a substance that reaches a specific tissue (e.g. the liver). 3. The amount of a substance available for interaction with metabolic processes after crossing the outer boundary of an organism.

**Dose Rate -** In exposure assessment, dose per time unit (e.g. mg/day), sometimes also called dosage.

**Dose Response -** Changes in toxicological responses of an individual (such as alterations in severity of symptoms) or populations (such as alterations in incidence) that are related to changes in the dose of any given substance.

**Drift -** That portion of a sprayed chemical that is moved by wind off a target site.

**Endangered Species –**Any species listed in the *Federal Register* as being in danger of extinction throughout all or a significant portion of its range.

**Endangered Species Act (ESA) -** A law passed in 1973 to conserve species of wildlife and plants determined by the Director of the Fish and Wildlife Service or the NOAA Fisheries to be endangered or threatened with extinction in all or a significant portion of its range. Among other measures, ESA requires all federal agencies to conserve these species and consult with the Fish and Wildlife Service or NOAA Fisheries on federal actions that may affect these species or their designated critical habitat.

**Endemic -** "A species or other taxonomic group that is restricted to a particular geographic region due to factors such as isolation or response to soil or climatic conditions" (Allaby 1996). Compare to "Indigenous" and "Native".

**Exposure assessment -** The process of estimating the amount of contact with a chemical or biological agent that an individual or a population of organisms will receive from a pesticide application conducted under specific, stated circumstances.

**Exotic -** "Not native; introduced from elsewhere, but not completely naturalized" (Harris, 1994). See "Alien Species".

**Extirpate -** To destroy completely; wipe out.

**Extrapolation -** The use of a model to make estimates of values of a variable in an unobserved interval from values within an already observed interval.

**Fauna -** The wildlife or animals of a specified region or time.

**Federally Listed Species -** Formally listed as a threatened or endangered species under the ESA. Designations are made by the FWS or NMFS.

**FIFRA Pesticide Ingredient -** An ingredient of a pesticide that must be registered with EPA under the Federal Insecticide, Fungicide, and Rodenticide Act. Products making pesticide claims must submit required information to EPA to register under FIFRA and may be subject to labeling and use requirements.

**Flora -** Plant life, especially all the plants found in a particular country, region, or time regarded as a group. Also, a systematic set of descriptions of all the plants of a particular place or time.

**Foaming -** Hot foam as a tool for controlling invasive plants has been tested by the Nature Conservancy and used by the BLM effectively on puncture vine and slender false brome. Hot foam is a mechanical method. It is effective on seedlings and annuals and can be applied under weather conditions including wind and light rain.

**Food chain -** a hierarchical sequence of organisms, each of which feeds on the next, lower member of the sequence.

**Forage -** Food for animals. In this document, term applies to both availability of plant material for wildlife and domestic livestock.

**Formulation -** A commercial preparation of a chemical including any inerts and/or contaminants.

**Fungi -** Molds, mildews, yeasts, mushrooms, and puffballs, a group of organisms that lack chlorophyll and therefore are not photosynthetic. They are usually non-mobile, filamentous, and multi-cellular. (Source: Carbon Dioxide Information Analysis Center, 1990)

**Game Fish** - Species like trout, salmon, or bass, caught for sport. Many of them show more sensitivity to environmental change than non-game fish.

**Granitic –** Coarse-grained, acidic, intrusive rock

**Ground water -** The supply of fresh water found beneath the Earth's surface, usually in aquifers, which is often supplies wells and springs.

**Habitat -** The place where a population (e.g., human, animal, plant, microorganism) lives and its surroundings, both living and non-living.

**Halftime or half-life -** The time required for the concentration of the chemical to decrease by one-half.

**Hazard quotient (HQ) -** The ratio of the estimated level of exposure to a substance from a specific pesticide application to the RfD (reference dose) for that substance, or to some other index of acceptable exposure or toxicity. A HQ less than or equal to one is presumed to indicate an acceptably low level of risk for that specific application.

**Hazard identification -** The process of identifying the array of potential effects that an agent may induce in an exposed of humans or other organisms.

**Herbaceous -** A plant that does not develop persistent woody tissue above the ground (annual, biennial, or perennial). Herbaceous vegetation includes grasses and grass-like vegetation, and broadleaved forbs.

**Herbicide -** A chemical preparation designed to kill plants, especially weeds, or to otherwise inhibit their growth.

**Humus -** Organic portion of the soil remaining after prolonged microbial decomposition.

**Indian Rights and Interest -** Indian treaty and other rights or interests recognized by treaties, statutes, laws, executive orders, or other government action, or federal court decisions. (McConnell, 2003)

**Indian Tribe -** Any American Indian or Alaska Native tribe, band, nation, pueblo, community, rancheria, colony, or group meeting the provisions of the Code of Federal Regulations Title 25, Section 83.7 (25 FR 83.7) or those recognized in statutes or treaties with the United States. (McConnell, 2003)

**Inerts -** Anything other than the active ingredient in a pesticide product; not having pesticide properties.

**Infested Area -** A contiguous area of land occupied by a single invasive plant species. An infested area of land is defined by drawing a line around the actual perimeter of the infestation as defined by the canopy cover of the plants, excluding areas not infested. Generally, the smallest area of infestation mapped will be 1/10th (0.10) of an acre or 0.04 hectares. (NRIS Standards).

**Integrated Weed Management (IWM) -** An interdisciplinary weed management approach for selecting methods for preventing, containing, and controlling noxious weeds in coordination with other resource management activities to achieve optimum management goals and objectives (FSM 2080.5).

**Interdisciplinary team (IDT) -** A group of individuals with varying areas of specialty assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad enough to adequately analyze the problem and propose an action.

**Introduced Species -** An alien or exotic species that has been intentionally or unintentionally released into an area as a result of human activity. "Introduced (agricultural crops may fit the definition as well as 'native' or 'introduced' wildland species) or exotic species whose genetic material originally evolved and developed under different environmental conditions than those of the area in which it was introduced, often in geographically and ecologically distant locations" (Brown, 1997). See also "Noxious Weed" and "Exotic."

**Introduction -** "The intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity" (Executive Order 13112, 2/3/99).

**Invasive Plant Species -** An alien plant species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112, 2/3/99).

**Irreversible effect -** Effect characterized by the inability of the body to partially or fully repair injury caused by a toxic agent.

**Irritant -** Non-corrosive material that causes a reversible inflammatory effect on living tissue by chemical action at the site of contact as a function of concentration or duration of exposure.

**LC50 (lethal concentration50) -** A calculated concentration of a chemical in air or water to which exposure for a specific length of time is expected to cause death in 50 percent of a defined experimental animal population.

**LD50 (lethal dose50) -** The dose of a chemical calculated to cause death in 50 percent of a defined experimental animal population over a specified observation period. The observation period is typically 14 days.

**Label -** All printed material attached to or part of the pesticide container.

**Land allocation -** Commitment of a given area of land or a resource to one or more specific uses (e.g. Wilderness). In the Northwest Forest Plan, one of the seven allocations of Congressionally Withdrawn Areas, Late-Successional Reserves, Adaptive Management Areas, Managed Late-Successional Areas, Administratively Withdrawn Areas, Riparian Reserves, or Matrix.

**Leachate -** Water that collects chemicals as it trickles through soil or other porous media containing the chemicals.

**Leaching -** the process by which chemicals on or in soil or other porous media are dissolved and carried away by water, or are moved into a lower layer of soil.

**Level of Concern (LOC) -** The concentration in media or some other estimate of exposure above which there may be effects.

**Lichens -** Complex thallophytic plants comprised of an alga and a fungus growing in symbiotic association on a solid surface (such as a rock, bark, or soil).

**Littoral zone -** 1). That portion of a body of fresh water extending from the shoreline lakeward to the limit of occupancy of rooted plants. 2). The strip of land along the shoreline between the high and low water levels.

**Lowest-observed-adverse-effect level (LOAEL) -** The lowest dose of a chemical in a study, or group of studies, that produces statistically or biologically significant increases in frequency or severity of adverse effects between the exposed and control populations.

**Manual Control -** The use of any non-mechanized approach to control or eliminate invasive plants (i.e. hand-pulling, grubbing).

**Material safety data sheet (MSDS) -** a compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals, health and physical hazards, exposure limits, and precautions.

**Mechanical Control -** The use of any mechanized approach to control or eliminate invasive plants (i.e. mowing, weed whipping, weed whacking, hot foam)

**Microorganisms -** A generic term for all organisms consisting only of a single cell, such as bacteria, viruses, protozoans and some fungi.

**Minimum tool -** Use of a weed treatment alternative that would accomplish management objectives and have the least impact on resources.

**Miocene –** Geological epoch of warmer climate from 24 to 5 million years ago.

**Mollusks -** Invertebrate animals (such as slugs, snails, clams, or squids) that have a soft unsegmented body usually enclosed in a calcareous shell; representatives found on National Forest System land include snails, slugs, and clams.

**Monitoring -** A process of collecting information to evaluate if objectives and anticipated or assumed results of a management plan are being realized or if implementation is proceeding as planned (USDA, USDI 1994a).

**Morbidity -** Rate of disease, injury or illness.

**National Environmental Policy Act (NEPA) -** An Act passed in 1969 to declare a National policy that encourages productive and enjoyable harmony between humankind and the environment, promotes efforts that prevent or eliminate damage to the environment and biosphere, stimulates the health and welfare of humanity, enriches the understanding of the ecological systems and natural resources important to the nation, and establishes a Council on Environmental Quality (USDA, USDI 1994a).

**National Forest Management Act (NFMA) -** A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring preparation of Forest Plans and the preparation of regulations to guide that development (USDA, USDI 1994a).

**National Marine Fisheries Service (NMFS) -** The federal agency that is the listing authority for marine mammals and anadromous fish under the ESA.

**Native Species -** With respect to a particular ecosystem, a species which, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem (Executive Order 13112, 2/3/99).

**Naturalized -** “Applied to a species that originally was imported from another country but that now behaves like a native in that it maintains itself without further human intervention and has invaded native populations” (Allaby 1996).

**NLAA -** See **Not Likely to Adversely Affect**

**Non-local Native -** “This term has two meanings: 1) a population of a native plant species which does not occur naturally in the local ecosystem and/or 2) plant material of a native species that does not originate from genetically local sources. (Northern Region Native Plant Handbook, 1995).

**Non-target -** Any plant or animal that is not the intended organism to be controlled by a pesticide treatment.

**No-observed-adverse-effect level (NOAEL) -** exposure level at which there are no statistically or biological significant differences in the frequency or severity of any adverse effect in the exposed or control populations.

**No-Observed-Effect-Level (NOEL) -** exposure level at which there are no statistically or biological significant differences in the frequency or severity of any effect in the exposed or control populations.

**Not Likely to Adversely Affect (NLAA) -** determinations are applied to those species that had very little habitat on National Forests in Region Six, were not in habitats susceptible to invasive plants, or were known to tolerate herbicide treatments without effects.

**Noxious Weed -** “Any living stage (including but not limited to, seeds and reproductive parts) of any parasitic or other plant of a kind, or subdivision of a kind, which is of foreign origin, is new to or not widely prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation or the fish and wildlife resources of the United States or the public health” (Public Law 93-629, January 3, 1975, Federal Noxious Weed Act of 1974).

**NPDES -** See **National Pollutant Discharge Elimination System**

**Paleosols –** Soils that formed on a landscape of the past, usually buried by more recent parent materials.

**Pathogen -** A living organism, typically a bacteria or virus that causes adverse effects in another organism.

**Percolation –** A downward flow or filtering of water through pores or spaces in rock or soil.

**Perennial -** A plant species having a life span of more than 2 years.

**Periphyton -** Microscopic plants and animals that are firmly attached to solid surfaces under water such as rocks, logs, pilings and other structures.

**Persistence -** refers to the length of time a compound, once introduced into the environment, stays there.

**Personal Protective Equipment (PPE) -** Clothing and equipment worn by pesticide mixers, loaders and applicators and re-entry workers, hazmat emergency responders, workers cleaning up Superfund sites, etc., which is worn to reduce their exposure to potentially hazardous chemicals and other pollutants.

**Pest -** An insect, rodent, nematode, fungus, weed or other form of terrestrial or aquatic plant or animal life that is classified as undesirable because it is injurious to health or the environment.

**Pesticide -** Any substance used for controlling, preventing, destroying, repelling, or mitigating any pest. Includes fungicides, herbicides, fumigants, insecticides, nematicides, rodenticides, desiccants, defoliants, plant growth regulators, and so forth. (W, modified).

**Pesticide tolerance -** the amount of pesticide residue allowed by law to remain in or on a harvested crop.

**pH -** The negative log of the hydrogen ion concentration. A high pH (>7) is alkaline or basic and a low pH (<7) is acidic.

**Pleistocene:** Geologic epoch of glacial advance and retreat from 1.8 million to 11,000 BC.

**Population -** "A group of individuals of the same species in an area" (Wilson and Hipkins, 1999).

**Population at Risk -** A population subgroup that is more likely to be exposed to a chemical, or is more sensitive to the chemical, than is the general population.

**Porosity -** Degree to which soil, gravel, sediment, or rock is permeated with pores or cavities through which water or air can move.

**Potable Water -** Water that is considered safe for drinking and cooking.

**Pre-disturbance surveys** - See "Surveys Prior to Habitat-Disturbing Activities."

**Proposed species** - Any plant or animal species that is proposed by the Fish and Wildlife Service or NOAA Fisheries in a Federal Register notice to be listed as threatened or endangered.

**Potential Vegetation Type –** The term potential vegetation type (PVT) is used to represent the combination of species that could occupy the site in the absence of disturbance.

**Protozoa -** Single-celled, microorganisms without cell walls containing visibly evident nuclei and organelles. Most protozoa are free-living although many are parasitic.

**Reference Dose (RfD) -** The RfD is a numerical estimate of a daily exposure to the human population, including sensitive subgroups such as children, that is not likely to cause harmful effects during a lifetime. RfDs are generally used for health effects that are thought to have a threshold or minimum dose for producing effects.

**Registered Pesticides -** Pesticide products which have been approved for the uses listed on the label (W).

**Registration -** Formal licensing with EPA of a new pesticide before it can be sold or distributed. Under the Federal Insecticide, Fungicide, and Rodenticide Act, EPA is responsible for registration (pre-market licensing) of pesticides on the basis of data demonstrating no unreasonable adverse effects on human health or the environment when applied according to approved label directions.

**Restoration -** "[Ecological restoration] is the process of assisting the recovery and management of ecological integrity. Ecological integrity includes a critical range of variability in biodiversity, ecological processes and structures, regional and historical context, and sustainable cultural practices" (Society of Ecological Restoration, 2000).

**Revegetation -** "The re-establishment of plants on a site (does not imply native or nonnative; does not imply that the site can ever support any other types of plants or species and is not at all concerned with how the site 'functions' as an ecosystem)". (Northern Region Native Plant Handbook, 1995).

**RfD -** A daily dose which is not anticipated to cause any adverse effects in a human population over a lifetime of exposure. These values are derived by the U.S. Environmental Protection Agency.

**Rhyolitic –** Light colored, fine-grained, acidic, extrusive volcanic rock.

**Riparian Area -** A geographic area containing an aquatic ecosystem and adjacent upland areas that directly affect it (Northwest Forest Plan).

**Riparian Reserves -** Areas along live and intermittent streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian Reserves are important to the terrestrial ecosystem as well, serving as dispersal habitat for certain terrestrial species (USDA, USDI 1994a).

**Risk Assessment -** An analytic process that is firmly based on scientific considerations, but also requires judgments to be made when the available information is incomplete. These judgments inevitably draw on both scientific and policy considerations.

**Risk -** the chance of an adverse or undesirable effect.

**Risk assessment -** the qualitative and quantitative evaluation performed in an effort to estimate the risk posed to human health and/or the environment by the presence or potential presence and/or use of specific chemical or biological agents.

**Saturated zone -** a subsurface area in which all pores and cracks are filled with water under pressure equal to or greater than that of the atmosphere.

**Sensitive species –** Species identified by the Regional Forester for which population variability is a concern, as evidenced by significant current or predicted downward trend in population numbers or density; or significant current or predicted downward trends in habitat capability that would reduce a species existing distribution (FSM 2670).

**Species -** "A group of organisms all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms" (Executive Order 13112, 2/3/99).

**Standards and guidelines -** The rules and limits governing actions, as well as the principles specifying the environmental conditions or levels to be achieved and maintained (USDA, USDI 1994a).

**Subchronic exposure -** An exposure duration that can last for different periods of time (5 to 90 days), with 90 days being the most common test duration for mammals. The subchronic study is usually performed in two species (rat and dog) by the route of intended use or exposure.

**Subchronic toxicity -** the ability of one or more substances to cause effects over periods from about 90 days but substantially less than the lifetime of the exposed organism. Subchronic toxicity only applies to relatively long-lived organisms such as mammals.

**Submerged Aquatic Vegetation -** Vegetation that lives at or below the water surface; an important habitat for young fish and other aquatic organisms.

**Substrate -** With reference to enzymes, the chemical that the enzyme acts upon.

**Surface water -** All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors which are directly influenced by surface water.

**Surfactant -** a surface active agent; usually an organic compound whose molecules contain a hydrophilic group at one end and a lipophilic group at the other. Promotes solubility of a chemical, or lathering, or reduces surface tension of a solution.

**Survey and Manage -** Mitigation measure adopted as a set of standards and guidelines within the Northwest Forest Plan Record of Decision and replaced with standards and guidelines in 2001 (Record of Decision) intended to mitigate impacts of land management efforts on those species that are closely associated with Late-Successional or old-growth forests whose long term persistence is a concern. This mitigation measure applies to all land allocations and requires land managers to take certain actions relative to species of plants and animals, particularly some amphibians, bryophytes, lichens, mollusks, vascular plants, fungi, and arthropods, which are rare or about which little is known. These actions include: (1) manage known sites; (2) survey prior to habitat-disturbing activities; and, (3) conduct extensive and general regional (strategic) surveys.

**Synergistic effect -** situation in which the combined effects of exposure to two chemicals simultaneously is much greater than the sum of the effect of exposure to each chemical given alone.

**Take -** To kill or capture a species covered by the ESA.

**Threatened species -** Plant or animal species likely to become endangered throughout all or a significant portion of its range within the foreseeable future. A plant or animal identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register (USDA, USDI 1994a).

**Threshold -** The maximum dose or concentration level of a chemical or biological agent that will not cause an effect in the organism.

**Tolerances -** Permissible residue levels for pesticides in raw agricultural produce and processed foods. Whenever a pesticide is registered for use on a food or a feed crop, a tolerance (or exemption from the tolerance requirement) must be established. EPA establishes the tolerance levels, which are enforced by the Food and Drug Administration and the Department of Agriculture.

**Toxicity -** The inherent ability of an agent to affect living organisms adversely. As defined by U.S. EPA, toxicity is "...the degree to which a substance or mixture of substances can harm humans or animals.

**Toxicology -** The study of the nature, effects, and detection of poisons in living organisms. Also, substances that are otherwise harmless but prove toxic under particular conditions. The basic assumption of toxicology is that there is a relationship among the dose (amount), the concentration at the affected site, and the resulting effects.

**Treated Area -** An infested area where weeds have been treated or retreated by an acceptable method for the specific objective of controlling their spread or reducing their density. (NRIS Standards).

**U.S. Fish and Wildlife Service (USDI FWS) -** The federal agency that is the listing authority for species other than marine mammals and anadromous fish under the ESA.

**Viability -** Ability of a wildlife or plant population to maintain sufficient size to persist over time in spite of normal fluctuations in numbers, usually expressed as a probability of maintaining a specific population for a specified period (USDA, USDI 1994a).

**Viable Population -** Wildlife or plant population that contains an adequate number of reproductive individuals appropriately distributed on the planning area to ensure the long-term existence of the species (USDA, USDI 1994a).

**Weed -** "A plant growing where man does not want it to grow" (Daubenmire 1978).

**Well distributed -** Distribution sufficient to permit normal biological function and species interactions, considering life history characteristics of the species and the habitats for which it is specifically adapted.

**Wetlands -** an area that is regularly saturated by surface or ground water and subsequently is characterized by a prevalence of vegetation that is adapted for life in saturated soil conditions. Examples include swamps, bogs, fens, marshes, and estuaries.

**Wilderness -** Areas designated by Congressional action under the 1964 Wilderness Act. Wilderness is defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation. Wilderness areas are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or for a primitive and confined type of recreation; include at least 5,000 acres or are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and may contain features of scientific, educational, scenic, or historical value as well as ecological and geologic interest.

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# APPENDIX A

## Project Area Units with Invasive Species Present and Treatment Prescriptions

**Appendix A** presents data tables that display information about each treatment area, such as a description, species present, acreage of infestation, comments, and preferred herbicides. Prior to implementation the Project Design Features would be applied and application methods verified.

**Acronyms used in the table:**

CH – Chemical Herbicide
MA – Manual
MECH – Mechanical
BIO – Biological Control Agent

| PLANT CODE | GENUS | SPECIES | COMMON NAME |
|---|---|---|---|
| ACRE3 | *Acroptilon* | *repens* | Russian knapweed |
| ARMI2 | *Arctium* | *minus* | lesser burdock |
| BRRA | *Brassica* | *rapa* | field mustard |
| BRSY | *Brachypodium* | *sylvaticum* | slender false brome |
| BRTE | *Bromus* | *tectorum* | cheatgrass |
| CADR | *Cardaria* | *draba* | whitetop |
| CANU4 | *Carduus* | *nutans* | musk thistle |
| CAPU6 | *Cardaria* | *pubescens* | hairy whitetop |
| CARDA | *Cardamine* | | bittercress |
| CEBI2 | *Centaurea* | *biebersteinii* | spotted knapweed |
| CEDET | *Centaurea* | *debeauxii* | meadow knapweed |
| CEDI3 | *Centaurea* | *diffusa* | diffuse knapweed |
| CENTA | *Centaurea* | | knapweed |
| CESO | *Ceanothus* | *sonomensis* | Sonoma ceanothus |
| CESO3 | *Centaurea* | *solstitialis* | yellow star-thistle |
| CIAR4 | *Cirsium* | *arvense* | Canada thistle |
| CIVU | *Cirsium* | *vulgare* | bull thistle |
| COAR4 | *Convolvulus* | *arvensis* | field bindweed |
| CYOF | *Cynoglossum* | *officinale* | houndstongue |
| CYSC4 | *Cytisus* | *scoparius* | Scotch broom |
| DAGL | *Dactylis* | *glomerata* | orchardgrass |
| DIFU2 | *Dipsacus* | *fullonum* | teasel |
| DIFUS2 | *Dipsacus* | *fullonum* | teasel |
| DIPSA | *Dipsacus* | | teasel |
| ELRE4 | *Elymus* | *repens* | quackgrass |
| EUES | *Euphorbia* | *esula* | leafy spurge |
| HYPE | *Hypericum* | *perforatum* | St. Johnswort |
| ISTI | *Isatis* | *tinctoria* | Dyer's woad |
| KOSC | *Kochia* | *scoparia* | kochia |

| PLANT CODE | GENUS | SPECIES | COMMON NAME |
|---|---|---|---|
| LEPID | *Lepidium* | | pepperweed |
| LEVU | *Leucanthemum* | *vulgare* | oxeye daisy |
| LIDA | *Linaria* | *dalmatica* | Dalmatian toadflax |
| LINAR | *Linaria* | | toadflax |
| LIVU | *Ligustrum* | *vulgare* | European privet |
| LIVU2 | *Linaria* | *vulgaris* | butter and eggs |
| MAVU | *Marrubium* | *vulgare* | horehound |
| MEOF | *Melilotus* | *officinalis* | yellow sweetclover |
| ONAC | *Onopordum* | *acanthium* | Scotch thistle |
| PHAR3 | *Phalaris* | *arundinacea* | reed canarygrass |
| PHARP | *Phalaris* | *arundinacea* | ribbongrass |
| PORE5 | *Potentilla* | *recta* | sulphur cinquefoil |
| RUDI2 | *Rubus* | *discolor* | Himalayan blackberry |
| SAAE | *Salvia* | *aethiopis* | Mediterranean sage |
| SAKA | *Salsola* | *kali* | Russian thistle |
| SEJA | *Senecio* | *jacobaea* | tansy ragwort |
| SIAL | *Silphium* | *albiflorum* | white rosinweed |
| SIMA3 | *Silybum* | *marianum* | blessed milkthistle |
| TACA8 | *Taeniatherum* | *caput-medusae* | medusahead |
| TAPA6 | *Tanacetum* | *parthenium* | feverfew |
| URDI | *Urtica* | *dioica* | stinging nettle |
| VETH | *Verbascum* | *thapsus* | common mullein |

# Table A.1. Project Area Summary Report

**11-01** Hwy 97 + 9701-100 Rd. + Rd. on west **PROJECT ACRES =** 635.25 **Infested ACRES =** 340.55
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 54%
**COMMENTS:** Major transportation route/vector for invasive plant spread. Knapweed greatly reduced from 98 EA-approved herbicide treatments, but SAKA has increased. Bisects Newberry National Volcanic Monument.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |
| ONAC | Eradicate | CHMA | Scotch thistle | Clopyralid | chlorsulfuron | Metsulfuron methyl | |
| SAKA | Control | CHMA | Russian thistle | chlorsulfuron | Metsulfuron methyl | Glyphosate | |

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**11-02** Rd. 18 **PROJECT ACRES =** 1,278. **Infested ACRES =** 12.82
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Major access route from Bend into eastern portions of Bend/Ft. Rock District. Small invasive plant sites scattered along road of 5 different invasive species.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |
| SAKA | Control | CHMA | Russian thistle | chlorsulfuron | Metsulfuron methyl | Glyphosate | |

****

**11-03** Rd. 21 + 10-mile sno-park **PROJECT ACRES =** 845.20 **Infested ACRES =** 6.33
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Within Newberry National Monument. Access road to Paulina and East Lakes; 10-mile snopark. Fourteen small sites along road, in snopark, & other rec sites.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| HYPE | Eradicate | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-04** Pine Mountain **PROJECT ACRES =** 383.98 **Infested ACRES =** 172.67
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 45%
**COMMENTS:** Roads in Pine Mt. Area. Fourteen mapped sites of 4 species ranging in size from 0.01 ac.to 0.5 ac. (gross acres - GIS polygons).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |
| SAKA | Control | CHMA | Russian thistle | chlorsulfuron | Metsulfuron methyl | Glyphosate | |

****

**11-05** Hwy 31 **PROJECT ACRES =** 515.28 **Infested ACRES =** 379.87
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 74%
**COMMENTS:** Major transportation route from Hwy 97 east, from Deschutes NF into Fremont National Forest. Of the 13 mappes sites on Deschutes NF lands, CEBI2 is primary species.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| SAKA | Control | CHMA | Russian thistle | chlorsulfuron | Metsulfuron methyl | Glyphosate | |

****

**11-06** Skyliner Road **PROJECT ACRES =** 442.71 **Infested ACRES =** 4.66
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Skyliner Rd. is a popular recreation access to Tumalo Falls and OMSI camp. Within Tumalo Creek Restoration Project; bare ground created by stream restoration project is high prevention priority. CEBI2 occurs along road & riparian area.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-07** Hwy 46 **PROJECT ACRES =** 1,719. **Infested ACRES =** 25.89
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:** Major access route to Mt. Bachelor and high elevation trails/lakes; National Scenic Highway. CEBI2 infestations dense near Bend; isolated small plants pop up in widely scattered locations.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

****

**11-08** Rd. 41 **PROJECT ACRES =** 365.90 **Infested ACRES =** 77.85
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 21%
**COMMENTS:** Access route between Sunriver Resort and Highway 46, though not as heavily used as Road 45 (Treatment Area 11-12). Of the 9 mapped sites, population sizes range from 10 plants to 5,000+.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

****

**11-09** Rd. 40 **PROJECT ACRES =** 589.70 **Infested ACRES =** 4.37
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Another major access route between Sunriver Resort and Highway 46 (access to Cultus Lake, Crane Prairie Reservoir, Wickiup Reservoir). Mapped weed sites closer to Hwy 97, Sunriver.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

****

**11-10** Rd. 42 **PROJECT ACRES =** 693.52 **Infested ACRES =** 7.09
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Arterial access route connects Hwy 97 and Hwy 46, accesses Deschutes River sites, Wickiup and Crane Prairie Reservoirs and other popular recreation spots. 12 mapped sites, largest near spur road to boat launch. RCG weed whack; spray after regrowth

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |
| CYSC4 | Control | CHMA | Scotch broom | Triclopyr | Picloram | Glyphosate | |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |
| PHAR3 | Suppress | MECHMACU | reed canarygrass | Glyphosate | Imazapyr | Sethoxydim | |

****

**11-11** Rd. 43 **PROJECT ACRES =** 219.94 **Infested ACRES =** 1.61
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Access road to Little Deschutes and Deschutes River recreation sites; connects with Road 42; crosses thru Pringle Falls Experimental Forest. 3 sites of CEBI2, LIDA.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

****

**11-12** Rd. 45 **PROJECT ACRES =** 372.16 **Infested ACRES =** 0.52
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Major access road between Sunriver Resort and Mt. Bachelor, high elevation trails/lakes, winter snowparks, etc. Three small mapped sites of CEBI2.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

****

**11-13** Rd. 22 **PROJECT ACRES =** 1,252. **Infested ACRES =** 3.53
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Bull thistle currently only known invasive species. Road accesses Bend/Ft. Rock lands east of LaPine.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |

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**11-14** Rd. 4603 **PROJECT ACRES =** 38.60 **Infested ACRES =** 0.17
**SITE TYPE:** RoadStream **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Access road from 4601 (Skyliner Rd.) to Tumalo Falls. Riparian access. Spotted knapweed along road and in riparian.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |

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**11-15** Rd. 4606 South **PROJECT ACRES =** 59.55 **Infested ACRES =** 3.38
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 6%
**COMMENTS:** Collector roads that head north & south from Skyliner Rd. Five CEBI2 sites, ranging in size from < 30 plants to 2,500+ plants (as of 2005).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-17** Tumalo Creek **PROJECT ACRES =** 256.92 **Infested ACRES =** 3.38
**SITE TYPE:** FloodPlain **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Tumalo Creek is a stream restoration project. Dispersed use by public & Cascade Science School. CEBI2 on banks/islands within stream and along road. Bare ground created by stream channel restoration is high prevention priority.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-18** Ogden Group Camp **PROJECT ACRES =** 18.56 **Infested ACRES =** 5.88
**SITE TYPE:** Stream **Reveg:** PassiveRest **% TREATED =** 32%
**COMMENTS:** Within Newberry National Volcanic Monument. Ogden Group Camp and trail along Paulina Creek used by public. Some areas quite disturbed and soil compaction/rocky ground makes hand-pulling difficult. Five CEBI2 sites; one CIVU.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |

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**11-19** Cottonwood Road **PROJECT ACRES =** 32.87 **Infested ACRES =** 29.66
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 90%
**COMMENTS:** Cottonwood Road access from Hwy 97 to north part Sunriver resort. Dramatic decrease in CEDI3 since 1998-approved herbicide use. Seedbank & high use will require constant vigilance.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**11-21** Cultus Creek **PROJECT ACRES =** 1.19 **Infested ACRES =** 1.07
**SITE TYPE:** RoadStream **Reveg:** PassiveRest **% TREATED =** 90%
**COMMENTS:** Cultus Creek - HYPE estimated at about 1 acre. Adjacent to Cultus River RNA.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |

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**11-22** West side of Wickiup Reservoir **PROJECT ACRES =** 0.07 **Infested ACRES =** 0.07
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 100%
**COMMENTS:** West of Wickiup Reservoir along 120 spur road. One small site of LIDA (in 2005 estimated at 38 plants).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-23** South side Dilman Meadow **PROJECT ACRES =** 1.73 **Infested ACRES =** 1.07
**SITE TYPE:** Meadow **Reveg:** PassiveRest **% TREATED =** 62%
**COMMENTS:** Dillman Meadow is northeast of Wickiup Reservoir. CIAR4 site at least 200 ft. from river; HYPE also occurs.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |

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**11-24** Southeast shore Wickiup Reservoir **PROJECT ACRES =** 87.60 **Infested ACRES =** 5.28
**SITE TYPE:** RoadStream **Reveg:** PassiveRest **% TREATED =** 6%
**COMMENTS:** Ten mapped sites. One heavy infestation of CEBI2 (7,000+ plants), many seedlings underneath bitterbrush. PHAR majority of sites; weed whack; spray after regrowth

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| PHAR3 | Contain | MECHMACU | reed canarygrass | Glyphosate | Imazapyr | Sethoxydim | |

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**11-25** Sixteen Butte opal mine and vicinity **PROJECT ACRES =** 30.81 **Infested ACRES =** 1.49
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 5%
**COMMENTS:** CEBI2 occurs in flat open area where roads meet and may extend up road.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |

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**11-26** Coyote Flat **PROJECT ACRES =** 79.05 **Infested ACRES =** 4.01
**SITE TYPE:** HarvestUnit **Reveg:** PassiveRest **% TREATED =** 5%
**COMMENTS:** Timber sale area. CIAR4, CEBI2, and CIVU.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | MA | spotted knapweed | N/A | N/A | N/A | N/A |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |

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**11-27** Horse Butte Rd. + Horse Butte **PROJECT ACRES =** 78.65 **Infested ACRES =** 12.61
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 16%
**COMMENTS:** Horse Butte Road (Rd. 1815) is close to Bend, highly used road. Horse Butte is popular dispersed rec site, very disturbed lands. CEBI2, CEDI3, LIDA & SAKA sites.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |
| SAKA | Control | CHMA | Russian thistle | chlorsulfuron | Metsulfuron methyl | Glyphosate | |

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**11-28** 1800-019 Road **PROJECT ACRES =** 25.34 **Infested ACRES =** 0.46
**SITE TYPE:** Utility **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:** Between Rd. 18 (China Hat Rd.) and city of Bend. Two small mapped sites of CEBI2; 4 sites of LIDA, ranging from a few plants to about 500 plants.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-29** ~1 mile NW of Horse Butte **PROJECT ACRES =** 63.13 **Infested ACRES =** 0.27
**SITE TYPE:** GeneralForest **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Collector roads and adjacent areas on Forest boundary near southeast Bend. LIDA and CEBI2.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-30** South shore Wickiup **PROJECT ACRES =** 11.82 **Infested ACRES =** 5.32
**SITE TYPE:** Lake **Reveg:** PassiveRest **% TREATED =** 45%
**COMMENTS:** Large CIAR4 site in sand and rocky outcrops (latter makes manual treatment difficult). CEBI2 also occurs.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |

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**11-31** Red Crater Quarry **PROJECT ACRES =** 0.49 **Infested ACRES =** 0.02
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 3%
**COMMENTS:** CIAR4.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |

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**11-32** Sparks Lake **PROJECT ACRES =** 0.50 **Infested ACRES =** 0.11
**SITE TYPE:** Lake **Reveg:** PassiveRest **% TREATED =** 22%
**COMMENTS:** Two sites of CIAR4.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |

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**11-33** West shore Paulina Lake **PROJECT ACRES =** 11.60 **Infested ACRES =** 5.17
**SITE TYPE:** Lake **Reveg:** PassiveRest **% TREATED =** 45%
**COMMENTS:** High recreation use -- hiking, boating. PHAR3 mapped along west shore, near resort and by boat launch. CIVU also occurs.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |
| PHAR3 | Suppress | MECHMACU | reed canarygrass | Glyphosate | Imazapyr | Sethoxydim | |

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**11-34** West side Hosmer Lake **PROJECT ACRES =** 1.64 **Infested ACRES =** 1.00
**SITE TYPE:** Lake **Reveg:** PassiveRest **% TREATED =** 61%
**COMMENTS:** PHAR3 mapped at 0.5 gross acres. Much of shoreline of Hosmer Lake is native vegetation.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| PHAR3 | Suppress | MECHMACU | reed canarygrass | Glyphosate | Imazapyr | Sethoxydim | |

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**11-35** Blue Lagoon **PROJECT ACRES =** 11.02 **Infested ACRES =** 7.47
**SITE TYPE:** Lake **Reveg:** PassiveRest **% TREATED =** 68%
**COMMENTS:** Approximately 2 acres (GIS polygon) of PHAR3.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| PHAR3 | Suppress | MECHMACU | reed canarygrass | Glyphosate | Imazapyr | Sethoxydim | |

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**11-37** Rd. 25 ~1,500' from jct. with Rd. 2510 **PROJECT ACRES =** 0.06 **Infested ACRES =** 0.01
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 17%
**COMMENTS:** Near Rd. 25 that connects Hwy 20 with Rd. 18 (China Hat Rd.), northwest of Pine Mt. One mapped site of CEBI2.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | MA | spotted knapweed | N/A | N/A | N/A | N/A |

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**11-38** All Bull Thistle **PROJECT ACRES =** 173.76 **Infested ACRES =** 63.92
**SITE TYPE:** GeneralForest **Reveg:** PassiveRest **% TREATED =** 37%
**COMMENTS:** This Treatment Area covers numerous bull thistle sites on BFR. This species is a low priority for treatment and will be tolerated (no treatment) on some sites; pulled on others as opportunities allow.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |

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**11-39** Lava Lake **PROJECT ACRES =** 38.10 **Infested ACRES =** 22.16
**SITE TYPE:** Lake **Reveg:** PassiveRest **% TREATED =** 58%
**COMMENTS:** Popular recreation spot. PHAR3 occupies about 2 acres along shoreline.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| PHAR3 | Contain | MECHMACU | reed canarygrass | Glyphosate | Imazapyr | Sethoxydim | |

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**11-40** Kelsey Butte Seed Orchard **PROJECT ACRES =** 25.38 **Infested ACRES =** 25.36
**SITE TYPE:** Admin **Reveg:** PassiveRest **% TREATED =** 100%
**COMMENTS:** One mapped site that has CEBI2, LIDA and CIVU.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | MA | spotted knapweed | N/A | N/A | N/A | N/A |
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-41** 18 Fire + Bessie Fire **PROJECT ACRES =** 1,256. **Infested ACRES =** 98.42
**SITE TYPE:** Fire **Reveg:** PassiveRest **% TREATED =** 8%
**COMMENTS:** 18 Fire area (2003). Very large SAKA site radiated out from quarry; other smaller sites of SAKA, CEBI2, LIDA, & CIVU scattered in area.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIVU | Control | MA | bull thistle | N/A | N/A | N/A | N/A |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |
| SAKA | Control | CHMA | Russian thistle | chlorsulfuron | Metsulfuron methyl | Glyphosate | |

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**11-42** 1810 Road/Hazy TS #15 **PROJECT ACRES =** 0.39 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 25%
**COMMENTS:** Hazy Timber Sale unit along 1810 road (south of Bend, east of Deschutes River); one site of CEBI2 mapped in 2004.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**11-43** Geothermal test drilling. **PROJECT ACRES =** 0.79 **Infested ACRES =** 0.20
**SITE TYPE:** Lake **Reveg:** PassiveRest **% TREATED =** 25%
**COMMENTS:** Geothermal test drill sites in the Paulina Peak area. Along ponds created by geothermal testing. Two mapped sites of CIAR4.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Contain | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |

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**11-44** Road 25 at Forest Boundary **PROJECT ACRES =** 0.39 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 25%
**COMMENTS:** One relatively small site of SAKA (estimated at 75 plants in 2004).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| SAKA | Eradicate | CHMA | Russian thistle | chlorsulfuron | Metsulfuron methyl | Glyphosate | |

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**11-45** Pine Mountain - Road 2017-300 **PROJECT ACRES =** 0.39 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 25%
**COMMENTS:** Small population of LIDA (estimated at 15 plants in 2004) in center of road where there had been recent downfall of ponderosa pine.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-46** Road 2268-600 **PROJECT ACRES =** 4.31 **Infested ACRES =** 0.20
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 5%
**COMMENTS:** Two small sites of CEBI2 mapped along this network of roads in Pine Mt. area.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**11-47** Road 4601-310/320 Jct. **PROJECT ACRES =** 0.54 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 18%
**COMMENTS:** South of Skyliners Road; one mapped site of CEBI2.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | MA | spotted knapweed | N/A | N/A | N/A | N/A |

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**11-48** Road 4615/4615-070 Jct. **PROJECT ACRES =** 0.54 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 18%
**COMMENTS:** Road travels north from Hwy 46 by Virginia Meissner Sno-Park. Only 2 plants of LIDA found in 2004.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-49** Proposed Midstate Electric Powerline **PROJECT ACRES =** 26.03 **Infested ACRES =** 0.52
**SITE TYPE:** GeneralForest **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:** Five mapped weed sites of CEBI2 & LIDA. As of 2004, ranged in size from 40 to 300 plants.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-50** Adjacent to Oregon Water Wonderland **PROJECT ACRES =** 3.30 **Infested ACRES =** 0.14
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 4%
**COMMENTS:** Two mapped sites of CEBI2.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**11-51** SW of Pistol Butte **PROJECT ACRES =** 0.11 **Infested ACRES =** 0.06
**SITE TYPE:** GeneralForest **Reveg:** PassiveRest **% TREATED =** 59%
**COMMENTS:** LIDA site along road, north of Rd. 42 and south of Pistol Butte.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-52** Rd 4180 **PROJECT ACRES =** 14.26 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Very small CEBI2 site when located in 2004 (only 2 plants). Rd. 4180 is east of Edison Butte (snopark) and northwest of Pitsua Butte.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | MA | spotted knapweed | N/A | N/A | N/A | N/A |

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**11-53** Rd 4285 + SE arm of Crane Prairie **PROJECT ACRES =** 158.82 **Infested ACRES =** 26.69
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 17%
**COMMENTS:** High recreational use. Several very large (1,000's of plants) sites of CEBI2. One site identified as a high district priority because potential vector source; occurs behind cabins, at dam, edge of Deschutes River. CIAR4, HYPE, PHAR3 occur also.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Contain | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| PHAR3 | Contain | MECHMACU | reed canarygrass | Glyphosate | Imazapyr | Sethoxydim | |

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**11-54** South Twin Lake **PROJECT ACRES =** 25.52 **Infested ACRES =** 1.78
**SITE TYPE:** Lake **Reveg:** PassiveRest **% TREATED =** 7%
**COMMENTS:** Popular recreation site. One mapped site has CEBI2, CIAR4, PHAR3, and CIVU.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |
| PHAR3 | Contain | MECHMACU | reed canarygrass | Glyphosate | Imazapyr | Sethoxydim | |

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**11-55** Cabin Butte Cinder Pit **PROJECT ACRES =** 119.45 **Infested ACRES =** 1.48
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** CEBI2 and SAKA. As of 2005, CEBI2 had not spread beyond the mapped area.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| SAKA | Contain | CHMA | Russian thistle | chlorsulfuron | Metsulfuron methyl | Glyphosate | |

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**11-56** Crane Prairie Res - West **PROJECT ACRES =** 3.26 **Infested ACRES =** 3.26
**SITE TYPE:** Lake **Reveg:** PassiveRest **% TREATED =** 100%
**COMMENTS:** Three different reed canarygrass sites along the west side of Crane Prairie Reservoir.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| PHAR3 | Contain | MECHMACU | reed canarygrass | Glyphosate | Imazapyr | Sethoxydim | |

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**11-57** Tetherow Meadow **PROJECT ACRES =** 18.08 **Infested ACRES =** 18.08
**SITE TYPE:** Meadow **Reveg:** PassiveRest **% TREATED =** 100%
**COMMENTS:** ONAC is estimated at 18 acres (GIS polygon); about one acre of ELRE.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ELRE4 | Contain | MAMECH | quackgrass | Glyphosate | Chlorsulfuron+Sulfo | Sethoxydim | Imazapyr |

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**11-58** Old pits south of Phil's trailhead **PROJECT ACRES =** 118.98 **Infested ACRES =** 104.45
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 88%
**COMMENTS:** South of Skyliner Road and Phil's trailhead, close to Bend and popular recreation areas. Three mapped sites of CEBI2 & LIDA.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-59** Coyote Butte Cinder Pit **PROJECT ACRES =** 58.03 **Infested ACRES =** 2.09
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 4%
**COMMENTS:** Three mapped large sites of CEBI2 (1,000's of plants). Some areas very compacted, manual treatment difficult. CEBI2 has spread from cinder pit to adjacent roads.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| SAKA | Contain | CHMA | Russian thistle | chlorsulfuron | Metsulfuron methyl | Glyphosate | |

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**11-60** Area west of Entrada Lodge **PROJECT ACRES =** 39.31 **Infested ACRES =** 6.27
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 16%
**COMMENTS:** Access to public land just west of Entrada Lodge gets dispersed use. Eight mapped weed sites of CEBI2 & LIDA.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-61** Deschutes River - Entrada **PROJECT ACRES =** 1.14 **Infested ACRES =** 0.35
**SITE TYPE:** Stream **Reveg:** PassiveRest **% TREATED =** 31%
**COMMENTS:** Recreation site along Deschutes River close to Entrada Lodge. One mapped site of CEBI2 estimated at 500+ plants in 2004.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**11-62** Meadow Camp **PROJECT ACRES =** 30.82 **Infested ACRES =** 4.41
**SITE TYPE:** RoadStream **Reveg:** PassiveRest **% TREATED =** 14%
**COMMENTS:** Popular day use area along the Deschutes River & access to Deschutes River Trail. Close to Bend. CEBI2, CIAR4, & CIVU occur. Manual treatments have occurred for years; difficult in areas with compacted ground & where plants under bitterbrush.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |

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**11-63** Inn of 7th Mtn - RD 41 Jct **PROJECT ACRES =** 44.96 **Infested ACRES =** 4.96
**SITE TYPE:** Trail_multi **Reveg:** PassiveRest **% TREATED =** 11%
**COMMENTS:** Dispersed recreation use in general area. This TA is by Inn of 7th Mt. Resort and junction Rds. 41 and 46. Two mapped CEBI2 sites.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**11-64** Arnold Ditch Access Road **PROJECT ACRES =** 2.02 **Infested ACRES =** 0.02
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Road access to water diversion used by Arnold Ditch Company. Three small sites of CEBI2 & LIDA occur.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-65** Dillon Falls Day Use area **PROJECT ACRES =** 2.66 **Infested ACRES =** 1.96
**SITE TYPE:** Parking **Reveg:** PassiveRest **% TREATED =** 74%
**COMMENTS:** Dillon Falls Day Use area is a popular recreation spot (boat landing, hiking, mt. biking, etc.). CEBI2 & LIDA occur; some in trail in compacted areas.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-66** Ryan Ranch meadow **PROJECT ACRES =** 12.84 **Infested ACRES =** 10.63
**SITE TYPE:** Meadow **Reveg:** PassiveRest **% TREATED =** 83%
**COMMENTS:** Ryan Ranch meadow is along the Deschutes River, south of Dillon Falls Day Use Area. Hiking & biking mostly concentrated along trail by river. PHAR3 occurs throughout meadow. CIVU also occurs.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| PHAR3 | Suppress | MECHMACU | reed canarygrass | Glyphosate | Imazapyr | Sethoxydim | |

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**11-67** Slough Camp + Trail to North **PROJECT ACRES =** 14.38 **Infested ACRES =** 0.22
**SITE TYPE:** Trail_multi **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:** This Treatment Area includes Slough Camp Day Use area and Deschutes River trails. CEBI2 & LIDA occur.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-68** Benham Falls complex **PROJECT ACRES =** 12.43 **Infested ACRES =** 0.85
**SITE TYPE:** Trail_multi **Reveg:** PassiveRest **% TREATED =** 7%
**COMMENTS:** Benham Falls area is high use recreation site for hiking, mt. biking, etc. Four mapped sites of CEBI2, CIAR4, CIVU, HYPE, LIDA.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-69** Deschutes River Party Site **PROJECT ACRES =** 2.79 **Infested ACRES =** 0.42
**SITE TYPE:** CampDispersed **Reveg:** PassiveRest **% TREATED =** 15%
**COMMENTS:** Dispersed camping site on west side of Deschutes River. Notorious party site. Large CEBI2 population (1,000's of plants).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**11-70** North of Cardinal Bridge **PROJECT ACRES =** 0.35 **Infested ACRES =** 0.10
**SITE TYPE:** Meadow **Reveg:** PassiveRest **% TREATED =** 28%
**COMMENTS:** West side of Deschutes River, north of Cardinal Bridge, which adjoins to Sunriver. One mapped site of CIAR4.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |

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**11-71** Besson Road **PROJECT ACRES =** 30.00 **Infested ACRES =** 14.81
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 49%
**COMMENTS:** Besson Day Use Area is along west side of Deschutes River across from Sunriver Resort. Dispersed recreation area. CEBI2 occurs along road & in meadow; compacted ground makes handpulling difficult; small EUES site appears to have not spread much.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| EUES | Control | CHMA | leafy spurge | Picloram | Glyphosate | Imazapic | |

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**11-72** Deer Run Seed Orchard **PROJECT ACRES =** 38.95 **Infested ACRES =** 37.77
**SITE TYPE:** Admin **Reveg:** PassiveRest **% TREATED =** 97%
**COMMENTS:** CEBI2.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**11-73** Geothermal test drilling. **PROJECT ACRES =** 0.39 **Infested ACRES =** 0.10
**SITE TYPE:** Lake **Reveg:** PassiveRest **% TREATED =** 25%
**COMMENTS:** One LIDA mapped site.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| LIDA | Contain | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**11-74** Rd 4613 **PROJECT ACRES =** 13.47 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Collector road runs from Edison Butte area northeast to Hwy 46. Small mapped CEBI2 site (< 30 plants in 2004).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**11-75** North Twin Lake **PROJECT ACRES =** 3.83 **Infested ACRES =** 1.07
**SITE TYPE:** Lake **Reveg:** PassiveRest **% TREATED =** 28%
**COMMENTS:** High recreation use. One mapped site of CEBI2; one of CIVU.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |

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**11-76** Crane Prairie Res - NorthEast **PROJECT ACRES =** 0.19 **Infested ACRES =** 0.19
**SITE TYPE:** Lake **Reveg:** PassiveRest **% TREATED =** 100%
**COMMENTS:** Reed canarygrass & Canada thistle along shoreline of Crane Prairie Reservoir.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| PHAR3 | Contain | MECHMACU | reed canarygrass | Glyphosate | Imazapyr | Sethoxydim | |

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**11-77** Quinn Gravel Pit **PROJECT ACRES =** 21.36 **Infested ACRES =** 4.26
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 20%
**COMMENTS:** Four acres (GIS polygon) of CEBI2.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**11-78** Ice Rock Quarry **PROJECT ACRES =** 21.10 **Infested ACRES =** 19.62
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 93%
**COMMENTS:** ELRE mapped at 19 acres (GIS polygon).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ELRE4 | Eradicate | CHMA | quackgrass | Glyphosate | Chlorsulfuron+Sulfo | Sethoxydim | Imazapyr |

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**11-79** Brown's Crossing **PROJECT ACRES =** 2.27 **Infested ACRES =** 0.18
**SITE TYPE:** Stream **Reveg:** PassiveRest **% TREATED =** 8%
**COMMENTS:** Popular recreation spot. Access to fishing, hiking. One mapped site that has CEBI2, CIAR4, CIVU, HYPE, PHAR3.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| PHAR3 | Suppress | MECHMACU | reed canarygrass | Glyphosate | Imazapyr | Sethoxydim | |

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**11-80** Rd 44 at Bull Bend **PROJECT ACRES =** 1.38 **Infested ACRES =** 1.07
**SITE TYPE:** Stream **Reveg:** PassiveRest **% TREATED =** 78%
**COMMENTS:** A popular Deschutes River recreation area. PHAR3 occurs along river.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| PHAR3 | Contain | MECHMACU | reed canarygrass | Glyphosate | Imazapyr | Sethoxydim | |

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**12-01** Moore Creek timber sale units **PROJECT ACRES =** 379.67 **Infested ACRES =** 17.64
**SITE TYPE:** Plantation **Reveg:** PassiveRest **% TREATED =** 5%
**COMMENTS:** SEJA scattered throughout units. Hand-pulling has been effective & is preferred treatment. If herbicides needed, would be at specific sites that are expanding & selective backpack treatment.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIVU | Control | MA | bull thistle | N/A | N/A | N/A | N/A |
| SEJA | Eradicate | MACH | tansy ragwort | Clopyralid | chlorsulfuron | Picloram | |

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**12-02** Hwy 58, west **PROJECT ACRES =** 185.23 **Infested ACRES =** 128.17
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 69%
**COMMENTS:** West portion of Hwy 58 on east side of Odell Lake to Forest boundary. Major travel route. 13+ species occur along ROW. Numerous sites, mostly small, but some larger mapped sites of HYPE, CYSC, CEBI2.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | MA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CIVU | Control | MA | bull thistle | N/A | N/A | N/A | N/A |
| CYOF | Eradicate | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| CYSC4 | Eradicate | MA | Scotch broom | N/A | N/A | N/A | N/A |
| HYPE | Control | MA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| LIDA | Eradicate | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |
| LIVU2 | Suppress | MA | butter and eggs | Picloram | chlorsulfuron | Imazapic | |
| ONAC | Eradicate | MA | Scotch thistle | N/A | N/A | N/A | N/A |
| SEJA | Eradicate | CHMA | tansy ragwort | Clopyralid | chlorsulfuron | Picloram | |
| SIAL | Suppress | MA | white rosinweed | N/A | N/A | N/A | N/A |

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**12-03** Road 60 from 58 jct around Crescent lake, Crescent Lake Dam **PROJECT ACRES =** 269.58 **Infested ACRES =** 255.13
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 95%
**COMMENTS:** Seven weed species mapped at 4 sites, ranging in size (GIS polygons) from 0.1 to 5 acres. CIAR4, LIDA, CIVU are the largest mapped sites.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Eradicate | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CIVU | Control | MA | bull thistle | N/A | N/A | N/A | N/A |
| CYSC4 | Eradicate | MA | Scotch broom | N/A | N/A | N/A | N/A |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| LIDA | Eradicate | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**12-04** Hwy 58, east **PROJECT ACRES =** 275.23 **Infested ACRES =** 96.49
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 35%
**COMMENTS:** East portion of Hwy 58 from Hwy 97 west to Rd. 60. Major travel route. Eleven different species mapped at 6 sites. CEBI2 & HYPE dominate. Individual new plants of CESO found & pulled.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CAPU6 | Eradicate | CHMA | hairy whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CESO3 | Eradicate | CHMA | yellow star-thistle | Clopyralid | Picloram | Glyphosate | |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| COAR4 | Eradicate | CHMA | field bindweed | Picloram | Imazapic | Imazapyr | Glyphosate |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| KOSC | Eradicate | CHMA | Kochia | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |
| MEOF | Suppress | CHMA | yellow sweetclover | No Chemical | | | |
| SAKA | Eradicate | CHMA | Russian thistle | chlorsulfuron | Metsulfuron methyl | Glyphosate | |

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**12-05** Big Marsh **PROJECT ACRES =** 16.61 **Infested ACRES =** 2.74
**SITE TYPE:** Wetland **Reveg:** Revegetate **% TREATED =** 17%
**COMMENTS:** Though PHAR occurs throughout the marsh, the proposed treatment focuses on the east & west ditches where hydrologic restoration activities occur. reveg bare areas and treated areas with plugs or direct transplants.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Eradicate | MA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CIVU | Eradicate | MA | bull thistle | N/A | N/A | N/A | N/A |
| PHAR3 | Suppress | CU | reed canarygrass | Glyphosate | Imazapyr | Sethoxydim | |

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**12-06** Hwy 97 from Crescent to DES/WIN Forest Boundary **PROJECT ACRES =** 185.19 **Infested ACRES =** 116.34
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 63%
**COMMENTS:** Major travel route with new invasive species continually popping up. Currently, CEBI2, CEDI3, HYPE, CIVU occur.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Eradicate | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CIVU | Tolerate | MA | bull thistle | N/A | N/A | N/A | N/A |
| HYPE | Control | MAMECH | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |

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**12-07** Road 61 from Hwy 58 Jct east to Forest Boundary **PROJECT ACRES =** 108.06 **Infested ACRES =** 107.97
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 100%
**COMMENTS:** Five species occur within one mapped site; 2nd site of COAR occurs.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIVU | Control | MA | bull thistle | N/A | N/A | N/A | N/A |
| COAR4 | Eradicate | CHMA | field bindweed | Picloram | Imazapic | Imazapyr | Glyphosate |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| SAKA | Eradicate | MA | Russian thistle | N/A | N/A | N/A | N/A |

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**12-11** Hwy 46 from BFR boundary to 46/61 Jct **PROJECT ACRES =** 250.59 **Infested ACRES =** 137.49
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 55%
**COMMENTS:** Ten weed species have been found and pulled along this road.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Eradicate | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CIVU | Control | CHMA | bull thistle | Clopyralid | | | |
| CYSC4 | Eradicate | MA | Scotch broom | N/A | N/A | N/A | N/A |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| LEPID | Eradicate | MA | pepperweed | N/A | N/A | N/A | N/A |
| LIVU2 | Control | CHMA | butter and eggs | Picloram | chlorsulfuron | Imazapic | |
| ONAC | Eradicate | CHMA | Scotch thistle | Clopyralid | chlorsulfuron | Metsulfuron methyl | |
| SEJA | Eradicate | CHMA | tansy ragwort | Clopyralid | chlorsulfuron | Picloram | |

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**12-12** Davis Lake Shoreline **PROJECT ACRES =** 17.10 **Infested ACRES =** 17.09
**SITE TYPE:** FloodPlain **Reveg:** PassiveRest **% TREATED =** 100%
**COMMENTS:** Large CIAR4 site (7 ac. GIS polygon). PHAR3 also occurs but not proposed for treatment due to other higher priorities.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |

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**12-13** Along access road to RR T25S.R8E.S31 **PROJECT ACRES =** 1.45 **Infested ACRES =** 1.45
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 100%
**COMMENTS:** CIAR4 (0.5 gross mapped acres) occurs along a road that accesses the railroad.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Eradicate | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |

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**12-14** Harvest unit between roads 62 and 730 **PROJECT ACRES =** 4.11 **Infested ACRES =** 4.11
**SITE TYPE:** Plantation **Reveg:** PassiveRest **% TREATED =** 100%
**COMMENTS:** Tansy ragwort in harvest unit between roads 62 & 730.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| SEJA | Eradicate | CHMA | tansy ragwort | Clopyralid | chlorsulfuron | Picloram | |

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**12-15** 5800-017 road near RR tracks **PROJECT ACRES =** 1.00 **Infested ACRES =** 1.00
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 100%
**COMMENTS:** LIVU2 occurs along 5800-017 road near railroad tracks.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| LIVU2 | Control | CHMA | butter and eggs | Picloram | chlorsulfuron | Imazapic | |

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**12-16** RR ROW south of Odell Lake on Rd 6000-810 **PROJECT ACRES =** 193.47 **Infested ACRES =** 192.41
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 99%
**COMMENTS:** Railroad ROW runs east & NE of the Diamond Peak Wilderness and south of Odell Lake. 6 weed species.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CIVU | Control | MA | bull thistle | N/A | N/A | N/A | N/A |
| CYSC4 | Control | MA | Scotch broom | N/A | N/A | N/A | N/A |
| HYPE | Control | CH | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |

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**12-20** TS unit on the 6240010 road **PROJECT ACRES =** 1.00 **Infested ACRES =** 1.00
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 100%
**COMMENTS:** LIDA occurs within a timber sale unit on the 6240010 rd.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| LIDA | Eradicate | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**12-21** Rd 5835 just west of Little Deschutes River **PROJECT ACRES =** 3.58 **Infested ACRES =** 1.30
**SITE TYPE:** RangeAllot **Reveg:** PassiveRest **% TREATED =** 36%
**COMMENTS:** EUES occurs along Rd. 5835 just west of the Little Deschutes River (1 ac. GIS polygon).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| EUES | Contain | MAMECH | leafy spurge | Picloram | Glyphosate | Imazapic | |

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**15-01** Little Montana, 800 Rd **PROJECT ACRES =** 430.15 **Infested ACRES =** 262.13
**SITE TYPE:** HarvestUnit **Reveg:** PassiveRest **% TREATED =** 61%
**COMMENTS:** Large CEBI2 site in old timber sale unit and along roads. HYPE, CIAR4, CEDI3, SEJA also occur.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | MECH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| HYPE | Control | MA | St. Johnswort | N/A | N/A | N/A | N/A |
| SEJA | Eradicate | MA | tansy ragwort | N/A | N/A | N/A | N/A |

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**15-02** Abbot Butte Area **PROJECT ACRES =** 428.35 **Infested ACRES =** 114.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 27%
**COMMENTS:** Thirteen mapped sites; 6 species.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CYSC4 | Eradicate | MA | Scotch broom | N/A | N/A | N/A | N/A |
| HYPE | Control | MA | St. Johnswort | N/A | N/A | N/A | N/A |
| LIDA | Eradicate | MA | Dalmatian toadflax | N/A | N/A | N/A | N/A |

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**15-03** Rd. 16, Whychus Creek Wash areas **PROJECT ACRES =** 708.20 **Infested ACRES =** 238.76
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 34%
**COMMENTS:** Well-traveled access route to Three Creeks Meadows and trailheads. CEBI2 & CEDI3 spreading along road.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | MA | spotted knapweed | N/A | N/A | N/A | N/A |
| CEDI3 | Control | MA | diffuse knapweed | N/A | N/A | N/A | N/A |

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**15-04** Indian Ford, Sisters District, N Sisters Gravel Pit **PROJECT ACRES =** 255.48 **Infested ACRES =** 191.67
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 75%
**COMMENTS:** Includes a very disturbed former dump site often used by OHVs.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| SAKA | Control | CHMA | Russian thistle | chlorsulfuron | Metsulfuron methyl | Glyphosate | |

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**15-05** Hwy 20 road corridor & adjacent areas **PROJECT ACRES =** 686.09 **Infested ACRES =** 480.30
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 70%
**COMMENTS:** CEBI2 greatly expanding especially within B&B Fire area. Encroaching onto Willamette NF. HYPE, CEDI3, CYSC, LIDA all occur.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIVU | Suppress | MA | bull thistle | N/A | N/A | N/A | N/A |
| CYSC4 | Eradicate | MA | Scotch broom | N/A | N/A | N/A | N/A |
| HYPE | Control | CHMABIO | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| LIDA | Eradicate | MA | Dalmatian toadflax | N/A | N/A | N/A | N/A |

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**15-06** Hwy 242, Reed's Ranch **PROJECT ACRES =** 342.55 **Infested ACRES =** 340.77
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 99%
**COMMENTS:** Access route to McKenzie Pass and over to Willamette NF. Heavy use in summer. Two mapped sites of CEBI2 & CEDI3.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**15-07** Cache Fire Area **PROJECT ACRES =** 372.27 **Infested ACRES =** 76.15
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 20%
**COMMENTS:** HYPE sites along roads throughout Treatment Area and expanding since Cache Fire.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | MA | diffuse knapweed | N/A | N/A | N/A | N/A |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CIVU | Tolerate | NO | bull thistle | N/A | N/A | N/A | N/A |
| HYPE | Control | CHMABIO | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |
| SAKA | Eradicate | MA | Russian thistle | N/A | N/A | N/A | N/A |

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**15-09** Suttle Lake Area, including east of Blue Lake **PROJECT ACRES =** 128.62 **Infested ACRES =** 65.34
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 51%
**COMMENTS:** Major recreation area. CEBI2, CEDI3, HYPE occur.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| HYPE | Control | CHMABIO | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |

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**15-10** Rd 1230, "parking lot" and west BnB **PROJECT ACRES =** 827.89 **Infested ACRES =** 331.35
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 40%
**COMMENTS:** Rd. 1230 leaves Rd. 12; acces eventually leads to Mt. Jefferson Wilderness (Jack Lake). Numerous (24) mapped sites of varying sizes of 7 weed species.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | MA | diffuse knapweed | N/A | N/A | N/A | N/A |
| CIAR4 | Eradicate | MECH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CYSC4 | Eradicate | MA | Scotch broom | N/A | N/A | N/A | N/A |
| HYPE | Control | MABIO | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| SEJA | Eradicate | MA | tansy ragwort | N/A | N/A | N/A | N/A |

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**15-11** Black Butte, Rd. 1110, 1105 **PROJECT ACRES =** 524.83 **Infested ACRES =** 140.95
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 27%
**COMMENTS:** Rds. Access popular Black Butte trail. Manual treatment proposed for 4 species that occur in small populations scattered along the roads.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | MA | spotted knapweed | N/A | N/A | N/A | N/A |
| CEDI3 | Eradicate | MA | diffuse knapweed | N/A | N/A | N/A | N/A |
| HYPE | Control | MA | St. Johnswort | N/A | N/A | N/A | N/A |
| SEJA | Eradicate | MA | tansy ragwort | N/A | N/A | N/A | N/A |

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**15-12** Fly Creek area, including heli-pit, Rd 64 **PROJECT ACRES =** 482.76 **Infested ACRES =** 268.50
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 56%
**COMMENTS:** Only TACA8 site known on Deschutes NF. Fly Creek area had numerous weed sites, dry habitats, dispersed public use, different land ownerships = problem area. Goats used after Eyerly Fire to prevent seed production.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIVU | Control | MA | bull thistle | N/A | N/A | N/A | N/A |
| CYSC4 | Eradicate | MA | Scotch broom | N/A | N/A | N/A | N/A |
| HYPE | Control | CHMABIO | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| TACA8 | Control | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**15-13** 1260 Rd CIAR4 **PROJECT ACRES =** 11.09 **Infested ACRES =** 0.54
**SITE TYPE:** Plantation **Reveg:** PassiveRest **% TREATED =** 5%
**COMMENTS:** Four mapped sites of CIAR4; largest in Roaring Ck. Riparian zone..

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | MECH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |

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**15-14** Eyerly/Four Corners Area, Gunsight Pass **PROJECT ACRES =** 1,851. **Infested ACRES =** 337.07
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 18%
**COMMENTS:** Arterial & collector roads leading into NE portion Sisters District. Numerous small weed sites (mostly CEBI2, CEDI3, HYPE).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIVU | Control | CHMA | bull thistle | Clopyralid | | | |
| CYSC4 | Eradicate | MA | Scotch broom | N/A | N/A | N/A | N/A |
| HYPE | Control | MA | St. Johnswort | N/A | N/A | N/A | N/A |
| TACA8 | Control | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**15-15** Round Lake, Rd. 1210 **PROJECT ACRES =** 313.46 **Infested ACRES =** 41.11
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 13%
**COMMENTS:** Ten mapped sites of CEBI2 & HYPE.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | MA | spotted knapweed | N/A | N/A | N/A | N/A |
| HYPE | Control | MA | St. Johnswort | N/A | N/A | N/A | N/A |

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**15-16** Rd. 1220 system **PROJECT ACRES =** 253.13 **Infested ACRES =** 56.07
**SITE TYPE:** GeneralForest **Reveg:** PassiveRest **% TREATED =** 22%
**COMMENTS:** Eight mapped sites of SEJA, CEBI2, CEDI3 & HYPE.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | MA | spotted knapweed | N/A | N/A | N/A | N/A |
| CEDI3 | Eradicate | MA | diffuse knapweed | N/A | N/A | N/A | N/A |
| HYPE | Control | MA | St. Johnswort | N/A | N/A | N/A | N/A |
| SEJA | Eradicate | MA | tansy ragwort | N/A | N/A | N/A | N/A |

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**15-17** Rd. 1499 **PROJECT ACRES =** 262.47 **Infested ACRES =** 235.05
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 90%
**COMMENTS:** Road leads to Horn of Metolius area. Four mapped sites of CEBI2 & HYPE; one of CYSC4.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMABIO | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | MA | diffuse knapweed | N/A | N/A | N/A | N/A |
| CYSC4 | Eradicate | MA | Scotch broom | N/A | N/A | N/A | N/A |
| HYPE | Control | MABIO | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |

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**15-18** Rd. 1419/1420 **PROJECT ACRES =** 116.19 **Infested ACRES =** 42.35
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 36%
**COMMENTS:** Largest weed concentration near jnct. w/ 1216.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | MA | spotted knapweed | N/A | N/A | N/A | N/A |
| CEDI3 | Eradicate | MA | diffuse knapweed | N/A | N/A | N/A | N/A |
| CYSC4 | Eradicate | MA | Scotch broom | N/A | N/A | N/A | N/A |
| LIDA | Eradicate | MA | Dalmatian toadflax | N/A | N/A | N/A | N/A |

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**15-19** Rd. 14 **PROJECT ACRES =** 325.30 **Infested ACRES =** 317.91
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 98%
**COMMENTS:** Major access route into Metolius River Area. Six species mapped in Treatment Area.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CYSC4 | Eradicate | MA | Scotch broom | N/A | N/A | N/A | N/A |
| HYPE | Control | MABIO | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| LIDA | Eradicate | MA | Dalmatian toadflax | N/A | N/A | N/A | N/A |
| SEJA | Eradicate | MA | tansy ragwort | N/A | N/A | N/A | N/A |

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**15-20** Rd. 1216 and Rd. 1217 **PROJECT ACRES =** 93.04 **Infested ACRES =** 53.40
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 57%
**COMMENTS:** CEBI2 & HYPE occur. Rd. 1216 runs through private land.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | MA | spotted knapweed | N/A | N/A | N/A | N/A |
| HYPE | Control | CHMABIO | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |

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**15-21** Rd. 12 and Dahl vicinity **PROJECT ACRES =** 634.93 **Infested ACRES =** 132.76
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 21%
**COMMENTS:** Access route for various recreation areas. Numerous sites (18) of CEBI2, CEDI3, CYSC4, HYPE, CIAR4, LIDA.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | MA | spotted knapweed | N/A | N/A | N/A | N/A |
| CEDI3 | Eradicate | MA | diffuse knapweed | N/A | N/A | N/A | N/A |
| CIAR4 | Eradicate | MECH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CYSC4 | Eradicate | MA | Scotch broom | N/A | N/A | N/A | N/A |
| HYPE | Eradicate | MA | St. Johnswort | N/A | N/A | N/A | N/A |
| LIDA | Eradicate | MA | Dalmatian toadflax | N/A | N/A | N/A | N/A |

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**15-22** Trout Creek Butte, swamp **PROJECT ACRES =** 468.96 **Infested ACRES =** 89.01
**SITE TYPE:** Meadow **Reveg:** Revegetate **% TREATED =** 19%
**COMMENTS:** Though TA appears to be mostly roads, it also includes large PHAR3 infestation in Trout Ck. Swamp; SEJA & CIAR4 occur in Treatment Area also. PHAR sites in Trout Creek Swamp are proposed for revegetation. RCG – weed whack; spray after regrowth

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Eradicate | MECH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CIVU | Control | MA | bull thistle | N/A | N/A | N/A | N/A |
| PHAR3 | Control | MECHMACU | reed canarygrass | Glyphosate | Imazapyr | Sethoxydim | |
| SEJA | Eradicate | MA | tansy ragwort | N/A | N/A | N/A | N/A |

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**15-24** Brooks Scanlon Rd. (Gist Rd. neighborhood) incl 4606 Rd. **PROJECT ACRES =** 269.60 **Infested ACRES =** 72.76
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 27%
**COMMENTS:** Two mapped sites of CEDI3 and CEBI2.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Eradicate | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**15-25** North of Dry Creek Swamp, 1028 Rd. **PROJECT ACRES =** 120.49 **Infested ACRES =** 30.13
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 25%
**COMMENTS:** One mapped site of CEBI2; one site of LIDA.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Eradicate | MA | Dalmatian toadflax | N/A | N/A | N/A | N/A |

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**15-27** Glaze Meadow **PROJECT ACRES =** 81.32 **Infested ACRES =** 71.21
**SITE TYPE:** Meadow **Reveg:** PassiveRest **% TREATED =** 88%
**COMMENTS:** Small LIDA population. CIVU is more dominant species.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIVU | Control | MA | bull thistle | N/A | N/A | N/A | N/A |

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**15-30** Corbett Sno-Park, Meadow Lakes Area **PROJECT ACRES =** 370.52 **Infested ACRES =** 161.63
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 44%
**COMMENTS:** HYPE greatly expanding since B&B Fire. High dispersed recreation use throughout area. Lot of HYPE radiating out from Corbett Sno-Park; large CEBI2 (> 1,000 plants as of 2004), plus smaller CEBI2 populations, CIAR4, and some CEDI3.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Eradicate | MECH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| HYPE | Control | CHMABIO | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| SEJA | Eradicate | MA | tansy ragwort | N/A | N/A | N/A | N/A |

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**15-31** NW 1290 and vicinity — **PROJECT ACRES =** 100.40 — **Infested ACRES =** 49.72
**SITE TYPE:** Road — **Reveg:** PassiveRest — **% TREATED =** 50%
**COMMENTS:** 1292 & associated rds. End at Mt. Jefferson Wilderness (Cabot Creek area). Four mapped sites of CEBI2, HYPE, CYSC, & LIDA.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CARDA | Eradicate | MA | bittercress | N/A | N/A | N/A | N/A |
| CEBI2 | Eradicate | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CYSC4 | Eradicate | CHMA | Scotch broom | Triclopyr | Picloram | Glyphosate | |
| HYPE | Control | MA | St. Johnswort | N/A | N/A | N/A | N/A |
| LIDA | Eradicate | MA | Dalmatian toadflax | N/A | N/A | N/A | N/A |

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**15-32** Metolius River — **PROJECT ACRES =** 119.28 — **Infested ACRES =** 119.19
**SITE TYPE:** Stream — **Reveg:** Revegetate — **% TREATED =** 100%
**COMMENTS:** Metolius River ribbongrass sites. Many unique natural values and high recreation use.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| PHARP | Control | CHMA | ribbongrass | Glyphosate | Imazapyr | Sethoxydim | |

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**71-01** North Fork Pit — **PROJECT ACRES =** 8.63 — **Infested ACRES =** 0.10
**SITE TYPE:** Quarry — **Reveg:** PassiveRest — **% TREATED =** 1%
**COMMENTS:** CEBI2.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**71-02** Hwy 26 — **PROJECT ACRES =** 274.77 — **Infested ACRES =** 1.57
**SITE TYPE:** Road — **Reveg:** PassiveRest — **% TREATED =** 1%
**COMMENTS:** High traffic corridor. Weeds can pop up anywhere along this road. Currently, 17 mapped sites, 8 weed species.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ACRE3 | Control | CHMA | Russian knapweed | Picloram | Clopyralid | chlorsulfuron | Glyphosate |
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CYOF | Control | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |
| ONAC | Control | CHMA | Scotch thistle | Clopyralid | chlorsulfuron | Metsulfuron methyl | |
| TACA8 | Control | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-03** Hon Spring — **PROJECT ACRES =** 1.11 — **Infested ACRES =** 0.40
**SITE TYPE:** Meadow — **Reveg:** PassiveRest — **% TREATED =** 36%
**COMMENTS:** CADR.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CADR | Control | CHMA | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |

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**71-04** Koch Butte — **PROJECT ACRES =** 1.10 — **Infested ACRES =** 0.24
**SITE TYPE:** GeneralForest — **Reveg:** PassiveRest — **% TREATED =** 22%
**COMMENTS:** EUES.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| EUES | Control | CHMA | leafy spurge | Picloram | Glyphosate | Imazapic | |

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**71-05** 2600-160 Rd — **PROJECT ACRES =** 1.11 — **Infested ACRES =** 0.24
**SITE TYPE:** Road — **Reveg:** PassiveRest — **% TREATED =** 22%
**COMMENTS:** CADR.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CADR | Control | CHMA | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |

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**71-06** 2730-501 Rd Pit — **PROJECT ACRES =** 2.97 — **Infested ACRES =** 0.10
**SITE TYPE:** Quarry — **Reveg:** PassiveRest — **% TREATED =** 3%
**COMMENTS:** About 3 acres of CEBI2.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**71-07** Walton Lk. Loop **PROJECT ACRES =** 19.05 **Infested ACRES =** 0.2
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** %
**COMMENTS:** Walton Lake Loop Rd. Heavy recreation use. CEBI2, CIAR4, SEJA occur.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | MA | spotted knapweed | N/A | N/A | N/A | N/A |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| SEJA | Control | MA | tansy ragwort | N/A | N/A | N/A | N/A |

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**71-08** Rd. 42 + s. portion of Rd. 30 + 42-320 **PROJECT ACRES =** 81.08 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Rd. 42 + s. portion of Rd. 30 + 42-320; One ONAC site estimated at 0.5 ac.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| ONAC | Control | CHMA | Scotch thistle | Clopyralid | chlorsulfuron | Metsulfuron methyl | |

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**71-10** 2200-459 Rd. **PROJECT ACRES =** 32.62 **Infested ACRES =** 18.27
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 56%
**COMMENTS:** CESO3 on 5 ac. Site; TACA8 on 0.5 ac.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CESO3 | Eradicate | CHMA | yellow star-thistle | Clopyralid | Picloram | Glyphosate | |
| TACA8 | Eradicate | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-11** 4215 Rd. **PROJECT ACRES =** 78.18 **Infested ACRES =** 44.59
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 57%
**COMMENTS:** Crosses Horse Heaven, Buck, & Lodgepole Creeks. CADR & HYPE occur.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CADR | Control | CHMA | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |

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**71-12** 4235 Rd. **PROJECT ACRES =** 49.09 **Infested ACRES =** 0.20
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Western edge of TA by a creek (not named) has CADR. Road crosses Lost Creek. TACA8 also mapped. ACRE3, CEBI2 & LIVU2 also occur.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ACRE3 | Control | CHMA | Russian knapweed | Picloram | Clopyralid | chlorsulfuron | Glyphosate |
| CADR | Control | CHMA | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIVU2 | Control | CHMA | butter and eggs | Picloram | chlorsulfuron | Imazapic | |
| TACA8 | Eradicate | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-13** 4240-200 **PROJECT ACRES =** 30.02 **Infested ACRES =** 0.39
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Two sites of ONAC & one site of SAAE currently mapped.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ONAC | Control | CHMA | Scotch thistle | Clopyralid | chlorsulfuron | Metsulfuron methyl | |
| SAAE | Control | CHMA | Mediterranean sage | Metsulfuron methyl | chlorsulfuron | Picloram | |

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**71-14** 2630 Rd System **PROJECT ACRES =** 46.27 **Infested ACRES =** 0.20
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Small CESO3 (as of 1998) site; one CYOF site mapped; TACA8 also occurs.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CESO3 | Eradicate | CHMA | yellow star-thistle | Clopyralid | Picloram | Glyphosate | |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| TACA8 | Eradicate | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-15** 2630 system **PROJECT ACRES =** 17.27 **Infested ACRES =** 9.60
**SITE TYPE:** GeneralForest **Reveg:** PassiveRest **% TREATED =** 56%
**COMMENTS:** A portion of the 2630-450 Rd. has houndstongue along it. Road adjacent to Bridge Creek Wilderness. CYOF mapped length of Treatment Area.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**71-16** 2210 System **PROJECT ACRES =** 437.19 **Infested ACRES =** 243.77
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 56%
**COMMENTS:** Two large houndstongue sites (5 & 2 ac. Infestations; high priority LOM species) plust numerous smaller CYOF sites. ARMI2 & CEBI2 also occur.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ARMI2 | Control | CHMA | Lesser burdock | Metsulfuron methyl | Picloram | chlorsulfuron | |
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**71-17** 2610 Rd. and Coyle Material Source **PROJECT ACRES =** 51.61 **Infested ACRES =** 3.87
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 7%
**COMMENTS:** Eleven mapped sites of 6 different species.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ACRE3 | Control | CHMA | Russian knapweed | Picloram | Clopyralid | chlorsulfuron | Glyphosate |
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| SAAE | Control | CHMA | Mediterranean sage | Metsulfuron methyl | chlorsulfuron | Picloram | |
| TACA8 | Control | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-18** 42 Rd. **PROJECT ACRES =** 186.56 **Infested ACRES =** 0.20
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:**

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIVU2 | Control | CHMA | butter and eggs | Picloram | chlorsulfuron | Imazapic | |
| SAAE | Control | CHMA | Mediterranean sage | Metsulfuron methyl | chlorsulfuron | Picloram | |

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**71-19** 22 Rd. **PROJECT ACRES =** 679.16 **Infested ACRES =** 11.74
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:** Primary access route; access to Walton Lake; extensive road network with 29 mapped weed sites, 7 species. (TACA8, CYOF, ONAC, CEBI2 are in the top 5 priority species for treatment on LOM).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| ONAC | Control | CHMA | Scotch thistle | Clopyralid | chlorsulfuron | Metsulfuron methyl | |
| SAAE | Control | CHMA | Mediterranean sage | Metsulfuron methyl | chlorsulfuron | Picloram | |
| TACA8 | Eradicate | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-22** 2300-200 System **PROJECT ACRES =** 126.35 **Infested ACRES =** 0.39
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Currently, 3 mapped sites of CEBI2 and one mapped site of CIAR4.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | BIO | Canada thistle | N/A | N/A | N/A | N/A |

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**71-23** 2200 Rd. System & 2630, 2630-358, 2630-368 Rds **PROJECT ACRES =** 187.29 **Infested ACRES =** 0.30
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Accesses south side Bridge Ck. Wilderness & Mt. Pisgah Lookout. CEBI2 & CYOF occur.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**71-24** 3010 Rd System **PROJECT ACRES =** 28.19 **Infested ACRES =** 21.96
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 78%
**COMMENTS:** CEBI2 occurs along road.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**71-25** 4240 Rd System **PROJECT ACRES =** 172.33 **Infested ACRES =** 0.24
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Access rd. from Rd. 42 to North Fork Crooked River Wild & Scenic River. CYOF near river near upper falls. CIVU, LIVU2, CEDI3 occur.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIVU | Tolerate | NO | bull thistle | N/A | N/A | N/A | N/A |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**71-28** 2600-700 System **PROJECT ACRES =** 38.42 **Infested ACRES =** 0.99
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 3%
**COMMENTS:** Snowshoe Point area. Ten mapped weed sites, 9 < 0.1 ac.; largest site, TACA8, is 0.5 acre.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| COAR4 | Control | CHMA | field bindweed | Picloram | Imazapic | Imazapyr | Glyphosate |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| TACA8 | Eradicate | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-29** 2600-100 **PROJECT ACRES =** 52.62 **Infested ACRES =** 0.20
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Access to Mill Creek Wilderness. Two CEDI3 mapped sites.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**71-30** 2600-250 **PROJECT ACRES =** 30.19 **Infested ACRES =** 0.06
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** One CEBI2 site mapped at north end of Treatment Area.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**71-31** 2600-450 **PROJECT ACRES =** 21.64 **Infested ACRES =** 0.30
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Rd. runs from Hwy 26 east towards Ochoco Divide RNA. Three mapped CYOF sites.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**71-32** 2600-600 System **PROJECT ACRES =** 223.03 **Infested ACRES =** 13.85
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 6%
**COMMENTS:** Roads access north portion of Ochoco Divide RNA. CYOF & TACA are higr priority spp. for LOM.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| COAR4 | Control | CHMA | field bindweed | Picloram | Imazapic | Imazapyr | Glyphosate |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| TACA8 | Eradicate | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |
| | | CHMA | yellow flag iris | Imazapyr | | | |

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**71-33** 2630 Rds.-- 150, 155, 350, 400, 415, 420. **PROJECT ACRES =** 274.89 **Infested ACRES =** 1.77
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Various roads that travel north off of the 2630 Rd. CYOF (high priority LOM species).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**71-34** Sears Creek Material Source **PROJECT ACRES =** 5.85 **Infested ACRES =** 0.10
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:**

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ONAC | Control | CHMA | Scotch thistle | Clopyralid | chlorsulfuron | Metsulfuron methyl | |

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**71-35** Blevins Seed Orchard **PROJECT ACRES =** 7.06 **Infested ACRES =** 0.00
**SITE TYPE:** Clearing **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:**

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Suppress | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |

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**71-36** 2600-050 **PROJECT ACRES =** 32.68 **Infested ACRES =** 0.20
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Currently, one mapped site of CEBI2 and one site of CIAR4 mapped.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |

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**71-37** 4200-050 **PROJECT ACRES =** 13.40 **Infested ACRES =** 0.19
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Currently one mapped site of CEBI2, one DIFU2.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| DIFU2 | Tolerate | NO | teasel | N/A | N/A | N/A | N/A |

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**71-38** Independent Mine **PROJECT ACRES =** 4.82 **Infested ACRES =** 0.10
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:** Quarry and trailhead. One mapped site of LIVU2.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| LIVU | Control | CHMA | butter and eggs | Picloram | Chlorsulfuron | Imazapic | |

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**71-39** 4200-170 **PROJECT ACRES =** 42.69 **Infested ACRES =** 0.53
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** CEBI2 - estimated on about 0.25 ac..

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**71-40** FS 1610, 1620 Rd. System **PROJECT ACRES =** 141.28 **Infested ACRES =** 0.67
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** 7 CIAR4 mapped sites, ranging in size from 0.1-0.5 gross ac.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ACRE3 | Control | CHMA | Russian knapweed | Picloram | Clopyralid | chlorsulfuron | Glyphosate |
| CADR | Control | CHMA | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| CIVU | Tolerate | NO | bull thistle | N/A | N/A | N/A | N/A |
| DIFU2 | Tolerate | NO | teasel | N/A | N/A | N/A | N/A |
| PORE5 | Control | CHMA | sulphur cinquefoil | Picloram | Triclopyr | Glyphosate | |

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**71-41** 4230-500, 600 **PROJECT ACRES =** 118.81 **Infested ACRES =** 1.18
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** CEBI2 & CEDI3.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**71-42** 2200-856 **PROJECT ACRES =** 8.08 **Infested ACRES =** 0.66
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 8%
**COMMENTS:** Only mapped site of CANU4 on LOM. TACA8 also occurs.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CANU4 | Control | CHMA | musk thistle | Clopyralid | Metsulfuron methyl | chlorsulfuron | |
| TACA8 | Eradicate | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-43** 4230-100 and Lutsey Pit **PROJECT ACRES =** 41.02 **Infested ACRES =** 0.05
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:**

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**71-44** 2600-300 and McGinnis Pit **PROJECT ACRES =** 15.11 **Infested ACRES =** 0.10
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** teasel also present in waste piles in pit

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CYSC4 | Control | CHMA | Scotch broom | Triclopyr | Picloram | Glyphosate | |

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**71-45** 2620-150, 020, Hamilton Pit **PROJECT ACRES =** 89.51 **Infested ACRES =** 1.97
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:**

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**71-46** 2610 Rd. System **PROJECT ACRES =** 162.27 **Infested ACRES =** 0.27
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** CYOF, CEBI2, and DIFU2.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| DIFU2 | Tolerate | NO | teasel | N/A | N/A | N/A | N/A |

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**71-48** 27, 33 Rd System, West **PROJECT ACRES =** 341.06 **Infested ACRES =** 14.67
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 4%
**COMMENTS:** At least 11 invasive species have been found along this primary access route to western parts of Lookout Mt. District.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CADR | Control | CHMA | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| COAR4 | Control | CH | field bindweed | Picloram | Imazapic | Imazapyr | Glyphosate |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| DIFU2 | Tolerate | NO | teasel | N/A | N/A | N/A | N/A |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| PORE5 | Control | CHMA | sulphur cinquefoil | Picloram | Triclopyr | Glyphosate | |
| TACA8 | Eradicate | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-49** 33 Rd. System, East **PROJECT ACRES =** 141.23 **Infested ACRES =** 1.16
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Primary access route to some trailheads, including Mill Ck. Wilderness. Twelve mapped sites; 8 different weed species occur at scattered locations along Rd. 33.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| COAR4 | Control | CHMA | field bindweed | Picloram | Imazapic | Imazapyr | Glyphosate |
| CYSC4 | Control | CHMA | Scotch broom | Triclopyr | Picloram | Glyphosate | |
| EUES | Control | CHMA | leafy spurge | Picloram | Glyphosate | Imazapic | |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| TACA8 | Eradicate | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-50** 2730, 2735 Rd System **PROJECT ACRES =** 571.68 **Infested ACRES =** 1.94
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Extensive network of roads with 22 mapped weed sites, 7 species. Accesses northern part of Mill Ck. Wilderness.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ACRE3 | Control | CHMA | Russian knapweed | Picloram | Clopyralid | chlorsulfuron | Glyphosate |
| CADR | Control | CHMA | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| PORE5 | Control | CHMA | sulphur cinquefoil | Picloram | Triclopyr | Glyphosate | |

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**71-51** FS 16, 17, 1680 Rd. System **PROJECT ACRES =** 650.24 **Infested ACRES =** 36.04
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 6%
**COMMENTS:** Road network in Maury Mts., including Antelope Reservoir. 36 mapped invasive plant sites; 8 species; scattered locations.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ACRE3 | Control | CHMA | Russian knapweed | Picloram | Clopyralid | chlorsulfuron | Glyphosate |
| CADR | Control | CHMA | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| CIVU | Tolerate | NO | bull thistle | N/A | N/A | N/A | N/A |
| DIFU2 | Tolerate | NO | teasel | N/A | N/A | N/A | N/A |
| PORE5 | Control | CHMA | sulphur cinquefoil | Picloram | Triclopyr | Glyphosate | |

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**71-52** 3360 Rd. System **PROJECT ACRES =** 57.58 **Infested ACRES =** 0.10
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Eight invasive species occur along the road.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| COAR4 | Control | CHMA | field bindweed | Picloram | Imazapic | Imazapyr | Glyphosate |
| CYSC4 | Control | CHMA | Scotch broom | Triclopyr | Picloram | Glyphosate | |
| EUES | Control | CHMA | leafy spurge | Picloram | Glyphosate | Imazapic | |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| TACA8 | Eradicate | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-53** 3370 Rd. System **PROJECT ACRES =** 60.83 **Infested ACRES =** 0.42
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Five HYPE sites along the 3380 rd. that branches off of the 3370 rd.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| COAR4 | Control | CHMA | field bindweed | Picloram | Imazapic | Imazapyr | Glyphosate |
| CYSC4 | Control | CHMA | Scotch broom | Triclopyr | Picloram | Glyphosate | |
| EUES | Control | CHMA | leafy spurge | Picloram | Glyphosate | Imazapic | |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| TACA8 | Eradicate | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-54** E. Maury Mts Rd. System **PROJECT ACRES =** 126.07 **Infested ACRES =** 1.24
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** This road system that accesses the east portion of the Maury Mts. has 14 mapped, small (0.1 or < ac.) sites of 7 invasive species.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ACRE3 | Control | CHMA | Russian knapweed | Picloram | Clopyralid | chlorsulfuron | Glyphosate |
| CADR | Control | CHMA | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**71-55** 2720, 2725, 752 spur and Trout Timber Sale Roads **PROJECT ACRES =** 566.34 **Infested ACRES =** 4.07
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Network of roads for Trout Timber Sale. Numerous sites; 6 weed species; majority of sites 0.1 or < acres.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| PORE5 | Control | CHMA | sulphur cinquefoil | Picloram | Triclopyr | Glyphosate | |
| TACA8 | Eradicate | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-56** 2730, 2745, 2725 Rd. System **PROJECT ACRES =** 525.37 **Infested ACRES =** 1.79
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** This road complex accesses northern portion of Mill Creek Wilderness. Numerous, small, scattered invasive plant sites.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDET | Control | CH | meadow knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| PORE5 | Control | CH | sulphur cinquefoil | Picloram | Triclopyr | Glyphosate | |

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**71-57** Mill Cr. Wilderness **PROJECT ACRES =** 31.58 **Infested ACRES =** 0.49
**SITE TYPE:** Trail **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:** Accesses Mill Creek Wilderness (southwest portion). CEDI3 mapped on 5 sites estimated between 0.1-0.5 ac.in size.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | MA | spotted knapweed | N/A | N/A | N/A | N/A |
| CEDI3 | Control | MA | diffuse knapweed | N/A | N/A | N/A | N/A |

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**71-58** Allen Cr. **PROJECT ACRES =** 15.41 **Infested ACRES =** 0.28
**SITE TYPE:** RoadStream **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:** Less than 1/2 a section of FS land surrounded by private land. Road follows Allen Creek. CEBI2 mapped (2 sites, both estimated at 0.1 ac.).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CADR | Control | CHMA | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**71-59** 27 and 3320 Rd. System **PROJECT ACRES =** 364.52 **Infested ACRES =** 3.30
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Access to recreation sites (trailheads), Mill Creek Wilderness. Numerous weed sites, ranging from 0.1 - 1 ac. in size.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| CYSC4 | Control | CHMA | Scotch broom | Triclopyr | Picloram | Glyphosate | |
| DIFU2 | Tolerate | NO | teasel | N/A | N/A | N/A | N/A |
| PORE5 | Control | CHMA | sulphur cinquefoil | Picloram | Triclopyr | Glyphosate | |

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**71-60** 3300-213 Rd. **PROJECT ACRES =** 34.57 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** One site of CEDI3 mapped (estimated at 0.1 ac.).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**71-61** 3300-500 Rd. System **PROJECT ACRES =** 524.79 **Infested ACRES =** 3.90
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** This network of roads has numerous, scattered sites, 4 different species. Sites range from 0.1 ac.to 5 acres in size. CEBI2, CEDI3, CYOF, HYPE.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |

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**71-62** 1750-100, 150, 250 Rd. **PROJECT ACRES =** 237.70 **Infested ACRES =** 21.04
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 9%
**COMMENTS:** In southwest portion of Maury Mts.; 11 mapped weed sites ranging from 0.1 or < gross acres (CEDI3, CEBI2, ONAC, CIAR4) to 0.5 ac. (TACA8, CIAR4) to 5 ac. (SAAE).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| ONAC | Control | CHMA | Scotch thistle | Clopyralid | chlorsulfuron | Metsulfuron methyl | |
| SAAE | Control | CHMA | Mediterranean sage | Metsulfuron methyl | chlorsulfuron | Picloram | |

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**71-63** 1700-159 Rd. **PROJECT ACRES =** 15.02 **Infested ACRES =** 0.20
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** CIAR4 (2 mapped sites).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |

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**71-65** FS 16, 1670 Rd. System **PROJECT ACRES =** 385.02 **Infested ACRES =** 4.54
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Maury Mts. Numerous sites scattered along roads; 6 species. Majority of sites are 0.1 ac. Infestation or less; a few are estimated at 0.5 ac.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CADR | Control | CHMA | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| PORE5 | Control | CHMA | sulphur cinquefoil | Picloram | Triclopyr | Glyphosate | |

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**71-66** Appears to be a quarry on map **PROJECT ACRES =** 2.04 **Infested ACRES =** 0.10
**SITE TYPE:** RoadForest **Reveg:** PassiveRest **% TREATED =** 5%
**COMMENTS:** EUES - one site mapped.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| EUES | Control | CH | leafy spurge | Picloram | Glyphosate | Imazapic | |

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**71-67** Rd 2200-903 **PROJECT ACRES =** 22.84 **Infested ACRES =** 0.39
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:** Four mapped sites of TACA8, each estimated at 0.1 gross acres.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| TACA8 | Eradicate | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-68** Gibson Spring Quarry **PROJECT ACRES =** 5.89 **Infested ACRES =** 0.10
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:** About 5 acres CIAR4 infestation within quarry.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Eradicate | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |

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**71-69** Upper Hedgepath Creek **PROJECT ACRES =** 0.40 **Infested ACRES =** 0.10
**SITE TYPE:** Stream **Reveg:** PassiveRest **% TREATED =** 25%
**COMMENTS:** CIAR4.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |

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**71-70** Rd 2610-012 **PROJECT ACRES =** 11.75 **Infested ACRES =** 2.36
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 20%
**COMMENTS:** One mapped site of TACA8.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| TACA8 | Eradicate | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-71** Rd 4230-924 **PROJECT ACRES =** 0.42 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 23%
**COMMENTS:** CIVU occurs but not proposed for treatment.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIVU | Tolerate | NO | bull thistle | N/A | N/A | N/A | N/A |

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**71-72** Rd 4230-921 **PROJECT ACRES =** 0.42 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 23%
**COMMENTS:** CIVU occurs but not proposed for treatment.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIVU | Tolerate | NO | bull thistle | N/A | N/A | N/A | N/A |

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**71-73** Rd 2300-220 **PROJECT ACRES =** 1.62 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 6%
**COMMENTS:** One mapped site of CEDI3.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**71-74** Rd 3350 **PROJECT ACRES =** 21.99 **Infested ACRES =** 0.34
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:** CYSC, CYOF, TACA8 (one mapped site of each). TACA8 estimated at 0.5 ac. Other sites about 0.1 ac.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| CYSC4 | Control | CHMA | Scotch broom | Triclopyr | Picloram | Glyphosate | |
| TACA8 | Eradicate | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-75** Rd 4200115,2630,2630370,2200147,2610300,2300220,2300226 **PROJECT ACRES =** 63.72 **Infested ACRES =** 4.80
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 8%
**COMMENTS:** Need clarification. Treatment Area database lists numerous roads with numerous CIAR4 sites. Current GIS layer shows that TA has only one mapped CIAR4 site (#244) at < .1 ac.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |

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**71-76** Rd 3300-522 **PROJECT ACRES =** 15.77 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** One mapped site of TACA8.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| TACA8 | Eradicate | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-77** Rd 4240-211 **PROJECT ACRES =** 0.42 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 23%
**COMMENTS:**

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIVU | Tolerate | NO | bull thistle | N/A | N/A | N/A | N/A |

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**71-78** Rd 2610-050 **PROJECT ACRES =** 24.10 **Infested ACRES =** 0.20
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** One mapped site of CEDI3; one site of TACA8.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| TACA8 | Eradicate | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**71-80** 200 RD - MAURY **PROJECT ACRES =** 0.35 **Infested ACRES =** 0.10
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 28%
**COMMENTS:** ONAC site in SE Maury Mts.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ONAC | Control | CHMA | Scotch thistle | Clopyralid | chlorsulfuron | Metsulfuron methyl | |

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**71-81** Blaster Fire **PROJECT ACRES =** 22.95 **Infested ACRES =** 0.49
**SITE TYPE:** Fire **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:** fire occurred 1995. 5 sites of 4 species.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CYOF | Control | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| DIFU2 | Tolerate | NO | teasel | N/A | N/A | N/A | N/A |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |

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**72-01** 58, 5870, 58-800 roads **PROJECT ACRES =** 582.90 **Infested ACRES =** 45.13
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 8%
**COMMENTS:** Primary Rd. through Rager. Numerous small weed sites widely scattered along roads in this TA. 10 weed species mapped.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ACRE3 | Eradicate | CH | Russian knapweed | Picloram | Clopyralid | chlorsulfuron | Glyphosate |
| CADR | Eradicate | CH | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Eradicate | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| HYPE | Eradicate | CH | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| PORE5 | Control | CH | sulphur cinquefoil | Picloram | Triclopyr | Glyphosate | |

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**72-02** 3810 road (& 58 from Miller's to Wolf Cr) **PROJECT ACRES =** 155.77 **Infested ACRES =** 14.25
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 9%
**COMMENTS:** Includes portion of Rd. 42 (Database says Rd. 58, but does not appear to be in TA). Numerous relatively small sites of 8 species scattered along TA.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CADR | Eradicate | CH | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Eradicate | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| HYPE | Eradicate | CH | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| LIDA | Eradicate | CH | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |
| PORE5 | Suppress | CHMA | sulphur cinquefoil | Picloram | Triclopyr | Glyphosate | |

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**72-03** 42 Road **PROJECT ACRES =** 361.91 **Infested ACRES =** 16.75
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 5%
**COMMENTS:** Primary access route bisecting Paulina District. Numerous mapped sites mapped; one large, dense CYOF (#419) listed in TA 72-03, 72-15, & 72-37, but mostly in 72-37; 2nd large CYOF site (#324) mostly in 72-39.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ACRE3 | Eradicate | CH | Russian knapweed | Picloram | Clopyralid | chlorsulfuron | Glyphosate |
| CADR | Eradicate | CH | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Eradicate | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CYOF | Eradicate | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| HYPE | Eradicate | CH | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |

**72-04** 4250 road to 4256 jct. and the 4250-100 road **PROJECT ACRES =** 144.43 **Infested ACRES =** 10.35
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 7%
**COMMENTS:** Six weed species are found along this road.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| COAR4 | Eradicate | CH | field bindweed | Picloram | Imazapic | Imazapyr | Glyphosate |
| CYOF | Eradicate | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| CYSC4 | Eradicate | CH | Scotch broom | Triclopyr | Picloram | Glyphosate | |
| LIDA | Eradicate | CH | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |
| PORE5 | Control | CH | sulphur cinquefoil | Picloram | Triclopyr | Glyphosate | |

**72-05** 30 Road and 30-750 **PROJECT ACRES =** 195.11 **Infested ACRES =** 26.96
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 14%
**COMMENTS:** 3 small populations mapped. Herbicide spraying has occurred along road & in plantations. Both CEBI2 & CEDI3.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

**72-06** 2630 Rd and 12 Rd to Forest Boundary **PROJECT ACRES =** 235.79 **Infested ACRES =** 1.12
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Small sites of 4 different weed species scattered along roads & in plantation.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CYOF | Eradicate | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| DIFU2 | Eradicate | CH | teasel | No Chemical | | | |

**72-07** 38 Road, 3820 rd, 38-120 road **PROJECT ACRES =** 434.20 **Infested ACRES =** 4.93
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Provides access to roads that lead to Black Canyon Wilderness. Rock Ck. Trailhead appears close to 2 CIAR4 sites.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CESO3 | Eradicate | CH | yellow star-thistle | Clopyralid | Picloram | Glyphosate | |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |

**72-08** 5820 Road **PROJECT ACRES =** 254.83 **Infested ACRES =** 1.35
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** 5 weed species. One TACA site has 1,000's of plants - Highest priority species for control on Paulina District.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CADR | Eradicate | CH | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Eradicate | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| CYOF | Eradicate | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| TACA8 | Eradicate | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

**72-09** 5840 and the 5830-400 system **PROJECT ACRES =** 303.69 **Infested ACRES =** 1.73
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Access to Wolf Mt. Lookout & SW of Black Canyon Wilderness. Five weed species. Two TACA sites on 5830-400 road are high district priority.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| HYPE | Eradicate | CH | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| TACA8 | Eradicate | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**72-10** 5850 and 5850-400 roads **PROJECT ACRES =** 267.44 **Infested ACRES =** 0.49
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Access to SE Black Canyon Wilderness. Four weed species occur, relatively widely dispersed along roads.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CADR | Control | CH | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| DIFU2 | Eradicate | CH | teasel | No Chemical | | | |
| PORE5 | Tolerate | NO | sulphur cinquefoil | N/A | N/A | N/A | N/A |

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**72-11** 58-550 Road **PROJECT ACRES =** 111.24 **Infested ACRES =** 1.65
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Below (SE) of Hardscrabble Ridge. Sites of four species mapped, but large CYOF site also reported to occur on both sides of 550 rd. near jnct. w/ 58 Rd. (also CEBI2 at jnct.).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| EUES | Eradicate | CH | leafy spurge | Picloram | Glyphosate | Imazapic | |
| PORE5 | Control | CH | sulphur cinquefoil | Picloram | Triclopyr | Glyphosate | |

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**72-12** `Parts of the 12, 4250 and 4274 roads **PROJECT ACRES =** 281.13 **Infested ACRES =** 0.87
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Three weed species widely scattered along roads in treatment area.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |

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**72-13** 4270 road, part of 4274 road and 4254 road **PROJECT ACRES =** 271.31 **Infested ACRES =** 1.11
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Numerous small weed sites scattered along roads; 6 different weed species.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Eradicate | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CYOF | Eradicate | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| HYPE | Eradicate | CH | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |
| LIDA | Eradicate | CH | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |
| PORE5 | Control | CH | sulphur cinquefoil | Picloram | Triclopyr | Glyphosate | |

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**72-14** 4260 Road **PROJECT ACRES =** 324.33 **Infested ACRES =** 13.60
**SITE TYPE:** RoadPlus **Reveg:** Revegetate **% TREATED =** 4%
**COMMENTS:** Road crosses other treatment areas/weed sites (overlap with TA 72-20, 38, 42, & 44). Mostly numerous CYOF scattered along road, but also TACA, CIAR4, and very small DIFU2.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| DIFU2 | Eradicate | CH | teasel | No Chemical | | | |
| TACA8 | Eradicate | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**72-15** 4280 road, 4280-060 and 4280-061 **PROJECT ACRES =** 187.21 **Infested ACRES =** 58.73
**SITE TYPE:** RoadStream **Reveg:** Revegetate **% TREATED =** 31%
**COMMENTS:** Both CYOF & CIAR; bisects large, dense CYOF in timber sale plantations - site is mostly in TA 72-37.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CYOF | Control | MEFICHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-16** 4260-570 **PROJECT ACRES =** 14.12 **Infested ACRES =** 0.20
**SITE TYPE:** RoadPlus **Reveg:** Revegetate **% TREATED =** 1%
**COMMENTS:** Two TACA8 sites mapped in 1998; one on private land.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| TACA8 | Eradicate | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**72-17** 4260-560 system **PROJECT ACRES =** 50.80 **Infested ACRES =** 21.17
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 42%
**COMMENTS:** TACA8 site at lower portion of TA by Forest boundary. Other CYOF sites dispersed along rd.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| TACA8 | Eradicate | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**72-18** 4260-650 road **PROJECT ACRES =** 106.41 **Infested ACRES =** 35.34
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 33%
**COMMENTS:** Mostly CYOF; small population of CEDI3 by northern portion of road. Largest CYOF sites overlap with TA 72-38 & 72-39.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Eradicate | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CYOF | Control | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-19** 4260-500 and 4260-501 Roads **PROJECT ACRES =** 34.44 **Infested ACRES =** 5.61
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 16%
**COMMENTS:** Three mapped CYOF sites (2 > 500 plants in 2004; 1 about 100 plants in 2005).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-20** 4260-400, 4260-300 and 4260-360 roads **PROJECT ACRES =** 369.29 **Infested ACRES =** 245.58
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 66%
**COMMENTS:** Several CYOF sites, all > 500 plants (as observed in 2004 & 2005; one site > 1,000 seedlings). One PORE site. One CYOF site north of 4260 Rd. overlaps with TA 72-14.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| PORE5 | Control | MA | sulphur cinquefoil | N/A | N/A | N/A | N/A |

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**72-21** 4260-100, 200 and 300 roads **PROJECT ACRES =** 65.23 **Infested ACRES =** 6.55
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 10%
**COMMENTS:** CYOF occurs in Treatment Area. One large site (estimated at > 500 plants in 2005); at several sites no plants were observed in 2005. Paulina weed site #369 on 300 rd. also has CIAR4.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Eradicate | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-22** 4290 road **PROJECT ACRES =** 38.95 **Infested ACRES =** 0.20
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Two mapped weed sites: one CYOF site at a cattle guard and one CIAR4 site.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CYOF | Eradicate | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-23PVT** 12 road from the forest boundary to highway 26 **PROJECT ACRES =** 73.92 **Infested ACRES =** 0.00
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** This is on private lands (not FS), so no data in NRIS Terra. Partnerships to treat this section with Crook County.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**72-25** 4280-067 road **PROJECT ACRES =** 11.71 **Infested ACRES =** 2.56
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 22%
**COMMENTS:** One small (as of 2005) site of CYOF (about 10 plants).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-26** 4260-754 and 4280-050 roads **PROJECT ACRES =** 38.53 **Infested ACRES =** 4.78
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 12%
**COMMENTS:** Three mapped sites of CYOF, occuring on both sides of road and on bank edge of trail. One mapped site of CIAR west side of Dipping Vat Creek that also occurs in Treatment Area 72-15.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CYOF | Control | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-27** 4260-750 road **PROJECT ACRES =** 68.63 **Infested ACRES =** 13.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 19%
**COMMENTS:** Several mapped sites of CYOF. Site 444 is > 1,000 plants (2002 observation) & moving SE down drainage along skid trails. Other populations were estimated in 2004 to be < 100 plants.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-28** 42-660 road **PROJECT ACRES =** 35.84 **Infested ACRES =** 8.90
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 25%
**COMMENTS:** In 2004, there were < 25 CYOF plants very scattered in roadbed and along sides of 660 Rd.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-29** 4260-700 road **PROJECT ACRES =** 36.67 **Infested ACRES =** 0.28
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Three very small (as of 2005) CYOF sites (each < 15 plants).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CYOF | Control | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-30** 4260-320 system **PROJECT ACRES =** 52.87 **Infested ACRES =** 0.39
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Four CYOF sites; larges (#374) > 500 plants; other 3 very small (as of 2005), < 25 plants each.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-31** 4290-028 ROAD **PROJECT ACRES =** 35.28 **Infested ACRES =** 4.79
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 14%
**COMMENTS:** Four mapped weed sites of 3 species.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CADR | Eradicate | CH | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEDI3 | Eradicate | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| SAAE | Eradicate | CH | Mediterranean sage | Metsulfuron methyl | chlorsulfuron | Picloram | |

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**72-32** 3810-500 SYSTEM **PROJECT ACRES =** 69.32 **Infested ACRES =** 0.29
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** Follows East Wolf Creek. Three mapped CADR sites. Two sites are small; one site > 500 plants.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CADR | Eradicate | CH | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |

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**72-33** 58-806 ROAD **PROJECT ACRES =** 12.43 **Infested ACRES =** 0.62
**SITE TYPE:** RoadPlant **Reveg:** PassiveRest **% TREATED =** 5%
**COMMENTS:** One site of CEDI3 mapped towards west end of Treatment area; another site of CEDI3 in adjacent TA 72-01 at jnct. 58-800/58-806.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Eradicate | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**72-34** 5870-300 **PROJECT ACRES =** 36.04 **Infested ACRES =** 0.20
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Two sites of CIAR4 & PORE (both < 0.01 ac. In 1998).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| PORE5 | Control | CH | sulphur cinquefoil | Picloram | Triclopyr | Glyphosate | |

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**72-35** 58-800 SYSTEM **PROJECT ACRES =** 73.35 **Infested ACRES =** 0.69
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Five sites of CIAR4; 2 sites of CADR. Though sites scattered along road, most of sites within lower (south) portion of Treatment Area.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CADR | Contain | CH | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |

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**72-36** 1280 ROAD SYSTEM **PROJECT ACRES =** 25.02 **Infested ACRES =** 0.18
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Barnhouse Campground in Treatment Area. Two sites of CIAR4 mapped in 2002.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |

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**72-37** DIPPING VAT TRIB AND 4260-565 ROAD **PROJECT ACRES =** 202.84 **Infested ACRES =** 90.54
**SITE TYPE:** RoadStream **Reveg:** Revegetate **% TREATED =** 45%
**COMMENTS:** Large (18 ac. infestation), dense CYOF pop in T14S, R 23 E, S34 (also listed in TA 72-03 & 72-15 because roads bisect it.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | MEFICHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-38** Hewed Log Creek east of 4260-650 road **PROJECT ACRES =** 121.62 **Infested ACRES =** 27.27
**SITE TYPE:** Stream **Reveg:** PassiveRest **% TREATED =** 22%
**COMMENTS:** CYOF. Check w/ Deb about meadow as 2nd type.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-39** TRIB OF ROBA CREEK AND CLOSED ROADS OFF 4260-651 **PROJECT ACRES =** 384.49 **Infested ACRES =** 153.24
**SITE TYPE:** RoadStream **Reveg:** PassiveRest **% TREATED =** 40%
**COMMENTS:** CYOF only species recorded; several sites. Large CYOF site (4 ac.) occurs s. Rd. 42 & also listed in TA 72-03. Largest CYOF (10 ac.; site #252) is also listed in TA 72-18 due to overlap.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-41** 4260-656 ROAD AND ROBA CREEK TRIBUTARY **PROJECT ACRES =** 113.57 **Infested ACRES =** 34.82
**SITE TYPE:** RoadStream **Reveg:** PassiveRest **% TREATED =** 31%
**COMMENTS:** Two CYOF sites mapped; largest occurs on skid trails and very heavy infestation at spring upstream at drainage confluence.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-42** ROBA CREEK SOUTH OF 42560-500 **PROJECT ACRES =** 44.95 **Infested ACRES =** 14.77
**SITE TYPE:** Stream **Reveg:** PassiveRest **% TREATED =** 33%
**COMMENTS:** One CYOF site, northern end of population on private land, also occurs in TA 72-14 (Rd. 4260) which traverses Project Area.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-43** ROBA CREEK SOUTH OF 4260-650 ROAD **PROJECT ACRES =** 21.33 **Infested ACRES =** 3.90
**SITE TYPE:** Stream **Reveg:** PassiveRest **% TREATED =** 18%
**COMMENTS:** One CYOF site > 500 plants.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-44** Indian Creek and 4260-420 road **PROJECT ACRES =** 191.64 **Infested ACRES =** 38.32
**SITE TYPE:** RoadStream **Reveg:** PassiveRest **% TREATED =** 20%
**COMMENTS:** Four mapped sites of CYOF. 2 sites overlap with TA 72-14 (Rd. 4260).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-46** PAULINA CREEK, SOUTH OF MARBLE RESERVOIR **PROJECT ACRES =** 13.07 **Infested ACRES =** 0.49
**SITE TYPE:** Stream **Reveg:** PassiveRest **% TREATED =** 4%
**COMMENTS:** One site of CYOF estimated (in 2005) between 250-500 plants.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Eradicate | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-47** Head of Paulina Creek **PROJECT ACRES =** 35.37 **Infested ACRES =** 5.77
**SITE TYPE:** Stream **Reveg:** PassiveRest **% TREATED =** 16%
**COMMENTS:** One site of CYOF (about 500 plants seen in 2005).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Eradicate | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-48** Cottonwood Trail near Forest Boundary **PROJECT ACRES =** 10.55 **Infested ACRES =** 0.75
**SITE TYPE:** Trail_hike **Reveg:** PassiveRest **% TREATED =** 7%
**COMMENTS:** Only known site of RUDI2 on Paulina District and only site in our EIS.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| RUDI2 | Eradicate | CH | Himalayan | Triclopyr | Glyphosate | Picloram | |

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**72-49** 12-300 road **PROJECT ACRES =** 10.75 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** One site of CEDI3 mapped (.25 ac.).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Eradicate | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**72-50** Burnt Corral Creek south of 4260-300 to Burnt Corral Spring **PROJECT ACRES =** 98.31 **Infested ACRES =** 54.48
**SITE TYPE:** Stream **Reveg:** PassiveRest **% TREATED =** 55%
**COMMENTS:** Large CYOF site (1,000 seedlings seen in 2005); has been manually treated by NW Youth Corps.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-52** Black Canyon Wilderness **PROJECT ACRES =** 117.09 **Infested ACRES =** 0.92
**SITE TYPE:** Trail_hike **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Black Canyon Wilderness Area. One CIAR4 site proposed CHMA; othere 8 CIVU sites proposed for manual treatment.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | MA | Canada thistle | N/A | N/A | N/A | N/A |
| CIVU | Control | MA | bull thistle | N/A | N/A | N/A | N/A |

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**72-53** Trailhead on So. Fork John Day River **PROJECT ACRES =** 34.36 **Infested ACRES =** 11.90
**SITE TYPE:** RoadStream **Reveg:** PassiveRest **% TREATED =** 35%
**COMMENTS:** On edge of Black Canyon Wilderness. Though appears as one large weed site on our maps, actually 5 sites of 4 different weed species (ONAC, CIAR4, CYOF, & DIFU2).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| CYOF | Eradicate | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |
| DIFU2 | Control | CHMA | teasel | No Chemical | | | |
| ONAC | Control | CHMA | Scotch thistle | Clopyralid | chlorsulfuron | Metsulfuron methyl | |

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**72-59** 5820-011 road (closed) area. Sensitive plant site (ACHE10) **PROJECT ACRES =** 1.38 **Infested ACRES =** 0.10
**SITE TYPE:** GeneralForest **Reveg:** PassiveRest **% TREATED =** 7%
**COMMENTS:** Small TACA8 site - no plants seen in 2005.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| TACA8 | Eradicate | MA | medusahead | N/A | N/A | N/A | N/A |

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**72-60** 4260-250 road. Old skid trail and landing **PROJECT ACRES =** 17.88 **Infested ACRES =** 0.10
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** One CYOF site with between 250-500 plants.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CH | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-61** 2630-726 and 729 roads. **PROJECT ACRES =** 33.09 **Infested ACRES =** 0.96
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 3%
**COMMENTS:** Two weed sites mapped; 1 says CEDI3 but also includes a few CEBI2 plants; other is CIAR4.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Control | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |

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**72-62** Murray Fire **PROJECT ACRES =** 15.66 **Infested ACRES =** 0.10
**SITE TYPE:** Fire **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** CIAR4 (BIOC treatment). Fire year 2002.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |

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**72-63** 4260-700 road near North Wolf Creek **PROJECT ACRES =** 2.81 **Infested ACRES =** 0.10
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 4%
**COMMENTS:** One mapped site of CIAR4.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Suppress | BIO | Canada thistle | N/A | N/A | N/A | N/A |

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**72-64** Turnpike Pit 5840-780 Rd. **PROJECT ACRES =** 26.92 **Infested ACRES =** 3.51
**SITE TYPE:** Quarry **Reveg:** Revegetate **% TREATED =** 13%
**COMMENTS:** Road accesses quarry. TACA8 (Paulina priority species for treatment). Infestation on the rocky soil. A second small TACA8 site is adjacent to this pit, in TA 72-09.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| TACA8 | Eradicate | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**72-65** Paulina Reservoir, 4260-345 rd **PROJECT ACRES =** 5.19 **Infested ACRES =** 0.10
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:** One CYOF site < 50 plants in 2005.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-66** Roba Cr. trib above 4260-500 jct **PROJECT ACRES =** 2.61 **Infested ACRES =** 0.10
**SITE TYPE:** Stream **Reveg:** PassiveRest **% TREATED =** 4%
**COMMENTS:** One mapped CYOF site estimated between 100-250 plants in 2004.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-67** 4260-230 rd, dispersed site **PROJECT ACRES =** 2.07 **Infested ACRES =** 0.10
**SITE TYPE:** RoadPlus **Reveg:** PassiveRest **% TREATED =** 5%
**COMMENTS:** Dispersed recreation use. One CYOF site, no plants seen in 2005; CIAR4 also in area; lot of cheatgrass observed in 2005.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-68** NF Crooked trib, east of 4260-200 rd **PROJECT ACRES =** 0.91 **Infested ACRES =** 0.10
**SITE TYPE:** Stream **Reveg:** PassiveRest **% TREATED =** 11%
**COMMENTS:** One small CYOF site, < 25 plants (in 2005); CIAR4 also.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIAR4 | Control | CH | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| CYOF | Control | CHMA | houndstongue | Metsulfuron methyl | chlorsulfuron | Picloram | Glyphosate |

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**72-69** Sunflower Pit **PROJECT ACRES =** 2.74 **Infested ACRES =** 0.00
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 0%
**COMMENTS:** CEBI2 occurs in pit and is adjacent to pit in TA 72-01 (Paulina Weed Site #281).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Eradicate | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**72-70** Podo Meadows Material Source **PROJECT ACRES =** 2.00 **Infested ACRES =** 1.79
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 89%
**COMMENTS:** CEDI3 estimated about 0.25 ac.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Eradicate | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**75-02** Hwy 26 **PROJECT ACRES =** 224.36 **Infested ACRES =** 2.44
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** This major highway had numberous scattered weed sites of 4 different species. Majority is CEDI3, but also CEBI2, HYPE, & TACA8.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| HYPE | Control | CHMA | St. Johnswort | Metsulfuron methyl | Picloram | Glyphosate | |

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**75-03** Road 51 **PROJECT ACRES =** 37.31 **Infested ACRES =** 11.64
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 31%
**COMMENTS:** Two mapped sites of CEBI2 on Monner Spring Rd. & at Monner Spring Exclosure; ACRE3 also occurs.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ACRE3 | Control | CHMA | Russian knapweed | Picloram | Clopyralid | chlorsulfuron | Glyphosate |
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**75-05** N Combs Spring **PROJECT ACRES =** 194.11 **Infested ACRES =** 3.82
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:** Treatment Area follows County Rds. TACA8, CEBI2, CADR, CIAR4. Lower portion of TA runs along east edge of Rimrock Springs Wildlife Mngt. Area.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CADR | Control | CH | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CHMA | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |
| TACA8 | Control | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**75-07** Cyrus Spring area **PROJECT ACRES =** 66.67 **Infested ACRES =** 2.98
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 4%
**COMMENTS:** Large CEBI2 site (300 gross acres). Western edge of another large CEBI2 site in TA 72-44 overlaps with this Treatment Area. LIDA also occurs in this Treatment Area.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Control | CH | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**75-08** Old Hwy 97 Roadside **PROJECT ACRES =** 109.51 **Infested ACRES =** 74.86
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 68%
**COMMENTS:** Jefferson County road 1-27 leads to Haystack Reservoir. As with TA 75-23, CEDI3 in Hwy 97 corridor area at Juniper Butte. CEBI2 on Old Culver Hwy and access to Haystack Reservoir.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**75-10** Rd 6120 and Geneva MS **PROJECT ACRES =** 257.21 **Infested ACRES =** 109.02
**SITE TYPE:** Quarry **Reveg:** PassiveRest **% TREATED =** 42%
**COMMENTS:** TACA8 occurs as isolated piece on east side of Crooked River Gorge, NW of Opal Springs storage tanks; ONAC on isolated piece of CRNG land at Opal Springs access to Crooked River Gorge; CEBI2 & CEDI3 also occur.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| ONAC | Control | CHMA | Scotch thistle | Clopyralid | chlorsulfuron | Metsulfuron methyl | |
| TACA8 | Control | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**75-14** Cotter Pond **PROJECT ACRES =** 43.72 **Infested ACRES =** 0.49
**SITE TYPE:** GeneralForest **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Portion of Treatment Area follows Jefferson Co. Rds. No mapped weed sites in Terra, but CEBI2 occurs.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| ONAC | Control | CH | Scotch thistle | Clopyralid | chlorsulfuron | Metsulfuron methyl | |

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**75-17** Boyce Corral area + **PROJECT ACRES =** 44.68 **Infested ACRES =** 0.57
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Six weed species; 6 mapped sites.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ACRE3 | Control | CHMA | Russian knapweed | Picloram | Clopyralid | chlorsulfuron | Glyphosate |
| CADR | Control | CHMA | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIVU | Tolerate | No | bull thistle | | | | |
| COAR4 | Control | CHMA | field bindweed | Picloram | Imazapic | Imazapyr | Glyphosate |

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**75-20** Rimrock Springs Dam **PROJECT ACRES =** 226.62 **Infested ACRES =** 4.14
**SITE TYPE:** Stream **Reveg:** Revegetate **% TREATED =** 2%
**COMMENTS:** ACRE occurs on the dam for the Rimrock Springs reservoir within Rimrock Springs Wildlife Management Area. CIAR4 & CEBI2 also occur.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ACRE3 | Control | CHMACU | Russian knapweed | Picloram | Clopyralid | chlorsulfuron | Glyphosate |
| CEBI2 | Control | CHMACU | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | CHMACU | Canada thistle | Clopyralid | Picloram | chlorsulfuron | Glyphosate |

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**75-22** Skull Hollow **PROJECT ACRES =** 44.19 **Infested ACRES =** 1.46
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 3%
**COMMENTS:** Mostly CEBI2; 1 mapped site of KOCH. All along Lone Pine Road, varying distances from Skull Hollow Rd. turnoff.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| KOCH | Control | CHMA | Kochia | Chlorsulfuron | Metsulfuron | Glyphosate | |

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**75-23** Hwy 97, Juniper Butte **PROJECT ACRES =** 60.25 **Infested ACRES =** 60.13
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 100%
**COMMENTS:** CEDI3 in Hwy 97 corridor at Juniper Butte. CEBI2 on old Culver Hwy & cut-across to Haystack Reservoir, scattered along road ROW.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**75-24** Haystack CG + Rd 7130 **PROJECT ACRES =** 188.01 **Infested ACRES =** 107.06
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 57%
**COMMENTS:** Seven weed species, most along roads. CEDI3 in campground. ACRE (20 gross ac.) in draw which parallels Haystack reservoir road.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ACRE3 | Control | CH | Russian knapweed | Picloram | Clopyralid | chlorsulfuron | Glyphosate |
| CADR | Control | CHMA | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| CIVU | Tolerate | NO | bull thistle | N/A | N/A | N/A | N/A |
| COAR4 | Control | CHMA | field bindweed | Picloram | Imazapic | Imazapyr | Glyphosate |
| LIDA | Control | CHMA | Dalmatian toadflax | Picloram | chlorsulfuron | Imazapic | |

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**75-25** 57-500 Road. Gray Butte Trailhead. McCoin Orchard. **PROJECT ACRES =** 89.32 **Infested ACRES =** 30.17
**SITE TYPE:** Trail **Reveg:** PassiveRest **% TREATED =** 34%
**COMMENTS:**

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**75-28** Mud Springs **PROJECT ACRES =** 153.17 **Infested ACRES =** 1.93
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** No mapped weed sites in Terra, but CEBI2, CEDI3 & TACA8 occur.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| TACA8 | Control | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**75-29** Grizzly **PROJECT ACRES =** 5,313. **Infested ACRES =** 3,560.0
**SITE TYPE:** GeneralForest **Reveg:** ActiveRest **% TREATED =** 67%
**COMMENTS:** This large Treatment Area encompasses 5,000+ acres due to 2 huge TACA8 sites, each 1,000 gross ac. Containment strategy will treat perimeter and access routes; reveg at some treatment sites.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CIAR4 | Control | BIO | Canada thistle | N/A | N/A | N/A | N/A |
| KOSC | Control | CHMA | Kochia | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| TACA8 | Control | CUCH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**75-37** Upper Wychus Cr. **PROJECT ACRES =** 0.61 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 16%
**COMMENTS:** HYPE approx. 0.25 mi. west of Wychus Ck. & 0.25 mi. north of southern CRNG boundary.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| HYPE | Control | BIO | St. Johnswort | N/A | N/A | N/A | N/A |

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**75-38** Grandview cemetery **PROJECT ACRES =** 18.03 **Infested ACRES =** 0.10
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Jordan Rd. that goes by Grandview cemetery. One mapped site of CEBI2 (5 ac. GIS polygon).

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**75-42** Tai Flat **PROJECT ACRES =** 84.94 **Infested ACRES =** 36.51
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 43%
**COMMENTS:** CEBI2 (or CEDI3 - waiting for clarificaiton) occurs on Tai Flat rd. & spur, adjacent to Tai Flat.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |

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**75-43** Tai Flat part1 **PROJECT ACRES =** 697.95 **Infested ACRES =** 552.91
**SITE TYPE:** GeneralForest **Reveg:** PassiveRest **% TREATED =** 79%
**COMMENTS:** Encompasses 700 gross ac. Of TACA8, which is all of the CRNG land surrounding Lynne Miller's private land. CEDI3 also occurs.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| TACA8 | Control | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**75-44** Scales Corral **PROJECT ACRES =** 752.66 **Infested ACRES =** 236.62
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 31%
**COMMENTS:** Two CEBI2 sites, one is 300 gross acres in Scales pasture and overlaps with TA 72-07.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| COAR4 | Control | CHMA | field bindweed | Picloram | Imazapic | Imazapyr | Glyphosate |

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**75-47** The Island RNA **PROJECT ACRES =** 46.51 **Infested ACRES =** 46.51
**SITE TYPE:** GeneralForest **Reveg:** PassiveRest **% TREATED =** 100%
**COMMENTS:** FS parcel within BLM ACEC (Area of Critical Environmental Concern) - The Island. Flat-topped peninsula overlooking Lake Bill Chinook. TACA8. BLM, FS, & Native Plant Society partner to pull medusahead.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| TACA8 | Control | Manual | medusahead | N/A | N/A | | |

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**75-50** Buck Butte **PROJECT ACRES =** 554.24 **Infested ACRES =** 217.18
**SITE TYPE:** General Forest **Reveg:** PassiveRest **% TREATED =** 39%
**COMMENTS:** This TA occurs SE of Buck Butte. Large TACA8 (170 gross ac.) adjacent to Buck Butte, includes powerline & gas ROWs; 2nd (60 ac.) is in powerline ROW NW thru mouth of Wagonblast Canyon. Two CEBI2 sites within & adjacent to gas pipeline ROW.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Control | CH | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| TACA8 | Control | CUCH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**75-54** Schmaker Spring **PROJECT ACRES =** 270.03 **Infested ACRES =** 132.74
**SITE TYPE:** GeneralForest **Reveg:** PassiveRest **% TREATED =** 49%
**COMMENTS:** Large TACA8 (160 acres) site occurs in and around Schmoker Spring, from edge of spring to top of local hills. Distance to water is 0-2,000 ft.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| TACA8 | Control | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**75-56** Wychus Creek and Trail Area **PROJECT ACRES =** 1,411. **Infested ACRES =** 646.79
**SITE TYPE:** Stream **Reveg:** PassiveRest **% TREATED =** 46%
**COMMENTS:** CEDI3 (100 gross ac.) all over area from the ridge down to Alder Springs Trail & up to road crossing. TACA8 (40 gross acres) along access road to Alder Sprgs. Trailhead. Also, 4 CEBI2 sites.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CHMA | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| TACA8 | Control | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**75-57** Lithgow Area **PROJECT ACRES =** 31.87 **Infested ACRES =** 2.49
**SITE TYPE:** General Forest **Reveg:** PassiveRest **% TREATED =** 8%
**COMMENTS:** Two CEBI2 sites mapped, one on closed road, both in Scales pasture. TACA8 also occurs.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEBI2 | Control | CH | spotted knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| TACA8 | Control | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**75-58** 7130 road **PROJECT ACRES =** 39.24 **Infested ACRES =** 32.79
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 84%
**COMMENTS:** COAR & CIVU west of Hwy 26.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CIVU | Tolerate | NO | bull thistle | N/A | N/A | N/A | N/A |
| COAR4 | Control | CHMA | field bindweed | Picloram | Imazapic | Imazapyr | Glyphosate |

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**75-59** 89 road **PROJECT ACRES =** 92.12 **Infested ACRES =** 1.14
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 1%
**COMMENTS:** Local Adams Rd., Irving Dr., Imbler Lane. Three species (CADR, CIVU, COAR) mapped on 12 sites along roads.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CADR | Control | CH | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |
| CIVU | Tolerate | NO | bull thistle | N/A | N/A | N/A | N/A |

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**75-60** 55 road **PROJECT ACRES =** 18.33 **Infested ACRES =** 0.28
**SITE TYPE:** Road **Reveg:** PassiveRest **% TREATED =** 2%
**COMMENTS:** Two mapped sites of CADR; one mapped site of CIVU. Only CADR targeted for treatment.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CADR | Control | CH | whitetop | chlorsulfuron | Metsulfuron methyl | Glyphosate | |

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**75-61** South Haystack Butte **PROJECT ACRES =** 17.61 **Infested ACRES =** 6.47
**SITE TYPE:** General Forest **Reveg:** PassiveRest **% TREATED =** 37%
**COMMENTS:** ONAC on the south side of Haystack Butte near route to the saddle where water storage tank is, north of the Henderson flat motorized recreation area. Top of Haystack Butte is RNA, but not yet threatened by this ONAC site.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| ONAC | Control | CHMA | Scotch thistle | Clopyralid | chlorsulfuron | Metsulfuron methyl | |

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**75-62** Round Butte Dam Entrance **PROJECT ACRES =** 34.82 **Infested ACRES =** 4.45
**SITE TYPE:** General Forest **Reveg:** PassiveRest **% TREATED =** 13%
**COMMENTS:** Two mapped weed sites on east side of Jefferson County Rd. 1-13 (Belmont Lane) that leads to Round Butte Dam. CEDI2 & TACA8 both along spur roads.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| TACA8 | Control | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**75-63** Round Butte **PROJECT ACRES =** 197.93 **Infested ACRES =** 49.99
**SITE TYPE:** General Forest **Reveg:** PassiveRest **% TREATED =** 25%
**COMMENTS:** Two mapped weed sites, both adjacent to subdivisions. CEDI3 at Round Butte cinder pits; TACA8 at Round Butte overlook.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| TACA8 | Control | CHMA | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**75-65** Tai Flat part2 **PROJECT ACRES =** 64.10 **Infested ACRES =** 28.88
**SITE TYPE:** GeneralForest **Reveg:** PassiveRest **% TREATED =** 45%
**COMMENTS:** TACA8 - 0.5 gross acres along unnumbered road in draw going into back side of Miller's private land. Several small patches of medusahead in that burned area.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| TACA8 | Control | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**75-66** Tai Flat part3 **PROJECT ACRES =** 83.39 **Infested ACRES =** 58.85
**SITE TYPE:** GeneralForest **Reveg:** PassiveRest **% TREATED =** 71%
**COMMENTS:** Two gross acres mapped of TACA8. Scattered patches.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| TACA8 | Control | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**75-67** Tai Flat part4 **PROJECT ACRES =** 22.65 **Infested ACRES =** 10.91
**SITE TYPE:** GeneralForest **Reveg:** PassiveRest **% TREATED =** 48%
**COMMENTS:** TACA8 on flat, north of the head of Carcass Canyon, east of Dry Lake (south of Dry Lake Rd.). CEDI3 also occurs.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| TACA8 | Control | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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**75-68** Tai Flat part5 **PROJECT ACRES =** 31.17 **Infested ACRES =** 24.55
**SITE TYPE:** GeneralForest **Reveg:** PassiveRest **% TREATED =** 79%
**COMMENTS:** TACA8 about 0.25 mi. NW of Geneva townsite (50 ac.). CEDI3 also occurs.

| TARGET | OBJECTIVE | TREATMENT | COMMON NAME | HERBICIDE1 | HERBICIDE2 | HERBICIDE3 | HERBICIDE4 |
|---|---|---|---|---|---|---|---|
| CEDI3 | Control | CHMA | diffuse knapweed | Clopyralid | Picloram | Glyphosate | Imazapyr |
| TACA8 | Control | CH | medusahead | Sulfometuron methyl | Chlorsulfuron+Sulfo | Imazapic | Glyphosate |

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## Types of Mechanical Treatments
## Proposed in Des/Och/CRNG Invasive Plant EIS

***Summary:*** Mechanical treatments are proposed for 5 species: reed canarygrass (PHAR3), ribbongrass (PHARP), St. Johnswort (HYPE), leafy spurge (EUES), Canada thistle (CIAR4) and houndstongue (CYOF).

- **PHAR3 and PHARP**: A gas-powered weed whacker would be used to cut tall stems, reducing the biomass prior to herbicide spraying.
- **HYPE**: Of the numerous HYPE sites proposed for treatment, mechanical treatment is only proposed on this species in one Treatment Area on Crescent District on the southern portion of Hwy 97. HYPE would be mowed along the highway.
- **EUES**: Crescent is only district proposing mechanical treatment at its one EUES site, and this would be using a gas-powered weed whacker to cut stems prior to herbicide treatment.
- **CIAR4**: Mechanical treatment is proposed at 3 sites on Sisters District and a gas-powered weed whacker would be used to cut tall stems prior to herbicide treatments.
- **CYOF**: Proposed in two Treatment Areas (72-15; 72-37) in portions of timber sale plantations where there are very dense stands of CYOF. In these areas, the proposed treatment is to burn the units, boomspray the germinating CYOF seedlings, then disc (mechanical treatment) and revegetate. ***This would be the only ground-disturbing mechanical treatment; weed whacking/mowing are above-ground treatments.***

**Table A-2. The following table lists Treatment Areas where mechanical treatments are proposed. Codes:** ***WW*** =gas-powered weed whacker; ***RM*** = roadside brush/mower equipment; ***D*** = discing

| Project Area | Location | Target Species | Type Mechanical Treatment |
|---|---|---|---|
| 11-10 | Rd. 42 | PHAR3 | WW |
| 11-24 | SE shore Wickiup Reservoir | PHAR3 | WW |
| 11-33 | West shore Paulina Lake | PHAR3 | WW |
| 11-34 | West side Hosmer Lake | PHAR3 | WW |
| 11-35 | Blue Lagoon | PHAR3 | WW |
| 11-39 | Lava Lake | PHAR3 | WW |
| 11-53 | Rd. 4285 & SE arm of Crane Prairie | PHAR3 | WW |
| 11-54 | South Twin Lake | PHAR3 | WW |
| 11-56 | Crane Prairie Reservoir - West | PHAR3 | WW |
| 11-66 | Ryan Ranch Meadow | PHAR3 | WW |
| 11-80 | Rd. 44 at Bull Bend | PHAR3 | WW |
| 12-05 | Big Marsh | PHAR3 | WW |
| 12-06 | Hwy 97 from Crescent to DES/WIN Forest boundary | HYPE | RM |
| 12-21 | Rd. 5835 west of Little Deschutes River | EUES | WW |
| 15-01 | Little Montana, 800 Rd. | CIAR4 | WW |
| 15-07 | Cache Fire Area | CIAR4 | WW |
| 15-10 | Rd. 1230, “parking lot” & west B&B Fire | CIAR4 | WW |
| 15-21 | Rd. 12 and Dahl vicinity | CIAR4 | WW |
| 15-22 | Trout Creek Swamp | PHAR3 | WW |
| 15-30 | Corbett Sno-Park, Meadow Lakes area | CIAR4 | WW |
| 15-32 | Metolius River | PHARP | WW |
| 72-15 | Rds. 4280, 4280-060, 061 | CYOF | D |
| 72-37 | Dipping Vat Trib & Rd. 4260-565 | CYOF | D |

**Table A-3. Project Area Units planned for active revegetation of invasive plant sites. See Appendix E for a discussion of restoration and revegetation in the project area.**

| Project Area # | Location | Invasive Species | Comments |
|---|---|---|---|
| 12-05 | Big Marsh | Reed canarygrass | Very wet site with unique values. PHAR Infestations throughout the marsh with dense monoculture especially at the north end. Drainage ditches on the east and west sides of the marsh are being filled in to restore historic hydrologic function. These areas will be revegetated using adjacent native sedges, grasses, forbs and shrubs. |
| 15-22 | Trout Creek Swamp | Reed canarygrass | Very wet site with unique values. Dense monoculture of PHAR at northern end will be revegetated using adjacent plugs of adjacent native sedges and grasses. |
| 15-32 | Metolius River | Ribbongrass | Due to the unique qualities of the Metolius River, any ribbongrass treatments would be followed up with planting of locally native sedges, grasses, forbs, and/or shrubs. |
| 72-14 | Rd. 4260 | Medusahead | Areas where medusahead occurs on road cutbanks, ditches and the transition to forest habitat, would be revegetated with cultivar grass species to compete with this aggressive grass. |
| 72-15 | Rd. 4280 (& 060, 061) | Hounds-tongue | Dense areas of houndstongue within forest plantations and other disturbed areas would be revegetated with a grass and forb cultivar mix, to occupy the site and compete with the weeds. |
| 72-16 | Rd. 4260-570 | Medusahead | Areas where medusahead occurs on road cutbanks, ditches and the transition to forest habitat, would be revegetated with cultivar grass species. |
| 72-37 | Dipping Vat Trib. | Hounds-tongue | Dense areas of houndstongue within forest plantations and other disturbed areas would be revegetated with a grass and forb cultivar mix, to occupy the site and compete with the weeds. |
| 72-64 | Turnpike Pit | Medusahead | Some areas within the material source would be revegetated with native bunchgrasses and forbs. If native seed were not available, grass cultivars would be used. Most areas of the weed site are down to bedrock, and revegetation is not practical. |
| 75-20 | Rimrock Springs Dam | Russian thistle, spotted knapweed, Canada thistle | Revegetate to protect adjacent Rimrock Springs Wildlife Area. |

# APPENDIX B

# Treatment Options and Common Control Measures for the Deschutes and Ochoco National Forests and Crooked River National Grassland

**Table B-1.** Treatment options for invasive plant species, Deschutes and Ochoco National Forest and Crooked River National Grassland Invasive Plant EIS. Most information comes from Mazzu (2005) and Oregon Department of Agriculture (Langland 2005, personal communication); other references are cited. Species are grouped based on similar biology and treatment methods and are listed alphabetically by the common name of the 1st species listed.

| Target Species | Notes specific to Deschutes, Ochoco, CRNG | General Notes & Prescription | Herbicide Options | When/How to treat chemically |
|---|---|---|---|---|
| **Bull thistle**<br>*Cirsium vulgare*<br>(CIVU)<br><br>**Musk (nodding) thistle**<br>*Carduus nutans*<br>(CANU4)<br><br>*Biennial (musk thistle can be a winter annual, annual, or biennial)* | Bull thistle is common, and a lower priority species for treatment. The majority of sites will be tolerated (no treatment) or manually controlled.<br><br>Currently only one known site of musk thistle on Lookout Mt. District, Ochoco NF. | - Any manual method that severs the root below the soil surface will kill these plants. Hand-pull bolting plants prior to onset of flowering but after fully bolting. Bag & remove from site if plant has a flower head. - Repeated visits at weekly intervals over the 4 to 7 week blooming period provide most effective control.<br>- Mowing is an option, but timing of mowing is critical (within 2 days of full flowering for musk thistle).<br>- If chemicals are used, manual treatments could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time.<br>- Biological controls may be helpful to suppress populations in combination with other methods.<br>- Bull thistle sites do not usually need revegetation; at most sites, will be replaced as successional changes take place. | **Upland Bull Thistle**:<br>1. Clopyralid<br><br>**Upland Musk Thistle:**<br>1. Clopyralid<br>2. Metsulfuron methyl<br>3. Chlorosulfuron<br><br>**Riparian/High Water Table/Porous Soils**: Aquatic labeled glyphosate | ***Drier, upland Site Types (Roads, Quarries, Upland Forest/Rangeland):*** Spot spray whenever possible. ***Wetter site types (wet meadows, riparian)***: Wick application.<br><br>***Timing***: Apply to rosettes in either the spring or fall. |

| Target Species | Notes specific to Deschutes, Ochoco, CRNG | General Notes & Prescription | Herbicide Options | When/How to treat chemically |
|---|---|---|---|---|
| **Canada thistle**<br>*Cirsium arvense*<br>(CIAR4)<br><br>*Rhizomatous Perennial* | Very common on Lookout Mt. District, Ochoco NF (> 250 sites); less common on other districts. | - Herbicide treatment is most effective.<br>- The only manual technique would be hand cutting of flower heads, which only suppresses seed production.<br>-Mowing may be effective in rare cases if done monthly (this intensity is likely to damage native plant species).<br>-Covering with plastic tarping may also work for small infestations.<br>- Revegetate high priority sites with desirable species if possible. | **Upland:**<br>1. Clopyralid<br>2. Picloram<br>3. Chlorosulfuron<br>4. Glyphosate<br><br>**Riparian/High Water Table/Porous Soils:** Aquatic labeled glyphosate (best in fall) | ***Drier upland sites (Road, Quarries & Upland Forest/Rangeland):*** If feasible, weed whack first to reduce biomass. Broadcast spray in dense cover, where dominant plant community is non-native. Spot spray whenever possible, especially in areas with good native plant cover.<br>***Sensitive Sites or Special Management Areas where more selective treatment is desired:*** Spot spray or wick application to target individual plant.<br><br>***Timing***: Apply in spring to rosettes and prior to flowering, or apply in fall to rosettes. Season is dependent upon herbicide used. |
| **Dalmatian toadflax**<br>*Linaria dalmatica*<br>(LIDA)<br><br>**Butter 'n' eggs**<br>*Linaria vulgaris*<br>(LIVU2)<br><br>*Rhizomatous Perennials* | Dalmatian toadflax is most common on Bend/Ft. Rock District (> 60 sites).<br><br>Only 10 sites currently known of butter 'n' eggs (7 on Crescent District; 3 on Lookout Mt. District). | - Hand pull or dig small, easily accessible populations. Multiple entries per year are required. Plants can be left on site, but may reduce germination of desirable species due to mulching effect. Success will depend on consistent labor for each growing season until plants are eradicated. If flowers are present, bag and remove from site.<br>-Cutting stands in spring or early summer will eliminate plant reproduction, but not the infestation.<br>- These treatments may take up to ten years due to long term seed viability.<br>- If chemicals are used, manual treatments could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time.<br>- Revegetate with desirable species at high priority sites when possible. Plant communities in good condition may recover without replanting. | **Upland:**<br>1. Picloram<br>2. Chlorosulfuron<br>3. Imazapic (Use in native grass stands; fall application only)<br><br>**Riparian/High Water Table/Porous Soils:** Aquatic labeled glyphosate | Broadcast spray in dense cover, where dominant plant community is non-native. However, this species tends to be scattered, so spot spraying (backpack or on OHV) is usually more appropriate.<br><br>***Timing:*** Apply during active growth in spring before bloom or in late summer or fall during re-growth.<br><br>***Notes:*** Revisits will be necessary; the number of which is dependent on the chemical used and the seedbank. This control could vary by site. Even after three years of consecutive treatments, control may range widely. |

| Target Species | Notes specific to Deschutes, Ochoco, CRNG | General Notes & Prescription | Herbicide Options | When/How to treat chemically |
| --- | --- | --- | --- | --- |
| **Diffuse knapweed** *C. diffusa* (CEDI)<br><br>**Spotted knapweed** *Centaurea biebersteinii* (CEBI2)<br><br>**Meadow knapweed** *Centaurea debeauxii* ssp. *thuillieri* (CEDET)<br><br>*Tap rooted Biennials or Perennials* | Diffuse & spotted knapweeds are very common and high priority species on all units. Meadow knapweed occurs on Lookout Mt. District; has been treated since 1998 and is now in maintenance mode. Five plants of meadow knapweed were found & pulled on Crescent District along Hwy 58 in the Odell Lake area. | - Hand pull or dig small, easily accessible populations. Multiple entries per year are required. Pull bolting plants prior to seed set. Bag flowering plants and dispose of properly. Success will depend on consistent labor for each growing season until plants are eradicated.<br>- Mowing is possible, but timing is critical.<br>- These treatments may take up to ten years due to long term seed viability.<br>- If chemicals are used, manual treatments could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time.<br>- Revegetate with desirable species at high priority sites when possible. | **Upland**:<br>1. Clopyralid<br>2. Picloram<br>3. Glyphosate<br><br>**Riparian/High Water Table/Porous Soils**: Aquatic labeled glyphosate (will require the most repeated treatments) | ***Drier upland sites (Road, Quarries & Upland Forest/Rangeland):*** Broadcast spray in dense cover, where dominant plant community is non-native. Spot spray whenever possible, especially in areas with good native plant cover.<br><br>***Wet Meadows, Riparian:*** Selective spot spraying to target specific plants.<br><br>***Timing:*** Preferred treatment is spring before bud stage or early summer so use less herbicide. |

| Target Species | Notes specific to Deschutes, Ochoco, CRNG | General Notes & Prescription | Herbicide Options | When/How to treat chemically |
|---|---|---|---|---|
| **Field bindweed**<br>*Convolvulus arvensis*<br>(COAR4)<br><br>*Rhizomatous perennial* | 25 sites are mapped, most occurring on CRNG. | - Successful control is most likely if the above-ground biomass is removed (by tillage, hand-pulling or herbicide application) followed by competition from other species (e.g., the surround vegetation or restoration efforts), and continuous monitoring for resprouts (The Nature Conservancy 1998b).<br>- Tilling may be useful for ridding infestations; for small areas this may be done using hand-held tools, but for large areas machinery is required.<br>- Mowing is unsuccessful because plants can be missed and it encourages ground-hugging plants.<br>- Seedlings should be cultivated or hoed before they are a month old.<br>- The Nature Conservancy (2004) mentioned that pulling field bindweed should be done frequently and timing is important; the goal would be to continually (throughout the growing season) pull the above-ground portion. This may only be feasible for very small, easily accessible populations. | **Upland:**<br>1. Picloram<br>2. Imazapic<br>3. Imazapyr<br>4. Glyphosate<br><br>**Riparian/High Water Table/Porous Soils:** Aquatic labeled glyphosate. | ***Drier upland sites (Road, Quarries & Upland Forest/Rangeland):*** Broadcast spray in dense cover, where dominant plant community is non-native. Spot spray whenever possible, especially in areas with good native plant cover.<br><br>***Wet Meadows, Riparian:*** Selective spot spraying to target specific plants.<br><br>***Timing:*** Herbicide application should be applied when the herbicide will be translocated to the roots, but before seed set. |
| **Himalayan blackberry**<br>*Rubus discolor*<br>(RUDI2)<br><br>*Rhizomatous Perennial (canes die off annually)* | One mapped site occurs on Paulina District in Project Area 72-48, along Cottonwood Trail. In 2006, found one plant along Hwy 58 adjacent to Odell Lake; pulled it & will monitor. | - Chemical treatment can be followed up with manual and/or mechanical treatment. Relative amounts of herbicide to manual treatments would decline over time.<br>- On large populations, mechanical removal of large biomass in the summer (using a mower, brush hog or brush claw), followed by manual removal of resprouting canes and roots, then herbicide treatment of new growth in the fall/winter is most effective.<br>- The massive root crown must be fully dug out at some point if using only manual/mechanical techniques.<br>- The cultural technique of grazing with goats is also a technique proving successful if goats can be confined to the blackberry area.<br>- Revegetate high priority sites with desirable species if possible. | **Upland:**<br>1. Triclopyr<br>2. Glyphosate<br>3. Picloram<br><br>**Riparian/High Water Table/Porous Soils:** Aquatic labeled glyphosate | ***Drier upland sites (Road, Quarries & Upland Forest/Rangeland):*** Cut and paint larger canes. Boom broadcast spray is possible after canes are cut if non-target species are not an issue. Spot spray whenever possible.<br><br>***Moist to Wet meadows and Riparian***: Wick application.<br><br>***Timing***: Remove large biomass in summer; herbicide treatment of new growth in fall/winter. |

| Target Species | Notes specific to Deschutes, Ochoco, CRNG | General Notes & Prescription | Herbicide Options | When/How to treat chemically |
|---|---|---|---|---|
| **Houndstongue**<br>*Cynoglossum officinale*<br>CYFO)<br><br>*Taprooted Biennial or Short-lived Perennial* | Occurs on both Lookout Mt. and Paulina Districts, with the majority of sites/acres on Paulina. | - Hand pull or dig for small populations. Entire root system must be removed. Plants could be left on site if no seed pods are present (seed can remain viable for more than one year). If seed pods present, bag and remove from site.<br>- These treatments may take up to five years.<br>- If chemicals are used, manual treatments could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time.<br>- Revegetate high priority sites with desirable species when possible. | **Upland:**<br>1. Metsulfuron methyl<br>2. Chlorosulfuron<br>3. Picloram<br>4. Glyphosate<br><br>**Riparian/High Water Table/Porous Soils:** Aquatic labeled glyphosate | ***Drier upland sites (Road, Quarries & Upland Forest/Rangeland):*** Broadcast spray in dense cover, where dominant plant community is non-native. Spot spray whenever possible, especially in areas with good native plant cover. ***Sensitive Sites and moist to wet meadows (high water table), wetlands/riparian:*** Spot spray or wick application to target individual plants.<br><br>***Timing:*** Apply during active growth, preferably basal rosette stage. |
| **Kochia**<br>*Kochia scoparia*<br>(KOSC)<br><br>*Annual* | Three sites are inventoried and proposed for treatment (on Crescent and CRNG). This species is relatively abundant in drier disturbed areas. | - Because kochia is an annual, small populations could be hand pulled, with the goal being prevention of seed production. Mowing or slashing plants before flowering is effective in reducing seed production.<br>- If chemicals are used, timing of treatment may be important, ensuring that treatment is done before seed set. Manual treatment could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time.<br>- Revegetate high priority sites with desirable species when possible. | **Upland:**<br>1. Chlorsulfuron<br>2. Metsulfuron methyl<br>3. Glyphosate<br><br>**Riparian/High Water Table/Porous Soils:** Aquatic labeled glyphosate | ***Drier upland sites (Road, Quarries & Upland Forest/Rangeland):*** Broadcast spray in dense cover, where dominant plant community is non-native. Spot spray whenever possible, especially in areas with good native plant cover. ***Moist to wet meadows (high water table), wetlands/riparian:*** Spot spray or wick application to target individual plants.<br><br>***Timing:*** Treatment should occur before plants set seed. |

| Target Species | Notes specific to Deschutes, Ochoco, CRNG | General Notes & Prescription | Herbicide Options | When/How to treat chemically |
|---|---|---|---|---|
| **Leafy spurge**<br>*Euphorbia esula*<br>(EUES)<br><br>*Rhizomatous perennial* | There are very few sites of leafy spurge. Bend/Ft. Rock, Crescent, Lookout Mt. and Paulina each have one mapped site. | - Requires combination of techniques for successful control. Multiple entries per year are required.<br>- Manual treatment is rarely effective.<br>- Repeated mowing or hand cutting can control seed production but must be used with herbicides for adequate control of the site.<br>- Repeated mowing could reduce competitive ability of desirable species.<br>- Some success has been found with using biological control (flea beetle) with fall herbicide treatments.<br>- Grazing when managed carefully (timing, livestock species, etc.) may help control leafy spurge (***see Common Control Measures****)*. | **Upland:**<br>1. Picloram<br>2. Glyphosate<br>3. Imazapic<br><br>**Riparian/High Water Table/Porous Soils:**<br>Aquatic labeled glyphosate | ***Drier upland sites (Road, Quarries & Upland Forest/Rangeland):*** Spot spray whenever possible. Broadcast spray in dense cover, where dominant plant community is non-native and leafy spurge population is large.<br>***Moist to Wet meadows (high water table) and Riparian***: Wick application to target individual plants.<br><br>***Timing*****:** All three herbicides can be used in the spring or fall, however, ODA would usually spray Picloram and Imazapic in the spring; glyphosate in the fall (Langland, 2005, *personal communication*).<br><br>***Notes***: Must be careful about herbicide rates – use lowest rate possible ((Langland, 2005, *personal communication*). |
| **Lesser burdock**<br>*Arctium minus*<br>(ARMI2)<br><br>*Biennial* | One mapped site exists on Lookout Mt. District in Project Area 71-16. | - Use a combination of manual and herbicide.<br>- Hand pull or dig small populations or when regular volunteers are available.<br>- If chemicals are used, manual treatments could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time.<br>- Revegetate high priority sites with desirable species if needed.<br>* Very little was found on this species.* | **Upland:**<br>1. Metsulfuron methyl<br>2. Picloram<br>3. Telar<br><br>**Riparian/High Water Table/Porous Soils:**<br>Aquatic labeled glyphosate | ***Drier Upland Site Types***: Spot spray whenever possible. ***Riparian and wet/moist meadows***: Spot or wick application to target individual plants.<br><br>***Timing***: Treat as a biennial. Treat in spring after rosettes are formed when non-targets are dormant or treat fall rosettes.<br><br>***Notes***: * Very little information was found on this species.* |

| Target Species | Notes specific to Deschutes, Ochoco, CRNG | General Notes & Prescription | Herbicide Options | When/How to treat chemically |
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| **Mediterranean sage**<br>*Salvia aethiopis*<br>(SAAE)<br><br>*Biennial* | Five sites are mapped on Lookout Mt. District; two sites are mapped on Paulina District. | - An integrated combination of control methods will be needed to successfully manage Mediterranean sage.<br>- Individual plants can be dug out. When the plant begins to bolt, cut or dig up the taproot two to three inches below the crown. This prevents re-sprouting. (Moser and Crisp 2000).<br>- If chemicals are used, manual treatments could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time. | **Upland:**<br>1. Metsulfuron methyl<br>2. Chlorsulfuron<br>3. Picloram | Broadcast spray in dense cover, where dominant plant community is non-native. Use more selective techniques (e.g., spot spraying or selective patch broadcast) if good native plant cover. |
| **Medusahead**<br>*Taeniatherum caput-medusae*<br>(TACA8)<br><br>*Annual* | Majority occurs on CRNG (> 3,000 acres mapped). | - First priority should be to keep uninfested sites weed-free. Second priority would be to treat sites that have enough native plant species to recolonize the site (at least 15% of native plant cover) (Sheley 2005, *personal communication*). For sites that have lost the native plant component, set up a containment strategy based on accessibility to do annual surveys and keep medusahead from moving into adjacent areas.<br>- Management should be focused at replacing medusahead with perennial plant cover. Revegetation strategy should strive to incorporate functional components of the ecosystem that should be on that site (e.g., combination of perennial taprooted forbs, bunchgrasses, rhizomatous grasses, annuals, or whatever components would normally be there (Sheley 2005, *personal communication*).<br>- Requires integrated management using a variety of techniques.<br>- Heavy spring grazing by sheep during the green stage has been reported to assist in control. | **Upland:**<br>1. Sulfometuron methyl<br>2. Landmark (Oust + Telar)<br>3. Imazapic<br>4. Glyphosate | ***Drier upland sites (Road, Quarries & Upland Forest/Rangeland):*** Broadcast spray in dense cover, where dominant plant community is non-native. Selective patch broadcast spray or spot spay if good native cover. ***Sensitive Sites (e.g., adjacent to moist meadows or riparian areas) or Special Management Areas where more selective treatment is desired:*** Spot spray or wick application to target individual plants.<br><br>***Timing***: |

| Target Species | Notes specific to Deschutes, Ochoco, CRNG | General Notes & Prescription | Herbicide Options | When/How to treat chemically |
|---|---|---|---|---|
| **Quackgrass**<br>*Elymus repens*<br>(ELRE4)<br><br>*Rhizomatous perennial* | Two sites occur on Bend/Ft. Rock District. | - Manual control is ineffective because root pieces can produce new plants.<br>- Fabric mulches or roofing paper have been useful for small infestations.<br>- Mowing is recommended when conditions are too wet for tilling (to reduce seed production).<br>-Tilling forces plants to use reserves, but can also spread plant; therefore multiple tillings will be needed.<br>- Prescribed burning can increase population vigor.<br>- Use of herbicides (glyphosate) alone has shown some effectiveness.<br>- Using a combination of mowing, burning, herbicide and reseeding may be the most effective. For example, tilling in early October before a hard frost, then treating with glyphosate has been effective.<br>- Revegetate high priority sites with desirable species if needed and possible. | **Upland:**<br>1. Glyphosate<br>2. Landmark (Telar + Oust)<br>3. Sethoxydim<br>4. Imazapic<br><br>**Riparian/High Water Table/Porous Soils:** Aquatic labeled glyphosate | ***Drier upland sites (Road, Quarries & Upland Forest/Rangeland):*** Spot spray whenever possible. Broadcast spray in dense cover, where dominant plant community is non-native. ***Moist to Wet meadows (high water table) and Riparian***: Spot and wick application to target individual plants.<br><br>***Timing***: Apply in spring or fall during active growth. |

| Target Species | Notes specific to Deschutes, Ochoco, CRNG | General Notes & Prescription | Herbicide Options | When/How to treat chemically |
|---|---|---|---|---|
| **Reed canarygrass** *Phalaris arundinacea* (PHAR3)<br><br>**Ribbongrass** *Phalaris arundinacea* var. *picta* (PHARP3<br><br>*Rhizomatous Perennials* | Reed canarygrass is much more abundant of the 2 species; only certain sites are proposed for treatments. Ribbongrass is only known from the Metolius River in Sisters. | - Successful treatment has been to mow or weed-whack plants down to about 4"tall; let stems grow back for 1-2 months to about 10-12" tall, then fall application of aquatic labeled glyphosate (Tu 2005, *personal communication*). Repeat this treatment in year two. Follow-up with planting of intermittent plugs of desirable species.<br>Requires a combination of techniques, which might include herbicides, manual, mechanical, or cultural. Prescribed burning can be used as a pretreatment before tilling, applying shade cloth, or herbicide application, since the fire will remove the aboveground dead litter and standing vegetation. However, in a fen on the Deschutes NF, Tu did not recommend burning because of potential damage to soil and native plant species (Tu, 2005, *personal communication*).<br>- Choice of techniques will depend on what you are able/willing to do for how long, as well as timing, and logistics.<br>- Manual or mowing treatments by themselves are only practical for small populations when multiple entries per year can be made. The entire population must be removed 2 to 3 times per year for at least five years.<br>- Mechanical methods (mowing, weed wacking) can be used to reduce biomass, reduce the amount of herbicide used, and to ensure more direct foliar application of herbicides (Tu 2005, *personal communication*).<br>- Discing or plowing can be effective especially after herbicide treatment.<br>- Solarization (covering populations with clear or black plastic or use of a thick woven geotextile shade cloth) may be effective if shoots are not allowed to grow beyond tarps. This technique could take over two years to be effective. It may work on distinct patches of reed canarygrass that exist within a matrix of native vegetation (Tu 2004). However, this technique is reported to kill soil mycorrhizal fungi, etc. | **Riparian/High Water Table/Porous Soils:**<br>1. Aquatic labeled Glyphosate<br>2. Imazapyr (Habitat formulation)<br>3. Sethoxydim<br><br>**Upland**: Highly unlikely this species would occur in upland sites. These species need to be in wet conditions.. | Reed canary grass will be found in **wetter site types (wet meadows and riparian).** Depending on the size and distribution of the infestation, herbicide can be foliar-applied using a dripless wick applicator, backpack sprayer, or selective patch broadcast spray technique.<br><br>***Timing***: Application can occur in mid-summer (just prior to summertime dormancy) or preferably in late fall (just prior to frost and wintertime dieback). This will time herbicide application when reed canarygrass is most actively translocating carbohydrates (along with the herbicide) down into the root system.<br><br>***Notes***: Much of treatment information comes from Tu (2004, 2005). |

| Target Species | Notes specific to Deschutes, Ochoco, CRNG | General Notes & Prescription | Herbicide Options | When/How to treat chemically |
|---|---|---|---|---|
| **Russian knapweed** *Acroptilon repens* (ACRE3)<br><br>*Perennial with adventitious shoots* | Six sites are mapped on CRNG, Lookout Mt. and Paulina Districts. | - Hand-pulling Russian knapweed is very difficult, but can be effective for small infestations during the establishment year only. Pull plants when soil is wet and before seeds have formed. Remove all plant parts from site.<br>- Cutting or mowing reduces the current year growth and will eliminate seed production, but will not kill the roots of this species. Cut/mow several times annually to control existing top growth; re-emerging plants will be smaller in size and lower in vigor. Must be frequently repeated (at least 3 times/year – spring, summer, and fall).<br>- Discing or plowing produces broken root fragments that spread quickly and resprout.<br>- Russian knapweed is poisonous to horses. Livestock will graze, but it is usually avoided. Grazing provides only a negligible effect on vigor and viability of root system.<br>- In most situations, Russian knapweed cannot be effectively managed by herbicides alone.<br>- Lasting control requires an integration of techniques (mechanical, manual, chemical, and possibly biological control), proper land management, and revegetation to outcompete the thistle (The Nature Conservancy 1998).<br>- Competitive plantings are usually necessary. | **Upland:**<br>1. Picloram<br>2. Clopyralid<br>3. Telar<br>4. Glyphosate<br><br>**Riparian/High Water Table/Porous Soils:** Aquatic labeled glyphosate | ***Drier upland sites (Road, Quarries & Upland Forest/Rangeland):*** Broadcast spray in dense cover, where dominant plant community is non-native. Spot spray whenever possible, especially in areas with good native plant cover. ***Moist to Wet meadows (high water table) and wetlands/ riparian:*** Spot spray or wick application to target individual plants; follow-up with manual treatments.<br><br>***Timing***:<br><br>***Notes***: |

| Target Species | Notes specific to Deschutes, Ochoco, CRNG | General Notes & Prescription | Herbicide Options | When/How to treat chemically |
|---|---|---|---|---|
| **Russian thistle**<br>*Salsola kali*<br>(SAKA)<br><br>*Annual* | This is an abundant species that is only proposed for treatment on selective, priority sites. | - Pull or uproot young plants or hoe just below ground level before seed set (The Nature Conservancy 1999). Cutting flowers before maturity has worked for some Nature Conservancy preserve stewards.<br>- Mowing tends to cause the plant to grow low but repeated mowing may provide control. | **Upland:**<br>1. Chlorsulfuron<br>2. Metsulfuron methyl<br>3. Glyphosate | This species occurs in upland, drier site types. Broadcast spray in dense cover, where dominant plant community is non-native. Spot spray whever possible, especially in areas with good native plant cover.<br><br>***Timing:***<br><br>***Notes:*** The Nature Conservancy (1999) states that some plants in the Pacific Northwest are resistant to sulfonylurea herbicides and resistance to the trazine herbicides has also been observed. If these types of herbicides are used, need to monitor for treatment effectiveness. |
| **Scotch broom**<br>*Cytisus scoparius*<br>(CYSC4)<br><br>*Woody Perennial* | Most of the mapped scotch broom sites are on Sisters District (10 sites), but other mapped sites are proposed for treatment on Crescent, Bend/Ft. Rock, Lookout Mt. and Paulina. | - Hand pull, cut, weed wrench or dig small populations or when regular volunteers are available. Hand pulling or weed wrenching is most effective in moist soils. Plants can be left on site if no seed pods are present (seed can remain viable for more than one year). Cutting will require multiple visits in one year.<br>- These treatments may take up to ten years due to long term seed viability.<br>- If chemicals are used, manual treatments could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time.<br>- Revegetate high priority sites with desirable species when possible. | **Upland:**<br>1. Triclopyr<br>2. Picloram<br>3. Glyphosate<br><br>**Riparian/High Water Table/Porous Soils:**<br>Aquatic labeled glyphosate | ***Roads, Quarries and other drier, upland Site Types:*** Larger plants: Cut and paint herbicide on stump. Smaller plants: Spot spray where hand pulling or weed wrenching is not feasible. Broadcast spray of triclopyr not permitted. ***Riparian, meadows (high water table):*** Same as other sites with either cut/stump method or selective spot spray technique.<br><br>***Timing:*** Apply during active growth preferably in the spring to young plants. |

| Target Species | Notes specific to Deschutes, Ochoco, CRNG | General Notes & Prescription | Herbicide Options | When/How to treat chemically |
|---|---|---|---|---|
| **Scotch thistle**<br>*Onopordum acanthium*<br>(ONAC)<br><br>*Taprooted Biennial or Short-lived Perennial* | 16 sites of Scotch thistle are mapped on all units except Sisters, with the majority (8 sites) on Lookout Mt. District. | - Only reproduces by seed, so preventing seed production & spread should be main focus.<br>- Severing the root below the soil surface will kill the plant.<br>- Mowing to ensure seed heads don't form can work, but need to mow more than once since plants do not mature uniformly. Mow after plants bolt and before flower since seed from cut flowers can mature (University of Idaho 2005).<br>- Goats will graze Scotch thistle; sheep and cattle will not. Proper grazing management can allow grasses to compete with Scotch thistle, but continuous stocking of animals tends to reduce grass health and allow Scotch thistle a competitive advantage. | **Upland:**<br>1. Clopyralid<br>2. Chlorosulfuron<br>3. Metsulfuron<br><br>**Riparian/High Water Table/Porous Soils:** Aquatic labeled glyphosate. (**Tends to like drier sites but can occur in wet places).** | ***Drier upland sites (Road, Quarries & Upland Forest/Rangeland):*** Broadcast spray in dense cover, where dominant plant community is non-native. Spot spray whenever possible, especially in areas with good native plant cover. ***Wet Meadows, Riparian:*** Spot or wick applications to target specific plants.<br><br>***Timing:*** Preferred treatment is spring before bud stage or early summer so use less herbicide. |
| **St. Johnswort**<br>*Hypericum perforatum*<br>(HYPE)<br><br>*Rhizomatous Perennial* | Occurs on all units, with the majority (65 mapped sites) on Sisters District. Has expanded after recent wildfires. | - Hand removal of small populations or isolated stems is possible, but repeated treatments will be necessary as lateral roots give rise to new plants. Remove plants from the site and dispose of properly.<br>- These treatments may take up to ten years due to long term seed viability.<br>- Biological controls will most likely not be effective in damp, cool climates.<br>- Revegetate high priority sites if needed with desirable species if possible. | **Upland:**<br>1. Metsulfuron methyl<br>2. Picloram<br>3. Glyphosate<br><br>**Riparian/High Water Table/Porous Soils:** Aquatic labeled glyphosate (not found as effective in the literature) | ***Drier upland sites (Road, Quarries & Upland Forest/Rangeland):*** Spot spray whenever possible. Boom broadcast spray in dense cover, where dominant plant community is non-native.<br><br>***Moist to Wet meadows (high water table) and Riparian***: Wick application to target individual plants.<br><br>***Timing:*** Apply metsulfuron methyl when plants are fully emerged and in active growth. Apply picloram in early growth stages before bloom. |

| Target Species | Notes specific to Deschutes, Ochoco, CRNG | General Notes & Prescription | Herbicide Options | When/How to treat chemically |
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| **Sulfur cinquefoil** Potentilla recta (PORE5)<br><br>*Taprooted perennial that may have several shallow, spreading branch roots but no rhizomes* | Occurs on Lookout Mt. and Paulina Districts. | - Hand-digging may effectively control small infestations (The Nature Conservancy 2004).<br>- There are no approved biological controls for this species.<br>- In large infestations, selective herbicides applied at recommended label rates are likely the only method of effective control (The Nature Conservancy 2004).<br>- Using prescribed fire alone does not appear to be effective; however, integrated approaches incorporating prescribed fire, herbicide application, and seeding of native seeds may be effective.<br>- This species is a strong competitor and is capable of suppressing native vegetation. If sulfur cinquefoil populations are reduced (i.e., by herbicide, hand-pulling), native plants are usually able to rapidly re-colonize sites if sufficient native seed is still viable in the soil. Seeding of native species under adequate environmental conditions, reducing grazing pressure, and continued spot herbicide re-treatments will result in a more rapid and stable restored native plant community (The Nature Conservancy 2004). | **Upland:**<br>1. Picloram<br>2. Triclopyr<br>3. Glyphosate<br><br>**Riparian/High Water Table/Porous Soils:** Aquatic labeled glyphosate | From Mazzu (2005): On dry sites, picloram is preferred; backpack or wick to minimize drift, though broadcast spray may be necessary for large infestations.<br><br>***Timing***: Apply picloram in fall or spring prior to late bud stage. |
| **Tansy ragwort** *Senecio jacobaea* (SEJA)<br><br>*Taprooted biennial or short-lived perennial* | Occurs on Crescent and Sisters Districts. All 20 sites will be manually treated. On Crescent, chemical would only be used if tansy spreads & manual no longer effective. | - Hand-pulling is effective if done in moist soils. This is most effective after the population has been brought under control.<br>- Manual Disposal: Plants with flower heads should be removed from site, as young cut flower heads will continue to mature, producing viable seeds if moisture is present.<br>- If chemicals are used, manual treatments should be used for follow-up treatment. Relative amounts of herbicide to manual treatments would decline over time.<br>- Treatments may take up to ten years due to long-term seed viability.<br>- Revegetate with desirable species if needed; most of areas already have good native plant species component.. | **Upland:**<br>1. Clopyralid<br>2. Chlorsulfuron<br>3. Picloram | Manual treatment is preferred. If chemicals used, spot spray to target individual plants. If broadcast spray was needed, a selective "patch broadcast" technique would be used. |

| Target Species | Notes specific to Deschutes, Ochoco, CRNG | General Notes & Prescription | Herbicide Options | When/How to treat chemically |
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| **Teasel**<br>*Dipsacus fullonum*<br>(DIFU2)<br><br>*Taprooted Biennial* | 15 sites are mapped on Ochoco NF. Populations on Lookout Mt. are not proposed for treatment (10 sites). Five sites on Paulina are proposed for treatment in places where high priority invasives are also being treated. | - Little information was found on treatment of teasel.<br>- Cutting, digging, and cultivation can work if repeated enough to eliminate seed production (Stevens County Noxious Weed Control Board 2006).<br>- If chemicals are used, manual treatments should be used for follow-up treatment. | **Upland:**<br>1. Metsulfuron methyl<br>2. Chlorosulfuron<br>3. Clopyralid + Triclopyr (= Redeem)<br><br>**Riparian/High Water Table/Porous Soils:** Aquatic labeled glyphosate | Spot spray to target individual plants. If dense cover of teasel, a selective patch broadcast spray might be used.<br><br>***Timing:*** Apply to rosettes or early season growth; control is difficult later in growth cycle. |
| **Whitetop**<br>*Cardaria draba, C. pubescens*<br>(CADR)<br><br>**Hairy whitetop**<br>*Cardaria pubescens*<br>(CAPU6)<br><br>*Rhizomatous Perennial* | Whitetop occurs on the Ochoco NF and CRNG, with the majority of sites on Paulina District. One site of hairy whitetop occurs on Crescent District. | - Diligent hand pulling or digging can control small infestations, but plants must be completely removed within 10 days after emergence throughout growing season for two to four years.<br>- Mowing followed a month later by herbicide may be effective. Mowing must be done during full flowering.<br>- If chemicals are used, manual treatments could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time.<br>- Revegetate high priority sites with desirable species if needed & possible. | **Upland:**<br>1. Chlorosulfuron<br>2. Metsulfuron methyl<br>3. Glyphosate<br><br>**Riparian/High Water Table/Porous Soils:** Aquatic labeled glyphosate | ***Drier upland sites (Road, Quarries & Upland Forest/Rangeland):*** Spot spray whenever possible. Broadcast spray in dense cover, where dominant plant community is non-native. ***Moist to Wet meadows (high water table) and Riparian***: Wick application to target individual plants.<br><br>***Timing***: Apply at pre-bloom to bloom growth stage or to rosettes in the fall |
| **Yellow flag iris**<br>*Iris pseudacorus*<br>(IRPS)<br><br>*Rhizomatous perennial* | Occurs on Sisters District (Metolius River); occurs on non-FS land along Deschutes River (Bend/Ft. Rock District) | - Manual or mechanical methods that remove the entire rhizome mass can successfully control small, isolated patches (The Nature Conservancy 2003). These methods, however, are very time and labor-intensive, since even small rhizome fragments can resprout.<br>- Can be effectively controlled by herbicides (The Nature Conservancy 2003). | **Riparian/High Water Table/Porous Soils:** Aquatic labeled glyphosate; Habitat formulation of Imazapyr | ***Moist to Wet meadows (high water table) and Riparian***: Wick application to target individual plants. |

| Target Species | Notes specific to Deschutes, Ochoco, CRNG | General Notes & Prescription | Herbicide Options | When/How to treat chemically |
|---|---|---|---|---|
| **Yellow sweet clover** *Melilotus officinalis* (MEOF)<br><br>*Annual, winter annual or biennial* | This species is relatively abundant and only proposed for treatment along Hwy 58 on Crescent District, where it occurs with other high priority invasive species. | - Burning (and sometimes a combination of cutting and burning) was the focus of sweet clover treatments in prairies by The Nature Conservancy (1987). Our one site proposed for treatment is along a highway and does not lend itself to burning.<br>- Hand pulling is effective on small infestations when the soil is moist (Minnesota Dept. of Natural Resources 2006).<br>- Cutting should be done before flowers emerge. The goal is to halt flowering and then concentrate on depleting viable seeds in the soil.<br>- If chemicals are used, hand pulling and/or cutting flowers may be used as a follow-up. | **Upland:**<br>1. Clopyralid | ***Drier upland sites (Road, Quarries & Upland Forest/Rangeland):*** Spot spray whenever possible. Broadcast spray in dense cover, where dominant plant community is non-native. ***Moist to Wet meadows (high water table) and Riparian***: Wick application to target individual plants.<br><br>***Timing:*** Sweet clover enters a "critical growth period" about the 1st of September, when root weight begins to increase rapidly as food is translocated from the tops for storage overwinter. |
| **Yellow starthistle** *Centaurea solstitialis* (CESO3)<br><br>*Annual* | Lookout Mt. and Paulina Districts each have one mapped site. Lookout Mt. site is treated under the 1998 EA has been reduced to hand-pulling after 5 years of treatment. Crescent District finds individual plants each year on Highway 58, pulling them to prevent spread onto the Deschutes NF; they found 2 sites in 2003; 1 site in 2004; not found again in 2005 & 2006. | - Hand-pull small patches or maintenance programs where plants are sporadically located. Remove all above ground material (leaving even a two inch piece of stem can result in recovery if leaves and buds are still attached at base of plant). Pull after bolted but before it produces viable seed. On relatively large populations of < 40 acres, start removing plants at outward edge of population and work toward interior (Bradley Method).<br>- Mowing can be useful but timing is critical (before viable seed production, but too early can result in rapid re-growth).<br>- In areas with many non-target species, early summer tillage will control yellow starthistle provided roots are detached from the shoots; repeated cultivation will be necessary in same season when rainfall stimulates germination.<br>- Mazzu (2005) discusses biological control, prescribed burning, and grazing. Timing and intensity of grazing and type of grazing animal needs to be considered. Prescribed burning may be best used after herbicide treatment. Two biological control insects have reduced seed production by up to 76% in California.<br>- Revegetate high priority sites if needed with desirable species if possible. | **Upland**:<br>1 - Clopyralid<br>2 - Picloram<br>3 - Glyphosate<br><br>**Riparian/High Water Table/Porous Soils**: Aquatic labeled glyphosate | ***Drier upland sites (Road, Quarries & Upland Forest/Rangeland):*** Boom broadcast spray in dense cover, where dominant plant community is non-native. Spot spray whenever possible, especially in areas with good native plant cover.<br><br>***Sensitive Sites (e.g., adjacent to moist meadows or riparian areas) or Special Management Areas where more selective treatment is desired:*** Spot spray or wick application to target individual plants.<br><br>***Timing***: Spring application. |

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## Biological Control

Biological control agents undergo a rigorous testing procedure prior to being available for release. Initial testing occurs in quarantine laboratories abroad and in the United States. The agents are tested for their effectiveness in controlling the target organism and for their host specificity. Testing includes potential effects on economic crops, rare plants, and similar species found in North America. An agent can be released only after it has been determined that it is unlikely that the agent will feed or cause injury to any native or agronomic species. It generally takes between ten and fifteen years for an agent to be cleared for release. The analyses for effects of such tools have already been completed under documents developed by Animal and Plant Health Inspection Service (APHIS) for approval of entry of such organisms.

The APHIS analysis assumes that agents will spread throughout North America, to wherever the target species exists. It is intended that this analysis will satisfy the intent of NEPA for the release and distribution of the agent in the United States. Like the invasive plants that are targeted, agents do not recognize property boundaries. The Forest Service has no control over the release of agents on adjacent weed populations. Agents are expected to spread onto National Forest system lands regardless of any action the Forest Service may take. More information is available in the R6 2005 FEIS. Biological control agents are a useful tool in the integrated weed management program, but are usually not completely effective in the control of invasive plants.

**Table B-2.** Invasive Plant Species Proposed for Biological Control in Deschutes/Ochoco/CRNG Invasive Plant EIS, and the Agents to be used. [1] Use of these agents complies with Standard #14 which requires use of only APHIS and State-approved agents that do not have direct negative impacts on non-target organisms.

| Invasive Plant | Common Name Biocontrol Agent | Scientific Name Biocontrol Agent | Activity | Non-target Effects | Notes |
|---|---|---|---|---|---|
| **Canada thistle** (*Cirsium arvense*) | Canada thistle stem weevil | *Ceutorhynchus litura* | Adults eat leaves and stem. Larvae eat stem and crown. | None have been reported. The host range of the beetle was found to be narrow, restricted to plants of the tribe *Cardueae*. | Favorable conditions include disturbed areas where Canada thistle is dense and where the plant is not stressed by grazing, dry conditions, flooding, mowing, or herbicides. |

[1] Information from Langland (2006) and Coombs et. al. (2004). Langland, Dave. 2004. Personal communication. Oregon Dept. of Agriculture Weed Specialist. Coombs, Eric M., Janet K. Clark, Gary L. Piper, and Alfred F. Cofrancesco, Jr. 2004. Biological Control of Invasive Plant in the United States. Oregon State University Press, Corvallis, Oregon.

| Invasive Plant | Common Name Biocontrol Agent | Scientific Name Biocontrol Agent | Activity | Non-target Effects | Notes |
|---|---|---|---|---|---|
| | Canada thistle stem gall fly | *Urophora cardui* | Forms galls which act like a metabolic sink, preventing plant's nutrients from being allocated to other areas (roots, flower). This reduced the plant's vigor. | None have been reported. | This fly does best in moist, disturbed areas with scattered Canada thistle plants. Semi-shaded areas seem to be slightly preferred over those in full sun. Fields subject to flooding, grazing, mowing, or chemical treatments are not conducive to fly survival. |
| **St. Johnswort** (*Hypericum perforatum*) | St. Johnswort root borer | *Agrilus hyperici* | Larvae eat roots. | The beetle attacks *Hypericum concinnum* in California, but no long-term impacts have been reported. | *Hypericum concinnum* does not occur in our Project Area and is currently only known from California (http://plants.usda.gov/)<br><br>In North America, is found mostly in mountain areas. Larvae are subject to fungal attack in damp sites. |
| | St. Johnswort moth | *Aplocera plagiata* | Larvae eat leaves and flowers. | No instances of nontarget plant feeding have been reported. | The effectiveness of this agent is quite variable. It appears to need warm dry areas with a summer season long enough to complete both generations. In favorable areas, this moth can be very effective; large populations of larvae can defoliate plants, thus inhibiting flower and seed formation. |
| | Klamathweed beetle | *Chrysolina hyperici* | Larvae and adult eat leaves and flowers. | No instances of nontarget feeding have been reported, although it may develop on several *Hypericum* species attacked by *C. quadrigemina* (see below) | The beetle prefers more moist conditions than *Chrysolina. quadrigemina* (see below) and avoids shaded or barren, rocky locations. It tolerates cold winter weather better than *C. quadrigemina*. |

| Invasive Plant | Common Name Biocontrol Agent | Scientific Name Biocontrol Agent | Activity | Non-target Effects | Notes |
|---|---|---|---|---|---|
| | Klamath weed beetle | *Chrysolina quadrigemina* | Larvae and adult eat leaves and flowers. | Adults will feed and oviposit on *Hypericum calycinum*, an introduced ornamental, and on *H. concinnum*, a native species. No population-level impacts have been reported on the native species. | *Hypericum concinnum* does not occur in our Project Area and is currently only known from California (http://plants.usda.gov/). Hypericum calycinum does not occur in the Project Area and is typically in moister regions of Oregon & California.<br><br>This agent is found in mountainous, open, sunny and warm areas. It apparently does not do well in shaded, barren, and excessively rocky locations.<br><br>Success has been variable. At many locations where the insect is established, many of the St. Johnswort populations are still increasing in size and density, while at others there is little change. |
| | St. Johnswort gall midge | *Zeuxidiplosis giardi* | Larvae attack the leaf buds which results in the formation of galls that provide the larvae with a protective environment as well as nutrition. | The midge is capable of forming galls on *Hypericum concinnum*, but the damage to the plant is insignificant. | *Hypericum concinnum* does not occur in our Project Area and is currently only known from California (http://plants.usda.gov/).<br><br>The midge seems to prefer damp locations with moderate to high relative humidity and high elevations. It also apparently does not like dry summers or continuously windy areas. It does not persist in areas heavily grazed by livestock. |

**Table B-3.** Biocontrol Agents that either exist in Oregon or could possibly move into the area on their own. (Langland 1998, *personal communication*, and http://www.oregon.gov/ODA/PLANT/weed_bioagent_targets_shtml).

| Noxious Weed | Common Name Biocontrol Agent | Scientific Name Biocontrol Agent | Activity | Known release sites in project area? | Notes |
|---|---|---|---|---|---|
| **Bull thistle** (*Cirsium vulgare*) | Bull thistle gall fly | *Urophora stylata* | Larvae feed on receptacle tissue where galls are also produced. | Y | Can prevent some seeding. |
| **Canada thistle** (*Cirsium arvense*) | Canada thistle seed weevil | *Ceutorhynchus litura* | Adults eat leaves and stem. Larvae eat stem and crown. | Y | Canada thistle weevil |
| | Thistle stem gall fly | *Urophora cardui* | Nutrient sinks in larval galls. | Y | Can prevent some seeding. |
| **Dalmatian toadflax** (*Linaria dalmatica*)<br><br>**Butter & Eggs** (*Linaria vulgaris*) | Toadflax flower-feeding beetle | *Brachypterolus pulicarius* | Larvae eat pollen, anthers, ovaries, and seeds. Adults eat shoot tips. | | Widespread and established in most of North America's toadflax populations. |
| | Toadflax moth | *Calophasia lunula* | Larvae eat young shoots and stem tips. | | Prefers hot summers. |
| | | *Gymnetron antirrhini* | Root-galling weevil | | |
| | | *Mecinus janthinus* | Stem boring weevil | | |
| **Diffuse knapweed** (*Centaurea diffusa*)<br><br>**Spotted knapweed** (*Centaurea biebersteinii*) | Sulphur knapweed moth | *Agapeta zoegana* | Larvae mine roots. | Y | |
| | Seed head weevil | *Bangasternus fausti* | Larvae consume most seeds in early season buds. | Y | |
| | Knapweed peacock fly | *Chaetorellia acrolophi* | Larvae eat receptacle, florets, and seeds. | | Primary host is spotted knapweed; diffuse knapweed is secondary host. |
| | Knapweed root weevil | *Cyphocleonus achates* | Larvae mine root cortex. | Y | |
| | Lesser knapweed flower weevil | *Larinus minutus* | Larvae eat seeds. Adults eat foliage. | Y | |
| | Blunt knapweed flower weevil | *Larinus obtusus* | Larvae eat seeds. | | Prefers meadow knapweed; spotted knapweed is secondary. |
| | Spotted knapweed seed head moth | *Metzneria paucipunctella* | Larvae consume seeds. | Y | |
| | Grey-winged root moth | *Pterolanche inspersa* | Larvae attacks root central vascular tissue. | | Has not yet been established in U.S. |
| | Bronze knapweed root-borer | *Sphenoptera jugoslavica* | Larvae deplete root carbohydrates. | Y | |
| | Verdant seed fly | *Terellia virens* | Larvae eat flower receptacle and seeds. | | |

| Noxious Weed | Common Name Biocontrol Agent | Scientific Name Biocontrol Agent | Activity | Known release sites in project area? | Notes |
|---|---|---|---|---|---|
| | Banded gall fly | *Urophora affinis* | Larvae form galls on flower receptacle and seeds, causing nutrient sink. | Y | Established throughout Pacific Northwest. |
| | UV knapweed seed head fly | *Urophora quadrafasciata* | Larvae eat flower receptacle and seeds. | Y | Established throughout Pacific Northwest. |
| **Leafy spurge** (*Euphorbia esula*) | | *Aphthona abdominalis* | Root/defoliating flea beetle | | |
| | | *Aphthona cyparissiae* | Root/defoliating flea beetle | | |
| | | *Aphthona czqalinae* | Root/defoliating flea beetle | | |
| | | *Aphthona lacertosa* | Root/defoliating flea beetle | | |
| | | *Aphthona flava* | Root/defoliating flea beetle | | |
| | | *Aphthona nigriscutis* | Root/defoliating flea beetle | | |
| | | *Hyles euphorbiae* | Defoliating moth | | Not established in Oregon. |
| | | *Oberea erythrocephala* | Root/stemboring beetle | | |
| | | *Spurgia esula* | Shoot tip gall midge | | Not established in Oregon. |
| **Musk thistle** (*Carduus nutans*) | | *Cheilosia corydon* | Crown/rootfly | | Established in Oregon. |
| | | *Rhinocyllus conicus* | Seed head weevil | | Because this agent has moved to native *Cirsium* plant species, ODA will not be moving this weevil to new sites. |
| | | *Trichosirocalus horridus* | Crown/root weevil | | |
| | | *Urophora solstitialis* | Seed head gall fly | | Not established in U.S.; is in Canada. |
| **Puncturevine** (*Tribulus terrestris*) | | *Microlarinus lareynii* | Seed weevil | | Does not work in cold climates. |
| | | *Microlarinus lypriformis* | Stem boring weevil | | Does not work in cold climates. |
| **Russian knapweed** (*Acroptilon repens*) | | *Subanguina picridis* | Leaf stem gall nematode | Y | On Crooked River National Grassland. |
| **Russian thistle** (*Salsola kali*) | | *Coleophora klimeschiella* | Leaf mining moth | | Parasitized by native insects so not effective biocontrol agent. |
| | | *Coleophora parthenica* | Stem boring moth | | Parasitized by native insects so not effective biocontrol agent. |
| **St. Johnswort** (*Hypericum* | St. Johnswort borer | *Agrilus hyperici* | Larvae eat roots. | | Established on east side of Cascade Mountains. |

| Noxious Weed | Common Name Biocontrol Agent | Scientific Name Biocontrol Agent | Activity | Known release sites in project area? | Notes |
|---|---|---|---|---|---|
| *perforatum*) | St. Johnswort inchworm | *Aplocera plagiata* | Larvae eat leaves and flowers. | Y | Some establishment on east side of Cascade Mountains. |
| | Klamath weed beetle | *Chrysolina hyperici* | Larvae and adult eat leaves and flowers. | | Established on west side of Cascade Mountains. Prefers fall rains. |
| | Klamath weed beetle | *Chrysolina quadrigemina* | Larvae and adult eat leaves and flowers. | Y | |
| | Klamath weed midge | *Zeuxidiplosis giardi* | Larvae create nutrient sink galls. | | Not established in Oregon. |
| **Scotch broom** (*Cytisus scoparius*) | | *Apion fuscirostre* | Seed weevil | | |
| | | *Bruchidius villosus* | Seed beetle | | |
| | | *Leucoptera spartifoliella* | Twig mining moth | | |
| **Tansy ragwort** (*Senecio jacobaea*) | | *Botanophila seneciella* | Seed head fly | Y | |
| | Ragwort flea beetle | *Longitarsus jacobaeae* | Larvae mine roots. Adults eat leaves. | | Highly effective on west side of Cascade Mountains. Thrives below 2600' elevation. |
| | Cinnabar moth | *Tyria jacobaeae* | Larvae eat leaves, terminal buds, and flowers. Requires dense host infestation. | Y | Requires dense host infestation. Very effective when combined with the ragwort flea beetle. Because it has moved to native *Senecio* plants, ODA will not be moving this agent to new sites. Not yet successful on east side of Cascade Mountains. |
| **Yellow starthistle** (*Centaurea solstitialis*) | | *Bangasternus orientalis* | Weevil | | |
| | | *Chaetorellia australis* | Seed head fly | | |
| | | *Chaetorellia succinea* | Seed head fly | | |
| | | *Eustenopus villosus* | Seed head weevil | | |
| | | *Larinus curtus* | Seed head weevil | | |
| | | *Urophora quadrifasciata* | Seed head gall fly | | |
| | | *Urophora sirunaseva* | Seed head fly | | |
| | | | | | |

**Table B-4.** Herbicides considered for use on invasive plant species, Deschutes and Ochoco NF and Crooked River National Grassland Invasive Plant EIS. (Oregon Department of Agriculture and Crook County provided numbered priorities).

| Species | Common Name | Chlor-sulfuron (Telar) | Clopyralid (Transline) | Glyphosate (RoundUp, Rodeo) | Imazapic (Plateau) | Imazapyr (Arsenal; Habitat)) | Metsulfuron methyl (Escort) | Pic-loram (Tordon) | Sethox-ydim (Poast) | Sulfomet-uron methyl (Oust) | Triclopyr (Garlon) | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Acroptilon repens* | Russian knapweed | **3** | **2** | **4** | | | | **1** | | | | Picloram 1st choice, but if sensitive non-target species (e.g., cottonwoods on CRNG) switch to Clopyralid. |
| *Arctium minus* | Lesser burdock | **3** | | | | | **1** | **2** | | | | |
| *Cardaria draba* | Whitetop | **1** | | **3** | | | **2** | | | | | |
| *Cardaria pubescens* | Hairy whitetop | **1** | | **3** | | | **2** | | | | | |
| *Carduus nutans* | Musk thistle | **3** | **1** | | | | **2** | | | | | |
| *Centaurea biebersteinii* | Spotted knapweed | | **1** | **3** | | **4** | | **2** | | | | |
| *Centaurea debeauxii* | Meadow knapweed | | **1** | **3** | | **4** | | **2** | | | | Suspected but not yet documented to occur. |
| *Centaurea diffusa* | Diffuse knapweed | | **1** | **3** | | **4** | | **2** | | | | |
| *Centaurea solstitialis* | Yellow star-thistle | | **1** | **3** | | | | **2** | | | | Would not use triclopyr; resistance to picloram possible in Northwest. |
| *Cirsium arvense* | Canada thistle | **3** | **1** | **4** | | | | **2** | | | | |
| *Convolvulus arvensis* | Field bindweed | | | **4** | **2** | **3** | | **1** | | | | |
| *Cynoglossum officinale* | Houndstongue | **2** | | **4** | | | **1** | **3** | | | | |
| *Cytisus scoparius* | Scotch broom | | | **3** | | | | **2** | | | **1** | |
| *Dipsacus fullonum* | Teasel | **2** | **3 (see notes)** | | | | **1** | | | | **3 (see notes)** | 3rd choice is Redeem (clopyralid + Triclopyr). |
| *Elytrigia repens var. repens* | Quackgrass | **2 (See notes)** | | **1** | | **4** | | | **3** | **2 (See notes)** | | Landmark (Telar + Oust). |
| *Euphorbia esula* | Leafy spurge | | | **2** | **3** | | | **1** | | | | |
| *Hypericum perforatum* | St. Johnswort | | | **3** | | | **1** | **2** | | | | |
| *Kochia scoparia* | Kochia | **1** | | **3** | | | **2** | | | | | |
| *Lepidium latifolium* | Perennial pepperweed | **1** | | **4** | | **3** | **2** | | | | | Suspected but not yet documented to occur. |
| *Linaria dalmatica* | Dalmatian toadflax | **2** | | | **3** | | | **1** | | | | Telar + Picloram mix works very well on Dalmatian Toadflax. |
| *Linaria vulgaris* | Butter & eggs | **2** | | | **3** | | | **1** | | | | |
| *Onopordum acanthium* | Scotch thistle | **2** | **1** | | | | **3** | | | | | |
| *Phalaris arundinacea* | Reed canarygrass | | | **1** | | **2** | | | **3** | | | Habitat formulation of Imazapyr may work well. |

| Species | Common Name | Chlor-sulfuron (Telar) | Clopyralid (Transline) | Glyphosate (RoundUp, Rodeo) | Imazapic (Plateau) | Imazapyr (Arsenal; Habitat)) | Metsulfuron methyl (Escort) | Pic-loram (Tordon) | Sethox-ydim (Poast) | Sulfomet-uron methyl (Oust) | Triclopyr (Garlon) | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Phalaris arundinacea var. picta* | Ribbongrass | | | **1** | | **2** | | | **3** | | | |
| *Potentilla recta* | Sulphur cinquefoil | | | **3** | | | | **1** | | | **2** | |
| *Rubus discolor* | Himalayan blackberry | | | **2** | | | | **3** | | | **1** | |
| *Salsola kali* | Russian thistle | **1** | | **3** | | | **2** | | | | | |
| *Salvia aethiopis* | Mediterranean sage | **2** | | | | | **1** | **3** | | | | |
| *Senecio jacobaea* | Tansy ragwort | **2** | **1** | | | | | **3** | | | | |
| *Silybum marianum* | Blessed milkthistle | **2** | **1** | | | | | **3** | | | | |
| *Taeniatherum caput-medusae* | Medusahead | **2 (See notes)** | | **4** | **3** | | | | **5** | **1**<br>**2 (See Notes)** | | Landmark (oust/telar) would be 2nd choice. |

# APPENDIX C

## Management Direction and Compliance with Forest Plan Standards

**Current Management Direction Relating to Invasive Plant Treatment:**

- Deschutes LRMP (1990)
- Ochoco NF & CRNG LRMP (1991)
- Ochoco NF & CRNG Weed EA (1995)
- NWFP (1994)

| FOREST | SCOPE | STANDARD AND GUIDELINE | COMMENT |
|---|---|---|---|
| CR Grassland | Forage and Livestock Use Grassland-wide | Control noxious weeds and invader plants to prevent threats to adjacent agricultural lands or to prevent unacceptable loss of range productivity. 4-75 | This sentence removed by 1995 Weed EA Amendment |
| CR Grassland | Grassland Health MA-G4 Research Natural Area | Take no action to control insects, disease, ~~or noxious weeds~~ unless the outbreak drastically alters the natural ecological processes within the RNA. 4-85 | "or noxious weeds" deleted by 1995 Weed EA Amendment |
| CR Grassland | Grassland Health Grassland-wide direction | Use Integrated Pest Management (IPM) strategies to manage pests within the constraints of laws and regulations, and meet Forest management objectives. IPM strategies include manual, mechanical, cultural, biological, chemical, prescribed fire, and regulatory means. Select strategy though the environmental analysis process, and in compliance with the 1988 Regional Vegetation Management Environmental Impact Statement. 4-85 | Direction in 1988 Veg EIS vacated with 2005 R6 ROD |
| CR Grassland | Grassland Health Grassland-wide direction | Coordinate strategies with the Agricultural Pest Health Inspection Service (APHIS) when proposing major control projects. | The biological control that is proposed in the project involves only agents that have previously been released. |
| CR Grassland | Grassland Health Grassland-wide direction | Pesticide application, if used, will conform with EPA regulations, label restrictions, and the Regional Environmental Impact Statement on Chemical applications. | The action alternatives are consistent with EPA regulations and label restrictions. Direction in 1988 EIS vacated with 2005 R6 ROD |
| CR Grassland | Forestwide Direction | Monitor plant communities/associations to determine conditions and trends. Encourage recovery or prevent deterioration where activities may be leading to poor conditions; downward trends; the displacement of native plants or plant communities by unusually weedy, annual, or noxious vegetation; or where cover is untypically low for the particular plant associations. | Covered by adoption of R6 2005 ROD standards for rehabilitation/revegetation and monitoring framework. |
| Och/CRNG 1995 Weed EA | Grassland-wide Direction | Maintain a current inventory of all noxious weed infestations. Monitor annually to detect population and distribution changes, and reasons thereto. | This standard is outside the scope of a treatment project. |

| | | | |
|---|---|---|---|
| Och/CRNG 1995 Weed EA | Grassland-wide Direction | Meet requirements specified in the noxious weed program agreement between the Oregon Dept. of Agriculture and the Pacific Northwest Region, Forest Service. | The action alternatives meet the requirements of the specified agreement. |
| Och/CRNG 1995 Weed EA | Grassland-wide Direction | Meet requirements specified in the Final Environmental Impact Statement (FEIS) for Managing Competing and Unwanted Vegetation in the Pacific Northwest Region, and the accompanying Mediated Agreement. | This direction vacated with 2005 R6 ROD |
| Och/CRNG 1995 Weed EA | Grassland-wide Direction | Provide for ongoing public participation and information, and other agency coordination during all noxious weed management activities. Coordinate with county officials and other to prevent and control noxious weeds. Identify species and infestations of greatest concern, and opportunities for joint prevention and control activities. | Public involvement has been provided for through the NEPA process (see Section 1.7 of DEIS). Extensive coordination has occurred with county officials. |
| Och/CRNG 1995 Weed EA | Grassland-wide Direction | Implement integrated noxious weed management, including manual, chemical, biological, cultural and mechanical methods, based on site-specific analysis. Maintain documentation of annual noxious weed treatments. | The action alternatives meet this standard. |
| Och/CRNG 1995 Weed EA | Grassland-wide Direction | Use chemical treatments only when other methods would be ineffective or impractical. | This standard replaced with amendment to be consistent with R6 2005 ROD standards for herbicide use. See Sections 2.3 and 3.15 of this DEIS. |
| Och/CRNG 1995 Weed EA | Grassland-wide Direction | Adhere to EPA regulations and herbicide label restrictions. | The action alternatives meet this standard. |
| Och/CRNG 1995 Weed EA | Grassland-wide Direction | Inform the public of planned herbicide use locations prior to initiating control projects. Record annually the quantity and kinds of herbicides used; document reduced reliance on herbicide use over time. | Public notification is provided for (see Section 2.4 and Appendix F. |
| Ochoco | Forestwide Direction | Control noxious weeds and invader plants to prevent threats to adjacent agricultural lands or to prevent unacceptable loss of range productivity. | This sentence removed by 1995 Weed EA Amendment |
| Ochoco | Mgmt. Area 15 - Riparian | Use all methods to control insect and disease except chemical spraying. | Insect and disease standard is not applicable to invasive plant species. |
| Ochoco | North Fork Crooked River Wild and Scenic River Plan | None | N/A |
| Och/CRNG 1995 Weed EA | Forest-wide Direction | Districts will coordinate closely with the respective county weed board to ensure sharing of information regarding infestations, treatments, etc. | There has been extensive coordination with counties. |

| | | | |
|---|---|---|---|
| Och/CRNG 1995 Weed EA | Forest-wide Direction | Provide for ongoing public participation and information, and other agency coordination during all noxious weed management activities. Coordinate with county officials and others to prevent and control noxious weeds. Identify species and infestation of most concern, and opportunities for joint prevention and control activities. | Public involvement has been provided for through the NEPA process (see Section 1.7 of DEIS). Extensive coordination has occurred with the state and county. |
| Och/CRNG 1995 Weed EA | Forest-wide Direction | Implement integrated noxious weed treatments, including manual, chemical, biological, cultural, and mechanical methods, based on site-specific analysis. Maintain documentation of annual noxious weed treatments. | This is consistent with R6 2005 ROD. Action alternatives meet this standard. |
| Och/CRNG 1995 Weed EA | Forest-wide Direction | Use chemical treatments only when other methods have proven ineffective or impractical. Adhere to EPA regulations and herbicide label restrictions. | See Forest Plan Amendment Sections 2.3 and 3.15 of DEIS. |
| Och/CRNG 1995 Weed EA | Forest-wide Direction | Inform the public of planned herbicide use locations prior to initiating control projects. | PDFs include public notification. Also see Appendix F, Implementation Guide. |
| Och/CRNG 1995 Weed EA | Forest-wide Direction | Record annually the quantity of herbicides used; document reduced reliance on herbicide use over time. | Action alternatives meet this standard. See Annual Implementation Guide, Appendix F. |
| Deschutes | Forestwide Direction | Herbicides will be used in accordance with direction in the Region 6 Vegetative Management Environmental Impact Statement. | Direction in 1988 ROD vacated by 2005 ROD. |
| Deschutes | Forestwide Direction | Pesticides will be used following all applicable state and Federal laws, including the labeling instructions of the EPA. | Action alternatives meet this Standard. |
| Deschutes | Forestwide Direction | Pesticide use will be conducted in accordance with direction in the following Forest Service Manuals: 2150 (Pesticide-Use Management and Coordination), 2109.11(Pesticide Project Handbook), 2109.12(Pesticide Storage, Transportation, Spills, and Disposal Handbook); 2109.13(Pesticide Project Personnel Handbook); 6709.11(Health and Safety Code Handbook, Chapter 9). | Action alternatives meet this standard. See PDFs (Section 2.4 of DEIS) and Appendix F. Manual and handbook sections in project record. |
| Deschutes | Forestwide Direction | Activities such as noxious weed or predator control will be approved, as needed, to achieve desired future conditions in cooperation and coordination with the appropriate state and federal agencies. | Proposed action meets this Standard. See Section 4.1 of DEIS for consultation with other agencies. |
| Deschutes | Mgmt. Area 6 - Wilderness | Only native species will be used for site revegetation. | No invasive plant sites within Wilderness on the Deschutes. |
| Deschutes | Mgmt. Area 6 - Wilderness | Fertilizer may be used on a limited basis to stimulate initial growth. | No invasive plant sites within Wilderness on the Deschutes. |
| Deschutes | Mgmt. Area 15 - Old growth, Mgmt. Area | Exotic plants will not be introduced. Vegetation management to enhance forage production or species composition for livestock | The purpose of invasive species control is not to improve forage production or species |

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| | 27 - Metolius Old Growth | consumption is not permitted. | composition for livestock. Action alternatives meet this standard. |
| Deschutes | Mgmt. Area 9 - Scenic Views, Management Area 21 - Metolius Black Buttes Scenic Area | Vegetation manipulation such as brush removal, reseeding and prescribed burning will be designed to meet visual objectives. | Action alternatives meet this standard. |
| Deschutes | Mgmt. Area 2 - Research Natural Areas, Mgmt. Area 24 - Metolius RNA | Action should be taken when the damage has the potential to modify ecological processes to the point that the area has little value for observation and research. | Action alternatives meet this standard. See Section 3.14 for information on RNAs. |
| Deschutes Newberry National Volcanic Monument Plan | Newberry National Volcanic Monument | M-33 Take action to eliminate or control existing populations of undesirable exotic plant species within the monument. Where feasible and effective, choose methods that mimic natural processes (such as prescribed fire). Other treatments that may be used where appropriate include mechanical and herbicide treatments. Establish priorities for treatment based on rate of spread, threats to native populations, etc. In some cases, the re-establishment of native species through natural regeneration methods, seeding or planting may be appropriate to reduce further encroachment by undesirable, exotic plants. The collection of certain plants by American Indian Tribes and/or individuals will be reviewed on a case-by-case basis. | Action alternatives meet this standard. |
| Deschutes Metolius W&S River Plan | Metolius Wild and Scenic River | MTWQ-4: Applications of chemical agents in streams and riparian areas are restricted to actions such as tracing movement of flows, or detection and control of water pollution. | This standard not applicable to invasive plant control. |
| Deschutes Metolius W&S River Plan | Metolius Wild and Scenic River | MTWQ-5: Mixing and loading operations for any chemical or biological application will take place in an area where an accidental spill will not flow into natural surface water bodies.<br>MTWQ-6: Suction hoses or pumps used for chemical or biological applications will not be used to draw water from natural surface water bodies. | These standards are in reference to retardant chemicals used in firefighting (Bonacker, personal communication 2006). |
| Deschutes | Metolius Wild and Scenic River | Weeds: Weed prevention and early detection efforts are emphasized. Herbicide application is selective, site-specific, and in accordance with an Integrated Weed Management Plan (scheduled to be developed for the Deschutes NF), and the Region 6 Mediated Agreement for Managing Unwanted Vegetation. Weed control is coordinated between agencies. Weed awareness is pursued through education. | Action alternatives meet this standard. |

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| Deschutes | Metolius Wild and Scenic River | MTEV-11: Chemical herbicides are used only where biological or manual control is impractical or ineffective in preventing degradation of native plant habitat. | Action alternatives meet this standard. |
| Deschutes | Big Marsh Wild and Scenic River | Control spread of reed canary grass. Appropriate methods include fire, seeding, and willow staking. Use of a chemical treatment will be allowed as long as water quality is not affected. | Action alternatives meet this standard (see Section 3.6 for water quality information). |
| Deschutes | Little Deschutes Wild and Scenic River | None | N/A |
| Deschutes | Upper Deschutes Wild and Scenic River | V-7 Noxious weeds in riparian and upland vegetation types will be controlled using prevention, biological, mechanical, or chemical methods (consistent with Regional direction) where such activities will not adversely affect river values. | Action alternatives meet this standard (see Section 3.14). |
| NWFP | Deschutes - NWFP Area, Late Successional Reserves | Evaluate impacts of nonnative species (plant and animal) currently existing within reserves, and develop plans and recommendations for eliminating or controlling nonnative species that are inconsistent with Late-Successional Reserve objectives. These will include an analysis of the effects of implementing such programs to other species or habitats within Late-Successional Reserves. | Action alternatives meet this standard. See Section 3.9 for effects to LSR habitats/species. |
| NWFP | Deschutes-NWFP Area, Riparian Reserves | RA-3. Herbicides, insecticides, and other toxicants, and other chemicals shall be applied only in a manner that avoids impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives. | Action alternatives meet this standard. See Sections 3.6 and 3.7 |
| NWFP | Deschutes-NWFP Area, Matrix | Modify site treatment practices, particularly the use of fire and pesticides, and modify harvest methods to minimize soil and litter disturbance. | Action alternatives meet this standard. PDFs section 2.4 minimize adverse soil impacts. |
| 2005 R6 ROD | Deschutes, Ochoco and CRNG-wide | Prioritize infestations of invasive plants for treatment at the landscape, watershed or larger multiple forest/multiple owner scale. | See Section 2.3.4 for prioritization strategy, and Appendix F, Implementation Guide. |
| 2005 R6 ROD | Deschutes, Ochoco and CRNG-wide | Develop a long-term site strategy for restoring/revegetating invasive plant sites prior to treatment. | See Section 2.3.4 for restoration information and Appendix E, Revegetation Planning. |
| 2005 R6 ROD | Deschutes, Ochoco and CRNG-wide | Native plant materials are the first choice in revegetation for restoration and rehabilitation where timely natural regeneration of the native plant community is not likely to occur. Non-native, non-invasive plant species may be used when: 1) needed in emergency conditions to protect basic resource values (e.g., soil | Prescriptions for proposed active restoration (Appendix A, Table A-3) meet this standard. |

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| | | stability, water quality and to help prevent the establishment of invasive species), 2) as an interim, non-persistent measure designed to aid in the re-establishment of native plants, 3) native plant materials are not available, and 4) in permanently altered plant communities. Under no circumstances will non-native invasive plant species be used for revegetation. | |
| 2005 R6 ROD | Deschutes, Ochoco and CRNG-wide | Use only APHIS and State-approved biological control agents. Agents demonstrated to have direct negative impacts on non-target organisms would not be released. | Action alternatives meet this standard. See Section 2.3.4 and Appendix B, Table B-2. |
| 2005 R6 ROD | Deschutes, Ochoco and CRNG-wide | Application of any herbicides to treat invasive plants will be performed or directly supervised by a State or Federally licensed applicator.<br>All treatment projects that involve the use of herbicides will develop and implement an herbicide transportation and handling safety plan. | Requirements to be included in contracts and agreements (See PDFs, Section 2.4). |
| 2005 R6 ROD | Deschutes, Ochoco and CRNG-wide | Select from herbicide formulations containing one or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. Mixtures of herbicide formulations containing 3 or less of these active ingredients may be applied where the sum of all individual Hazard Quotients for the relevant application scenarios is less than 1.0. 3<br><br>All herbicide application methods are allowed including wicking, wiping, injection, spot, broadcast and aerial, as permitted by the product label. Chlorsulfuron, metsulfuron methyl, and sulfometuron methyl will not be applied aerially. The use of triclopyr is limited to selective application techniques only (e.g., spot spraying, wiping, basal bark, cut stump, injection).<br><br>Additional herbicides and herbicide mixtures may be added in the future at either the Forest Plan or project level through appropriate risk analysis and NEPA/ESA procedures. | Action alternatives meet this standard. See Section 3.2 for herbicide information and Table A-1 for herbicides proposed in project area. |
| 2005 R6 ROD | Deschutes, Ochoco and CRNG-wide | Use only adjuvants (e.g. surfactants, dyes) and inert ingredients reviewed in Forest Service hazard and risk assessment documents such as SERA, 1997a, 1997b; Bakke, 2003. | Action alternatives meet this standard. |
| 2005 R6 ROD | Deschutes, Ochoco and CRNG-wide | To minimize or eliminate direct or indirect negative effects to non-target plants, terrestrial animals, water quality and aquatic biota (including amphibians) from the application of herbicide, use site-specific soil characteristics, proximity to surface water and local water table depth to determine herbicide formulation, size of | See Section 2.4 for Project Design Features that will minimize or eliminate adverse effects, based on site-specific resource information. |

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| | | buffers needed, if any, and application method and timing. Consider herbicides registered for aquatic use where herbicide is likely to be delivered to surface water. | |
| 2005 R6 ROD | Deschutes, Ochoco and CRNG-wide | #20. Design invasive plant treatments to minimize or eliminate adverse effects to species and critical habitats proposed and/or listed under the Endangered Species Act. This may involve surveying for listed or proposed plants prior to implementing actions within un-surveyed habitat if the action has a reasonable potential to adversely affect the plant species. Use site-specific project design (e.g. application rate and method, timing, wind speed and direction, nozzle type and size, buffers, etc.) to mitigate the potential for adverse disturbance and/or contaminant exposure. | See Section 3.4 for sensitive plant information and 3.9 for wildlife information. Project Design Features in Section 2.4 were adopted to minimize or eliminate potential for adverse effects. |
| 2005 R6 ROD | Deschutes, Ochoco and CRNG-wide | #21. Provide a minimum buffer of 300 feet for aerial application of herbicides near developed campgrounds, recreation residences and private land (unless otherwise authorized by adjacent private landowners). | The Invasive Plant Treatment Project does not involve any aerial application of herbicides. |
| 2005 R6 ROD | Deschutes, Ochoco and CRNG-wide | #22. Prohibit aerial application of herbicides within legally designated municipal watersheds. | The Invasive Plant Treatment Project does not involve any aerial application of herbicides. |
| 2005 R6 ROD | Deschutes, Ochoco and CRNG-wide | #23. Prior to implementation of herbicide treatment projects, National Forest system staff will ensure timely public notification. Treatment areas will be posted to inform the pubic and forest workers of herbicide application dates and herbicides used. If requested, individuals may be notified in advance of spray dates. | Notification is addressed in PDFs; also see Appendix F, Implementation Guide. |

*Prevention S&Gs are not included in this table.

# APPENDIX D

## Herbicide Information and Project Design Feature Crosswalk

# HERBICIDE INFORMATION SUMMARY AND PDF CROSSWALK

Prepared by Shawna L. Bautista, Pacific Northwest Region, Portland, OR
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April 14, 2006

Deschutes and Ochoco National Forest and Crooked River National Grassland
PDF Information Incorporated by Beth Peer, Deschutes National Forest, Bend, Oregon
June 22, 2006

The following information is designed to aid in the understanding of herbicides used for invasive plant control. Any attempt to summarize the complex information about herbicides is prone to over-simplification and errors. The information in these tables should be used as an introduction to the herbicides, but should not be the sole source of information used for analysis purposes. It is important to refer to the respective risk assessments prepared by Syracuse Environmental Research Associates (SERA), Inc. and peer-reviewed literature for effects analysis information.

These tables have five columns labeled herbicide characteristics, basic hazard identification, risk characterization, label restrictions and information, and Project Design Features (PDF). Herbicide characteristics are general pieces of information about the herbicide and its use, often taken from the *Herbicide Handbook* (Weed Science Society of America 2002) or the respective risk assessments (SERA, Inc). Qualitative statements (e.g. highly water soluble) are based on information in charts on water solubility and soil mobility found at the end of the document. These categories are not absolute, but have been gleaned from a variety of sources. These charts (water solubility and soil mobility) need to be completed and updated, as they are a work in progress.

To better understand each herbicide, it is important to recognize the difference between the inherent risks from the chemical (i.e. hazard identification) from those risks associated with the intended use, which take into account application and exposure amounts (i.e. risk characterization). The hazard identification and risk characterization information is mostly taken from the respective risk assessments for each herbicide, prepared by SERA, Inc., as well as analysis results from the Region 6 Invasive Plant Program EIS (USFS 2005a). The R6 EIS already has conducted the analysis of effects from the hazard ID and risk characterization information. It need not be repeated. Standards added to the Deschutes and Ochoco Land and Resource Management Plans from the Invasive Plant ROD (USDA Forest Service 2005b) further reduce the potential risks listed in the risk characterization column. Project Design Features (PDF) (Section 2.4 of the DEIS) focus on reducing risks remaining after the application and exposure amounts are taken into consideration (i.e. risk characterization), along with compliance with label directions and new forest plan standards.

We have also included brief summaries of some label restrictions or information. Please note: the label restrictions column in these tables is not a comprehensive listing of all label requirements. The information is largely brief excerpts of *some* requirements from *some* formulations. Labels are also updated and revised periodically, so it is important to obtain and read the full label for complete information. Labels may be downloaded from the following website: www.cmds.net/manuf/default.asp.

This version of the table contains, for each herbicide, the priority target species for the Deschutes and Ochoco NFs and Crooked River NG. The herbicide became a first priority for the identified invasive plants based on efficacy of the herbicide on that species, as per recommendations from the local State and County weed specialists. Environmental and seasonal variables, as well as infestations that contain several species, may require using a different herbicide in a given treatment area.

Herbicide grazing restrictions are summarized in the table on pages 35-36.

LOC used in the table=Level of Concern. The concentration in media or some other estimate of exposure above which there may be effects.

RfD = Reference dose. The RfD is a numerical estimate of a daily exposure to the human population, including sensitive subgroups such as children, that is not likely to cause harmful effects during a lifetime. RfDs are generally used for health effects that are thought to have a threshold or minimum dose for producing effects.

*The use of product names is for illustrative purposes only and is not intended as a recommendation for use or an endorsement of these products by the USDA Forest Service.*

Active Ingredient: **Chlorsulfuron** Trade Name(s): **Telar, Glean, Corsair**

Mode of Action: Acetolactate synthesis inhibitor Chemical family: Sulfonylurea

DES-OCH-CRNG target species: 1st priority: perennial pepperweed, whitetop, kochia

2nd priority: houndstongue, Dalmatian toadflax, butter 'n eggs, Scotch thistle, Med. Sage, tansy ragwort, milk thistle

Project Design Features 8 and 9 are applicable to all herbicide characteristics and risks: Herbicides would be used in accordance with label restrictions, except where more restrictive measures are required as described; Herbicide application will only treat the minimum area necessary to meet site objectives; Herbicide use would comply with standards in the Pacific Northwest Regional Invasive Plant Program – Preventing and Managing Invasive Plants ROD (2005), including standards on herbicide selection, restrictions on broadcast use of some herbicides, tank mixing, licensed applicators, and use of adjuvants, surfactants, and other additives.

## Chlorsulfuron

| Herbicide Characteristics | Basic Hazard Identification | Risk Characterization (SERA Risk Assess.) | Label Restrictions & Information | Project Design Features |
|---|---|---|---|---|
| SELECTIVE: controls broadleaf weeds some and grasses | | | Supplemental label for mix with clopyralid for control of yellow starthistle in Oregon | |
| Very high water solubility at pH 7; decreases to medium solubility at pH 5 | Leaching, runoff | Rainfall post treatment: Off target movement and non-target effects. | Do not contaminate water | (17) precipitation |
| Moderate affinity for organic material, but adsorption to clay is low | High mobility in soils | | Treatment of powdery, dry soil and light sandy soils when there is little likelihood of rainfall soon after treating may result in off target movement and possible damage to susceptible crops when soil particles are moved by wind or water. | (47) chlorsulfuron use on soils |
| In H20, degraded by sunlight | Half-live in water is 1 month | Very low application rates; therefore, little potential to enter ground water | | (16) drift<br>(54, 55, 58) aquatic buffers |
| Degradation by soil microbes is slow | Half-life in field avg 40 days (range 4-6 wks); shorter at lower pH | | | (64, 65) botanical buffers |

## Chlorsulfuron

| Herbicide Characteristics | Basic Hazard Identification | Risk Characterization (SERA Risk Assess.) | Label Restrictions & Information | Project Design Features |
|---|---|---|---|---|
| | Low toxicity to soil microorganisms | Exposure far below level of concern | | |
| In field, degraded primarily by hydrolysis, but rates are slow | Persistent | | Residues may injure susceptible plants up to 4yrs after application in high pH soils | (64, 65) botanical buffers<br>(69) sulfonylurea use near TES plants |
| Absorbed thru roots and foliage; active in soil as a pre-emergent | | | Do not apply thru irrigation system | |
| Resistant Biotypes may develop | | | Application should be based on IPM principles | |
| Maintains native perennial grasses | | | | |
| Potent herbicide. Requires small amounts of AI to be effective. | May damage non-target plants and trees; Wind erosion concern | Adverse effects on some nontarget plants are plausible | | no aerial application<br>(12) application rate<br>(64, 65) botanical buffers<br>(69) sulfonylurea buffers |
| | Can cause body weight loss in mammals | Worker and public exposures below level of concern (LOC) except workers using ground broadcast applications, which is slightly above LOC at high application rate (0.14 lb/acre) | Do not apply in a way that will contact workers or other persons, either directly or through drift. | (12) application rate<br>(15, 16) drift<br>(11) personal protective gear |
| | Mild eye and skin irritant | Mild irritation to skin and eyes from exposures to high levels from mishandling | Only protected handlers may be in the area during application. | (12) application rates<br>(11) personal protective gear |
| | May alter insulin production, cholesterol levels, and triglycerides at high doses | Exposures far below levels of concern | | (12) application rates |
| does not bioaccumulate or bioconcentrate | No evidence of reproductive risk, malformations, cancer, or mutagenicity | | | (12) application rates |

| Chlorsulfuron | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| | Can cause mild body weight loss in mammals and birds | Exposures well below levels of concern | | |
| | | No plausible risk to insectivorous species | | |
| | Very low toxicity to fish, no effects to egg & fry | Exposures far below levels of concern | | (12) application rates<br>(54, 55) aquatic buffers |
| | Very low toxicity to aquatic invertebrates | Exposures far below levels of concern | | (12) application rates<br>(54, 55) aquatic buffers |
| | No data on effects to amphibians, fish used as a surrogate | Exposures far below levels of concern | | (12) application rates<br>(54, 55) aquatic buffers<br>(81) spotted frog buffers |
| | Aquatic plants are susceptible to chlorsulfuron, algae is less susceptible | Peak exposures could damage aquatic plants at typical and high application rates; algae may be damaged at high rates | | (12) application rates<br>(54, 55)aquatic buffers |
| | Low toxicity to bees or beetles | Exposure below level of concern | | |

Active Ingredient: **Clopyralid** Trade Name(s): **Transline; Reclaim; Stinger**

Mode of Action: Plant growth regulator Chemical family: Not known

DES-OCH-CRNG target species: 1st choice: true knapweeds (not Russian), thistles, tansy ragwort,

2nd choice: Russian knapweed

Project Design Features 8 and 9 are applicable to all herbicide characteristics and risks: Herbicides would be used in accordance with label restrictions, except where more restrictive measures are required as described; Herbicide application will only treat the minimum area necessary to meet site objectives; Herbicide use would comply with standards in the Pacific Northwest Regional Invasive Plant Program – Preventing and Managing Invasive Plants ROD (2005), including standards on herbicide selection, restrictions on broadcast use of some herbicides, tank mixing, licensed applicators, and use of adjuvants, surfactants, and other additives.

| **Clopyralid** | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| Extremely SELECTIVE for broadleaves. Post emergent herbicide | | Selectivity reduces threat to non-target plants | Avoid non-target contact with spray in treated areas | (64, 65) botanical buffers |
| Targets: knapweeds and families Asteraceae, Fabaceae, Solanaceae. Canada thistle; Does NOT affect conifers, grasses are tolerant | | | Supplemental label for control on tree plantations and forest sites | |
| High water solubility | 0.01 % of that applied may reach stream after first significant rainfall | Contamination threat to water resources and non-target species | Do not contaminate water. Do not apply directly to water or to areas where surface water is present. Do not contaminate irrigation ditches. | (54, 55) aquatic buffers<br>(27, 28) water intake buffer<br>(17) precipitation |
| Photo degradation and hydrolysis do not occur | 8-40 day ½ life in water | | | |
| Weakly adsorbed to soil | Very high mobility in soil | | Users are advised not to apply where soils have a rapid to very rapid permeability throughout the profile (such as loamy sand to sand) and the water table is shallow. | (54, 55) aquatic buffers<br>(43) low aquatic risk herb.<br>(45) high porosity soils |

## Clopyralid

| Herbicide Characteristics | Basic Hazard Identification | Risk Characterization (SERA Risk Assess.) | Label Restrictions & Information | Project Design Features |
|---|---|---|---|---|
| Degraded by soil microbes | Half-life in field avg 40 days (range 12-70 days) | Relatively rapid breakdown reduces potential for run-off or leaching | | |
| | Low toxicity to soil organisms | Exposures far below level of concern | | (12,13) application rate |
| Non-microbial degradation does not occur | | | Do not use hay or straw from treated areas for composting or mulching on susceptible plants | |
| Contaminated with hexachlorobenzene (HCB) (less than that in picloram) | HCB is a persistent carcinogen and it bioaccumulates | Exposure levels far below level of concern. Amount of HCB in Clopyralid does not present any substantial cancer risk. | | (12) application rates |
| Clopyralid does not bioaccumulate or bioconcentrate | No evidence of reproductive risk, malformations, cancer, or mutagenicity | Exposures far below levels of concern | | (12) application rates |
| | High acute doses cause depression of central nervous system in mammals | Exposures far below levels of concern | | (12) application rates |
| | Chronic doses cause weight loss, thicken stomach lining in mammals | Exposures far below levels of concern | | (12) application rates |
| | Low toxicity to birds | Exposures far below levels of concern | | (12) application rates |
| | | Chronic risk to insect-eating birds or mammals unknown | | (12) application rates |
| | Slight skin and eye irritation | | Avoid contact with skin and eyes or clothing. Avoid breathing spray mist. Applicators and handlers must wear long-sleeved shirt and long pants, waterproof gloves, shoes plus socks | (12) application rate<br>(11) personal protective gear<br>(26) public notification |

| Clopyralid | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| Potent herbicide. Requires small amounts of AI to be effective. | May damage susceptible non-target terrestrial plants | Adverse effects on some non-target plant species due to drift are likely under certain conditions | | (15, 16) drift<br>(64, 65) botanical buffers<br>(13) application method |
| | Low toxicity to birds and mammals | Exposures below levels of concern | No grazing restriction | (12) application rates |
| | low toxicity to fish or aquatic invertebrates | Exposures very far below levels of concern | | (12) application rates<br>(54, 55) aquatic buffers |
| | No chronic tests to fish, or eggs and fry studies available; use surrogate | Exposures very far below levels of concern | | (12) application rates<br>(54, 55) aquatic buffers |
| | No data on effects to amphibians, fish used as a surrogate | Exposures far below levels of concern | | (12) application rates<br>(54, 55) aquatic buffers<br>(81) spotted frogs |
| | Aquatic plants and algae are not susceptible | Exposures far below levels of concern | | (12) application rates<br>(54, 55) aquatic buffers |
| | Low toxicity to bees and earthworms | Exposures far below level of concern | | (12) application rates |

Active Ingredient **Glyphosate** Trade Name(s): **Roundup; Accord; Glypro, many others**

Aquatic formulations: **Rodeo; Aquamaster**

Mode of Action: Inhibits 3 amino acids and protein synthesis Chemical family: None generally accepted

DES-OCH-CRNG target species: 1st choice: quackgrass, reed canarygrass, ribbongrass

2nd choice: leafy spurge, Himalayan blackberry

Project Design Features 8 and 9 are applicable to all herbicide characteristics and risks: Herbicides would be used in accordance with label restrictions, except where more restrictive measures are required as described; Herbicide application will only treat the minimum area necessary to meet site objectives; Herbicide use would comply with standards in the Pacific Northwest Regional Invasive Plant Program – Preventing and Managing Invasive Plants ROD (2005), including standards on herbicide selection, restrictions on broadcast use of some herbicides, tank mixing, licensed applicators, and use of adjuvants, surfactants, and other additives.

## Glyphosate

| Herbicide Characteristics | Basic Hazard Identification | Risk Characterization (SERA Risk Assess.) | Label Restrictions & Information | Project Design Features |
|---|---|---|---|---|
| Broad spectrum, NON selective | Will kill contacted desirable plants, | boom-spray drift may adversely affect non-target species | Keep people and pets off treated areas until spray solution has dried to prevent transfer of this product onto desirable vegetation. | (15, 16) drift<br>(64, 65) botanical buffers<br>(13) application method<br>(11) personal protective gear<br>(26) notification |
| Quickly absorbed by leaves and rapidly moves thru plant; no root absorption | | No risk to non-target plants from runoff | | (64, 65) botanical buffers |
| Aquatic Use formulations exist | | | | (43) soils & aquatic label herbicides |
| Very high water solubility | Runoff, leaching potential | | Rainfall within 6 hours may reduce effectiveness; | (17) precipitation |
| Strongly adsorbed to soil particles, especially clay | Low mobility in soil | Low likelihood of runoff due to strong adsorption to soil; soil-bound glyphosate not available to plants | | |
| No photo degradation or hydrolysis | | | | |
| Degraded by soil microbes | Avg half-life 25-47 days (range 3-130 days) | | | |

| **Glyphosate** | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| | May cause transient population decrease or increase in some bacteria & fungi | | | |
| Does not bioaccumulate or bioconcentrate | No evidence of dose-related reproductive risk, malformations, cancer, or mutagenicity | All exposures for workers and public far below level of concern | | (12) application rate<br>(11) personal protective gear<br>(26) notification |
| | May damage mucosal tissue, weight loss in mammals; mild liver toxicity | All exposures for workers and public far below level of concern | Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks, and protective eyewear. | (12) application rates<br>(11) personal protective gear |
| | Mild to moderate irritant to skin and eyes. | | Do not get in eyes or on clothing; Avoid breathing vapor or spray mist; | (12) application rates<br>(15, 16) drift<br>(11) personal protective gear |
| | Can cause diarrhea, weight loss in mammals; weight loss in birds at very high doses; some mortality to pregnant rabbits observed | Mortality to some large vegetation-eating mammals plausible at highest application rates only; some risk to insect-eating birds & mammals at high rate | | (12) application rates |
| | | Chronic risk to insect-eating birds at typical rate unknown; at highest rate, chronic risk to insect-eating birds and mammals unknown | | (12) application rates |
| Surfactants (tallow amine or POEA) in non-aquatic use formulations very toxic to aquatic organisms | Low toxicity to fish; surfactant in some formulations much more toxic than glyphosate | Even aquatic formulation exceeds level of concern for **endangered fish**, with max risk assumptions; surfactant formulations may cause mortality at high application rate only | | ROD standard<br>(12) application method<br>(43) aquatic labels/low aquatic risk<br>(12, 44) surfactant buffer and application rate |

## Glyphosate

| Herbicide Characteristics | Basic Hazard Identification | Risk Characterization (SERA Risk Assess.) | Label Restrictions & Information | Project Design Features |
|---|---|---|---|---|
| | Low toxicity to aquatic invertebrates | Exposures below level of concern | | (12) application rate<br>(54, 55) aquatic buffers |
| | No malformations in amphibians; toxicity to amphibians is comparable to that of fish | at typical rate, all exposures below level of concern | | (12) application rates, NPE application rate<br>(54, 55) aquatic buffers<br>(81) spotted frog |
| | Surfactants may be highly toxic to aquatic organisms | | Do not apply (surfactant formulations) directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment. | (44) surfactant buffers<br>(12) surfactant application rates<br>(52) equipment rinsing<br>(54, 55) aquatic buffers |
| | Aquatic plants and algae are susceptible to glyphosate; but it does not control submerged plants | Exposures below levels of concern; some algae growth stimulated at low concentrations | No restriction on the use of treated water for irrigation, recreation, or domestic purposes. If emerged weeds cover entire water body, treatment of aquatic weeds may result in oxygen depletion. | (12) application rates<br>(28) water intake buffer<br>(54, 55). aquatic buffer |
| | Low or no toxicity to bees, beetles, spider mites, wasps, isopods, earthworms, or snails. | Highest application rate may pose risk to some individual bees, but not likely to populations | | (13) application rates<br>(54, 55) aquatic buffers |

Active Ingredient: **Imazapic** Trade Name(s): **Plateau**

Mode of Action: acetolactate synthesis inhibitor Chemical family: Imidazolinone

DES-OCH-CRNG target species: 2nd choice: field bindweed

3rd choice: leafy spurge, Dalmatian toadflax, butter 'n eggs, medusa head

Project Design Features 8 and 9 are applicable to all herbicide characteristics and risks: Herbicides would be used in accordance with label restrictions, except where more restrictive measures are required as described; Herbicide application will only treat the minimum area necessary to meet site objectives; Herbicide use would comply with standards in the Pacific Northwest Regional Invasive Plant Program – Preventing and Managing Invasive Plants ROD (2005), including standards on herbicide selection, restrictions on broadcast use of some herbicides, tank mixing, licensed applicators, and use of adjuvants, surfactants, and other additives.

| **Imazapic** | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| Selective against some broadleaves & some grasses | | | | (64, 65) botanical buffers |
| Uptake by roots & leaves; active in soil as pre-emergent | May damage non-target plants and trees | Drift or runoff may cause some damage to susceptible species | Do not treat inside of irrigation ditches; conduct small test areas to determine risk to desirable trees and plants | (15, 16) drift<br>(64, 65) botanical buffers<br>(62) botanical buffers/adaptive management |
| Very high water solubility | Leaching, runoff | | Do not contaminate water | (28) water intake buffer<br>(43) low risk formulations<br>(54, 55) aquatic buffers |
| Adsorbs to OM in soil | Moderately mobile in soils, leachable in coarse soils | | | |
| Degraded by soil microbes | Half-life avg. 120d | | Treatment of areas that were previously treated with chlorsufl, metsulfuron methyl, sulfometuron or imazapyr may cause compound injury or death to desirable plants | (64, 65) botanical buffers<br>(62) botanical buffers/adaptive management |
| No info on toxicity to soil microbes | | | | |

| **Imazapic** | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| In H20, degraded by sunlight | | | | |
| | Not irritating to skin, minimal irritation to eye | Mild eye irritation from mishandling; no exposure scenario exceeded RfD for workers or public except spill | | (11) personal protective gear |
| Does not bioaccumulate or bioconcentrate | No adverse effects to mammal reproduction or development, not carcinogenic or mutagenic | | | |
| | Muscle, liver, & blood damage in dogs at high chronic doses | Exposures far below levels of concern | | (12) application rates |
| | Low toxicity to birds | Exposures far below levels of concern | | (12) application rates |
| | | No plausible risk to insectivorous species | | (12) application rates |
| | Low toxicity to fish, no effects to egg & fry | Exposures far below levels of concern | | (12) application rates<br>(54, 55) aquatic buffers |
| | No data on effects to amphibians, fish used as a surrogate | Exposures far below levels of concern | | (12) application rates<br>(54, 55) aquatic buffers<br>(81) spotted frogs |
| | Aquatic plants sensitive, algae is not | Potential risk to aquatic plants at highest application rate only, no risk to algae | | (12) application rates<br>(54, 55) aquatic buffers |
| | Low toxicity to bees | Exposure far below level of concern | | (12) application rates |

Active Ingredient: **Imazapyr** Trade Name(s): **Arsenal, Chopper, Stalker,**

Aquatic Formulation: **Habitat**

Mode of Action: acetolactate synthesis inhibitor Chemical family: Imidazolinone

DES-OCH-CRNG target species: 2nd choice: reed canarygrass, ribbongrass

3rd choice: field bindweed, perennial pepperweed

Project Design Features 8 and 9 are applicable to all herbicide characteristics and risks: Herbicides would be used in accordance with label restrictions, except where more restrictive measures are required as described; Herbicide application will only treat the minimum area necessary to meet site objectives; Herbicide use would comply with standards in the Pacific Northwest Regional Invasive Plant Program – Preventing and Managing Invasive Plants ROD (2005), including standards on herbicide selection, restrictions on broadcast use of some herbicides, tank mixing, licensed applicators, and use of adjuvants, surfactants, and other additives.

## Imazapyr

| Herbicide Characteristics | Basic Hazard Identification | Risk Characterization (SERA Risk Assess.) | Label Restrictions & Information | Project Design Features |
|---|---|---|---|---|
| Non-selective | | | | |
| Uptake by roots & leaves; active in soil as pre-emergent | May damage non-target plants; may be exuded into soil from roots of treated plants | Drift or runoff may cause some damage to susceptible species | Do not apply to irrigation ditches; prevent drift to desirable plants | (15, 16) drift<br>(64, 65) botanical buffer |
| Very high water solubility | | | Do not contaminate water | (54, 55) aquatic buffer |
| Weakly bound to soil, but OM and lower pH increase adsorption to moderate levels | Moderately mobile in soils | | | |
| Photodegrades in H2O | Half-life in water 1-2 d | | May be used in intermittent drainages, flood plains, and bogs when no water is present | (54, 55) aquatic buffer |
| Degrades by soil microbes | Half-life in soil 25-142 d; weed control for 3 mo-2yrs | | | |
| | Slight effect on soil microbes at high doses | Peak concentrations in soil well below level of concern | | (12) application rates |

| Imazapyr | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| | Mildly irritating to eyes and skin | Mild eye irritation from mishandling; no exposure scenario exceeded RfD for workers or public except spill | | (11) personal protective equipment |
| Does not bioaccumulate or bioconcentrate | No adverse effects to mammal reproduction or development, not carcinogenic or mutagenic | | | |
| | No effects to birds or mammals even at high doses | Exposures all below level of concern | | (12) application rates |
| | | No plausible risk to insectivorous species | | (12) application rates |
| | Low toxicity to North American fish | Exposures very far below levels of concern | | (12) application rates |
| | No data on effects to amphibians, fish used as a surrogate | Exposures far below levels of concern | | (12) application rates<br>(54, 55) aquatic buffers<br>(81) spotted frog |
| | Some aquatic plant species sensitive to imazapyr | Potential risk to aquatic plants at typical application rate, no risk to algae | | (12) application rates<br>(54, 55) aquatic buffers |
| | Low or no toxicity to bees | Exposure well below level of concern | | (12) application rates |

Active Ingredient: **Metsulfuron methyl** Trade Name(s): **Escort, Ally**

Mode of Action acetolactate synthesis inhibitor Chemical Family: Sulfonylurea

DES-OCH-CRNG target species: 1st choice: houndstongue, St. Johnswort, lesser burdock, Med. Sage

2nd choice: whitetop, kochia, pepperweed, Russian thistle, musk thistle

Project Design Features 8 and 9 are applicable to all herbicide characteristics and risks: Herbicides would be used in accordance with label restrictions, except where more restrictive measures are required as described; Herbicide application will only treat the minimum area necessary to meet site objectives; Herbicide use would comply with standards in the Pacific Northwest Regional Invasive Plant Program – Preventing and Managing Invasive Plants ROD (2005), including standards on herbicide selection, restrictions on broadcast use of some herbicides, tank mixing, licensed applicators, and use of adjuvants, surfactants, and other additives.

| **Metsulfuron methyl** | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| Selective for some broad-leaf and woody species; can damage conifers | | | | (64, 65) botanical buffers |
| Resistant biotypes may develop | | | Manage herbicide resistance, use IPM | |
| Potent herbicide; uptake by roots & leaves | May damage non-target plants and trees; highly potent herbicide at low rates | Drift, runoff or wind erosion, may cause damage to susceptible species | This herbicide is injurious to plants at extremely low concentrations. Non-target plants may be adversely affected from drift and run-off. Do not use on irrigation ditches. | No aerial application<br>(15, 16) drift<br>(29) water intake buffer<br>(64, 65) botanical buffer<br>(54, 55) aquatic buffer |
| High water solubility | Runoff, leaching potential | | Do not contaminate water; do not apply or rinse equipment near desirable plants; | (52) equipment rinsing<br>(64, 65) botanical buffers<br>(54, 55) aquatic buffers |

## Metsulfuron methyl

| Herbicide Characteristics | Basic Hazard Identification | Risk Characterization (SERA Risk Assess.) | Label Restrictions & Information | Project Design Features |
|---|---|---|---|---|
| Low adsorption to clay, OM increases adsorption; active in soil as pre-emergent | Very high mobility in soils | | Treatment of powdery, dry soil or light sandy soil when there is little likelihood of rainfall soon after treating may result in off target movement and possible damage to susceptible crops when soil particles are moved by wind or water. | (15) wind<br>(17) precipitation |
| No photo degradation | | | | |
| Slow microbial degradation at high pH, fast at low pH | Typical half-life 30 d (range 1-6 wks) | | | |
| | Short-term toxicity to soil microbes | | | (43) aquatic label & low risk herb |
| Degrades by hydrolysis | | | May be used in intermittent drainages, flood plains, marshes, and bogs when no water is present | (54, 55) aquatic buffers<br>(12) application rates |
| | May alter insulin production, cholesterol levels, and triglycerides at high doses | Exposures well below levels of concern even at highest application rates | | (12) application rates<br>(11) personal protective gear |
| | Irritates skin and eyes | Mild eye irritation from mishandling; all exposures below levels of concern for workers and public | Applicator and other handlers must wear long-sleeved shirt, long pants, shoes plus socks | (11) personal protective gear |
| Does not bioaccumulate or bioconcentrate | No adverse effects to mammal reproduction or development, not carcinogenic or mutagenic | | | |
| | Can cause body weight loss in mammals & birds | Exposures well below levels of concern even at highest application rates | | (12) application rates |
| | | No plausible risk to insectivorous species | | (12) application rates |

| Metsulfuron methyl | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| | Low toxicity to fish, no effects to egg & fry | Exposures very far below levels of concern | | (12) application rates<br>(54, 55) aquatic buffers |
| | No data on effects to amphibians, fish used as a surrogate | Exposures very far below levels of concern | | (12) application rates<br>(54, 55) aquatic buffers<br>(81) spotted frogs |
| | Can damage aquatic plants in acute exposures | Potential risk to aquatic plants at typical application rate, no risk to algae | | (54, 55) aquatic buffers<br>(12) application rates |
| | Low or no toxicity to bees | Exposure well below level of concern | | (12) application rates<br>(54, 55) aquatic buffers |

Active Ingredient: **Picloram** Trade Name(s): **Tordon 22K; Pathway**

Mode of Action: Plant growth regulator Chemical family: Pyridcarboxylic acid or picolinic acid

DES-OCH-CRNG target species: 1st choice: Russian knapweed, field bindweed, leafy spurge, Dalmatian toadflax, butter 'n eggs, sulphur cinquefoil

2nd choice: lesser burdock, true knapweeds, Canada thistle, Scotch broom, St. Johnswort

Project Design Features 8 and 9 are applicable to all herbicide characteristics and risks: Herbicides would be used in accordance with label restrictions, except where more restrictive measures are required as described; Herbicide application will only treat the minimum area necessary to meet site objectives; Herbicide use would comply with standards in the Pacific Northwest Regional Invasive Plant Program – Preventing and Managing Invasive Plants ROD (2005), including standards on herbicide selection, restrictions on broadcast use of some herbicides, tank mixing, licensed applicators, and use of adjuvants, surfactants, and other additives.

**Picloram**

| Herbicide Characteristics | Basic Hazard Identification | Risk Characterization (SERA Risk Assess.) | Label Restrictions & Information | Project Design Features |
|---|---|---|---|---|
| Selective: rate and season dependant; pre-emergent and soil active | | Off-site drift of picloram may cause damage to susceptible plant species | Minimize drift and runoff | (15, 17) drift<br>(46) soils (picloram and sulfo met) one app per year |
| Target: composite, legume, buckwheat, and parsley families.<br>Less affected families: mustard, lily, figwort. | | | | (64, 65) botanical buffers |
| High water solubility | Run-off, leaching potential; | | Under some conditions, picloram may also have a high potential for runoff into surface water… Do not apply directly to water, to areas where surface water is present. Do no allow run-off or spray to contaminate wells, irrigation ditches or any body of water used for irrigation or domestic purposes. | (28) water intake buffer<br>(54, 55) aquatic buffers<br>(48) soils (picloram and sulfo met)<br>(46) one app per year |

## Picloram

| Herbicide Characteristics | Basic Hazard Identification | Risk Characterization (SERA Risk Assess.) | Label Restrictions & Information | Project Design Features |
|---|---|---|---|---|
| Photodegradation | Half-life in H20 is 2.6 days | | | |
| Weakly adsorbed to soils | Very high mobility in soils; leaching potential greatest in sandy soils with low OM | 1-6% of application mobilized and reached drainage channels (monitoring results) | Picloram is known to leach through soil into ground water under certain conditions as a result of agricultural use. Use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in ground water contamination. | (12) application rates<br>(46) soils (picloram and sulfo met)<br>(48) one app per year |
| Degraded slowly in soil by microbes | Half-life avg. 90 days (range 20-300 d) | | NTE 2 qts/ac/growing season as a broadcast application | (46) soils (picloram and sulfo met)<br>(48) one app per year |
| | Can inhibit microbial activity | Microbial activity inhibition likely at rates used by FS | | (46) soils (picloram and sulfo met)<br>(48) one app per year |
| Contaminated with hexachlorobenzene HCB (more than clopyralid) | HCB is a persistent carcinogen and it bioaccumulates | Exposure levels below level of concern. Picloram does not present any substantial cancer risk. | | (13) application rates |
| Does not bioaccumulate or bioconcentrate | No adverse effects to mammal reproduction or development, not carcinogenic or mutagenic | | | |
| | Weight loss and increased liver weight in mammals following long term exposure to high concentrations | No exposures for workers or public exceeded levels of concern except spill | | (12) application rates<br>(11) personal protective gear |

| Picloram | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| | Moderate eye irritant, can cause skin sensitization | Eye irritation and skin sensitization can occur with mishandling | Applicator and other handlers must wear long-sleeved shirt, long pants, shoes plus socks | (12) application rates<br>(11) personal protective gear |
| | Low toxicity to mammals | Exposure to insect-eating mammals exceed acute levels of concern only at highest application rates | | (12) application rates |
| | Almost nontoxic to birds | Exposures below levels of concern | | (12) application rates |
| | | Chronic risk to insect-eating birds or mammals unknown at typical and highest rates | | (12) application rates |
| | Toxic to fish | Exposures exceed level of concern for listed fish at typical and highest application rate | | (12) application rates<br>(54, 55) aquatic buffers |
| | No data on effects to amphibians, fish used as a surrogate | Potential adverse effects to amphibians at typical and highest application rates | | (12) application rates<br>(54, 55) aquatic buffers<br>(81) spotted frog |
| | Relatively nontoxic to bees | Exposures below level of concern even at highest application rates | | (12) application rates |

Active Ingredient: **Sethoxydim** Trade Name(s): **POAST**

Mode of Action: Inhibits acetyl co-enzyme (ACE) Chemical family: Cyclohexanedione or cyclohexenone

DES-OCH-CRNG target species: 3rd choice: quackgrass, reed canarygrass, ribbongrass

Project Design Features 8 and 9 are applicable to all herbicide characteristics and risks: Herbicides would be used in accordance with label restrictions, except where more restrictive measures are required as described; Herbicide application will only treat the minimum area necessary to meet site objectives; Herbicide use would comply with standards in the Pacific Northwest Regional Invasive Plant Program – Preventing and Managing Invasive Plants ROD (2005), including standards on herbicide selection, restrictions on broadcast use of some herbicides, tank mixing, licensed applicators, and use of adjuvants, surfactants, and other additives.

## Sethoxydim

| Herbicide Characteristics | Basic Hazard Identification | Risk Characterization (SERA Risk Assess.) | Label Restrictions & Information | Project Design Features |
|---|---|---|---|---|
| Selective for annual and perennial grasses | | | Low likelihood of impacting non-target plants from drift | (64, 65). botanical buffers (15, 16) drift |
| Soil activity prevents germination of grasses | | | | |
| Absorbed rapidly by foliage and roots. Systemic | | | | |
| Broadleaf and sedges are tolerant | | | Some herbicide resistance can develop | |
| Very high water solubility | Leaching, run-off potential | | Do not contaminate water. | (54, 55) aquatic buffers |
| Medium mobility in soil | | | | |
| Photodegrades | Phytolysis in <4 hours in soil; <1 hr in water | Low soil persistence | | |
| Degraded by soil microbes | 5-25 day ½ life (avg is 5 days) | Rapidly degraded | | |
| | Causes skin and eye irritation | Skin or eye irritation from mishandling. | Applicators and other handlers must wear coveralls over short-sleeved shirt and short pants; chemical resistant gloves and footwear, plus socks; protective eyewear; etc. | (11) personal protective gear |
| Does not bioaccumulate or bioconcentrate | Not mutagenic or carcinogenic | | | (12) application rates |

| Sethoxydim | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| | Can cause liver and blood toxicity in chronic doses | All chronic exposures well below level of concern for workers and public | | (12) application rates |
| | Decreased reproduction and maternal toxicity in high doses | All acute exposures below level of concern except for drinking water contaminated by accidental spill | | (12) application rates |
| | Reproductive and neurological effects to small mammals at high doses | Exposures below levels of concern for mammals | | (12) application rates |
| | Low toxicity to birds but reduced hatching for chronic exposures | Exposures below levels of concern except chronic dose for grass-eating bird at highest application rate | | (12) application rates |
| | | Chronic risk to insect-eating birds or mammals unknown at typical and highest rates | | |
| | Highly toxic to fish due to petroleum inert | Exposure exceeds level of concern for federally listed fish at typical rate, and max exposure assumptions | This product is toxic to aquatic organisms. Do not apply directly to water or to areas where surface water is present. | (12) application rates<br>(17) precipitation<br>(54, 55) aquatic buffers |
| | No data on effects to amphibians, fish used as a surrogate | Plausible risk to amphibians | | (12) application rates<br>(55, 55) aquatic buffers salamander and mollusk |
| | Nontoxic to bees | Exposure below level of concern | | (12) application rates |

Active Ingredient: **Sulfometuron methyl** Trade Name(s): **Oust XP; DPX 5648**

Mode of Action: acetolactate synthesis inhibitor Chemical family: Sulfonylurea

DES-OCH-CRNG target species: 1st choice: medusahead

2nd choice: medusahead & quackgrass (when combined with chlorsulfuron)

Project Design Features 8 and 9 are applicable to all herbicide characteristics and risks: Herbicides would be used in accordance with label restrictions, except where more restrictive measures are required as described; Herbicide application will only treat the minimum area necessary to meet site objectives; Herbicide use would comply with standards in the Pacific Northwest Regional Invasive Plant Program – Preventing and Managing Invasive Plants ROD (2005), including standards on herbicide selection, restrictions on broadcast use of some herbicides, tank mixing, licensed applicators, and use of adjuvants, surfactants, and other additives.

| **Sulfometuron methyl** | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| Non-selective Preemergent and post emergent. | | | If a surfactant is used, contact with tree foliage may injure or kill trees. | (12) application rates<br>(12) NPE application rate<br>(64, 65) botanical buffers |
| Target: annual and perennial broadleaf weeds, some grasses and some woody tree species | | | Do not apply more than 8 oz/ac/yr | (12) application rates |
| Potent herbicide; uptake by roots & leaves | May damage non-target plants and trees; highly potent herbicide at low rates | Drift, runoff or wind erosion, may cause damage to susceptible species | Potential for drift is an issue. Use weather and droplet size criteria | Standard 16 in R6 2005 ROD (no aerial application) |
| Only medium solubility in water; difficult to create high concentrations | May leach or runoff into water | Low application rates and microbe degradation pose little risk for water contamination | Do not treat dry or frozen soils, unless rainfall is anticipated | (15) wind<br>(16) drift<br>(17) precipitation<br>(64, 65) botanical buffers |

| **Sulfometuron methyl** | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| High mobility in soil | | | Treatment of powdery, dry soil and light sandy soils when there is little likelihood of rainfall soon after treating may result in off target movement and possible damage to susceptible crops when soil particles are moved by wind or water. | (12) application rates<br>(48) soils (picloram and sulfo met)<br>(46) one app per year |
| Degraded by microbes, light and hydrolysis | 30 day ½ life in silt loam soils | | | |
| | Some growth inhibition to soil microbes in lab, but not demonstrated while in soil | Percolation could inhibit growth of microbes if lab results are relevant in the field | | (48) soils (picloram and sulfo met)<br>(46) one app per year |
| Does not bioaccumulate or bioconcentrate | Not mutagenic, carcinogenic | | | (12) application rates |
| | Reproductive and immune system effects to mammals at higher doses; very high doses cause neurotoxic effects | Exposures far below levels of concern | | (12) application rates |
| | Irritating to skin and eyes at high doses | Mild irritation to skin and eyes from exposures to high levels from mishandling | Only protected handlers may be in the area during treatment | (12) application rates<br>(11) personal protective gear<br>(26) public notification |
| | Causes hemolytic anemia and weight loss in mammals | Exposures far below levels of concern | | (12) application rates |
| | Slightly toxic to fish. Highly toxic to embryo hatch | Exposures very far below level of concern | Do not apply directly to water or where surface water is present | (12) application rates<br>(54, 55) aquatic buffers |
| | Can cause malformations in amphibians | Exposures very far below level of concern | | (12) application rates<br>(54, 55) aquatic buffers |
| | Low toxicity to bee | Exposures well below level of concern | | (12) application rates |

Active Ingredient: **Triclopyr** Trade Name(s): **Garlon 4; Remedy; PathFinder;**

Aquatic formulation: **Garlon 3A**

Mode of Action: Plant growth regulator Chemical family: Pyridinecarboxylic acid

DES-OCH-CRNG target species: 1st choice: Scotch broom, Himalayan blackberry

2nd choice sulphur cinquefoil

Project Design Features 8 and 9 are applicable to all herbicide characteristics and risks: Herbicides would be used in accordance with label restrictions, except where more restrictive measures are required as described; Herbicide application will only treat the minimum area necessary to meet site objectives; Herbicide use would comply with standards in the Pacific Northwest Regional Invasive Plant Program – Preventing and Managing Invasive Plants ROD (2005), including standards on herbicide selection, restrictions on broadcast use of some herbicides, tank mixing, licensed applicators, and use of adjuvants, surfactants, and other additives.

## Triclopyr

| Herbicide Characteristics | Basic Hazard Identification | Risk Characterization* (SERA Risk Assess.) | Label Restrictions & Information | Project Design Features |
|---|---|---|---|---|
| Selective for broadleaf and woody plants | | | | |
| Target: Woody and herbaceous plants, especially root- or stem-sprouting species | | | | Restricted to selective application methods by forest plan standard (R6 2005 ROD) |
| Absorbed thru roots, foliage and green bark. | Non-target plant effects possible; some bryophytes and lichens sensitive to triclopyr | | Do not apply through any type of irrigation system. | |
| Two forms: salt (acid) (Garlon 3A) and ester (Garlon 4) | Ester form more toxic and volatile | | Apply at cool temps with no wind. Combustible. | (15) wind |
| Salt formulation is highly soluble in water | Runoff, leaching | | Do not contaminate water when cleaning equipment. | (52) equipment washing<br>(28) water intake buffers<br>(54, 55) aquatic buffers |
| Ester formulation has medium water solubility. | Less mobile | | | |

| **Triclopyr** | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization* (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| Low adsorption to soils, varies with clay and OM content | Very high mobility in soils | | The use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination. | (43) low risk herbicides R6 standard – application method |
| Degraded by photolysis in soil and water | ½ life 2-6 hours in water | | | |
| Degraded by microbes in soil | ½ life avg 30days in soils; range 10-46 days | | | |
| | Inhibits growth of soil fungi and bacteria | Transient inhibition in the growth of some bacteria or fungi might be expected | | (13) application method |
| | Can cause severe eye damage | | Applicators and other handlers must wear long-sleeved shirt and long pants; shoes plus socks; protective eyewear; chemical resistant gloves. | (11) personal protective gear |
| Does not bioaccumulate or bioconcentrate | Ester has much higher lipophilic tendancy ($K_{ow}$ = 10, 233) than salt ($K_{ow}$ = 0.35) | | | |
| | Adverse effects to mammal reproduction or development only at doses that are maternally toxic | | Except for lactating dairy animals, there are no grazing restrictions | (12) application rates |
| | Evidence for carcinogenicity is marginal (not convincing, but not entirely negative) | | | (12) application rates |

| **Triclopyr** | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization* (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| | Effects to kidney are basis of risk to for acute and chronic exposures humans | At high application rates, chronic exposures to workers exceed level of concern; acute exposures do not exceed level of concern for workers. At high application rates, some acute and chronic exposures exceed level of concern for public. No exposures exceed level of concern at typical application rate. | Do not apply this product in a way that will contact workers or other persons, either directly or through drift. | (12) application rates drift<br>(11) personal protective gear |
| | For wildlife, acute lethality only at very high doses, but effects to kidney and liver at lower doses | Acute exposures below level of concern at typical application rate, but exceed level of concern for grass and insect eating mammals | | R6 standard – application method<br>(12) application rates |
| | Primary effect from chronic doses is to the kidney | Using protective assumptions, chronic exposures exceed level of concern for grass-eating mammals. Risk from chronic exposure to contaminated insects unknown. | | R6 standard – application method<br>(12) application rates<br>(11) personal protective equipment |
| | Formulations contain inerts that are neurotoxic (Garlon 3A = ethanol)<br>(Garlon 4 = kerosene) | Exposures very far below level of concern; less toxic than triclopyr | | (12) application rates<br>(11) personal protective gear |
| | Ester more toxic to birds than salt form | Several scenarios exceed level of concern at typical and highest application rates for acute and chronic exposures | | R6 standard – application method<br>(12) application rates |

| Triclopyr | | | | |
|---|---|---|---|---|
| **Herbicide Characteristics** | **Basic Hazard Identification** | **Risk Characterization* (SERA Risk Assess.)** | **Label Restrictions & Information** | **Project Design Features** |
| | Salt/acid formulation low toxicity to fish; has aquatic use label | Exposures exceed level of concern for federally listed fish at typical rate, but not other fish even at highest application rate | (Garlon 3A) Permissible to treat flood plains, marshes, swamps, bogs etc. Permissible to treat non-irrigation ditch banks. When making application to banks or shorelines of moving water sites, minimize overspray to open water. | R6 standard –application method<br>(12) application rates<br>(54, 55) aquatic buffers<br>(49) garlon4 buffer |
| | Ester formulation toxic to fish and aquatic invertebrates | Exposures exceed level of concern for federally listed fish at typical rate, but not other fish even at highest application rate | (Garlon 4) This pesticide is toxic to fish. Do not apply directly to water, to areas where surface water is present… Do not contaminate water when disposing of equipment washwaters. | (49) garlon4 buffer<br>(12) application rates<br>(52) equip. rinsing<br>(54, 55) aquatic buffers |
| | Metabolite TCP much more toxic to fish than the salt form, about the same toxicity as ester | At typical application rate, no TCP exposures exceed level of concern. At highest application rate, chronic exposure exceeds level of concern | | (12) application rates<br>(54, 55) aquatic buffers |
| | Ester form much more toxic to aquatic plants and algae than salt form | Only salt form exceeds level of concern for aquatic plants; algae not at risk from either form | | (13) application method<br>(12) application rates<br>(54, 55) aquatic buffers |
| | Ester formulation much more toxic to amphibians than salt formulation | At typical application rate, risk to amphibians from either form is low. At highest rate, exposure to run-off of either form could adversely affect responsiveness of tadpoles. | | (13) application rates<br>(54, 55) aquatic buffers<br>(81) spotted frog |
| | Practically non-toxic to bees | Exposure exceeds level of concern only for highest application rates | | (12) application rates<br>(54, 55) aquatic buffers |

*Results of these risk characterizations are from scenarios where triclopyr is broadcast sprayed over a large area. A standard in each Forest Plan that was added by the Region Six Invasive Plant Program ROD (USDA Forest Service 2005) prohibits this type of application. Triclopyr is restricted to selective application methods only. Therefore, in practice, it is not plausible to create the exposures causing concern during use of triclopyr for invasive plant control in Region Six.

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## Water Solubility Chart

| Solubility Class | Water Solubility (ppm=mg/L) | Examples |
|---|---|---|
| Very High | 3,000 – 1,000,000 | chlorsulfuron, glyphosate, imazapic, imazapyr, picloram, sethoxydim, |
| High | 300-3,000 | clopyralid, metsulfuron methyl, 2,4-D |
| Medium | 30-300 | sulfometuron, triclopyr |
| Low | 2-30 | |
| Slight | 0.5-2 | |
| Immobile | <0.5 | DDT (0.0012) |

Adapted From Jay Davis, US Fish and Wildlife Service

## Mobility in Soil (Koc)

| Mobility Class | Koc in Soil | Examples |
|---|---|---|
| Very High | 0-35 | clopyralid, picloram, metsulfuron methyl, triclopyr |
| High | 36-100 | sulfomet.,chlrosufluron, |
| Medium | 100-1,000 | imazapic, imazapyr, sethoxydim, atrazine |
| Low | 1,000-3,000 | glyphosate |
| Slight | 3,000-10,000 | Trifluralin |
| Immobile | >10,000 | chlorpyrifos, DDT |

Adapted from Jay Davis, US Fish and Wildlife Service.

Mobility class categories by S. Bautista and are general breakdowns, not a definitive classification.

## Grazing Restriction Table (Sources are Trade Name Labels for Specific Herbicides)

| Livestock Use Restrictions by Herbicide* | | | |
|---|---|---|---|
| **Herbicide** | **Brand Name** | **Restriction** | **Remarks** |
| Chlorsulfuron | Telar, Glean, Corsair, Landmark (oust + telar) | None | |
| Clopyralid | Transline, Redeem (Clopyralid + Triclopyr) | Redeem: Do not graze treated areas until poisonous plants are dry and no longer palatable to livestock. Withdraw livestock from grazing treated grass at least 3 days prior to slaughter. | See label for cropland grazing restrictions post treatment in pastures. Redeem: Herbicide application may increase palatability of certain poisonous plants. |
| Glyphosate | RoundUp, Rodeo, etc. | None | RoundUp: ingestion of this product or large amounts of freshly sprayed vegetation may cause temporary gastrointestinal irritation. |
| Imazapic | Plateau | Plateau: None.<br>Plateau DG: Do not use on areas to be grazed. | |
| Imazapyr | Arsenal, Chopper, Stalker | Arsenal: none.<br>Chopper: none.<br>Stalker: none. | |
| Metsulfuron methyl | (Escort)/Sulfonylurea | None. | |

This table is not meant to be an inclusive or up-to-date list; please refer to product labels for the most accurate and inclusive information.

**Grazing Restriction Table (Sources are Trade Name Labels for Specific Herbicides)**

| Livestock Use Restrictions by Herbicide*(con.) | | | |
|---|---|---|---|
| **Herbicide** | **Brand Name** | **Restriction** | **Remarks** |
| Picloram | Tordon | Tordon 101/22K/K: allow one week of grazing/feeding in non-exposure area before moving livestock onto broadleaf cropland. Tordon 22K: herbicide application may increase palatability of certain poisonous plants. Do not graze treated areas until poisonous plants are dry and no longer palatable to livestock. Meat grazing animals up to two weeks after treatment should be removed from treated areas 3 days prior to slaughter. | |
| Sethoxydim | Poast | None | |
| Sulfometuron methyl | (Oust)/Sulfonyl urea, & Landmark (oust + telar) | None | |
| Triclopyr | (Garlon, Pathfinder, Remedy)/Synthetic auxin, Redeem (Clopyralid + Triclopyr) | Forestry Garlon 4, Garlon 4, & Remedy: 2 quarts per acre or less, no restriction. If less than 25% of the grazing area is treated, there is no restriction. Slaughter: remove animals from treated area 3 days prior to slaughter. Garlon 3A: none. Remove animals from treated area 3 days prior to slaughter. Pathfinder II & Remedy RTU: 2.5 gallons per acre or less, no restriction. If less than 25% of the grazing area is treated, there is no restriction. Slaughter: remove animals from treated area 3 days prior to slaughter. Redeem: Do not graze treated areas until poisonous plants are dry and no longer palatable to livestock. Withdraw livestock from grazing treated grass at least 3 days prior to slaughter. | |

* This table is not meant to be an inclusive or up-to-date list; please refer to product labels for the most accurate and inclusive information

# Summaries of Herbicide Characteristics that Influence Their Potential Effects on the Soil Resource

**Picloram**

Picloram has a typical half-life of 90 days. Field studies (Brooks et al., 1995; Nolte and Fulbright, 1997) have not noted substantial adverse effects from this herbicide on soil productivity and health under normal application rates (SERA, 2003-picloram). Although the application of Picloram at typical rates may change microbial metabolism on site in the short term, detectable effects to soil productivity that might be expected if soil microbial activity were substantially damaged have not been identified in the literature.

- Since picloram is toxic to microorganisms at low levels, toxic effects can last for some time after application.
- Long-term effects to soil microorganisms are unknown, but persistence in soils could affect soil microorganisms by decreasing nitrification (SERA, 2003-picloram).
- The persistence of picloram increases with soil concentration, thus increasing the likelihood that it becomes toxic to soil microorganisms in the short-term.
- Picloram applied at a typical application rate is likely to change microbial metabolism, though detectable effects to soil productivity are not expected.
- Substantial effects to soil productivity from the use of picloram over the last 40 years have not been noted (SERA, 2003d).
- Picloram has been studied on a number of soil invertebrates.
- Metabolites may increase toxicity for some soil microorganisms.
- Picloram has a typical half-life of 90 days.
- Picloram soil degradation rates vary in soil, depending on application rate and soil depth.
- Picloram is water soluble, poorly bound to soils that are low in clays or organics, has a high leaching potential, and is most toxic in acidic soil.
- Picloram should not be used on coarse-textured soils with a shallow water table, where groundwater contamination is most likely to occur (KSU, 2001; SERA, 2003d).
- Picloram percolation is highest in loam and sandy soils (SERA, 2003d; Herbicide Handbook, 2002). However, modeling results indicate picloram runoff (not percolation) is highest in clay soils.

**Sulfometuron methyl**

This herbicide is the primary choice for control of medusahead, which is located most extensively on the finer textured soils of the CRNG, with some populations also located on the Lookout Mountain, Paulina and Sisters Ranger Districts.

- The typical half-life for sulfometuron methyl varies from 10 to 100 days, depending on soil texture and organic matter content in the mineral soil profile.
- Microbial inhibition in the short term is likely to occur at typical application rates and could be substantial in some cases, as indicated by the negative impacts that a formulation of sulfometuron methyl had a on the abundance of microorganisms and decreased soil nitrogen content on a Christmas tree farm (Arthur and Wang, 1999).
- Residues of these herbicides in the soil may alter the composition of soil microorganisms over an extended period of time on coarser textured and lower organic matter content soils with higher pH levels. Mobility of this herbicide following application also increases under these same characteristics.
- There are no studies on the effects of sulfometuron methyl on soil invertebrates.

- Sulfometuron methyl degradation occurs most rapidly at lower pH soils where rates are dominated by hydrolysis.
- Sulfometuron methyl mobility is generally greater at higher soil pH and lower organic matter content.
- Modeling results indicate sulfometuron methyl runoff is highest in clay and loam soils with peaks after the first rainfall. Sulfometuron methyl percolation is highest in sandy soils. Monitoring results generally support modeling results (SERA, 2003e; Herbicide Handbook, 2002).
- Sulfometuron methyl applied to vegetation at typical application rates would probably be accompanied by secondary changes to vegetation that affect the soil microbial community more certainly than direct toxic action of sulfometuron methyl on soil microorganisms (SERA, 2003e).

**Metsulfuron methyl**

Metsulfuron methyl and chlorsulfuron are also members of the Sulfonylurea chemical type, although they exhibit less toxic effects on soil microorganisms than sulfometuron methyl.

The half-life of metsulfuron methyl is approximately 30 days and the herbicide has a short-term toxicity to soil microorganisms identified on the label. This herbicide is the primary choice for treating houndstongue. Studies on the effects of metsulfuron methyl on soil biota are limited to *Pseudomonas* species, though there are a few studies of insects that live in soil. The lowest observed effect concentration is 5 mg/kg, based on the *Psuedomonas* study. At recommended use rates, no effects are expected for insects.

- Effects to soil microorganisms appear to be transient (SERA, 2003c).
- Metsulfuron methyl degrades in soil, with a variable half-life up to 120 days.
- Half-life is decreased by the presence of organic matter though microbial degradation of metsulfuron methyl is slow.
- Non-microbial hydrolysis is slow at high pH but rapid at lower pH.
- Adsorption to soil particles, which affects the runoff potential of metsulfuron methyl, increased with increased pH and organic matter.
- Metsulfuron methyl has low adsorption to clay.
- Modeling results indicate that off-site movement due to runoff could be significant in clay soils.
- Metsulfuron methyl percolates in sandy soils (SERA, 2003c; Herbicide Handbook, 2002).

**Chlorsulfuron**

The half-life of chlorsulfuron is approximately 40 days but has a very low toxicity to soil microbes identified on the label. This herbicide is the primary choice for perennial pepperweed and white top. Studies on the effects of chlorsulfuron on soil biota include lab and field studies on nematodes, fungi, populations of actinomycetes, bacteria, and soil microorganisms.

- No effects of chlorsulfuron were found for soil biota at recommended application rates, with the exception of transient decreases in soil nitrification (SERA, 2003a).
- The ‘no observable effects concentration’ for soil is 10 mg/kg, based on cellulose and protein degradation.
- Chlorsulfuron degrades in aerobic soil.
- Non-microbial hydrolysis plays an important role in chlorsulfuron breakdown, and hydrolysis rates increase as pH increases.
- Adsorption to soil particles, which affects the runoff potential of chlorsulfuron, is strongly related to the amount of organic material in the soil.
- Chlorsulfuron adsorption to clay is low.
- Chlorsulfuron is moderately mobile at high pH.

- Leaching is reduced when pH is less than six.
- Modeling results indicate that runoff would be negligible in relatively arid environments as well as sandy or loam soils.
- In clay soils, off-site loss could be substantial (up to about 55 percent of the applied amount) in regions with annual rainfall rates of 15 to 250 inches (SERA, 2003a; Herbicide Handbook, 2002).

**Triclopyr**

Triclopyr has been identified as capable of inhibiting soil fungi and bacteria, but research suggests that it is not persistent at levels high enough following recommended application rates to negatively affect soil productivity. Relationships between observed maximal residues and threshold concentrations for toxicity to soil biota suggest that sustained deleterious effects on soil organisms or functional processes are unlikely to result from normal operational use of either triclopyr or glyphosate herbicides (Thompson, et al. 2000).

The five commercial formulations of triclopyr contain one of two forms of triclopyr, BEE (butoxyethyl ester) or TEA (triethylamine). Triclopyr BEE is much more toxic to aquatic organisms than triclopyr TEA. A breakdown product, TCP (3,5,6-trichloro-2-pyridinol), is more toxic than either form of triclopyr. Site-specific cumulative effects analysis buffer determinations need to consider the form of triclopyr used and the proximity of any aquatic triclopyr applications, as well as toxicity to aquatic organisms (SERA, 2003f).

- R6 ROD Standard #16 restricts triclopyr to selective applications, which would reduce direct effects to ectomychorrhizal fungi.
- Triclopyr has not been studied on soil invertebrates. Triclopyr does have direct toxicity to ectomychorrhizal fungi.
- Soil fungi growth was inhibited at concentrations 2 to 5 times higher than concentrations expected from USDA Forest Service application rates.
- Triclopyr has an average half-life in soil of 46 days, while TCP has an average half-life in soil of 70 days. Warmer temperatures decrease the time to degrade triclopyr.
- Soil adsorption is increased as organic material increases and decreased as pH increases. Triclopyr is weakly adsorbed to soil, though adsorption varies with organic matter and clay content. Both light and microbes degrade triclopyr (SERA, 2003f; Herbicide Handbook, 2002).

**Glyphosate**

Glyphosate is a non-selective, non-residual, systemic, post emergence herbicide used for the control of a great variety of annual, biennial, and perennial grasses, sedges, broad-leaved weeds, and woody shrubs. It is very effective on deep-rooted perennial species.

- Glyphosate dissipates rapidly from the water column as a result of adsorption and possibly biodegradation. The half-life in water is a few days. Sediment is the primary sink for glyphosate. After spraying, glyphosate levels in sediment rise and then decline to low levels in a few months.
- Modeling results indicate glyphosate runoff is highest in loam soils with peaks after the first rainfall (SERA, 2003b; Herbicide Handbook, 2002).
- Studies suggest glyphosate does not adversely affect soil organisms.
- Glyphosate is readily metabolized by soil microorganisms and some species can use glyphosate as a sole source of carbon (SERA, 2003b).
- Numerous soil bacteria, fungi, invertebrates, and other microorganisms have been studied for effects of glyphosate application.
- It is degraded by microbial action in both soil and water.

- Sylvia and Jarstfer (1997) found that after 3 years, pine trees in plots with grassy invasive plants had 75 percent fewer mycorrhizal root tips than plots that had been treated 3 times per year with a mixture of glyphosate and metsulfuron methyl to remove invasive plants.
- Glyphosate degrades in soil, with an estimated half-life of 30 days.
- Glyphosate is highly soluble, but adsorbs rapidly and binds tightly to soil.
- Glyphosate has low leaching potential because it binds so tightly to soil.

**Clopyralid**

Clopyralid is a selective herbicide used for the control of broadleaf weeds, especially thistles and clovers. It is the only effective herbicide for the control of creeping thistle, *Cirsium arvense*, a noxious, perennial weed. Clopyralid is in the pyridine family of herbicides, which also includes picloram, triclopyr, and several less common herbicides. It is particularly active on members of the Asteraceae and Fabaceae families but does not affect grasses.

Clopyralid is a synthetic plant growth hormone and has some structural similarities to naturally occurring hormones called auxins. Clopyralid is similar in structure and mode of action to the herbicide picloram. It disrupts plant growth by binding to molecules that are normally used as receptors for the natural growth hormones. Because clopyralid is more persistent in plant tissue than auxins, the binding causes abnormal growth leading to plant death in a few days or weeks, depending on the species.

- Studies of clopyralid effects on soil invertebrates have been conducted, including field studies on the effects to microorganisms. Clopyralid is in the same chemical family as triclopyr and is identified as having a low toxicity to soil microorganisms.
- Soil concentrations from USDA Forest Service applications are expected to be 1,000 less than concentrations that would cause toxic effects. Therefore, no effects to soil invertebrates or microorganisms are expected from use of clopyralid (SERA, 1999a).
- Clopyralid is degraded by soil microbes, with an estimated half-life of 14 to 29 days, meaning that one-half of the amount applied remains in the soils after 14 to 29 days, one-fourth of the applied amount remains after 28 to 58 days, one –eight after 42 to 87 days, and so on.
- Increased soil moisture decreases degradation time.
- Clopyralid is weakly adsorbed and has moderate leaching potential.
- Modeling results indicate clopyralid runoff is highest in clay soils with peaks after rainfall events.
- Clopyralid percolation is highest in sandy loam soils (SERA, 1999a; Herbicide Handbook, 2002).

**Imazapic**

Imazapic is a relatively new herbicide, and there are no studies on the effects of imazapic on either soil invertebrates or soil microorganisms. This herbicide is a member of the Imidazolinones chemical family and appears to have low toxicity to soil microbes.

- If imazapic was extremely toxic to soil microorganisms, it is reasonable to assume that secondary signs of injury to microbial populations would have been reported (SERA, 2001a).
- Imazapic degrades in soil, with a half-life of about 113 days.
- Half-life is decreased by the presence of microflora.
- Imazapic is primarily degraded by microbes and it does not degrade appreciably under anaerobic conditions.
- Imazapic is weakly adsorbed in high soil pH, but adsorption increases with lower pH (acidic soils) and increasing clay and organic matter content.
- Field studies indicate that imazapic remains in the top 12 to 18 inches of soil and do not indicate any potential for imazapic to move with surface water.

- Modeling results indicate imazapic runoff is highest in clay and loam soils with peaks after the first rainfall. Imazapic percolation is highest in sandy soils (SERA, 2001a; Herbicide Handbook, 2002).

**Imazapyr**

Imazapyr is a non-selective herbicide used for the control of a broad range of weeds including terrestrial annual and perennial grasses and broadleaved herbs, woody species, and riparian and emergent aquatic species. It controls plant growth by preventing the synthesis of branched-chain amino acids. Because imazapyr is a weak acid herbicide, environmental pH will determine its chemical structure, which in turn determines its environmental persistence and mobility. Below pH 5 the adsorption capacity of imazapyr increases and limits its movement in soil. Above pH 5, greater concentrations of imazapyr become negatively charged, fail to bind tightly with soils, and remain available (for plant uptake and/or microbial breakdown). In soils imazapyr is degraded primarily by microbial metabolism.

There are no studies on the effects of imazapyr on soil invertebrates, and incomplete information on the effects on soil microorganisms.

- Imazapyr can persist in soil for over a year. Persistence studies suggest that imazapyr residues damage plants at concentrations that are not detectable by laboratory analysis.
- Imazapyr moves readily in soil. It has contaminated surface and ground water following aerial and ground forestry applications.
- Small amounts of imazapyr (as little as 1/50 of a typical application rate) can damage crop plants.
- Imazapyr exposure also has the potential to seriously impact rare plant species. The U.S. Fish and Wildlife Service has identified 100 counties in 24 states east of the Mississippi River where endangered species may be jeopardized by use of imazapyr.
- Over a half-dozen weedy plant species have developed resistance to imazapyr.
- This herbicide is a member of the Imidazolinones chemical family and appears to have low toxicity to soil microbes.
- One study indicates cellulose decomposition, a function of soil microorganisms, can be decreased by soil concentrations higher than concentrations expected from USDA Forest Service applications.
- There is no basis for asserting adverse effects to soil microorganisms (SERA, 1999b).
- Imazapyr degrades in soil, with a half-life of 25 to 180 days.
- Degradation rates are highly dependent on microbial action.
- Anaerobic conditions slow degradation.
- Adsorption increases with time as soil dries and is reversible.
- Field studies indicate that imazapic remains in the top 20 inches of soil and do not indicate any potential for imazapic to move with surface water.
- In forest field studies, imazapyr did not run off and there was no evidence of lateral movement.
- Modeling results indicate imazapyr runoff is highest in clay and loam soils with peaks after the first rainfall.
- Imazapyr percolation is highest in sandy soils (SERA, 1999b; Herbicide Handbook, 2002).

**Sethoxydim**

Selective post-emergence herbicide used to control annual and perennial grass weeds among broad-leaved plants.

- Sethoxydim is a member of the cylohexanone chemical family and has been researched to be very low in toxicity to soil microbes (Roslycky, 1986).
- Sethoxydim has not been studied on soil invertebrates.

- Assays of soil microorganisms noted transient shifts in species composition at soil concentration levels far exceeding concentrations expected from USDA Forest Service application.
- No adverse effects to soil organisms are expected (SERA, 2001c).
- Sethoxydim is degraded by soil microbes, with an estimated half-life of 1 to 60 days. Adsorption of sethoxydim varies with organic material content of the soil.
- Modeling results indicate sethoxydim runoff is highest in clay and loam soils with peaks after the first rainfall (SERA, 2001c; Herbicide Handbook, 2002).

# APPENDIX E

## Revegetation Planning & Implementation

## and

## Excerpts from the 2003 *Draft Guidelines for Revegetation of Invasive Weed Sites and Other Disturbed Areas on National Forests and Grasslands in the Pacific Northwest*

### Revegetation Planning and Implementation

In order to conserve and enhance the biodiversity and sustainability of wildland ecosystems, numerous authorities and policies are in place to promote the use of native species in restoration and revegetation (R6 2005 FEIS). Regional direction for the use of native plants was issued in 1994 with the Pacific Northwest Revegetation Policy. It set a long term goal for using native plant species as much as possible.

The Deschutes and Ochoco National Forests and Crooked River National Grassland have been actively collecting and propagating native seeds and plants for various projects; however, we do not yet have enough native seed to be able to meet all of our needs. We must prioritize where to use our limited quantities of native seeds and the available seed must be ecologically appropriate for the sites where it will be used. At some sites (e.g., Project Area Units 12-05, 15-22, and 15-32), we will collect and/or propagate plants of adjacent native species and replant those in the treated areas. Though our goal is to use native plant species whenever possible, some introduced species will continue to play an important role in site restoration. Introduced (“cultivar”) species may be used on Paulina District (e.g., Project Area Unit 72-15) in areas where the sites are highly degraded, the invasive plant species is very aggressive (e.g., medusahead and houndstongue), and the native plant community is absent or greatly reduced. On degraded invasive plant sites where desirable plant species are absent or in low abundance, revegetation with competitive grasses and forbs may be necessary to direct and accelerate plant community recovery, and achieve site-management objectives in a reasonable timeframe (Erickson et al. 2005).

Available information and expertise will be used to develop revegetation plans for the above-listed sites. One source of information will be the “Draft Guidelines for Revegetation of Invasive Weed Sites and Other Disturbed Areas on National Forests and Grasslands in the Pacific Northwest” (Erickson et al. 2005). These guidelines provide strategies and considerations for site assessment, selection of plant materials, site preparation, planting techniques, and use of mulches and fertilizers. Revegetation prescriptions will vary depending on site type (e.g., riparian or upland), erosion potential, and land use designation (e.g., special management area, such as wilderness, Research Natural Areas, and Special Interest Areas).

Revegetation will involve site preparation, such as raking to prepare a seed bed to promote seed germination, planting of seeds and/or propagules (depending on the species, this is done either in early spring or late fall to take advantage of available moisture), vigilant treatment of invasive plants as they germinate from the existing seedbank, and monitoring the results. In some cases, a follow-up seeding/planting may need to be done.

United States
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**Region**

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# Guidelines for Revegetation of Invasive Weed Sites and Other Disturbed Areas on National Forests and Grasslands in the Pacific Northwest


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# Introduction

This document provides methods and guidance for revegetation of invasive weed sites and other disturbed areas on National Forests and Grasslands in the Pacific Northwest (Region 6). Steps are outlined for assessing existing and potential site conditions, and for developing long-term revegetation strategies that are effective, affordable, and consistent with the ecological context and land management objectives of the site and surrounding landscape. The need for this document was driven by relatively new policies and programs that promote the use of native plant materials in revegetation projects (Appendix A,B). Historically, resource managers in the western United States have relied on introduced species (e.g., smooth brome, orchardgrass, timothy, crested wheatgrass) that have been selectively bred for characteristics that, at least in the short-term, made them logical choices for revegetation projects. Although some introduced species will continue to play an important role in site restoration, it has become increasingly clear that the widespread and excessive use of highly competitive and persistent non-native species has had adverse impacts on the diversity and health of our native forest, rangeland, and aquatic ecosystems (Detwyler 1971; Covington and Moore 1994; Kaufmann *et al*. 1994; Kay 1994; Mills *et al*. 1994; Brown 1995, Lesica and DeLuca 1996; Bartos and Campbell 1998; Schoennagel and Waller 1999; Brown and Rice 2000) As a consequence, new direction for revegetation projects strives for a balance between rapid establishment of high levels of competitive plant cover, and broader, more long-term objectives aimed at restoring inherent ecosystem properties (e.g., genetic and species diversity, vegetation structure) and processes (e.g., disturbance regimes, succession patterns, hydrologic regimes, and nutrient cycles).

Revegetation with carefully selected plant materials is a critical component of integrated weed management strategies. Commonly used control tactics, such as manual or chemical treatments, may eliminate or suppress invasive species in the short term, but the resulting gaps and bare soil create open niches that are susceptible to further invasion by the same or other undesirable plant species (Westman 1990; Jacobs *et al.* 1999; D'Antonio and Meyerson 2002). On degraded weed sites where reproducing individuals of desirable species are absent or in low abundance, revegetation with well-adapted and competitive grasses, forbs, and legumes can be used to direct and accelerate plant community recovery, and achieve site management objectives in a reasonable timeframe (Hobbs and Mooney 1993; Sheley *et al*. 1996, Brown and Amacher 1998). This document incorporates a landscape ecology approach to revegetation that first considers and prioritizes individual projects in the context of watershed scales. More fine-scale elements of a successful revegetation design are also addressed, including evaluation of existing and potential site conditions, identification of realistic site goals, and development and implementation of appropriate action strategies. Because the science and practice of restoration is rapidly evolving, and the potential and most effective usage of many native species has not been fully explored, an experimental approach to revegetation is advocated. Sections and references on monitoring principles and techniques are therefore included to provide tools for resource specialists to evaluate the efficacy of alternative revegetation treatments, and gain insights into how methods may be refined to better achieve desired outcomes (i.e., adaptive management).

The recommendations in this document follow National and Regional Forest Service authorities and policy guidelines (see Appendix A, B), and are intended to provide a conceptual framework from which site-specific revegetation prescriptions can be developed. A number of sections, including the Decision Matrix and Site Prescriptions, were initially developed by resource specialists on the Siuslaw National Forest (Region 6), and refined and augmented by multi-Forest revegetation teams in Region 2 in cooperation with the National Park Service (http://fsweb.arnfpng.r2.fs.fed.us/). Detailed treatment descriptions and management scenarios are beyond the scope of this document, and specialists including District and Forest botanists, silviculturists, geneticists, ecologists, soil scientists, and range conservationists should be consulted as necessary to refine revegetation prescriptions and identify the most appropriate plant materials (species and seed sources) and revegetation methods for a particular site. Restoration of disturbed sites should be approached as a multi-disciplinary effort, and will be most successful when local knowledge and expertise are fully utilized and integrated into comprehensive revegetation strategies.

## Revegetation in a Landscape Context

Revegetation programs and strategies should be developed using a landscape ecology approach that considers individual projects in the context of watershed scales. Thus, revegetation of invasive weed sites should fit into broader ecological strategies that address other major restoration issues of a given watershed, including departures from historical vegetative conditions, at-risk aquatic/wildlife/plant species, hydrology, uncharacteristic wildfire risks, etc..

Projects can then designed and prioritized so that they contribute to the overall goals for the particular watershed or landscape planning area. In addition, efforts should be taken to ensure that revegetation projects are fully integrated with the suite of other ongoing resource management projects, both spatially and temporally. One obvious example is that weed control operations must be tightly linked and coordinated with post-removal revegetation plans. A landscape ecology approach to revegetation also requires a thorough understanding of the underlying problems contributing to the need for revegetation, and how they interact with other processes within the watershed. This may be accomplished through assessments of the larger landscape area and its connection to the problem site. A key question is whether the site problem is unique, or symptomatic of other problems within the watershed that need to be addressed at a larger scale. Finally, in an era where the extent and intensity of management is declining and more aligned with natural processes, revegetation projects must be compatible with the dominant disturbance processes of the site and surrounding area (e.g., wildfire cycles, herbivory).

Some of the major issues to consider during the development of landscape-scale revegetation strategies for invasive weed sites include:

*(the following section is not compete)*

1. The current extent and patterns of spread of invasive species: Design projects to cut off or slow the spread paths and corridors using spatial strategies similar to those of wildfire management. Interrupt dominant vectors to minimize the degree and rate of propagule spread. Identify recurring points of invasion (e.g., roads/trails); revegetate the sites with highly competitive species. Tier revegetation to control prioritization scheme. Because funding for invasive spp. management efforts is typically limited, it is essential to prioritize revegetation of sites occupied by species and populations that are most important to control. Prioritization should be based on impacts of invader species, site characteristics, and potential for success.

2. Grazing and hydrologic issues in riparian systems: Revegetion species should be chosen based on consideration of site and landscape level aquatic strategies and goals. Utilize the Rosgen or other hydrologic classification schemes to determine succession on the stream and physical site characteristics to help select species for revegetation that will be compatible with the dominant hydrologic disturbance

processes. Design projects with hydrologic disturbance in mind. Ungulate herbivory can be the dominate disturbance process (e.g., in the Blue Mountains) and must be factored into design and cost of revegetation.

3. Historical range of variability (HRV) and degree of departure: Quantify historical range and variability of landscape pattern dynamics to assess current landscape conditions and define limits of acceptable change. Design appropriate landscape vegetation treatments consistent with overarching ecosystem management goals. In upland settings, consider implications of fire regime (e.g., low intensity, frequent return interval versus infrequent high intensity). In high intensity fire areas, for example, revegetation efforts may emphasize use of species that disperse and spread rapidly, have high seed production, and are tolerant of fire.

# Site Assessment

Following the development of larger scale landscape strategies, site assessment is the next critical phase in the design of a successful revegetation project. There are 3 primary steps in determining whether a given site requires active revegetation. These include:

- Evaluation of site history and existing conditions
- Defining land management and site goals
- Determining the need for action

## Site History and Existing Conditions:

The evaluation of existing site conditions involves first determining what resources or values are at risk from degradation of the site. Example of site risks to be considered include: (1) erosion and soil loss potential, (2) the likelihood of invasion or re-invasion by undesirable plant species, (3) loss of cultural, visual, or social values, and (4) potential effects on threatened, endangered, or sensitive (TES) species, and their forage and habitat.

Site dominated by invasive weed species may have an increased risk of surface run-off and soil erosion due to the loss of vegetative cover and native plants that have inherent soil stabilizing growth habits (e.g., extensive fibrous root systems). Risk of erosion will be higher on steep slopes (>40-50%) and sites with crusted, shallow, compacted, or highly erodible soils.

Erosion can have negative effects on “downstream” ecosystem processes and species through sediment transport and deposition. On site, loss of the soil surface layer may strongly affect the degree and speed of revegetation due to depletion of organic matter, water holding capacity, and critical nutrient reserves.

Risk of noxious weed invasion or re-invasion on a site is largely dependent on the abundance of undesirable species in the seed bank, the size and proximity of surrounding weed populations, the ease of seed movement to the site, and the growth and spread characteristics of any adjacent weed species (D’Antonio and Meyerson 2002). For example, a population of an aggressive knapweed less than a quarter mile down a well-traveled road renders a site highly susceptible to invasion. In contrast, a site surrounded by several miles of dense forest that separates it from a population of a rhizomatous weed species such as white top is at fairly low risk of invasion. Loss of native vegetative cover may negatively impact the availability and abundance of culturally important medicinal or food species. Artifacts present in the soil also may be at risk of being disturbed or transported by soil erosion accompanying the loss of vegetative cover. Aesthetics and recreational quality are diminished by patches of bare soil, as well as by unattractive invasive plants that have sharp spines or thorns. Wildlife species have co-evolved with native plant species and are highly dependent on them for food, or cover, or both. Of special concern are TES species that may be directly or indirectly affected by degraded vegetative conditions resulting from weed invasions. For example, listed fish species may be adversely affected by altered seasonal water flows or by increased sediment loads in streams due to erosion of disturbed weed sites. Propagules from weed sites in close proximity to special management areas of high social or ecological value can disperse and become established in the pristine habitats that often harbor TES plant species. Finally, revegetation of invasive weed sites with aggressive non-native cover species may unintentionally introduce equally invasive, though not officially designated as noxious, plants into the vicinity of TES plant populations resulting in excessive competition with rare native species that are already in decline or at risk of extirpation.

In additional to risk assessment, it is also important to determine the causes of site degradation. Broad categories include soil disturbance, loss of native species, and loss of whole plant communities whose structure normally regulates the processes of nutrient cycling and water retention. Within these broad categories, the agents contributing to disturbance and their relationship to ecosystem degradation should be identified and evaluated in terms of their continued presence and ongoing effects. For instance, if road construction has disturbed soils in the past, is the road still maintained (bladed annually, subject to ditch cleaning, sprayed annually to control existing weed infestations), or has it been closed or even obliterated? Or, if native plants have been lost due to heavy grazing pressure by domestic or wild ungulates, do those animals still have access to the area? Revegetation, especially with native species, is difficult to impossible in the face of continuing disturbance. Passive restoration (the removal of the disturbing agent so that unassisted site recovery can take place) will be the simplest and most cost-effective step towards revegetation of some sites, and is requisite to the success of active revegetation methods.

## Desired Future Condition:

Defining revegetative goals, or desired future condition, for a given site is a crucial step in site assessment. In many cases, the recovery of natural ecosystem processes and pre-disturbance conditions, or some close approximation, will be assumed as the preferred state. This suggests a plant community that is structurally diverse, fully functioning in all ecosystem processes, and consisting of locally adapted native species. A knowledgeable botanist or a plant ecologist should be consulted at this stage to help in identifying realistic goals for site revegetation. In some cases, such as in the presence of ongoing degradation or large-scale infestations, complete recovery to pre-disturbance conditions may not be an appropriate objective. Revegetation goals must also be realistic, both in the sense that they may actually be achieved, and that they are affordable. Some common and overarching goals for revegetation of National Forests and Grasslands include:

- Contribute to the restoration of ecosystem structure and function.
- Minimize or contain surface erosion, particularly if the project or downstream area is susceptible to impacts of erosion and/or sedimentation.
- Maintain or re-establish nutrient cycling as quickly as possible through establishment of desirable vegetative cover for nutrient uptake, and placement of woody debris or mulch for nutrient input.
- Avoid or minimize stream or riparian area sedimentation
- Exclude noxious weeds and undesirable non-native species by revegetating sites with local native species or non-persistent cover crops that will not be overly competitive with native vegetation in the target area.
- Give special consideration to sites of high ecological or social value, and areas containing TES species or habitat. Revegetation with local native species (local

ecotypes) is a high priority within intact and pristine ecosystems, core conservation areas, and their buffers and connecting corridors.

## Need For Action:

Determining the need for action on a specific site requires consideration of the potential for natural recovery. For example, is there adequate moisture available to support natural regeneration, sprouting, and establishment of native vegetation within a reasonable period of time? The degree of disturbance, as indicated by the proportion of the existing plant cover that consists of desirable native species, will also affect revegetation outcome. Ten to twenty percent native cover is considered a minimum required to facilitate natural recovery of a site (James 1992, Sheley *et al*. 1996, Goodwin and Sheley 2003). The diversity, abundance, and viability of plant propagules of desirable species in the seed bank or within the immediate vicinity are additional important determinants in natural recruitment and recovery. A novel method for quantifying site disturbance and the potential for natural recovery based on the plant cover of individual species, and their longevity and native/non-native status is described in McArthur *et al*. (1995). The formula[1] could easily be modified to incorporate information on additional life history traits such as root morphology (e.g,. rhizomatous vs. non-rhizomatous) and seral status. Sites dominated by propagule pools of early seral (pioneering) native species are predicted to have the greatest likelihood of natural colonization and recovery, while those reliant on late seral species for regeneration or dominated by undesirable rhizomatous species will generally be less successful.

The size of the invasion and the length of time that weeds have been present may strongly influence revegetation strategies and the need for active manipulations. Very small sites are the most easily re-colonized by the extant seed bank and by plant propagules dispersed from surrounding sources. Depending on the ecological setting, it is reasonable to allow revegetation to occur on its own on sites less than about 0.25 acres, or to possibly assist natural recovery through the redistribution of seed from surrounding plants by hand. The longer the site has been occupied by invasive plants, the greater the potential for the seed bank to become dominated by undesirable species, and for chemical or physical changes in soil conditions (e.g., shifts in

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[1] Disturbance value = Sum[Cover*(Longevity-Origin Scores)]/Number of Species. Longevity: 1=annual, 2=biennial, 3=biennial to perennial, 4=perennial. Origin: 1=native to local area, 2=exotic to the area, but native to North America, 3=exotic to North America.

nitrogen pools and pH) and associated microbial communities that may adversely affect species replacement dynamics and natural site recovery (Evans *et al*. 2001; Svejcar and Sheley 2001; D'Antonio and Meyerson 2002).

Other soil conditions influencing outcome include the degree of substrate disturbance (loss or mixing of soil horizons) and seedbed physical characteristics, including the extent of crusting and compaction. As fertility and water holding capacity are lost with the A and B soil horizons it becomes increasingly difficult to establish vegetation. Regardless of the method of regeneration, cultural amendments and manipulations may be required on highly degraded sites to help decrease the competitive advantage of exotic species, and improve the number and condition of regeneration sites available for germination and root extension of desired species. Examples include topsoil replacement, incorporation of organic matter, mulching, seedbed disking and imprinting to aid water infiltration and soil aeration, liming to adjust pH, and nutrient enhancements/manipulations. An experimental technique of great promise in *Bromus tectorum* dominated communities is the application of sucrose to reduce plant-available nitrogen and create a soil environment more conducive to the establishment of native perennial vegetation (McLendon and Redente 1992; Young *et al*. 1999;Paschke *et al*. 2000).

# Selection of Plant Materials

## Regional Priorities and Guidelines:

When site assessment indicates a need for active revegetation, the next critical step is to determine the species and seed sources that will establish and perform well on the site without impeding natural community recovery and succession, or compromising the diversity, genetic integrity, and long-term viability of resident wild populations. The potential risks and impacts of revegetation treatments are greatest for seeding and planting projects that involve large acreages, or that occur in or near management areas of high social or ecological value. In 1994, Region 6 formulated revegetation policy that set general guidelines and priorities for plant material usage in disturbed areas on national forests and grasslands, including sites occupied by invasive exotic plants (see Appendix B). Regional priorities, as well as definitions and rational, are as follows:

*Priority 1 - Local Native*: Plant materials of native species that originate from genetically local sources. Benefits of use include high adaptation to spatial and temporal extremes, and low input requirements (e.g., supplemental water, fertilizer). Local native plant materials are recommended for projects of all sizes (Fig. 1, adapted from Lesica and Allendorf 1999), especially in and around pristine or relatively intact habitats and ecosystems such as designated or proposed wilderness, roadless areas, wild and scenic river corridors, Research Natural Areas (RNAs), Special Interest Areas (SIAs), riparian areas, wetlands, cultural use areas, TES species habitat and connecting corridors, etc. For severe and large-scale disturbances, a mixture of genotypes or seed sources from ecologically different populations has been suggested as a strategy for maximizing genetic variation and enhancing the likelihood of plant establishment and persistence in stressful environments (Fig. 1, adapted from Lesica and Allendorf 1999).

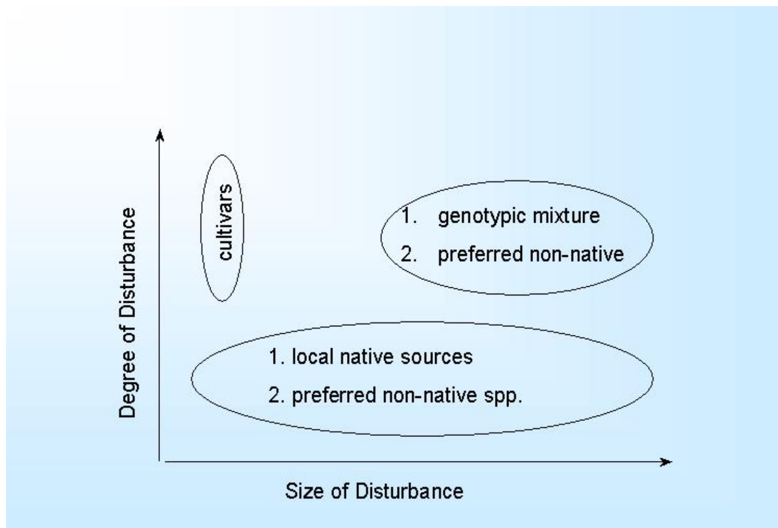


Fig. 1. Relationship between size and degree of disturbance and primary and secondary preferences for plant material for revegetation on National Forests and Grasslands in Region 6. (Adapted from Lesica and Allendorf 1999).

The ecological and geographic boundaries that define a local population are determined primarily by the heterogeneity of the climate and habitat, the genetic structuring of the populations, the extent of local adaptation, and the consequences of mixing distant gene pools (Fenstar and Dudash 1994; Knapp and Rice 1994; Linhart 1995; Montalvo *et al*. 1997; Lesica and Allendorf 1999; Hufford and Mazer 2003). Although seed zones and transfer guidelines have been developed for most Pacific Northwest conifer species (USDA 1973; Randall and Berrang 2002), such information is generally lacking for other native plant species. As a consequence, elevational restrictions along with existing spatial frameworks such as EPA ecoregions, 5th field watersheds, and conifer seed zones are frequently used to guide seed movement in native shrubs, grasses, and forbs (Erickson *et al.*, submitted). In the absence of supporting genetic data, the spatial scale of seed mixing and movement in the Pacific Northwest should be limited to geographic areas on the order of Level III ecoregions (Fig. 2; Omernik 1987, 1995), with additional restrictions based on elevation, cold hardiness, and local precipitation patterns. Area geneticists should be consulted for guidance in determining the most appropriate genetic sources of plant material for a particular restoration site.

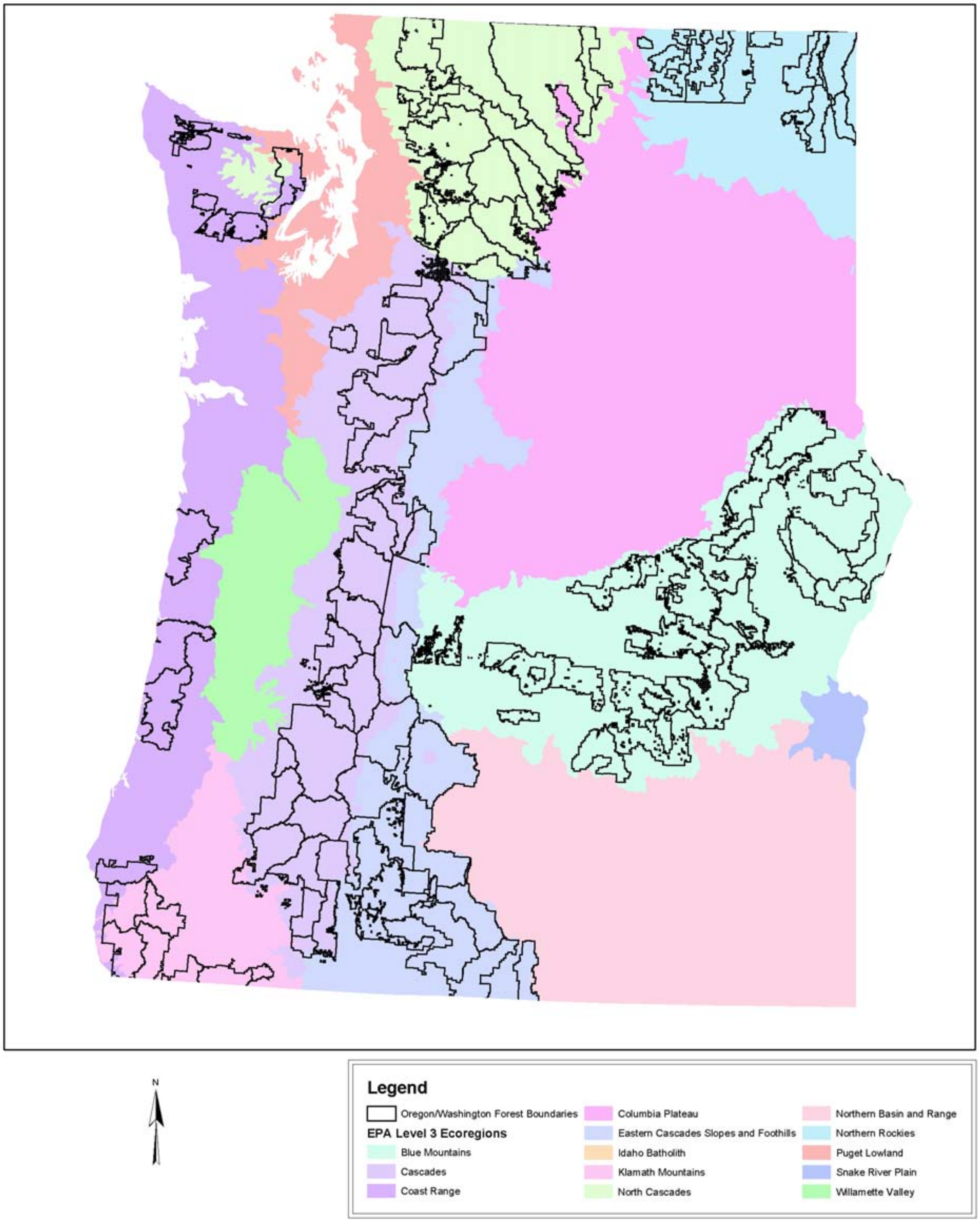


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Figure 2. Relationship between Level III ecoregions (in color) and R6 National Forest boundaries (outlined in black).

Use of local sources of native seed requires carefully coordinated and integrated programs to ensure adequate quantities of suitable seed are available at critical times for project work. A new 5-year Regional contract for native grass and forb seed production (53-04R3-03-14, http://www.fs.fed.us/r6/uma/native/) will help facilitate this process at reasonable cost. Table C-1 (Appendix C) contains seed yield and cost figures for native grass and forb species included in the contract. Table C-2 (Appendix C) describes ecological attributes and suggested seeding rates for a broad array of native species that have successfully been used in revegetation projects in the Pacific Northwest.

*Priority 2 - Preferred Non-Native*: The volume of seed needed for large-scale restoration may at times preclude the use of local native seed, particularly for unplanned events such as wildfires, or other disturbances where it is critical to quickly establish vegetation in order to protect basic resources values and prevent weed invasions. In these instances, a second choice would be sterile hybrids or annuals/biennial/perennial introduced plant species that are non-persistent and non-invasive (Fig.1, adapted from Lesica and Allendorf 1999). Preferred non-native species are those that will not aggressively compete with the naturally occurring native plant community, will not invade plant communities outside the project area, persist in the ecosystem over the long term, or exchange genetic material with local native plant species. Appendix D includes recommendations for non-native species that may be seeded as temporary ground cover for both erosion control and as noxious weed competitors until native species can become established and occupy the site. The list includes sterile hybrids, such as REGREEN and annuals such as white oats (*Avena sativa*) and winter wheat (*Triticum aestivum*). A more complete list of perennial non-natives that are suitably non-persistent may be developed on Districts/Forests by examining past revegetation efforts where the seeded species are known. Exotic species that have not already been introduced into the area, or that have been found to be aggressive and/or persistent, should be avoided. Table E-1 (Appendix E) provides a listing of non-native species that, although commonly used in the past, are generally no longer recommended due to their highly aggressive nature that has resulted in widespread loss or displacement of native species and plant communities in western wildlands. These include Kentucky bluegrass (*Poa pratensis*); smooth brome (*Bromus inermis*); crested wheatgrass (*Agropyron cristatum)*; orchard grass (*Dactylis glomerata*); yellow and white sweetclover

(*Melilotus officinale* and *M. albus*); alsike clover (*Trifolium hybridum*) and alfalfa (*Medicago sativa* to name a few. As a last resort, some of these "species-to-avoid" may play a limited role in revegetation of small, highly degraded sites where there is poor potential for native plant community recovery, or in settings where there is little risk of spread beyond the original site of introduction (e.g., seeding around buildings on administrative sites).

*Priority 3 - Non-local Native*: This category includes native species that do not occur naturally in the local ecosystem, or native plant material that does not originate from genetically local sources. These types of plant materials, including most commercial cultivars (Table E-2, Appendix E), are generally not preferable for wildland use due to concerns over adaptability, genetic diversity level, and the potential for genetic contamination or "swamping" of local native gene pools, including those of TES plants (Millar and Libby 1989; Knapp and Rice 1994; Linhart 1995; Montalvo *et al*. 1997; Lesica and Allendorf 1999; Hufford and Mazer 2003). Because commercial cultivars are typically selected for agronomic traits such as high fecundity, vegetative vigor, and competitive ability, their use may also adversely impact resident natural populations through direct competition and displacement. Moreover, cultivars of native species (and introduced look-alikes such as sheep fescue, *Festuca ovina*) can be very difficult to distinguish from native germplasm, which could severely complicate efforts to collect and propagate local material and waste valuable economic resources. Because of these concerns, cultivars are recommended for use only on small, highly disturbed sites (Fig. 1, adapted from Lesica and Allendorf 1999) that are not in close proximity to areas of high social or ecological value such as designated or proposed wilderness areas; Research Natural Areas (RNAs); Special Interest Areas (SIAs), TES species habitat or corridors, and riparian/wetland areas. Where cultivars have been used, it is important to document and map their locations so these areas can be avoided during seed harvesting activities.

## Designing Seed Mixes

The design of an effective seed mixes incorporates a number of factors, including land-use objectives and site characteristics such as existing and potential vegetation, weed density and biomass, precipitation/temperature regimes, soil characteristics, and shade conditions. In addition, short-term objectives of quick establishment of competitive plant cover must be balanced with more long-term goals of restoring fully functioning and self-sustaining plant communities that will be resilient to further disturbances (i.e., will not degrade to pre-treatment, weed-dominated conditions). This may be achieved by devising seed mixes containing compatible species that (1) maximally occupy available niches (enhance functional diversity), and (2) possess physiological and growth characteristics that facilitate their establishment, competitiveness, and tolerance of stress.

Researchers have found that sites with high functional group diversity, especially with respect to native forbs, are more competitive and resistant to weed invasion and establishment because site resources are fully utilized (Carpinelli 2000; Symstad 2000; Pokomy 2002). Although the full spectrum and diversity of the desired plant community rarely will be achieved during revegetation, niche occupation and resources use can be enhanced by combining key species that vary in their seasonal growth pattern, seral status, reproductive mechanisms, and growth form and root morphology (e.g., fibrous-rooted grasses and forbs with deep taproots) (Panetta and Groves 1990; Jacobs *et al*. 1999; Goodwin and Sheley 2003). Example of native cool-season grasses (grow in the early spring/summer and utilize soil resources in the upper soil profile) that can be competitive against invasive weeds include blue wildrye (*Elymus glaucus*), squirreltail (*Elymus elymoides*), mountain brome (*Bromus carinatus*), thickspike wheatgrass (*Elymus lanceolatus*), slender wheatgrass (*Elymus trachycaulus*), bluestem or western wheatgrass (*Pascopyrum smithii*), and prairie junegrass (Koelaria macrantha), Sandberg bluegrass (*Poa secunda*) (Borman et al. 1991; Brown and Amacher 1999; Goodwin and Sheley 2003). Idaho fescue (*Festuca idahoensis*), a cool-season bunchgrass, can also be a strongly competitive once mature stands are established. Competitive native forbs and legumes include blue flax, (*Linum lewisii*), common yarrow (*Achillea millefolium*), pearly everlasting (*Anaphalis margaritacea*), fireflower (*Epilobium angustifolium*) and various lupine (*Lupinus*) and vetch (*Vicia*) spp.

Native grass-like species, such as sedges, spikerushes, rushes, and bulrushes, may be useful in revegetating riparian and wetland areas. Under these conditions, containerized seedlings often show better survival and establishment than seeding. Deep-rooted shrubs may also be seeded or planted to more fully utilize resources from the lower soil profile, especially late in the growing season. Shrub vegetation can facilitate the establishment of understory species by increasing water availability and reducing understory temperatures and evapotranspiraation. Over the long term, perennial shrubs will also enhance soil fertility and structure and increase nutrient cycling (West 1989).

A more complete list of native species suitable for revegetation activities should be developed on Districts/Forests by knowledgeable plant resource specialists (i.e., range specialists, botanists, ecologists, etc.) through examination of target sites and nearby undisturbed reference areas. There's a broad array of competitive native species that may be useful in revegetation; however, research efforts have not fully explored their potential or the conditions under which they would be most effective. In general, characteristics that make a species well-suited for revegetation include broad ecological amplitude, rapid germination and early seedling growth, and aggressive root systems. Such species are often early seral natural colonizers of disturbed sites. Late seral species often have lower growth rates than colonizers, but still can be an important component of a seed mix because they tend to be highly competitive and often have high root/shoot ratios (Brown and Amacher 1999). Combining native and non-native species in seeding or planting mixes, however, is generally not recommended due to incompatible growth and life history strategies. An exception would involve the mixing of one or two long-lived perennial native species with a non-native temporary cover crop type species (e.g., from the list in Table D-1, Appendix D) that will rapidly colonize and occupy the site until the slower perennial species become established.

## Seed Labeling and Testing

The genetic origin of all native seed used in restoration should be known; purchased seed should be certified as to source identity. Purchased seed, both native and non-native, must have documented and recent (<1 year old) germination, purity, and "All State's Noxious Weed" test results. The more recent the test, the more likely it is to reflect the true condition of the seed . Testing should be conducted by a National Association of Official Seed Certification Analysis (AOSCA) approved seed testing laboratory (Table C-2, Appendix C). Copies of seed test results should be retained in associated project files.

Purity testing verifies the proportion of pure seed contained in the seed lot and identifies contaminants, including other crop seed, weed seed, and inert matter (e.g, stems, chaff, small stones). Graminoid seed with more than 10-15 percent inert matter will be difficult to apply through a rotary seeder or rangeland drill. Germination tests provide information on how well the pure seed portion of the seed lot will perform under favorable field conditions. The percentage of pure live seed (PLS), calculated as the percent purity multiplied by the percent germination, is commonly used as a standardized indicator of seed quality. See Table C-2,

Appendix C, for suggested minimum acceptable germination and purity standards for grass and forb seed.

Many native species produce seeds that are dormant and won't germinate without afterripening (time) or special germination enhancement treatments (stratification, scarification, gibberellic acid, etc.). In these cases, seed viability may be estimated using other procedures. Most widely used is the fast and inexpensive tetrazolium (TZ) test, which involves a biochemical staining technique with tetrazolium chloride that visibly stains live, germinable seed (Young and Young 1986).

Seed test results should verify that the seed lot contain no "Prohibited" noxious weed seed, and that seed meets or exceed standards for "Restricted" or "Other Weed Seed" content according to Oregon and/or Washington State standards for Certified Seed (Table C-2, Appendix C). Because each state has different lists of prohibited and restricted noxious weeds, request that the seed be tested with an "All-States Noxious Weed Exam". The name and number of seeds per pound of weed and other crop seed will be listed on the seed label. Be on the alert for aggressive nonnatives that, although not prohibited or restricted by the State, may still pose a threat to native plant communities.

## Determining Seeding Rates

Seeding rates for grasses and forbs can vary greatly depending on site condition, species, and methods of application. Recommended seeding rates for pure grass seed mixtures are generally in the range of 20-50 viable seeds per square foot (Goodwin and Sheley 2003); pure forb and shrub mixes will be lower (you wouldn't want 10 Elderberry shrubs in every square foot for example). Higher rates are often recommended for severely disturbed sites to compensate for high seedling morality due to limiting environmental factors and competition. Goodwin and Sheley (2003), for example, suggest a seeding rate of 80 PLS/$ft^2$ for perennial grasses in severely burned areas, and doubling or tripling rates when seeding to prevent weed invasions, or if broadcast seeding or hydroseeding. Brown and Amacher (1999) recommend 250-350 PLS seeds per $ft^2$ on severe disturbances. Increasing the seeding rate, however, will never make up for poor seedbed preparation, poor seeding methods, or improper timing of seeding.

Seeding rates are calculated using the following information:

1) total number of seeds per pound

2) percentage of each pound that is pure, live seed (PLS)
3) number of acres to be treated
4) target PLS /$ft^2$ after considering site conditions and seeding method

*<u>Example calculations for a single species seed mix</u>*: seed 1 acre with blue wildrye which has 131,000 seeds per pound and is 83% PLS to get a result of 20 PLS /$ft^2$:

(1 acre) x (43,560 $ft^2$/acre) x (20 PLS/$ft^2$) = 871,200 PLS

(131,000 seeds/lb) x (0.83) = 108,730 PLS/lb.

871,200 ÷ 108,730 = 8.01 lb.

*<u>Example calculations for a multi-species seed mixture</u>*: seed 1 acre with 4 species at different rates (to equalize competition) to obtain a coverage of 40 PLS/ft.$^2$:

| Species | Seeds per pound | PLS | Target Coverage (PLS/ft2) |
|---|---|---|---|
| Blue wildrye | 131,000 | 0.83 | 10 |
| Mountain brome | 81,500 | 0.86 | 10 |
| Prairie junegrass [a] | 2,300,000 | 0.80 | 10 |
| Sandberg's bluegrass | 925,000 | 0.80 | 10 |
| | | Total Coverage: | 40 PLS/$ft^2$ |

[a] Bluebunch wheatgrass may be substituted on drier sites. Idaho fescue would be a good addition to this mix if available.

Blue wildrye: (1 acres) x (43,560 $ft^2$/acre) x (10 PLS/$ft^2$) = 435,600 PLS

(131,000 seeds/lb) x (0.83) = 108,730 PLS/lb.

435,600 ÷ 108,730 = **4.01 lb/acre**.

Mountain brome: (1 acre) x (43,560 $ft^2$/acre) x (10 PLS/$ft^2$) = 435,600 PLS

(81,500 seeds/lb) x (0.86) = 70,090 PLS/lb.

435,600 ÷ 70,090 = **6.21 lb/acre**.

Prairie junegrass: (1 acre) x (43,560 $ft^2$/acre) x (10 PLS/$ft^2$) = 435,600 PLS

(2,300,000 seeds/lb) x (0.80) = 1,840,000 PLS/lb.

435,600 ÷ 1,840,000 = **0.24 lb/acre**.

Sandberg's bluegrass: (1 acre) x (43,560 $ft^2$/acre) x (10 PLS/$ft^2$) = 435,600 PLS

(925,000 seeds/lb) x (0.80) = 740,000 PLS/lb**.**

435,600 ÷ 740,000 = **0.59 lb/acre**.

**Total Mix = 11.05 lb/acre**

**How to use PLS:** If the plan calls for a certain amount of pounds of PLS seed per acre, how much bulk seed is needed? To calculate the corresponding bulk amount, divide the PLS percentage into the number of pounds recommended. Example: You want to plant 5 PLS pounds of Idaho Fescue per acre. The analysis label indicates 85% purity and the germination is 79%. .85 x .79 = .67 PLS. Divide .67 into 5 lbs/acre = 7.5 lbs of BULK seed/acre.

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# Internet Resources

# Weed Related Websites

| Weed ID Sites | |
|---|---|
| CropNet – Weeds | http://www.crop-net.com/weeds.htm |
| American Cyanamid Weed Guide | http://www.cyanamid.com/tools/weedguide/index.shtml |
| UC Pest Management Guidelines - Weed Photo Gallery | http://www.ipm.ucdavis.edu/PMG/r785700999.html |
| FMC Weed ID | http://ag.fmc.com/ag/weedbug |
| Idaho Noxious weeds | http://www.oneplan.state.id.us/pest/nw00.htm |
| University of Illinois Weed ID | http://web.aces.uiuc.edu/weedid.htm |
| Iowa State Weed ID | http://www.weeds.iastate.edu/weed-id/weedid.htm |
| Noxious Weeds of Kansas | http://www.ink.org/public/kda/phealth/phprot/weeds.html |
| Common Weed Seedlings of Michigan | http://www.msu.edu/msue/iac/e1363.htm |
| Oregon State Weed ID site | http://www.css.orst.edu/weeds/id.html |
| University of New England Weed ID | http://www.une.edu.au/agronomy/weeds/photo_library/ph_lib.html |
| Rutgers Coop Extension - Weeds of New Jersey | http://www.rce.rutgers.edu/weeds/index.html |
| Virginia Tech Weed Identification Guide | http://www.ppws.vt.edu/weedindex.htm |
| WSSA Photo herbarium | http://ext.agn.uiuc.edu/wssa/subpages/weed/herbarium0.html |
| Wyoming Noxious Weed Site | http://www.uwyo.edu/plants/weeds/id |
| **Weed Control** | |
| ARS Exotic and Invasive Weeds Unit | http://wric.ucdavis.edu/exotic.html |
| NC Aquatic Weeds (East) | http://www.cropsci.ncsu.edu/aquaticweeds |
| Yellow Star thistle | http://soils.ag.uidaho.edu/yst |
| Weeds of No-till Cropping Systems | http://www.btny.purdue.edu/Extension/Weeds/NoTillD/NoTillWeed1.html |
| North Carolina Cotton Weed Control | http://ipmwww.ncsu.edu/Production_Guides/Cotton/chptr10.html |
| New York Forage Crops Weed Control | http://wwwscas.cit.cornell.edu/forage/recommends/recindex.html |
| Weeds of Minnesota Wheat | http://www.smallgrains.org/techweed.htm |
| **Agricultural Companies** | |
| Aventis | http://www2.aventis.com |
| BASF | http://www.basf.com |
| Bayer | http://www.agro.bayer.com/ |
| Dow AgroSciences | http://www.dowagrosciences.com |
| DuPont | http://www.dupont.com |
| FMC Home Page | http://www.fmc.com |
| Monsanto | http://www.monsanto.com |
| Novartis | http://www.novartis.com/agri/index.html |
| Rohm and Haas Home Page | http://www.rohmhass.com |
| Zeneca Main page | http://www.zeneca.com |

| | |
|---|---|
| Herbicide Company Geneology | http://www.css.orst.edu/herbgnl/tree.html |
| **Educational Resources** | |
| American Society for the Advancement of Science | http://www.aaas.org |
| 1998 Weed Science Compendium | http://www.agsci.kvl.dk/weedsci/teaching/weedbk98.htm |
| BLM environmental Education | http://www.blm.gov/education/fire_and_weeds.html |
| K-8 Weed Projects | http://www.sped.ukans.edu/~unitest/explorer-db/html/835851687-81ED7D4C.html |
| National Science Foundation | http://www.nsf.gov |
| **Miscellaneous** | |
| Council for Agricultural Science and Technology | http://www.cast.science.org |
| The Environmental Weeds Home Page (Austrailia) | http://weeds.merriweb.com.au |
| Sustainable Agriculture Network | http://www.sare.org/san |
| University of New England, Australia | http://www.une.edu.au/agronomy/weeds |
| WeedJobs (Jobs in Weed Science) | http://www.NRCan.gc.ca/~bcampbel |
| **University Weed Science Sites** | |
| Auburn University | http://www.ag.auburn.edu/dept/ay |
| University of California, Davis | http://veghome.ucdavis.edu/weedsci/WWW/Welcome.html |
| Colorado State University | http://www.colostate.edu/Depts/IPM/nipm/agwee.html |
| University of Georgia Weed Science | http://mars.cropsoil.uga.edu/fac_weed.htm |
| University of Illonois, Urbana-Champaign | http://w3.aces.uiuc.edu/CropSci/weed-lab |
| Iowa State Weed Science | http://extension.agron.iastate.edu/extweeds/Default.htm |
| University of Maryland Weed Science | http://www.agnr.umd.edu/users/weed |
| University of Missouri-Colunbia Weed Science | http://www.psu.missouri.edu/agronx/weeds |
| University of Nebraska Weed Science | http://ianrwww.unl.edu/ianr/agronomy/ws.htm |
| New Mexico State University Weed Science | http://taipan.nmsu.edu/weeds/ |
| North Dakota State University | http://ncweeds@ndsuext.nodak.edu/extnews/weedpro/ |
| Oregon State University | http://www.css.orst.edu/weeds/ |
| Rutgers University | http://www.rce.rutgers.edu/weeddocuments/index.htm |
| Southern Illinois University | http://www.siu.edu/~weeds/ |
| Texas A&M | http://aggie-horticulture.tamu.edu/plantanswers/turf/publications/weed2.html |
| Virginia Tech Weed Science | http://www.ppws.vt.edu/ |
| University of Wyoming | http://www.uwyo.edu/plants/weeds/ |
| **U.S. Government Weed Related Sites** | |
| BLM Weed Site | http://www-a.blm.gov/weeds/ |
| BLM Weed Hall of Shame | http://www.blm.gov/education/weeds/hall_of_shame.html |
| Federal Interagency Committee | http://bluegoose.arw.r9.fws.gov/FICMNEWFiles/FICMNEWHomePage.html |

| | |
|---|---|
| FICMNEW | |
| National Agricultural Pests Information System | http://www.agnic.nal.usda.gov/agdb/napis.html |
| National Biological Control Institute | http://www.aphis.usda.gov/nbci/ |
| National Park IPM of Weeds | http://www.colostate.edu/Depts/IPM/natparks/natpark.html |
| USDA ARS Southern Weed Science | http://msa.ars.usda.gov/la/srrc |
| USDA ARS Weed Science Laboritory (Beltsville, MD) | http://www.barc.usda.gov/psi/wsl/wsl.htm |
| **Weed Science Societies and Organizations** | |
| American Crop Protection Association | http://www.acpa.org |
| Colorado Weed Management Assoc | http://www.fortnet.org/CWMA |
| European Weed Research Society | http://www.ewrs.ac.uk |
| Herbicide Resistance Action Committee | http://www.PlantProtection.org/HRAC |
| International Weed Science Society | http://www.css.orst.edu/weeds/iwss |
| International Weed Science Congress | http://www.sercomtel.com.br/ice/plantas |
| North American Weed Management Association | http://www.nawma.org |
| North Central Weed Science Society | http://www.ncwss.iastate.edu |
| Northeastern Weed Science Society | http://www.ppws.vt.edu/newss.htm |
| Southern Weed Science Society | http://www.weedscience.msstate.edu/swss |
| Weed Science Society of America | http://ext.agn.uiuc.edu/wssa |
| Weed Science Society of Victoria, Australia | http://home.vicnet.net.au/~weedsoc |
| Western Society of Weed Science | http://www.wsweedscience.org |
| **Individual State Weed Sites** | |
| Arizona Rangeland Weeds | http://ag.arizona.edu/OALS/agnic/weeds/home.html |
| Colorado's 10 Most Wanted Weeds | http://www.ag.state.co.us/commish/press/1999/weedweek.html |
| Control of Invasive Exotic Plants in the Great Plains | http://www.npsc/nbs.gov/resources/literatr/exotic/exotic.htm |
| Kansas Noxious Weeds | http://www.ink.org/public/kda/phealth/phprot/weeds.html |
| Michigan | http://mel.lib.mi.us/science/weeds.html |
| North Dakota Weed Information | http://www.ext.nodak.edu/extpubs/weeds.htm |
| Wyoming Weed and Pest Council | http://www.wyoweed.org/ |

# APPENDIX F

Early Detection/Rapid Response:

**Annual Implementation Guideline (Including Sample Notices, and Monitoring and Reporting Forms)**

# Invasive Plant Draft Implementation Guide
## Deschutes and Ochoco National Forests, Crooked River National Grassland

The following outlines the process that will be used to ensure that the selected alternative is properly implemented. It applies to invasive plant sites known and identified for treatment in the EIS as well as new sites found during inventory (early detection/rapid response). Annually, an invasive plant assessment review team will be assembled to identify sites for potential treatment and follow the steps below to ensure consistent and effective treatment is applied, appropriate Project Design Features are implemented, and necessary monitoring and reporting are completed.

1. **Convene interdisciplinary team to review the annual program**
    - Team members and a team leader will be assigned by the Forest Supervisors.
    - Appropriate fish and/or wildlife biologists will be part of this team when proposed project sites are near listed species or their habitats.

2. **Characterize invasive plant infestations to be treated**
    - Characterize infestation (density, type and no. of species, extent, etc.). See Exhibit 1 for an example.
    - Add or refine target species information to database (NRIS).
    - Identify site objective, short and long term desired condition.
    - Identify conditions at the site to be treated (affected environment, resources at risk)
    - Ensure that no extraordinary conditions exist that were not considered in the EIS.[1]

    **Pre-implementation documentation:** Maps and descriptions, finding that no extraordinary site conditions exist.

3. **Develop site-specific prescriptions and plans**
    - For new sites (not identified for treatment in the EIS) use Integrated Weed Management principles to identify preferred treatment method(s). Use Appendix B of the EIS and other sources as a reference. These methods are intended to be refined through monitoring and adaptive management.
    - Determine whether preferred methods are within the scope of those analyzed in the EIS[2]
    - Identify pre-treatment survey needs (e.g. survey and manage or TES plants).
    - Apply appropriate PDFs from EIS section 2.4 and PDCs from consultation documents. Consider:
        - ✓ Size of infestation, treatment history and response to past treatments
        - ✓ Proximity to sensitive species or habitats
        - ✓ Proximity to streams, lakes, or wetlands
        - ✓ Soil conditions
        - ✓ Domestic water intakes or position in municipal watershed

[1] Extraordinary conditions at site may trigger additional NEPA requirements.
[2] If preferred methods have effects that are outside the scope of those analyzed in the EIS, additional NEPA would be required. An analysis according to Section 18 of the 1909.15 Forest Service NEPA Handbook would be warranted if the treatment prescription was not similar to any analyzed in this EIS, there were circumstances not considered in this EIS, or herbicides are proposed that are not discussed in this EIS.

  - ✓ Recreation or special forest product uses.
  - ✓ Mineral Material source (in use or planned for use)
- Consider effectiveness of treatments once PDFs are applied.
- Review Forest Plan standards or other environmental criteria for treatment site location.
- Ensure no effect for heritage resources. Complete project review/exemption form.
- Prepare pre-treatment restoration plan. The need for active restoration will be re-assessed during post-treatment monitoring. For active restoration sites, ensure acceptable plant or mulch materials are available before implementation. (R6 Standard #12)
- Complete Form FS2100-2 (Exhibit 3), Pesticide Use Proposal. This form lists treatment objectives, specific herbicide(s) that would be used, the rate and method of application, and PDFs that apply.

**Pre-implementation documentation:** Detailed prescriptions that include appropriate PDFs, finding that treatment methods are within the scope of the EIS, finding of no effect on heritage resources, restoration/revegetation plans, completed FS2100-2.

**4. Coordination and Notification**

- Coordinate with adjacent landowners and partners if appropriate.
- Notify regulatory agencies if proposing treatment where listed species or habitat may be present. If the IDT identifies EDRR opportunities that "may affect" federally ESA-listed species, the Level 1 Team will be notified prior to project implementation. The Level 1 Team, which includes regulatory agencies, may convene to review the project and determine if the project is consistent with the programmatic consultation for the Invasive Plant Treatment Program. Project Consistency Evaluation Forms for treatment of PAUs and EDRR areas (Exhibit 8) that "may affect" federally ESA-listed species will be completed by November 1st and submitted to Forest Level 1 representatives. Forms will then be submitted to the regulatory agencies. Level 1 team members may schedule post-implementation field trips to monitor effectiveness.
- For treatments that fall below the ordinary high water mark (bankfull), and that cannot meet the In-Water Work Time Periods, consult with the Oregon Department of Fish and Wildlife.
- Prioritize sites to be treated on each Forest following the criteria in the EIS Chapter 2. Coordinate with road managers to ensure needed mineral material sources are considered in prioritization. (R6 Standard #11)
- Document a public notification plan based on the treatment areas (e.g. if they involve places where people gather or areas of special use forest product collection). See Exhibit 4 for an example of a newspaper notification. (R6 Standard #23).
- Before using herbicides in any Project Area Unit that has cultural (traditional) use plants either previously mapped or subsequently identified in the unit, notify tribal government leader, culture and heritage committee or person, and natural resources lead for relevant tribal organizations (Confederated Tribes of the Warm Springs Reservation, Burns Paiute Tribes, and the Klamath Tribes) with information about location, time of application, application methods, and herbicides used. Contact should be a combination of written notice and subsequent phone or email confirmation or discussion.

**Pre-implementation documentation:** notes of meetings; copies of notification.

### 5. Accomplishment and Compliance Monitoring

The R6 2005 ROD provides a monitoring framework (included as Appendix K of this FEIS) that will assist the Forests in tracking progress towards reaching the desired future condition and to document compliance with the treatment standards. As part of Forest Plan Implementation Monitoring and reporting, the Forests and Grassland will utilize a checklist database to determine if the actions are taking place as we describe them in this EIS.

An implementation/compliance monitoring database will track invasive plant treatment projects that are the subject of Section 7 consultations under the Endangered Species Act (ESA) across the Pacific Northwest Region (Region 6), generate annual reporting of compliance for use by the Services (NOAA Fisheries, U.S. Fish and Wildlife) and Forest Service (FS), and allow for common reporting of data on individual projects. As a minimum, on each project requiring consultation, reporting will be required on compliance with Standards 16, 18, 19, and 20 in the Invasive Plant EIS.

- Develop work plan for herbicide use according to FSH 2109.14.3, which presents organizational and operational details.
- Ensure contracts and agreements include appropriate prescriptions and that herbicide ingredients and application rates meet label requirements, R6 Standards 1 and 18, and site-specific PDFs.
- Where buffers are required, appropriate specialists and weed coordinator will apply and delineate buffers or other special restrictions.
- Document and report herbicide use and certified applicator information in the National pesticide use database, via the Forest Service Activity Tracking System (FACTS), and other forms.
- Determine whether public notification plan was appropriately implemented; document accomplishments.

**Pre-implementation Documentation:** Meeting notes of “plan in hand” review, contracts and agreements, notes of public notification accomplishments.

### 6. Treatment and Post-Treatment Monitoring and Adaptive Management

Post-treatment reviews will occur to determine whether prescriptions were effective and whether project design features were effective in protecting non-targets. This will often occur during re-treatment visits. Non-target vegetation (sensitive or protected survey & manage populations) would be evaluated before treatment, immediately after treatment, and two to three months later. Treatment buffers would be expanded if damage was found.

Monitoring of effectiveness of project design features which are intended to reduce adverse effects of treatments on non-target, federally listed species will occur for a sample of high risk sites as defined in the R6 ROD and follow the protocol to be developed by 2007. If the protocol is not developed before implementation of this project begins, the effectiveness monitoring will be evaluated in consultation with the U.S. Fish and Wildlife Service and National Marine Fisheries Service.

- Monitoring would occur during implementation to ensure PDFs are implemented as planned.
- Post-treatment reviews would occur on a sample basis to determine whether treatments were effective and whether or not passive/active restoration has occurred as expected. Post-treatment monitoring would also be used to detect whether PDFs were appropriately applied.

- Contract administration and other existing mechanisms would be used to correct deficiencies.
- Herbicide use would be reported as required by the FSH 2109.14 and FACTS.
- Post-treatment monitoring would assess re-treatment needs. For example, as the size of an infestation is reduced, treatment method would change from broadcast to spot spray or to hand pulling.
- Post-treatment monitoring would be used to refine active restoration prescriptions.
- Effectiveness monitoring would occur in sample sites to ensure non-target vegetation, especially sensitive plants are adequately protected. Non-target vegetation in selected areas would be evaluated before and immediately after treatment, and two to three months later. Treatment buffers would be expanded if damage were found as indicated by a decrease in the size of any non-target plant population, leaf discoloration, or chlorophyll change, or mortality to individual species of concern.
- Additional monitoring may be included as part of the Deschutes and Ochoco National Forests' annual forest plan monitoring or other programs such as state water quality monitoring.

**Monitoring documentation:** Post-treatment records, pesticide use reports, monitoring reports, including recommendations for changes in buffer widths.

**Exhibit 1: Invasive Plant Inventory Form**

**General Information (Range General Form)**

| | | |
|---|---|---|
| *Site ID:________________________ | *Date:___________________ (MM/DD/YYYY) | New? Re-measure? (Circle One) |
| *Examiner (Last, First, MI) | | |
| *Region 06: *Forest 01 –***or*** – 07 | *District | *State |
| *County | *Project Name (Terra) DES_Noxweeds OCH_Noxweeds | |

**Location**

| |
|---|
| Site Location/ Project/ Name |
| *Legal Description T._______ R._______ Sec., ______ ¼ ______ Willamette Meridian |
| *UTM's easting____________________________northing __________________________ Zone 10 NAD 27 |
| GPS file # |

**Existing Veg**

*Dominant Life Form of Invasive Site – Circle one

| | | |
|---|---|---|
| AL Algae | FB Forb/Herb | LC Lichen |
| LI Woody Liana | GR Graminoid | FU Fungus |
| NP Non-vascular | SH Woody Shrub | SS Sub-Shrub |
| TR Tree | VI Herbaceous Vine | UN Unknown |

**Data Elements (Invasive Plant Form)**

Note: if plant code is not in the NRCS-PLANTS database, enter NO-XWALK in the plant code

| | | |
|---|---|---|
| *Plant code | Common Name | |
| Phenology (Circle one) | F1 Vegetative, rosette F3 Fruiting<br>F2 Flowering F4 Senescent or dormant | |
| Lifeform of Invasive (Circle one) | AL, FB, LC, LI, GR, FU, NP, SH, SS, TR, VI, or UN | |
| Distribution (Circle one) | CL Clumpy SE Scattered Even<br>SP Scattered Patchy LI Linear | |
| *Infested area | *Unit of Measure | Pop. Size/Total |
| Gross area | Unit of Measure | Site Type |
| Proposed treatment | | |

**Choose Cover Class Code, or estimate collective canopy area of weed species at this site for Cover %**

| * Cover Ten Codes (NRMCOV) | **OR** * Daubenmire's (DAUBEN) | **OR *** Cover % |
|---|---|---|
| __________ | __________ | _________ % |
| T = 0-1.0% 6 = 55.1-65.0%<br>0 = 1.1-5.0% 7 = 65.1-75.0%<br>1 = 5.1-15.0% 8 = 75.1-85.0%<br>2 = 15.1-25.0% 9 = 85.1-95.0%<br>3 = 25.1-35.0% A = 91.1-99.0%<br>4 = 35.1-45% X = 99.1-100%<br>5 = 45.1-55% | T = 0.1-1%<br>1 = 1.1-5%<br>2 = 5.1-25%<br>3 = 25.1-50%<br>4 = 50.1-75%<br>5 = 75.1-95%<br>6 = 95.1-100% | |

**Exhibit 1 Continued: Invasive Plant Inventory Form**

Horizontal Distance to Water: __________Feet or Meters Vertical distance to Water: __________Feet or Meters Associated Species:

| Code | Genus | Species |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

**Comments/directions**:______________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

_____________________________________________________________________

**SITE MAP**

**Exhibit 2: Example of Invasive Plant Site Treatment Implementation Guide**

**Invasive Plant Site #:** **EIS Project Area Unit:**

**Location & Description:**

**INSERT MAP**

**Invasive Species Present:**

**Treatment and Schedule**

**Applicable Project Design Features**

Botany

Aquatic

Wildlife

Cultural

**Other Information (e.g. partners, effectiveness monitoring to occur post-treatment)**

**Exhibit 3: FS2100-2, Pesticide Use Proposal Form**

<table>
<tr><td rowspan="4">PESTICIDE - USE PROPOSAL<br><br>(Reference FSM 2150)</td><td>DEPARTMENT/ AGENCY</td><td colspan="2">CONTACT/PHONE NO.</td></tr>
<tr><td></td><td colspan="2"></td></tr>
<tr><td>REGION</td><td>FOREST</td><td>DATE SUBMITTED</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>1) OBJECTIVE<br>a) Project No.<br>b) Specific Target Pest<br>c) Purpose</td><td colspan="3">______<br>______<br>______</td></tr>
<tr><td>2) PESTICIDE<br>a) Common Name<br>b) Formulation<br>c) % AI,AE,or lb / Gal.<br>d) Registration No.</td><td colspan="3">______<br>______<br>______<br>______</td></tr>
<tr><td>3)<br>a) Form Applied<br>b) Use Strength (%) or Dilution Rate<br>c) Diluent</td><td colspan="3">______<br>______<br>______</td></tr>
<tr><td>4)<br>lbs. AI Per Acre or Other Rate</td><td colspan="3">______</td></tr>
<tr><td>5) APPLICATION<br>a) Method<br>b) Equipment</td><td colspan="3">______<br>______</td></tr>
<tr><td>6)<br>a) Acres or Other Unit to be Treated<br>b) Number of Applications<br>c) Number of Sites<br>d) Specific Description of Sites</td><td colspan="3">______<br>______<br>______<br>______</td></tr>
<tr><td>7)<br>a) Month(s) of Year<br>b) States</td><td colspan="3">______<br>______</td></tr>
<tr><td>8) SENSITIVE AREAS<br>a) Areas to be Avoided<br>b) Areas to be Treated with Caution</td><td colspan="3">______<br>______</td></tr>
</table>

| | |
|---|---|
| 9) REMARKS<br>a) Precautions to be Taken<br>b) Use of Trained / Certified Personnel<br>c) State and Local Coordination<br>d) Other Pesticides Being Applied to Same Site<br>e) Monitoring<br>f) Other | ______<br>______<br>______<br>______<br>______<br>______ |
| Approval (Signatures of Approving Official) | Date (mm/dd/yy): |

**Instructions for completing Form FS-2100-2, Pesticide Use Proposal**

**Heading** - Provide requested information.

**OBJECTIVE** (Block 1)

a) Project Number - Assign in accordance with field IPMWG procedures.
b) Specific Target Pest - Identify the target pest by common and scientific name. Identify life cycle stage for animals
or stage of growth for plants (e.g. emergent or pre-emergent, seedling, sapling, etc.)
c. Purpose - State exact purpose of pesticide use.

**PESTICIDE** (Block 2)

a) Common name of active ingredient(s) as indicated on the pesticide label. When a combination of pesticides are to be used on a single pest, use the word "AND" in listing the pesticide names. When alternate materials are proposed, use the word "OR" in listing the names.
b) Indicate product formulation (i.e., amine, ester, emulsifiable concentrate, granules, solution, etc.).
c) Percentage active ingredient, acid equivalent, or pounds per gallon (as indicated on the pesticide label).
d) List the EPA registration number from the pesticide label.

**PESTICIDE** - continued (Block 3)

a) Form Applied - e.g., dust, granule, emulsion, bait, solution, gas, etc.
b) Use strength or Dilution Rate - List the quantity of concentrate mixed with the quantity of diluent or indicate the percentage strength of the formulation.
c) Diluent - Identify the pesticide carrier, i.e., water, oil, talc, kerosene, etc.

**PESTICIDE** - continued - (Block 4)

Pounds of Active Ingredient Per Acre or Other Rate - State pounds of active ingredient per acre to be applied, unless some other unit is indicated. If reporting in acreage is not appropriate, indicate units used. Indoor applications of residual sprays may be expressed as percent of actual ingredient in the prepared spray in gallons per M (1,000) square feet. Point of runoff, which may appear on a label is generally considered to be 1 gallon per 1,ooo square feet on most indoor surfaces. If dusts are used instead of sprays, express as ounces or pounds of prepared dust per M (1,000) square feet. Treatment of trees is listed by number of trees or if application is by hydraulic sprayer, is expressed as pounds or quarts of concentrate per 100 gallons of diluent - oil or water, whichever is used. If the pesticide for trees or brush is applied by air or mist blower, express as pounds of active ingredient per acre. Fumigants or inside aerosols are expressed as pounds of the fumigant or aerosol per M (1,000) cubic feet. Rodent baits should be listed as ounces or pounds of the prepared bait per bait station. Treatments in water may be expressed in parts per million (ppm) by weight or volume - specify. In spot applications, the rate of application is expressed in pounds or gallons per 1,000 square feet indoors or pounds per acre of active ingredient outdoors applied to the spot area treated.

**APPLICATION** - (Block 5)

Indicate as specifically as possible the method (i.e., aerial, ground, etc.) of application and the type of equipment such as helicopter, hand compression sprayer, mist-dust blower, hydraulic sprayer, injector, etc.

**APPLICATION** - (Block 6)

a) Acres or Other Unit to be Treated. State in terms of acres, unless otherwise indicated. Some projects may require repeat applications. Report only the units to be treated for the first application.
b) Number of Applications - For projects that require repeat applications to the same area, indicate their estimated number and their timing.
c) Number of Sites - If the reported figures are a consolidation from several locations, indicate the number of locations.
d) Specific Descriptions of Sites - Indicate the type of area and pertinent portion of the area to be treated; such as ditchbank, rangeland, powerline right-of-way, tree nursery, etc. Specify if pesticide is to be applied in or around water and whether it will be applied directly to water or to the shore. Where applicable, indicate the slope of the treated area. For aquatic use, indicate water quality (hardness and pH) if available or applicable.

**APPLICATION** (Block 7)

a) Month(s) of Year - State month(s) of year.
b) State(s) - Indicate State and other designation that identifies the area geographically.

**SENSITIVE AREAS** (Block 8)

a) Areas to be Avoided - Identify sensitive areas to be avoided. Indicate if the area is subject to inadvertent treatment as a result of drift. Describe fully in "remarks" (Block 9) what protective measures are to be taken.
b) Areas to be Treated with Caution - Identify sensitive areas to be treated with special precautions to avoid contamination.

**REMARKS** (Block 9)

Use this line for information which will be helpful to the field IPMWG in evaluating the project.

a) Precautions to be Taken - Describe specific precautions be taken to protect sensitive areas; for example, no application within 100 feet of streams.
b) Use of Trained / Certified Personnel - Provide information on the status of training and/or certification of personnel doing the actual work and of those supervising. Has project been reviewed by a field biologist, agronomist, entomologist, or other appropriate subject matter specialist?
c) State and Local Coordination - Indicate coordination on the project at a State or local level.
d) Other Pesticides Being Applied to Same Site - Indicate what other pesticides are being or will be applied on the same site within the year.
e) Monitoring - Describe any monitoring of the operation be to conducted. Indicate effectiveness of prior projects and mention undesirable side effects observed.
f) Other - Indicate if the project is to be accomplished by contract.

Environmental analyses (EA's and/or EIS's) may be referred for additional information.

**APPROVAL** (Block 10)

a) Signature of Approving Official
b) Date of Signature

**Exhibit 4. Example of a Public Notice of Herbicide Use for Publication in Newspaper.**

**PUBLIC NOTICE**

**Deschutes National Forest Integrated Weed Management Program**

An integrated weed management program which includes the use of herbicides, hand pulling, and biological controls will be implemented on the Deschutes National Forest from June 1 to September 30, 2007. The locations and acreages of sites to be treated with herbicides are listed below:

Bend-Ft. Rock Ranger District: (Roads and legal locations listed)

Crescent Ranger District: (Roads and legal locations listed)

Sisters Ranger District: (Roads and legal locations listed)

All restrictions and regulations regarding the use of herbicides will be followed as stated in the Region 6 Environmental Impact Statement for Preventing and Managing Invasive Plants, and the Environmental Impact Statement for the Invasive Plant Treatments on the Deschutes and Ochoco National Forests and Crooked River National Grassland.

Herbicides will be applied directly to target weeds. Application dates are weather dependent. High use recreation areas and other areas of human use will be posted prior to spraying.

Persons who are known to be or suspect that they are hypersensitive to herbicides may contact the Forest Service to determine the appropriate risk management measures.

Questions regarding specific project areas, timing and treatment may be obtained by calling Byron Cheney at (541) 416-6695, or Dave Langland at Oregon Department of Agriculture, (503) xxx-xxxx.

**Exhibit 5. Example of Implementation Monitoring Form**

## Implementation Monitoring Form for Invasive Weed Treatments

This tracking form is to be completed by a contract administrator, licensed applicator, or specialist after treatment of invasive plants on National Forest lands. The purpose of this form is to monitor the implementation of projects covered under the Deschutes & Ochoco National Forests and Crooked River National Grassland Invasive Weed EIS. Projects that were determined to have the likelihood of an adverse effect on protected, endangered, threatened, or sensitive species prior to implementation will have an implementation monitoring form completed.

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

Project Name:_________________________ Implementation Date:________________

Name of Implementation Plan:____________________________________________

Weed(s) targeted:____________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________

Treatment Method: ( ) Herbicide ( ) Manual ( ) Mechanical ( ) Cultural

Herbicide Formulation(s):______________________________________________

Herbicide application method:__________________________________________

Herbicide rates used:___________________________________________________

Acres treated:___________ First, second, or third year of implementation:_____

If in riparian area, what waterbody was project implemented adjacent to?

Lake/Wetland Name:_____________________

Stream Name:___________________________HUC 6:__________________

Species of local interest found through pre-project implementation review:
( ) fish ( ) wildlife ( ) botany

Species names:_____________________________
_____________________________

Project Design Features applied:

**Exhibit 6: Inspection and Inventory Form for Mineral Material Sources**

**Ochoco NF / Deschutes NF / Crooked River NG**
**Mineral Material Source Weed Inspection Form**

NRIS Site #___________________

Pit Name: ________________________________ Pit Cleared: Y N Conditional ___
Location: ________________________________ Forest: ________________________
Public: ___ Private: ____ District: _______________________
Owner/Operator Name, Address, Tel. #:

______________________________________________________________________________________
______________________________________________________________________________________
_________________________________________________________

Weeds Present: Y N Species: ___________________________________________
Population Size/Density/# of plants: ___________________________________________
General weed location (narrative): (map on back)

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

Project Name: ___________________________
Type of Project: _________________________

Risk Assessment: H M L
Risk Narrative / Explanation: _________________________________________________

Recommendations(Conditions/Mitigations):________________________________________________
______________________________________________________________________________________
__________________

___ Do not use
___ Notify owner by Letter
___ Treat Weeds before Use

__________________________ ________________
Inspected by Date of Inspection

**Exhibit 7: Project Review for Heritage Resources under the Terms of the 2004 Programmatic Agreement among the USFS R6, ACHP, and SHPO, June 2004.**

| | |
|---|---|
| **Forest:** | |
| **Ranger District:** | |
| **County:** | |
| **Undertaking/Project Name** | |
| **USGS Quads:** | |

By signing this document, the Forest Specialist certifies that for this project the Forest complies with Section 106 of the National Historic Preservation Act, under the terms of the 2004 Programmatic Agreement (PA) for the State of Oregon. This form shall be kept on file as supporting documentation

| | | |
|---|---|---|
| | Stipulation III (A) 1 | Undertaking meets the criteria listed in Appendix A of the PA |
| | Date: | Inspection, monitoring, or other identification will be submitted to the Forest Specialist. |
| | Stipulation III(A)2 | Undertaking meets the criteria listed in Appendix B of the PA. |
| | Date: | Inspection, monitoring, or other identification will be submitted to the Forest Specialist. |
| | Stipulation III(A)3 | Undertaking meets the criteria listed in Appendix C (Exempt/Non-undertaking). |
| | Stipulation III (B)1 | Undertaking meets the criteria in the PA for a No Historic Properties Affected determination. |
| | Stipulation III(B)2 | Undertaking meets the criteria in the PA for a Historic Properties Avoided determination. |
| | Stipulation III(B)3 | The Forest has notified interested Tribes and persons, as appropriate, of the findings and made the findings available to the public. |
| | Stipulation III(B)5<br>Date: | No Adverse Effect (No Historic Properties Affected). The Forest finds that there are historic properties but the undertaking will have no effect on them as defined by 36 CFR 800.16(i). SHPO review period (30-day) required. |
| | Stipulation III(B)6<br>Date: | Historic Properties Affected: The Forest Service shall consult according to 36 CFR 800.5. |

| | |
|---|---|
| | |
| **Forest Specialist** | **Date** |

**For SHPO USE**: For Historic Properties Adversely Affected, please indicate your opinion of our determination by marking the appropriate box below, sign and return this form to the Forest.

| | | |
|---|---|---|
| | I concur with No Historic Properties Affected | |
| | I do not concur, because in my opinion | |
| | Date Received | |
| | SHPO Bibliographic Number: | |

**Exhibit 8. Example of Project Consistency Evaluation Form to be used for treatment of PAUs and EDRR areas (Exhibit 8) that "may affect" federally ESA-listed species.**

# PROJECT CONSISTENCY EVALUATION FORM

Project Name: ________________________ Project Coordinator: ___________________

**LOCATION INFORMATION**

| | |
|---|---|
| Forest: _____________________________ | District: _____________________________ |
| T.R.S.: _____________________________ | Watershed/HUC6: _____________________ |
| PAU #: _____________________________ | Non- PAU: ____________________________ |
| Size of Area Treated: ________________ | |

**TREATMENT**

| | | | |
|---|---|---|---|
| Treatment Type: | Herbicide | Non-Herbicide | Hand-Pull |
| Target Vegetation: | | | |
| Application Method: | Broadcast | Spot | Hand |
| Strategy: | Control | Eradicate | Contain |

Is this a re-treatment? Yes No If Yes, list number of treatment: ___________

Scheduled Treatment Date(s) Start _____________ End _______________

**TREATMENT AREA**

| Veg Type | Forested | Road Prism Rd # ________ | Riparian/Wetland | Emergent Veg $H_2O$ body_________ |
|---|---|---|---|---|
| **# Acres** | | | | |
| **% of Area Infested** | | | | |
| **Total** | | | | |

**HERBICIDE INFORMATION**

| Product Name | Herbicide Name | Application Rate |
|---|---|---|
| | | |
| | | |
| | | |

**EFFECTS**

Is the project within ¼ mile of an activity center? Yes No

Name of activity center: ____________________________________________

Does treatment occur between March 1 and Sept. 30? Yes No

Effects Determination No Effect NLAA

Describe rationale for effects determination:

**CONSISTENCY WITH EIS AND CONSULTATION**

Did the project implement PDFs as outlined in the EIS/BA? Yes No

If not, explain and forward form and issue to Level 1 Representative

| |
|---|
| |

Attach project map and species habitat and location/distribution maps.

Project Biologist:____________________________________________________________

Date: ________________________________________

# APPENDIX G

# Deschutes and Ochoco National Forests and Crooked River National Grassland Invasive Plant Species Prevention Practices

January 2006

# Table of Contents

## INTRODUCTION

In October 2004, Forests in Region 6 were directed to develop local invasive plant prevention practices. This document fulfills that obligation. The Invasive Plant Prevention Practices were developed using the Guide to Noxious Weed Prevention Practices (July 12, 2001).

The practices are preceded in this document by Forest Plan direction that was established with the Pacific Northwest Region Preventing and Managing Invasive Plants Record of Decision (October 2005). When the R-6 Invasive Plant Species FEIS ROD came out in October 2005, it amended R-6 Forest Plans and contained 23 Standards related to prevention and treatment of invasive plants. Additional direction for the management of invasive plants is contained in Forest Service Manual, Section 2080.

The invasive plant prevention practices are provided for use on the Deschutes and Ochoco National Forests and Crooked River National Grassland to minimize the introduction of invasive plants; minimize conditions that favor the establishment or spread of invasive plants; and to facilitate the integration of invasive plant management practices into resource programs. In order to display a complete list of the ways in which invasive plant establishment and spread can be prevented, required actions are also included.

## DESIRED FUTURE CONDITION

In National Forest lands across Region Six, healthy native plant communities remain diverse and resilient, and damaged ecosystems are restored. High quality habitat is provided for native organisms throughout the region. Invasive plants do not jeopardize the ability of the National Forests and National Grassland to provide goods and services communities expect. The need for invasive plant treatment is reduced due to the effectiveness and habitual nature or preventative actions, and the success of restoration efforts.

## GOALS AND OBJECTIVES (From the R-6 IPEIS ROD)

| **Goal 1-** Protect ecosystems from the impacts of invasive plants through an integrated approach that emphasizes prevention, early detection, and early treatment. All employees and users of the National Forest recognize that they play an important role in preventing and detecting invasive plants. | |
|---|---|
| Objective 1.1 | Implement appropriate invasive plant prevention practices to help reduce the introduction, establishment and spread of invasive plants associated with management actions and land use activities. |
| Objective 1.2 | Educate the workforce and the public to help identify, report, and prevent invasive plants |

| | |
|---|---|
| Objective 1.3 | Detect new infestations of invasive plants promptly by creating and maintaining complete, up-to-date inventories of infested areas, and proactively identifying and inspecting susceptible areas not infested with invasive plants. |
| Objective 1.4 | Use an integrated approach to treating areas infested with invasive plants. Utilize a combination of available tools including manual, cultural, mechanical, herbicides, biological control. |
| Objective 1.5 | Control new invasive plant infestations promptly, suppress or contain expansion of infestations where control is not practical, conduct follow up inspection of treated sites to prevent reestablishment. |
| **Goal 2-** Minimize the creation of conditions that favor invasive plant introduction, establishment and spread during land management actions and land use activities. Continually review and adjust land management practices to help reduce the creation of conditions that favor invasive plant communities. | |
| Objective 2.1 | Reduce soil disturbance while achieving project objectives through timber harvest, fuel treatments, and other activities that potentially produce large amounts of bare ground |
| Objective 2.2 | Retain native vegetation consistent with site capability and integrated resource management objectives to suppress invasive plants and prevent their establishment and growth |
| Objective 2.3 | Reduce the introduction, establishment and spread of invasive plants during fire suppression and fire rehabilitation activities by minimizing the conditions that promote invasive plant germination and establishment. |
| Objective 2.4 | Incorporate invasive plant prevention as an important consideration in all recreational land use and access decisions. Use Forest-level Access and Travel Management planning to manage both on-highway and off-highway travel and travel routes to reduce the introduction, establishment and spread of invasive plants. |
| Objective 2.5 | Place greater emphasis on managing previously "unmanaged recreation" (OHVs, dispersed recreation, etc.) to help reduce creation of soil conditions that favor invasive plants, and reduce transport of invasive plant seeds and propagules. |
| **Goal 3-** Protect the health of people who work, visit, or live in or near National Forests, while effectively treating invasive plants. Identify, avoid, or mitigate potential human health effects from invasive plants and treatments. | |
| Objective 3.1 | Avoid or minimize public exposure to herbicides, fertilizer, and smoke |
| Objective 3.2 | Reduce reliance on herbicide use over time in Region Six |
| **Goal 4–** Implement invasive plant treatment strategies that protect sensitive ecosystem components, and maintain biological diversity and function within ecosystems. Reduce loss or degradation of native habitat from invasive plants while minimizing adverse effects from treatment projects. | |
| Objective 4.1 | Maintain water quality while implementing invasive plant treatments. |
| Objective 4.2 | Protect non-target plants and animals from negative effects of both invasive plants and applied herbicides. Where herbicide treatment of invasive plants is necessary within the riparian zone, select treatment methods and chemicals so that herbicide application is consistent with riparian management direction, contained in Pacfish, Infish, and the Aquatic Conservation Strategies of the Northwest Forest Plan. |

| | |
|---|---|
| Objective 4.3 | Protect threatened, endangered, and sensitive species habitat threatened by invasive plants. Design treatment projects to protect threatened, endangered, and sensitive species and maintain species viability. |
| **Goal 5**– Expand collaborative efforts between the Forest Service, our partners, and the public to share learning experiences regarding the prevention and control of invasive plants, and the protection and restoration of native plant communities. | |
| Objective 5.1 | Use an adaptive management approach to invasive plant management that emphasizes monitoring, learning, and adjusting management techniques. Evaluate treatment effectiveness and adjust future treatment actions based on the results of these evaluations. |
| Objective 5.2 | Collaborate with tribal, other federal, state, local and private land managers to increase availability and use of appropriate native plants for all land ownerships. |
| Objective 5.3 | Work effectively with neighbors in all aspects of invasive plant management: share information and resources, support cooperative weed management, and work together to reduce the inappropriate use of invasive plants (landscaping, erosion control, etc.). |

## NEW FOREST PLAN STANDARDS (from the R-6 IPEIS ROD)

The following standards and an implementation schedule are from the Pacific Northwest Region Invasive Plant Program Record of Decision (October 2005) which amended Forest Plans in the Pacific Northwest Region.

| Standard # | Text of Standard | Implementation Schedule |
|---|---|---|
| **1** | Prevention of invasive plant introduction, establishment and spread will be addressed in watershed analysis; roads analysis; fire and fuels management plans, Burned Area Emergency Recovery Plans; emergency wildland fire situation analysis; wildland fire implementation plans; grazing allotment management plans, recreation management plans, vegetation management plans, and other land management assessments. | This standard will apply to all assessments and analysis documents started or underway as of March 1, 2006; this standard does not apply to assessments and analysis documents signed or completed by February 28, 2006. |
| **2** | Actions conducted or authorized by written permit by the Forest Service that will operate outside the limits of the road prism (including public works and service contracts), require the cleaning of all heavy equipment (bulldozers, skidders, graders, backhoes, dump trucks, etc.) prior to entering National Forest System Lands. This standard does not apply to initial attack of wildland fires, and other emergency situations where cleaning would delay response time. | This standard will apply to permits and contracts issued after March 1, 2006. Ongoing permits/contracts issued before this date may be amended, but are not required to be amended, to meet this standard.<br><br>This standard will apply to Forest Service force account operations starting March 1, 2006. |
| **3** | Use weed-free straw and mulch for all projects, conducted or authorized by the Forest Service, on National Forest System Lands. If State certified straw and/or mulch is not available, individual Forests should require sources certified to be weed free using the North American Weed Free Forage Program standards (see Appendix O) or a similar certification process. | Forests are already applying this standard on an informal basis; weed-free straw and mulch will be required as available, starting March 1, 2006. |
| **4** | Use only pelletized or certified weed free feed on **all National Forest System lands**. If state certified weed free feed is not available, individual Forests should require feed certified to be weed free using North American Weed Free Forage Program standards or a similar certification process. This standard may need to be phased in as a certification processes are established. | National Forest managers will encourage the use of weed-free feed across the National Forests in the Region. Pelletized feed or certified weed-free feed will be required in all Wilderness areas and Wilderness trailheads starting January 1, 2007. Pelletized or certified weed-free feed will be required on all National Forest System lands when certified feed is available (expected by January 1, 2009). Weed-free (or pelletized) feed requirements will be listed in individual Forest Closure orders. |
| **5** | No Standard | N/A |

| Standard # | Text of Standard | Implementation Schedule |
|---|---|---|
| **6** | Use available administrative mechanisms to incorporate invasive plant prevention practices into rangeland management. Examples of administrative mechanisms include, but are not limited to, revising permits and grazing allotment management plans, providing annual operating instructions, and adaptive management. Plan and implement practices in cooperation with the grazing permit holder. | This standard will apply to grazing permits beginning March 1, 2006. |
| **7** | Inspect active gravel, fill, sand stockpiles, quarry sites, and borrow material for invasive plants before use and transport.<br>Treat or require treatment of infested sources before any use of pit material.<br>Use only gravel, fill, sand, and rock that is judged to be weed free by District or Forest weed specialists. | This standard will apply to rock source management beginning March 1, 2006. |
| **8** | Conduct road blading, brushing and ditch cleaning in areas with high concentrations of invasive plants in consultation with District or Forest-level invasive plant specialists, incorporate invasive plant prevention practices as appropriate. | This standard will apply to all road blading, brushing and ditch cleaning projects beginning March 1, 2006. |
| **9** | No Standard | N/A |
| **10** | No Standard | N/A |
| **11** | Prioritize infestations of invasive plants for treatment at the landscape, watershed or larger multiple forest/multiple owner scale. | This standard will apply to invasive plant treatment projects with NEPA decisions signed after March 1, 2006. |
| **12** | Develop a long-term site strategy for restoring/revegetating invasive plant sites prior to treatment. | This standard will apply to invasive plant treatment projects with NEPA decisions signed after March 1, 2006. |
| **13** | Native plant materials are the first choice in revegetation for restoration and rehabilitation where timely natural regeneration of the native plant community is not likely to occur. Non-native, non-invasive plant species may be used in any of the following situations: 1) when needed in emergency conditions to protect basic resource values (e.g., soil stability, water quality and to help prevent the establishment of invasive species), 2) as an interim, non-persistent measure designed to aid in the re-establishment of native plants, 3) if native plant materials are not available, or 4) in permanently altered plant communities. Under no circumstances will non-native invasive plant species be used for revegetation. | This standard will apply to restoration and rehabilitation projects beginning March 1, 2006. |
| **14** | Use only APHIS and State-approved biological control agents. Agents demonstrated to have direct negative impacts on non-target organisms would not be released. | This standard will apply to biological control projects beginning March 1, 2006. |
| **15** | Application of any herbicides to treat invasive plants will be performed or directly supervised by a State or Federally licensed applicator.<br><br>All treatment projects that involve the use of herbicides will develop and implement herbicide transportation and handling safety plan. | This standard will apply to herbicide treatment projects as of March 1, 2006. |

| Standard # | Text of Standard | Implementation Schedule |
|---|---|---|
| **16** | Select from herbicide formulations containing one or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. Mixtures of herbicide formulations containing 3 or less of these active ingredients may be applied where the sum of all individual Hazard Quotients for the relevant application scenarios is less than 1.0. [1]<br><br>All herbicide application methods are allowed including wicking, wiping, injection, spot, broadcast and aerial, as permitted by the product label. Chlorsulfuron, metsulfuron methyl, and sulfometuron methyl will not be applied aerially. The use of triclopyr is limited to selective application techniques only (e.g., spot spraying, wiping, basal bark, cut stump, injection).<br><br>Additional herbicides and herbicide mixtures may be added in the future at either the Forest Plan or project level through appropriate risk analysis and NEPA/ESA procedures. | This standard will be applied to invasive plant projects with NEPA decisions signed after March 1, 2006. |
| **17** | No Standard | N/A |
| **18** | Use only adjuvants (e.g. surfactants, dyes) and inert ingredients reviewed in Forest Service hazard and risk assessment documents such as SERA, 1997a, 1997b; Bakke, 2003. | This standard will apply to invasive plant treatment projects with NEPA decisions signed after March 1, 2006. |
| **19** | To minimize or eliminate direct or indirect negative effects to non-target plants, terrestrial animals, water quality and aquatic biota (including amphibians) from the application of herbicide, use site-specific soil characteristics, proximity to surface water and local water table depth to determine herbicide formulation, size of buffers needed, if any, and application method and timing. Consider herbicides registered for aquatic use where herbicide is likely to be delivered to surface waters. | This standard will apply to invasive plant treatment projects with NEPA decisions signed after March 1, 2006. |
| **20** | Design invasive plant treatments to minimize or eliminate adverse effects to species and critical habitats proposed and/or listed under the Endangered Species Act. This may involve surveying for listed or proposed plants prior to implementing actions within unsurveyed habitat if the action has a reasonable potential to adversely affect the plant species. Use site-specific project design (e.g. application rate and method, timing, wind speed and direction, nozzle type and size, buffers, etc.) to mitigate the potential for adverse disturbance and/or contaminant exposure. | This standard will apply to invasive plant treatment projects with NEPA decisions signed after March 1, 2006. |
| **21** | Provide a minimum buffer of 300 feet for aerial application of herbicides near developed campgrounds, recreation residences and private land (unless otherwise authorized by adjacent private landowners). | This standard will apply to invasive plant treatment projects with NEPA decisions signed after March 1, 2006. |

| Standard # | Text of Standard | Implementation Schedule |
|---|---|---|
| **22** | Prohibit aerial application of herbicides within legally designated municipal watersheds. | This standard will apply to invasive plant treatment projects with NEPA decisions signed after March 1, 2006. |
| **23** | Prior to implementation of herbicide treatment projects, National Forest system staff will ensure timely public notification. Treatment areas will be posted to inform the public and forest workers of herbicide application dates and herbicides used. If requested, individuals may be notified in advance of spray dates. | This standard will apply to invasive plant treatment projects with NEPA decisions signed after March 1, 2006. |

1. ATSDR, 2004. Guidance Manual for the Assessment of Joint Toxic Action of Chemical Mixtures. U.S. Department Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry.

## DESCHUTES, OCHOCO, CRNG
## INTEGRATED INVASIVE PLANT PREVENTION PRACTICES

**These invasive plant prevention practices are supplemental to the previously listed Regional Prevention Standards, which are now Forest Plan Standards.**

## Education

**Management Objectives:**

1. Ensure public and employee knowledge of invasive plants to help reduce both the spread rate of existing invasive plants and the risk of infestation by new invasive plants.
2. Increase education and awareness to aid in the early detection of new invasive plant sites.

| # | Invasive Plant Prevention Practices | LRMP Objective |
|---|---|---|
| 1.1 | Educate employees on the Forests regarding the problems associated with and the identification of invasive plants. Add invasive plant awareness to Employee Orientation, Fire Effects and other training. Report infestation to the appropriate District Invasive plant Coordinator. | 1.2 |
| 1.2 | Work to increase public (including contractors and permittees) awareness of invasive plants and their potential negative impact on the environment. Use education programs to increase invasive plant awareness and prevent invasive plant spread | 1.2 |
| 1.3 | Increase the level of educational material regarding invasive plants displayed at trailheads and District offices. Use education programs to increase invasive plant awareness and prevent invasive plant spread by recreationists and other Forest users. Post prevention practices at NFS trailheads, roads, boat launches, and other forest recreation facilities. | 1.2 |
| 1.4 | Continue work with State, local and interested partners to develop additional educational materials that improve the understanding and identification of invasive plants in Central Oregon. | 1.2; 5.3 |
| 1.5 | Discuss invasive plant prevention practices at annual grazing permittee meetings and contractor pre-work sessions. | 1.2 |
| 1.6 | Coordinate invasive plant prevention efforts with other agencies. | 1.2, 5.3 |
| 1.7 | Project level personnel will be trained to recognize invasive plants occurring on or adjacent to their Districts and should be able to recognize potential invaders. | 1.2 |

## Project Need

### Management Objectives:

1. Weigh the need of the proposed project against the risk of invasive plant infestation.
2. Address invasive plant prevention needs when planning soil disturbance activities.

| # | Invasive Plant Prevention Practices | LRMP Objective or Standard Addressed |
|---|---|---|
| 2.1 | In the earliest stages of project consideration, look at the risks of invasive plant infestation and the long-term consequences of dealing with invasive plants. Determine which prevention practice / mitigation measure would apply and be effective to reduce the risk of invasive plant introduction or spread. | 2.4, Standard #1 |
| 2.2 | Evaluate the need for any ground disturbing activity and ways to minimize the possible effects of implementation, e.g. winter logging, minimizing openings. | 2.1, 2.2 |
| 2.3 | Be realistic during project size-up. Consider the cost and the chance of success of the invasive plant prevention practices. | |
| 2.4 | Invasive plant risk assessment and management will be considered in all NEPA planning activities where soil disturbance or invasive plant introduction or spread could result from that activity. Prevention will be emphasized as the preferred strategy for invasive plant management. | 1.1, 1.2, 2.3, 2.4, 2.5 FSM 2080.03 |
| 2.5 | NEPA analysis will consider the costs associated with preventing the occurrence or spread of invasive plants. | |

## Prevention – Minimize Transportation of Invasive Plant Seed

**Management Objective:** Reduce the spread of existing invasive plants across the Forests and Grassland and the risk of introducing new invasive species to project sites and other areas of the Forests/Grassland.

| # | Invasive Plant Prevention Practices | LRMP Objective or Standard addressed |
|---|---|---|
| 3.1 | When possible, keep active road construction sites closed to vehicles not involved with construction. | 2.1 |
| 3.2 | Treat invasive plants at all Forest Service administrative sites including Ranger Stations, compounds, staging areas, trailheads, boat launches, campgrounds, parking lots, airstrips, interpretive and historic sites, and roads leading to trailheads. | 1.4, 1.5 |
| 3.3 | Encourage motorized trail users to inspect and clean their vehicles prior to using NFS lands. Post message at trailheads and get information to Motorized Clubs. | 2.5 |
| 3.4 | Require all Forest Service employees to inspect, remove, and properly dispose of invasive plant seed and plant parts found on their clothing and personal equipment prior to leaving a project site. | 1.1, 1.2, |
| 3.5 | Consider using transitional pastures when moving livestock from invasive plant infested areas onto NFS lands, where livestock have been identified as a vector in transport of invasive plant seeds. (Transitional pastures are designated fenced areas that can be logistically and economically maintained in an invasive plant-free condition). | R-6<br>Standard #6 |
| 3.6 | Consider the exclusion of livestock, wildlife, and vehicles from high priority invasive plant sites where animals or vehicles are likely to cause a spread of the invasive plant off site. | 1.1, 2.4, 2.5 |
| 3.7 | The use of invasive plant-infested areas for fire camps, fire camp equipment, and crew bases should be avoided. Whenever possible, establish fire camps, vehicle and crew staging areas, helibases, helispots, and airstrips in areas inspected and verified as invasive plant-free. Where unavoidable, measures should be taken to prevent invasive plant spread. . | 2.3,<br>R-6<br>Standard #1 |
| 3.8 | Work with other jurisdictions to identify and limit boat trailer introduction of aquatic invasive plant species to small lakes within the forest boundaries. | 2.4 |

## Project Planning, Design, and Special Use Permit Administration

**Management Objectives:**

1. Integrate invasive plant management practices into all resource programs and project planning.
2. Ensure that the risks of invasive plant introduction and/or spread, and the mitigation required to minimize that risk are properly considered before ground disturbing activities begin.

| # | Invasive Plant Prevention Practices | LRMP Objective or Standard addressed |
|---|---|---|
| 4.1 | Invasive plant risk assessments will be completed, and invasive plant management will be considered in **all** NEPA planning activities where land disturbance or invasive plant introduction or spread could result from that activity. | 1.1, FSM 2080.03 |
| 4.2 | When conducting NEPA analysis, consider the costs associated with preventing the introduction or spread of invasive plants. | |
| 4.3 | For projects with the potential to introduce and spread invasive plants, involve the District invasive plant coordinator in the planning and implementation process. | 1.1, 2.1, 2.4, |
| 4.4 | Project level personnel should be trained to recognize invasive plant species occurring on or adjacent to their Districts. | 1.2 |
| 4.5 | Project or contract maps should show known invasive plant infestations as a means to aiding avoidance or monitoring. | 1.1, 1.2, 1.3, R6 Standard #1, 8 |
| 4.6 | Consider Logging systems design that would provide for minimal land disturbance and avoid understory reductions in or adjacent to invasive plant infestations. | 2.1, 2.2 |
| 4.7 | Where inventories indicate an infestation, the project should be designed, in coordination with the District invasive plant specialist, to plan for the long-term management of the infestation and to prevent the spread of the infestation off the site. | 1.1, 1.4, |
| 4.8 | Project should be designed to consider all resource values and tradeoffs, including the opportunity to restrict operators from working near high risk invasive plant sites during the time when invasive plants are capable of being spread by the operation, unless proper mitigation measures are used. | R6 Standard #8 |

| | | |
|---|---|---|
| 4.9 | Incorporate timber sale provisions C(T)6.6# (weed free seed) and B(T)6.35 (Equipment Cleaning)in all timber sale contracts. C(T)5.12# (Use of Roads by Purchaser), B(T)5.3 (Road Maintenance) and C(T)6.315# (Sale Operation Schedule) will be used as necessary to keep contract vehicles out of high-risk infestations during peak invasive plant seed dispersal periods. These types of requirements will also be incorporated in Federal Acquisition Regulation (FAR) contracts in Section H – Special Contract Requirements as deemed necessary (see page 22). | 1.1, 1.2, 2.3 |
| 4.10 | Revegetate disturbed land as soon as practical following ground-disturbing activities. Consider regeneration and other resource objective needs in planning for species to be seeded, timing, rates, etc. | 1.1, 2.1 |
| 4.11 | Favor the use of native species in preference to introduced species for re-vegetation seeding when the native species can accomplish the site objectives within a reasonable time frame, costs are not excessive, and seed is available. | 1.1, 1.4 |
| 4.12 | All seed purchased or otherwise designated or accepted for use on Forest System Lands will require testing for "All-States Noxious Weeds" according to AOSA (Association of Official Seed Analysts) standards and will be certified in writing by a Registered Seed Technologist or Seed Analyst as meeting the requirements of the Federal Seed Act and State Seed Law regarding the testing, labeling, sale and transport of prohibited and restricted noxious weeds. Only seed that has passed the testing for "All-States Noxious Weeds," will be accepted and used on NFS lands. This measure will be incorporated into all new contracts, purchases, or agreements, as appropriate, prior to awarding or issuing such documents. It will also be incorporated by modification into all existing contracts or agreements where seed purchase or use is required and has not yet been completed. | 1.1, 2.3 |
| 4.13 | Consider the exclusion of livestock, wildlife, and vehicles (on and off-road) and other human activities from high priority invasive plant sites where such are likely to spread the infestation. Revegetate such sites as needed. | 1.1, 1.5, 2.4, 2.5, |
| 4.14 | Where off-road vehicle (ORV) use is restricted to a specific area, that area will be closely monitored for invasive plants. Planning for the ORV area will consider prevention as a high priority. | 2.4, 2.5 |
| 4.15 | Road management objectives will consider allowing or encouraging desirable herbaceous vegetative growth on shoulders, cuts, and fills. | 2.2, 2.4 |

| | | |
|---|---|---|
| 4.16 | Road maintenance planning will address practices to prevent the introduction and spread of invasive plants. | 1.1, 2.4 |
| 4.17 | Road closures will be coordinated with the District invasive plant specialist to ensure that invasive plant prevention is considered. If closed roads are to be seeded, certified weed free seed would be used. | 2.4 |
| 4.18 | Develop invasive plant management plans with grazing permittees for each allotment, include: location of and ground disturbance associated with salt licks, watering sites, yarding/loafing areas, corrals and other heavy use areas. Monitor these sites for invasive plants and treat them as needed. Consider invasive plant seed transportation, maintaining healthy vegetation to compete with invasive plant species, invasive plant control methods, revegetation, reporting and education. | 1.1, 1.2, 5.1, 5.3, R6 Standard #6 |
| 4.19 | Annual operating plans (AOPs) should provide information to grazing permittees concerning invasive plant locations and management activities. | 1.1, 1.2, 5.1, 5.3, Standard #6 |
| 4.20 | In Allotment Management Plans (AMPs) and AOPs, to the extent possible, consider the use of livestock as a tool in preventing palatable invasive plants from setting seed. | Standard 6 |
| 4.21 | To reduce the risk of invasive plant introduction and spread following implementation of prescribed burning, pastures should be evaluated to determine if rest, deferment or other adjustments to livestock grazing use should be used. | 1.1, 5.1, 5.3, Standard #6 |
| 4.22 | Review mineral operating plans to ensure measures are implemented to prevent the introduction and spread of invasive plants. Use material only from invasive plant-free sources. Ensure that disturbed sites are re-vegetated as soon after disturbance as possible. | 1.1, 1.2 R-6 Standards #1, 7 |
| 4.23 | Consider invasive plant risk and spread factors in travel plan (road closure) decisions. | 2.4 R-6 Standard # 1 |
| 4.24 | Consider road closures in areas that are invasive plant free and/or at unusually high risk to invasive plant invasion. | 1.3, 2.4 |
| 4.25 | Incorporate invasive plant prevention considerations into road layout and design. Minimize the removal of trees and other roadside vegetation during road construction, reconstruction, and maintenance, particularly on southerly aspects. Design roads that are self-maintaining, e.g. outslope roads, rolling dips, take advantage of natural features. Design roads for revegetation success by saving and applying topsoil, laying back slopes, etc. | 2.1, 2.4 |

| | | |
|---|---|---|
| 4.26 | During trail planning and alternative development, evaluate invasive plant risk factors (presence of invasive plants, habitat type, aspect, shading, etc.) when determining trail location and design. | 2.4 |
| 4.27 | Include invasive plant prevention and control measures in all special use permits that involve ground disturbance. | 1.1, 1.5 R-6 Standard #2 |
| 4.28 | When administering Forest Roads and Trails Act and private road easements, require appropriate invasive plant prevention measures. | 2.4 |
| 4.29 | Plan for collection of KV or other funds to revegetate soil disturbance or treat invasive plants as needed after timber harvest and regeneration activities. | 1.1, 1.4, 1.5, 2.1 |
| 4.30 | Plan and apply for flood and/or fire rehabilitation funding to treat invasive plant infestations not treated effectively the first growing season after the disturbance event. | 1.5 |
| 4.31 | When possible, coordinate the timing of road maintenance activities and invasive plant control activities. Delay blading roads within two weeks of herbicide application. Delay spraying after blading until vegetative regrowth has occurred. | 1.1, 1.2, 1.5 R-6 Standard # 8 |

## Pre-Project Activity, Inventory, and Analysis

**Management Objective:** Minimize the spread of existing invasive plants into new project areas.

| # | Invasive Plant Prevention Practices | LRMP Objective or Standard Addressed |
|---|---|---|
| 5.1 | Pre-project inventories should be completed and used during the project planning process. Develop site-specific plans for treatment of existing invasive plant populations. Maintain an invasive plant inventory and monitoring system. | 1.3, 2.4, Standard 1, R6 Monitoring Framework |
| 5.1a | Establish Invasive Plant Prevention Areas (high value, invasive plant-free areas that are a priority to keep clean).<br>Prioritize Invasive Plant Prevention Areas for Early-Detection/Rapid Response strategy. | |
| 5.2 | Whenever budgets allow, Botanical surveys, range analyses, and other resource inventories should be expanded to note all invasive plant infestations by species, size of infestation, and location. | 1.3 |
| 5.3 | Before construction equipment moves into a project | Goal 2 |

| | | |
|---|---|---|
| | area, treat seed-bearing invasive plants along existing Forest Service access roads leading to the project area. Pretreat existing weed infestations prior to creating new seed beds. | |
| 5.4 | Treat invasive plants in road obliteration, closure, and reclamation projects before roads are made un-drivable. Monitor and retreat as necessary. | Goal 2 |
| 5.5 | Treat pre-existing and proposed landings, skid trails and helibases that are invasive plant infested before logging. | Goal 2, Objective 2.3 |
| 5.6 | Where practical, treat high risk areas for invasive plant infestations (e.g. roads, disturbed ground) before burning. Monitor and retreat after burning if necessary. | Goal 2 |

## Project Implementation

**Management Objectives:**

1. Minimize ground disturbance and the exposure of mineral soil during project activities, thereby reducing the potential for invasive plants to become established on new sites and the need to conduct revegetation activities.

| # | Invasive Plant Prevention Practices | LRMP Objective or Standard Addressed |
|---|---|---|
| 6.1 | Minimize soil disturbance and conserve existing topsoil (A and B soil horizons) for replacement whenever possible in situations where ground disturbing activities are unavoidable. | 2.1 |
| 6.2 | Reduce disturbance when doing road maintenance. Limit the amount of ditch pulling only to the amount necessary to assure proper drainage. Limit blading to running surfaces and the minimum necessary on road shoulders. | 2.1 |
| 6.3 | Maintain desirable roadside vegetation. If desirable vegetation is removed during blading or other ground disturbing activities revegetate the area. | 2.2 |
| 6.4 | Consider rock armor in areas that are constantly disturbed (e.g. cattle watering sites, pump chances) at road/stream crossings. | Goal 2 |
| 6.5 | In the overall context of meeting multiple resource objectives for a treatment area, Consider developing prescriptions and selecting logging and burning methods that minimize soil disturbance and that minimize weed establishment or spread. | 1.1, 2.1 |
| 6.6 | Minimize skid trails and the number and size of landings. | 2.1 |
| 6.7 | Minimize fire line and associated soil disturbance during prescribed burning. Utilize natural barriers and existing roads and skid trails for control lines where possible. | 2.1 |
| 6.8 | Where shoulders or drainage ditches are covered by desirable herbaceous cover, consider leaving it in place rather than blading it off if such a practice can be done without causing excessive damage to the road surface or significant public safety hazards. | 2.2 |

## Revegetation/Site Rehabilitation

**Management Objective:** Re-establish desirable vegetation on exposed mineral soil due to project activity and unplanned events such as fire, flood, or other disturbances to minimize the introduction and/or spread of invasive plants.

| # | Invasive Plant Prevention Practices | LRMP Objective or Standard Addressed |
|---|---|---|
| 7.1 | Revegetate disturbed land as soon as possible following disturbance. Consider revegetation (reseeding) unless it can be documented that natural regeneration can accomplish within a reasonable time frame the same prevention objectives as seeding. | Goal 2 |
| 7.2 | Favor the use of native species in preference to introduced species when the native species can accomplish the site objectives in a reasonable time-frame, costs are not excessive, and seed is available. | R-6 Standard #13 |
| 7.3 | All seed purchased or otherwise designated or accepted for use on Forest System lands will be required to be tested for invasive plants according to the Association of Official Seed Analysts standards and will be certified in writing by a Registered Seed Technologist or Seed Analyst as meeting the requirements of the Federal Seed Act and the State Seed law regarding the testing, labeling, sale and transport of prohibited and restricted invasive plants. | Goals 1 & 2 |
| 7.4 | Measure 7.3 will be incorporated into all new contracts, purchases, and agreements as appropriate, prior to awarding or issuing such documents. | 1.1 |
| 7.5 | Decommissioned roads should be seeded with certified weed-free seed to minimize potential invasion by invasive plants. | R-6 Standard #13 |
| 7.6 | Where shoulders or ditches are covered by desirable vegetation, consider leaving it in place rather than blading it off if such a practice can be done without causing excessive damage to the road surface or public safety hazards. | 2.2 |
| 7.7 | If fertilizer is determined to be beneficial, based on soil analysis and cost effectiveness, apply fertilizer one year after germination and establishment of grass has occurred. All contracts must include specific language for revegetation prescriptions, including the timing of application of fertilizer, if applied. | R-6 Standard #12 |
| 7.8 | Minimize and/or exclude grazing on restoration areas if not compatible with achieving revegetation efforts. | 1.1, Standard #6 |

## Monitoring

**Management Objective:** Conduct project follow-up and review to determine success of invasive plant treatments and revegetation efforts and detect new invasive plant sites requiring treatment and make corrections as necessary. Monitoring is a part of every project and as such, needs to be covered in NEPA discussions, and planned for as part of implementation. Conduct implementation compliance monitoring consistant with the 2005 ROD requirements – Appendix M of the FEIS.

| # | Invasive Plant Prevention Practices<br>R6 FEIS Standard | LRMP Objective or Standard Addressed |
|---|---|---|
| 8.1 | Determine if standards for use of herbicides are being adhered to, including mitigation measures, reducing reliance on herbicide, and record keeping. | 3.1, 4.1, 4.2, 4.3 |
| 8.2 | Determine if designated sites are being treated as proposed. | Goal 2 |
| 8.3 | Determine whether prescribed health and safety measures are being followed, and if chemical labels are being followed. | 3.1 |
| 8.4 | Determine whether the trend of invasive plant infestations are increasing or decreasing. Accomplish this by revisiting treated sites annually for five years, or until project objectives are met, conducting a comparison of yearly records, and establishing photo monitoring stations at selected sites. | 3.2, 5.1 |
| 8.5 | Determine whether the prescribed treatments are having the desired effect and whether site objectives or treatment methods need to be changed. Accomplish this by determining if specific site objectives are still valid, deciding whether prescribed treatments are achieving site objectives, and whether prescribed mitigation measures and safety measures are working. | 5.1 |
| 8.6 | Conduct post-project monitoring for invasive plants for all activities that have the potential to introduce or spread invasive plants on Forest Service Lands, including but not limited to: prescribed burning, timber harvest, road maintenance, and stream restoration projects. | 1.3, 5.1 |
| 8.7 | Conduct monitoring after a wildfire event to determine whether the fire caused existing infestation to spread, whether the fire established favorable sites for new infestations, and if suppression activities caused new invasive plant introduction. | 1.3, 2.3, 5.1 |
| 8.8 | Monitor areas of concentrated livestock use for invasive plant establishment. Treat new infestations. | 1.3, 1.4 |

| | | |
|---|---|---|
| 8.9 | Monitor rock pits and quarries to ensure no new invasive plant seeds are transported to the use site. | 1.3<br>R-6<br>Standard<br>#7 |
| 8.10 | Retain performance bonds from mining operations until revegetation objectives are achieved. | Goal 2 |

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# CONTRACT AND PERMIT CLAUSES -- EXAMPLES

## Mining Claims

CLEANING OF EQUIPMENT: Unless otherwise agreed, to prevent the introduction of seeds and noxious weeds onto National Forest System lands, the Claimant shall ensure all equipment moved onto National Forest System land is free of soil, seeds, vegetative matter, or other debris that could contain, or hold, seeds. The Claimant shall employ whatever cleaning methods necessary to ensure compliance with the terms of this provision. The Claimant shall notify the responsible Forest Service Officer prior to moving each piece of equipment onto National Forest System land, unless otherwise agreed in writing. Notification shall include identification of the location of the equipments most recent operation. Upon request by the Forest Service, arrangements shall be made for Forest Service inspection of each piece of equipment prior to entry upon National Forest System lands.

The Claimant shall certify compliance with the terms of this provision, in writing, prior to each entry of equipment onto National Forest System lands. For the purpose of this provision, “equipment” includes all construction and/or maintenance machinery, excluding pickup trucks, cars, and other passenger vehicles, used in the daily transport of personnel.

## Special Uses

**<u>Non-Native, Invasive Plant Prevention and Control</u>**

(*Use this clause in all authorizations involving ground disturbance, which could result in the introduction or spread of non-native, invasive plants. This clause may also be used where cooperative agreements for non-native, invasive plant control are in place with state and local governments*).

The holder/grantee shall be responsible for the prevention and control of non-native, invasive plants of concern on the area covered by this authorization and shall provide prevention and control measures as directed by the Forest Service. Non-native, invasive plants of concern are defined as those species recognized, as such, by Forest Service and/or State authorities in the area, where the authorized use is located.

The holder/grantee shall also be responsible for prevention and control of non-native, invasive plant infestations, which are determined by the Forest Service to have originated from the authorized area, including on National Forest System lands, which are not within the authorized area.

When determined to be necessary by the authorized officer, the holder/grantee shall develop a site-specific plan for non-native, invasive plant prevention and control. Such plan shall be subject to Forest Service approval. Upon Forest Service approval, the non-native, invasive plant, prevention and control plan shall become a part of this authorization, and its provisions shall be enforceable under the terms of this authorization.

**Equipment Cleaning to Prevent the Spread of Non-native, Invasive Plants**

*(Use this clause in authorizations involving ground disturbance where equipment cleaning is essential to prevent the spread of non-native, invasive species).*

To prevent the introduction of seeds and non-native, invasive plants onto National Forest System lands, the holder/grantee shall ensure all equipment moved onto National Forest System land is free of soil, seeds, vegetative matter, or other debris that could contain, or hold, seeds. The holder/grantee shall employ whatever cleaning methods are necessary to ensure compliance with the terms of this provision. The holder/grantee shall notify the responsible Forest Service Officer prior to moving each piece of equipment onto National Forest System land, unless otherwise agreed in writing. Notification shall include identification of the location of the equipment's most recent operation. Upon request by the Forest Service, arrangements shall be made for Forest Service inspection of each piece of equipment prior to entry upon National Forest System lands.

The holder/grantee shall certify compliance with the terms of this provision, in writing, prior to each entry of equipment onto National Forest System lands. For the purpose of this provision, "equipment" includes all construction and/or maintenance machinery, excluding pickup trucks, cars, and other passenger vehicles, used in the daily transport of personnel.

## Public Works Contracts

### H.7 NOXIOUS WEED CONTROL

(a) In order to prevent the potential spread of noxious weeds into the Ochoco or Deschutes National Forest, the Contractor shall be required to furnish the Forest Service with proof of weed-free equipment.

(b) Noxious weeds are defined as any exotic plant species established or that may be introduced in the State, which may render the land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses and which is designated by the Oregon Department of Agriculture or the Deschutes County Weed Board or by other appropriate agencies having jurisdiction.

(c) All equipment and vehicles to be used at the job site shall be cleaned and certified free of noxious weeds and their seeds prior to entrance onto the National Forest. The restriction shall include equipment and vehicles intended for off-road use as well as on road use, whether they are owned, leased, or borrowed by the contractor or subcontractor.

(d) Cleaning shall consist of the removal of all dirt, grease, debris, and materials that may harbor noxious weeds and their seeds. This may require the use of a pressure hose. Cleaning shall occur off Federal lands.

(e) Equipment, materials and vehicles shall be visually inspected by a designated Forest Service Officer, and certified in writing to be reasonably clean and weed free. Inspections will take place at a location designated by the Forest Officer in advance of equipment and material arrival. Equipment and vehicles are expected to proceed directly to the job site following the inspection. Materials to be used on the project will be delivered to the job site following the inspection and approval.

(f) Certification shall remain valid for each identified piece of equipment or vehicle only for the duration of the specified project and only as long as the vehicle or equipment remains at the job site. Equipment and vehicles (excepting passenger vehicles - this includes pickups and vans) that leave the job site will need to be re-certified as weed free before they are allowed to return to the job site or re-enter the National Forest.

# APPENDIX H

## Fisheries Analysis by Watershed and Tabular Data

This appendix will address specific effects to listed fish populations and their habitats by subbasin, watershed or subwatershed, in which they occur under this project. This analysis is summarized in Table 62 of the FEIS. Redband trout are Forest Service Region 6 Sensitive species and occur throughout the project area except for some areas on the Fort Rock portion of the Bend/Fort Rock Ranger District where there are no perennial streams or lakes, some areas of the upper Little Deschutes River, and a few other small closed systems that were historically fishless such as Sparks and Hosmer Lakes. Effects analysis for threatened fish species also applies to redband trout, except where effects to redband trout could be greater or different depending on treatment methods. Such effects to redband trout are discussed separately in the FEIS. Maps of these watersheds, streams, and fish distribution are contained in the fisheries report.

## LOWER DESCHUTES WATERSHEDS

### Willow Creek Watershed -- (Subwatersheds – Upper Willow Creek 170703060201, Rock Springs 170703060202, Middle Willow Creek 17070306020103, Dry Canyon 17070306020104, Lower Willow Creek 17070306020105)

No streams that contain bull trout or their habitat exist within this subwatershed. Bull trout do exist several miles downstream in Lake Simtustus. A population of redband trout and speckled dace exist in Willow Creek and Rimrock Springs Creek. Most invasive plant infestations are located in the uplands with some sites crossing intermittent streams and running along roads. Sites at Rimrock Springs Wildlife Area (RSWA) and Haystack Reservoir have the greatest potential to affect fish and aquatic biota. Invasive plants located in the 16 project areas are spotted knapweed, Russian knapweed, whitetop, field bindweed, St. Johnswort, Dalmation toadflax, diffuse knapweed, and medusahead. Manual and herbicide methods will be used to treat these species. First choice herbicides for treating these species are clopyralid, sulfometuron, chlorsulfuron, metsulfuron and picloram. Aquatic glyphosate may be used around RSWA because of the sensitive wetland habitat. These herbicides are low to moderate risk to fish and aquatics except for picloram and glyphosate which are high risk. Herbicide and sedimentation effects to fish bearing streams will only be addressed because these are the only two habitat indicators that could be affected.

**Manual Methods (Sedimentation**)

In most project areas hand pulling will be used on small patches of invasive plants, where there are only a few scattered individuals distributed over a large area or in sensitive areas where the potential effects of hand pulling outweigh the potential effects of herbicide application. Hand pulling will mostly be in areas away from waterbodies but some individual plants may be pulled next to or in the intermittent channel.

Pulling could occur at 1-2 times yearly over all the invasive plant populations. The effect of pulling scattered plants in the uplands and even within the riparian areas would leave small patches of bare soil until covered with organics from the grasslands or new vegetation sprouted which could take 1-3 years depending on location. Pulling could occur at anytime during the spring summer or fall in most project areas. Amounts of sediment produced from pulling would be very small and immeasurable against all of the other actions that have occurred in the watershed. Pulling invasive plants in these subwatersheds will have a no effect or impact on bull trout, reintroduced salmon and steelhead or redband trout.

Cumulative effects of sedimentation to fish populations would be immeasurable against the already high amounts of sedimentation produced by agricultural practices, grazing and roads in these subwatersheds.

**Herbicide Application (Chemical Contamination**)

Herbicides would be applied to sites using broadcast, patch broadcast or hand spray application. This would be done once a season, generally in the spring or summer. Although the invasive plant polygons show 1,772 acres for the entire watershed (Table 1) the professional estimate of actual acres of invasive plants on the ground is 597 acres. Mapped invasive plant sites total 74.6 acres in 32 locations within 100 feet of perennial waterbodies (Table 2). Actual acres of invasive plants to be treated in these 74.6 acres is less than this because they are not all filled with invasive plants, exactly how much less is not known. Three of the sites were estimated to have more than 10 acres of actual invasive plants, site 75-29 (200 acres), site 75-44 (309 acres) and site 75-24 (33 acres). Site 75-44 is only about half in the watershed. Most of the acreage in these larger sites is large medusahead infestations. Because of the large acreage medusahead will be contained with treatment targeted in areas that are more likely to increase spread such as along roads or trails. Intermittent streams have buffers depending on application method unless aquatic approved herbicides were used and this would most likely be using aquatic glyphosate for spot spraying of knapweed in the RSWA. The buffer distance between these fish populations and most of the invasive plant sites would allow time for the herbicides to break down. Even if a thunderstorm event occurred in the next few days after application amounts of low and moderate risk herbicides reaching the stream would not be at high enough levels to harm or affect fish living downstream. A PDF to reduce the chance of this requires no herbicide application if precipitation is predicted in the following 24 hour period.

SERA (2004) risk assessments found exposure levels to fish for sulfometuron, chlorsulfuron, metsulfuron and clopyralid to be below levels of concern for Forest Service programs. Some non aquatic formulations of glyphosate contain surfactants which are highly toxic to fish but the U.S. EPA/OPP (1993c in SERA 2003) classified technical grade glyphosate as non-toxic to practically non-toxic in freshwater fish (SERA 2003). Picloram is moderately toxic to aquatic animals, particularly some species of fish. There is substantial variability in the toxicity of picloram to aquatic species. While this variability adds uncertainty to the dose-response assessment, it has no substantial impact on the risk characterization. None of the hazard indices for fish, aquatic invertebrates, or aquatic plants exceed a level of concern (SERA 2003).

**Table H-1.** Acres and number of locations invasive plant sites occur within specified buffers for intermittent (Int.) streams by subwatershed and total acres and number of infested weed sites by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 100' of Int. Streams | Number of areas 100' from Int. Streams | Acres on Int. Stream Channels | Number of Infested Weed Sites | Total Weed Acres in HUC6 | Total Sub-watershed Acres |
|---|---|---|---|---|---|---|---|
| UPPER WILLOW CREEK | 170703060201 | 4.32 | 1 | 0.12 | 3 | 49.65 | 30758 |
| RIMROCK SPRING | 170703060202 | 135.58 | 7 | 4.12 | 48 | 1374.56 | 11085 |
| MIDDLE WILLOW CREEK | 170703060203 | 21.68 | 5 | 0.73 | 40 | 181.55 | 20726 |
| DRY CANYON | 170703060204 | 1.22 | 3 | 0.04 | 43 | 146.60 | 34023 |
| LOWER WILLOW CREEK | 170703060205 | 0.00 | 0 | 0.00 | 10 | 0.59 | 20373 |
| | **Totals** | 163.68 | 17.00 | 5.05 | 149.00 | 1772.21 | 128994 |

**Table H-2**. Acres and number of locations invasive plant sites occur within specified buffers for perennial streams, rivers, lakes, and springs by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 10' of perennial water | Number of areas 10' from perennial water | Acres within 100' of perennial water | Number of areas 100' from perennial water | Acres within 300' of perennial water | Number of areas 300' from perennial water |
|---|---|---|---|---|---|---|---|
| UPPER WILLOW CREEK | 170703060201 | 0.06 | 1 | 0.56 | 1 | 0.92 | 1 |
| RIMROCK SPRING | 170703060202 | 4.06 | 16 | 36.23 | 21 | 107.43 | 13 |
| MIDDLE WILLOW CREEK | 170703060203 | 2.52 | 3 | 25.33 | 4 | 61.57 | 6 |
| DRY CANYON | 170703060204 | 1.14 | 4 | 12.46 | 6 | 47.2 | 10 |
| LOWER WILLOW CREEK | 170703060205 | 0.00 | 0 | 0.00 | 0 | 0 | 0 |
| | | | | | | | |
| | **Totals** | 7.78 | 24.00 | 74.58 | 32.00 | 217.12 | 30.00 |

At RSWA, (site 75-20) application of aquatic glyphosate on this four acre site could cause some indirect or sub-lethal effects to redband trout if a rain event happens soon after application because of the proximity to the wetlands high water table, clay loam soils and the small size of the stream (<1.8 cfs). However spot spraying would be the preferred method to avoid killing native vegetation and this combined with the relatively flat terrain would greatly reduce the potential for effects. Clopyralid may also be used at this site but outside of the wetland and stream areas.

At Haystack Reservoir there are two sites (75-24 and 75-08) that run along streams and roads that flow or lead down slope into haystack reservoir. This reservoir does not contain any native fish but is a popular recreational put and take fishery. The professional estimate of acres of invasive plants at these sites was 33.3 and 0.2 acres, respectively. Russian knapweed, diffuse knapweed and medusahead are present and would be treated with clopyralid and sulfometuron. The use of buffer zones along with these low and moderate risk herbicides should prevent any adverse affects to fisheries or aquatics in the reservoir.

The use of picloram for treating Dalmatian toadflax would occur at one 0.64 acre site that is about 100 feet from an intermittent stream and the closest perennial water is approximately 9700 feet downstream. The use of picloram for treating field bindweed would occur at 14 sites that are each less than 0.1 acre and total 1.3 acres. These sites are scattered in the uplands with the closest perennial water approximately 2,900 feet downstream. The small size of these treatment areas combined with the large buffer distances between them and fish bearing streams would likely prohibit any detectable effects to fish and aquatics.

Herbicide application in the Willow Creek watershed will have no affect to bull trout or reintroduced salmon and steelhead because suitable and occupied habitat is several miles downstream. Herbicide application would most likely not have any direct effects to fish because of low and moderate risk herbicides that will be used near streams. Some indirect effects could occur to algae and macrophytes.

Cumulative effects to fish populations downstream would not be measurable against the larger quantities of herbicides and pesticides used on private agricultural lands in the watershed.

**Headwaters Deschutes River Watershed – Lake Simtustus subwatershed (HUC 1707030111)**

No streams that contain bull trout or redband trout or their habitat exist within this subwatershed. Both species do exist downslope from project areas within 148 acre Lake Simtustus. Fish are most likely trapped in the lake as downstream migrants from the Metolius/LBC population. Invasive plants located in two project areas are diffuse knapweed and medusahead. Sites are located in the uplands above the lake with one site that is located on an intermittent stream. Manual and herbicide methods will be used to treat these species. First choice herbicides for treating these species are clopyralid and sulfometuron, respectively. These herbicides are low to moderate risk to fish and aquatics. One of the two infested weed site is located on a small unnamed intermittent stream. Downstream herbicide and sedimentation effects to fish in Lake Simtustus will be addressed because these are the only two indicators that could affect this population.

**Manual Methods (Sedimentation**)

In most project areas hand pulling will be used on small patches of invasive plants, where there are only a few scattered individuals distributed over a large area or in sensitive areas where the potential effects of hand pulling outweigh the potential effects of herbicide application. Hand pulling will mostly be in areas away from waterbodies but some individual plants may be pulled next to or in the intermittent channel. Bull trout and redband trout will be not be effected by the pulling as they use the lake and only the immediate area where intermittent streams enter is there even a remote possibility for any effects. There is no spawning or rearing habitat associated with this lake most fish migrate in from populations upstream.

Pulling could occur at 1-2 times yearly over all the entire invasive plant populations. The effect of pulling scattered plants in the uplands and even within the riparian areas would leave small patches of bare soil until covered with organics from the grasslands or new vegetation sprouted which could take 1-3 years depending on location. Pulling could occur at anytime during the spring summer or fall in most project areas. Pulling invasive plants in this subwatershed will have no effect or impact on bull trout reintroduced salmon, steelhead or redband trout.

Cumulative effects of sedimentation to fish populations downstream would be immeasurable against the already high amounts of sedimentation produced by agricultural practices, grazing and roads in this subwatershed.

**Herbicide Application (Chemical Contamination**)

Herbicides would be applied to sites using patch broadcast or hand spray application. This would be done once a season, generally in the spring or summer. Although the infested weed polygons show 19.3 acres for the entire watershed (Table 3) the professional estimate of actual acres of invasive plants on the ground is 9.1 acres. All invasive plant sites are located 300 feet or more away from perennial waterbodies (Table 4). The infested areas are mixes of the above mentioned species but are mostly medusahead. Intermittent streams would have buffers depending on application method unless aquatic approved herbicides were used and this would most likely be using aquatic glyphosate for spot spraying of knapweed. The small size of the invasive plant populations and the buffer distance between these populations and the lake would allow time for the herbicides to break down. Even if a thunderstorm event occurred in the next few days after application any residues that reached the lake would be diluted by mixing from wind and currents in the reservoir.

SERA (2004) risk assessments found exposure levels to fish for sulfometuron, and clopyralid to be below levels of concern for Forest Service programs. Some non aquatic formulations of glyphosate contain surfactants which are highly toxic to fish but the U.S. EPA/OPP (1993c in SERA 2003) classified technical grade glyphosate as non-toxic to practically non-toxic in freshwater fish (SERA 2003). Picloram is moderately toxic to aquatic animals, particularly some species of fish. There is substantial variability in the toxicity of picloram to aquatic species. While this variability adds uncertainty to the dose-response assessment, it has no substantial impact on the risk characterization. None of the hazard indices for fish, aquatic invertebrates, or aquatic plants exceed a level of concern (SERA 2003).

Herbicide application in the Lake Simtustus subwatershed will have no effect on bull trout redband trout or reintroduced salmon and steelhead.

**Table H- 3.** Acres and number of locations invasive plant sites occur within specified buffers for intermittent (Int.) streams by subwatershed and total acres and number of invasive plant sites by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 100' of Int. Streams | Number of areas 100' from Int. Streams | Acres on Int. Stream Channels | Number of Infested Weed Sites | Total Weed Acres in HUC6 | Total Sub-watershed Acres |
|---|---|---|---|---|---|---|---|
| LAKE SIMTUSTUS | 170703060103 | 0.87 | 1 | 0.03 | 5 | 19.26 | 12028 |

There are no invasive plant sites within 300 feet of perennial water.

Cumulative effects to fish populations downstream would not be measurable against the larger quantities of herbicides and pesticides used on private agricultural lands in the watershed and upstream of Lake Simtustus.

**Upper Trout Creek Watershed - (6th HUC – Headwaters Trout Creek 170703070103, Foley Creek 170703070102, Opal Creek 170703070101)**

Streams in this watershed contain steelhead and redband trout (see Figure 3 of the Fisheries Report). Invasive plant species proposed for herbicide or manual treatments are spotted knapweed, diffuse knapweed, Russian knapweed, sulphur, medusahead, St. Johnswort, and whitetop. First choice herbicides for treating these species are clopyralid, sulfometuron, metsulfuron and picloram. Picloram should only be used on sulphur cinquefoil as that is the only effective herbicide to really treat this species (Dave Langland, Oregon Dept. of Agriculture, personal communication) Other herbicides are low to moderate risk to fish and aquatic. Invasive plant infestations are located along roads with project areas crossing and running near streams. Herbicides would be applied to sites using patch broadcast or hand spray application. This would be done once a season, generally in spring or summer.

**Manual Methods (Sedimentation)**

In most project areas hand pulling will be used on small patches of invasive plants, where there are only a few scattered individuals distributed over a large area or in sensitive areas where the potential effects of hand pulling outweigh the potential effects of herbicide application. Hand pulling will mostly be in areas away from waterbodies but some individual plants may be pulled next to perennial streams or in intermittent channels.

Pulling could occur at 1-2 times yearly over all the entire invasive plant populations and would likely only be feasible on smaller infestations. The effect of pulling scattered plants along roadsides and even within the riparian areas would leave small patches of bare soil until covered with organics from the forest or new vegetation sprouted which could take 1-3 years depending on location. Pulling could occur at anytime during the spring summer or fall in most project areas. Amounts of sediment produced from pulling would be very small and immeasurable against the other actions that have occurred in the watershed. Pulling invasive plants in these subwatersheds will have no effect or impact on steelhead or redband trout.

Cumulative effects of sedimentation to fish populations would be immeasurable against sediments produced by timber harvest, grazing, roads and past fires in these subwatersheds.

**Herbicide Application (Chemical Contamination)**

Herbicides would be applied to sites using patch broadcast or hand spray application. This would be done once a season, generally in the spring or summer. There are four project areas that contain 61 infested weed polygons that total 5.7 acres with the largest at 0.1 acres (Table 4). Mapped invasive plant sites total 0.5 acres in 10 locations within 100 feet of perennial waterbodies (Table 5). Actual acres of invasive plant to be treated in these 0.5 acres is less than this because they are not all filled with invasive plants, exactly how much less is not known.

**Table H-4**. Acres and number of locations invasive plant sites occur within specified buffers for intermittent (Int.) streams by subwatershed and total acres and number of invasive plant sites by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 100' of Int. Streams | Number of areas 100' from Int. Streams | Acres on Int. Stream Channels | Number of Infested Weed Sites | Total Weed Acres in HUC6 | Total Sub-watershed Acres |
|---|---|---|---|---|---|---|---|
| OPAL CREEK | 170703070101 | 0.00 | 0 | 0.00 | 3 | 0.27 | 11426 |
| FOLEY CREEK | 170703070102 | 0.00 | 0 | 0.00 | 10 | 0.62 | 22009 |
| HEADWATERS TROUT CREEK | 170703070103 | 0.09 | 1 | 0.00 | 59 | 4.78 | 16662 |
| | | | | | | | |
| | Totals | 0.09 | 1 | 0.00 | 72 | 5.67 | 50097 |

**Table H-5**. Acres and number of locations invasive plant sites occur within specified buffers for perennial streams, rivers, lakes, and springs by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 10' of perennial water | Number of areas 10' from perennial water | Acres within 100' of perennial water | Number of areas 100' from perennial water | Acres within 300' of perennial water | Number of areas 300' from perennial water |
|---|---|---|---|---|---|---|---|
| OPAL CREEK | 170703070101 | 0.00 | 0 | 0.10 | 1 | 0.20 | 2 |
| FOLEY CREEK | 170703070102 | 0.00 | 0 | 0.06 | 2 | 0.33 | 6 |
| HEADWATERS TROUT CREEK | 170703070103 | 0.03 | 1 | 0.34 | 7 | 1.50 | 21 |
| | | | | | | | |
| | Totals | 0.03 | 1 | 0.50 | 10 | 2.03 | 29 |

Two of these sites contain sulphur cinquefoil each is 0.1 acre in size and would be treated with picloram. Picloram is known to be toxic to fish. One sulphur site is located approximately 100 feet from Auger Creek and the other approximately 600 feet from Potlid Creek. The small size of the sites and buffer distances between them and the streams should prevent herbicides from entering the streams and any adverse affects to fish in these streams. Both intermittent and perennial streams would have buffers depending on application method. The buffer distance between these fish populations and the invasive plant sites would allow time for the herbicides to break down and bind to soils. Because of the small size of the sites and because they are spread throughout three subwatersheds even if a thunderstorm event occurred a few days after application the amounts of herbicide reaching the stream would not be at high enough levels to directly harm or effect fish living downstream.

SERA (2004) risk assessments found exposure levels to fish for sulfometuron, metsulfuron and clopyralid to be below levels of concern for Forest Service programs. Some non aquatic formulations of glyphosate contain surfactants which are highly toxic to fish but the U.S. EPA/OPP (1993c in SERA 2003) classified technical grade glyphosate as non-toxic to practically non-toxic in freshwater fish (SERA 2003). Picloram is moderately toxic to aquatic animals, particularly some species of fish. There is substantial variability in the toxicity of picloram to aquatic species. While this variability adds uncertainty to the dose-response assessment, it has no substantial impact on the risk characterization. None of the hazard indices for fish, aquatic invertebrates, or aquatic plants exceed a level of concern (SERA 2003).

It is unlikely detectable amounts of herbicide would reach the stream. If they did levels would not be high enough to cause harm to fish or aquatics. Cumulative effects to fish populations downstream on private lands would be difficult to detect against the larger quantities of herbicides and pesticides used on private agricultural lands in the watershed.

**Mud Springs Watershed -- (6th HUC - Upper Mud Springs Creek 170703070401, Sagebrush Creek 170703070402)**

No streams that contain bull trout or steelhead trout or their habitat exist within this subwatershed. Both species do exist several miles downstream in the Deschutes River and Trout Creek. A population of redband trout does exist in mud springs creek. Invasive plants located in five project areas are spotted knapweed, diffuse knapweed, scotch thistle and medusahead. First choice herbicides for treating these species are clopyralid and sulfometuron, respectively. These herbicides are low to moderate risk to fish and aquatics. Most invasive plants are located in the uplands with some sites crossing intermittent streams and running along roads. No infestations are within 100 feet of perennial streams. Manual and herbicide methods will be used to treat these species. Downstream herbicide and sedimentation effects to fish in perennial streams will only be addressed because these are the only two habitat indicators that could effect fish populations.

**Manual Methods (Sedimentation)**

In most project areas hand pulling will be used on small patches of invasive plants, where there are only a few scattered individuals distributed over a large area or in sensitive areas where the potential effects of hand pulling outweigh the potential effects of herbicide application. Hand pulling will mostly be in areas away from waterbodies but some individual plants may be pulled next to or in the intermittent channel. Fish will be not be effected by the pulling as they reside in the perennial channels downstream.

Pulling could occur at 1-2 times yearly over all the invasive plant populations. The effect of pulling scattered plants in the uplands and even within the riparian areas would leave small patches of bare soil until covered with organics from the grasslands or new vegetation sprouted which could take 1-3 years depending on location. Pulling could occur at anytime during the spring summer or fall in most project areas. Amounts of sediment produced from pulling would be very small and immeasurable against all of the other actions that have occurred in the watershed. Pulling invasive plants in these subwatersheds will have no effect or impact for bull trout, steelhead or redband trout.

Cumulative effects of sedimentation to fish populations downstream would be immeasurable against the already high amounts of sedimentation produced by agricultural practices, grazing and roads in this subwatershed.

**Herbicide Application (Chemical Contamination)**

Herbicides would be applied to sites using broadcast, patch broadcast or hand spray application. This would be done once a season, generally in the spring or summer. Although the invasive plant polygons show 363 acres for the entire watershed (Table 6) the professional estimate of actual acres of invasive plants on the ground is 179 acres of which 133 acres contain only medusahead. Mapped infested weed sites total 0.41 acres in one locations within 100 feet of perennial waterbodies (Table 7). Actual acres of invasive plants to be treated in these 74.6 acres is less than this because they are not all filled with invasive plants, exactly how much less is not known. Other polygons with mixes of the above mentioned species are mostly medusahead. Because of the large acreage medusahead will be contained with treatments targeted in areas that are more likely to be spread such as along roads or trails. Intermittent streams would have buffers depending on application method unless aquatic approved herbicides were used and this would most likely be using aquatic glyphosate for spot spraying of knapweed. The buffer distance between these fish populations and the invasive plant sites would allow time for the herbicides to break down. Even if a thunderstorm event occurred in the next few days after application amounts of herbicide reaching the stream would not be at high enough levels to harm or affect fish living downstream.

SERA (2004) risk assessments found exposure levels to fish for sulfometuron and clopyralid to be below levels of concern for Forest Service programs. Herbicide applications in the Mud Springs watershed will have no effect on bull trout or steelhead but could indirectly impact redband trout in the short term by slight short term reductions of aquatic algae and macrophytes.

Cumulative effects to fish populations downstream would not be measurable against the larger quantities of herbicides and pesticides used on private agricultural lands in the watershed.

**Table H-6.** Acres and number of locations invasive plants occur within specified buffers for intermittent (Int.) streams by subwatershed and total acres and number of invasive plant sites by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 100' of Int. Streams | Number of areas 100' from Int. Streams | Acres on Int. Stream Channels | Number of Infested Weed Sites | Total Weed Acres in HUC6 | Total Sub-watershed Acres |
|---|---|---|---|---|---|---|---|
| UPPER MUD SPRINGS CREEK | 170703070401 | 49.55 | 7 | 1.56 | 18 | 363.17 | 26203 |
| SAGEBRUSH CREEK | 170703070402 | 0.00 | 0 | 0.00 | 1 | 0.49 | 16336 |
| | | | | | | | |
| | Totals | 49.55 | 7 | 1.56 | 19 | 363.66 | 42539 |

**Table H-7.** Acres and number of locations invasive plants occur within specified buffers for perennial streams, rivers, lakes, and springs by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 10' of perennial water | Number of areas 10' from perennial water | Acres within 100' of perennial water | Number of areas 100' from perennial water | Acres within 300' of perennial water | Number of areas 300' from perennial water |
|---|---|---|---|---|---|---|---|
| UPPER MUD SPRINGS CREEK | 170703070401 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |
| SAGEBRUSH CREEK | 170703070402 | 0.00 | 0 | 0.41 | 1 | 0.49 | 1 |
| | | | | | | | |
| | Totals | 0.00 | 0 | 0.41 | 1 | 0.49 | 1 |

## UPPER DESCHUTES SUBBASIN

### Upper and Lower Metolius River Watersheds (HUC – Upper Metolius 1707030109 and Lower Metolius 1707030110)

The Upper and Lower Metolius River watersheds contain bull trout and redband trout. The reintroduction of chinook and sockeye salmon is expected in the next five years. At ribbon/reed canary grass sites treatments could affect temperature, fine sediment, herbicide input, cover and juvenile rearing areas. All other project areas could potentially affect fine sediment and herbicide input to waterbodies with bull trout or future salmon.

### Temperature - Manual (Hand Pulling), Mechanical (Weed Whacking), Cultural (Tarping) or Herbicide (Chemical) Methods

Invasive plants may be removed adjacent to streams that contain listed fish using one or a combination of methods listed above. In most cases this will be only be for a few scattered plants that are located along the waters edge. Most invasive plants to be removed are not riparian dependent species and will occasionally be found only along the edge of water. The exception to this in ribbongrass, reed canarygrass and iris infested sites. At sites that contain these species removal of emergent plants may occur that are growing out of the shallows or along the edge of the water. Measurable changes in water temperature from invasive plant removal are not expected (see hydrology report). Most invasive plants are small plants under 3 feet tall that contribute very little to overall shading in forested riparian settings. Most shading comes from native trees and shrubs or from the aspect of adjacent slopes to a given waterbody.

The greatest potential effects from invasive plant removal would be at ribbon/reed canary grass sites. The Metolius River (treatment area 15-32) has the largest ribbongrass site that covers 119 acres but a recent survey indicates there is only about an acre of actual weeds of which approximately 0.5 acres is emergent vegetation that would be suitable for pulling (USFS 2006 data on file). At ribbon/reed canary sites these methods would most likely only occur once per season of any individual plant. The amount of treatment each season will decrease as the infestation decreases from the subsequent treatments. The duration of invasive plant removal would most likely be short term and range from a one time occurrence to once or twice a year for up to five years. The rate at which native plants would provide shade for areas plants were removed from through natural recolonization or from replanting of natives is estimated to take between 1 and 5 years. Removal of plants would occur during times to avoid bull trout, redband or salmon spawning activities. Use of the ODFW in water work periods would be used to determine on which waterbody and when removal of invasive plants could occur.

The removal of invasive plants is not expected to contribute to increased temperatures of streams or lakes that could contribute to increased mortality of any fish life stages. Species life histories and appropriately designed ODFW in-water work periods for pulling would avoid the times when more sensitive life stages may be present. Therefore the project will result in a neutral effect for temperature effects to fish and aquatics. The effects from removing noxious weeds on water temperature are expected to be a neutral effect because most weeds are too small and individuals too scattered to provide large amounts of shading. Areas that contain ribbon/reed canary grass may have some localized reduction of streamside shade but this is not expected to effect measurable changes in temperature requirements for bull trout, redband, steelhead or Chinook EFH for any waterbody this is being proposed.

**Sedimentation – Manual (hand pulling) or Cultural Methods (tarping, soil enhancement)**

Hand pulling will mostly be in areas away from waterbodies but some individual plants may be pulled next to the stream or on islands. Along the Metolius River some of the emergent ribbongrass will be pulled. Tarping may be used in some locations to kill ribbon/reed canary and effects from this would be similar to pulling with less ground disturbance but larger single patches of soil would be devegetated. Replanting with native vegetation and soil enhancement such as mulching and fertilizers would be used on areas that were devegetated to help with water retention and in turn promote growth of native vegetation. Soil enhancement would have a beneficial effect on areas that had been treated by other methods.

Pulling along the Metolius would occur within the project area (15-32) which recent surveys indicate there is approximately one acre of ribbon/reed canary grass, half an acre of which is emergent and suitable for pulling (USFS 2006 data on file). Most of this would occur from Lake Creek down to House of Metolius Private Land (2.7 river miles). Below this point there are fewer scattered populations.

The effect of pulling scattered plants in the uplands and even within the riparian areas would leave small patches of bare soil until covered with organics from the forest or new vegetation sprouted which could take 1-3 years depending on location. Pulling of ribbon/reed canary grass would target emergent plants that have root mats or clumps that are growing on the rivers substrate or at the waters edge. Most of this sediment is already in the system and would get redistributed locally and to other locations just downstream in a small localized pulse. Some of the sediment would be fine silts that could travel for some distance in the water column before settling out. Most sediment would settle and clear in 0-3 hours after pulling occurred at a given location. Pulling could occur at anytime during the spring, summer or fall in most project areas. Areas directly adjacent to waters with TE listed fish such as the Metolius River pulling would happen during the ODFW in-water work period to avoid redds and newly emerged fry.

Pulling plants in most project areas will not have a noticeable or measurable effect on fish except in the Metolius River where pulling of ribbon/reed canary grass could disturb both bull trout and redband trout juveniles. Adults of these species primarily use deeper main channel habitats and disturbance to them would not be likely. Disturbance could occur to juvenile fish while pulling plants in the shallows. Fine sediments disturbed from the substrate could affect the ability of fish to see predators and some sediment particles might irritate fish gills. Sediment effects would be localized around where individual clumps or plants were pulled. The youngest life stages of fish would be most vulnerable to the effects of pulling while larger fish would be less affected as they generally do not use the shallower margins.

Pulling invasive plants at all of the project areas will have little to no measurable effect on fish because they are often pulled away from the water and occur in scattered individual locations. The exception is project area 15-32 along the Metolius River where pulling could cause disturbance of substrate sediments and to a lesser extent sediments at the waters edge. These actions could make fish relocate to other areas where they would be more vulnerable to predation. It may also cause some individual fish to stop eating for a short period of time, although fry sometimes will feed on insects floating in the water column from the disturbance. It is unlikely, but individual fish could get stepped on during the pulling by people standing in the water. These direct effects to redband trout, bull trout and future salmon habitat will not last more than a few days at any location along the river. The benefits of restoring native vegetation to these areas and stopping the ribbongrass monoculture that is taking over parts of the river would outweigh any short term negative effects or impacts to individual fish. Turbidity and dissolved oxygen from these activities are not expected to reach levels that could noticeably affect survival or fish behavior.

**Herbicide Application (Chemical Contamination)**

Although the infested weed polygons show 2,533 acres for the entire watershed (Table 8) the professional estimate of actual acres of weeds on the ground is much less with only five sites estimated to have more than 10 acres of actual weeds, site 15-01 (13.8 acres), site 15-05 (16.9 acres), site 15-12 (32.7 acres), site 15-14 (11.8 acres) and site 15-30 (33.9 acres). All of these larger sites except for the 15-01 site are in the Upper Lake Creek subwatershed or the Fly Creek Subwatershed. Sites in Upper Lake Creek subwatershed currently contain no TE listed fish but reintroduction of salmon and bull trout is likely to occur in Link Creek between Blue and Suttle Lakes. Mapped invasive plant sites are located higher in the watershed well upstream of Blue Lake. No TE listed fish have been found or are historically documented in Fly Creek. Fish migration to perennial sections of Fly Creek would be difficult because of a small 8-10 foot waterfall and the intermittent nature of the stream in the lower 4.4 miles (Dachtler 1998). Mapped infested weed sites total 74.6 acres in 32 locations within 100 feet of perennial waterbodies (Table 9). Actual acres of weeds to be treated in these 74.6 acres is less than this because they are not all filled with invasive plants, exactly how much less is not known.

**Table H-8.** Acres and number of locations invasive plant sites occur within specified buffers for intermittent (Int.) streams by subwatershed and total acres and number of invasive plant sites by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 100' of Int. Streams | Number of areas 100' from Int. Streams | Acres on Int. Stream Channels | Number of Infested Weed Sites | Total Weed Acres in HUC6 | Total Sub-watershed Acres |
|---|---|---|---|---|---|---|---|
| DRY CREEK | 170703010901 | 1.44 | 1 | 0.05 | 4 | 2.38 | 12497 |
| CACHE CREEK | 170703010902 | 0.98 | 1 | 0.03 | 12 | 126.58 | 11867 |
| UPPER LAKE CREEK | 170703010903 | 12.79 | 4 | 0.31 | 53 | 270.52 | 11136 |
| LOWER LAKE CREEK | 170703010904 | 10.52 | 3 | 0.32 | 30 | 244.18 | 10965 |
| HEADWATERS METOLIUS RIVER | 170703010905 | 21.57 | 15 | 0.67 | 202 | 385.55 | 15501 |
| FIRST CREEK | 170703010906 | 5.94 | 4 | 0.17 | 30 | 122.14 | 13177 |
| JACK CREEK | 170703010907 | 31.86 | 5 | 1.07 | 24 | 208.00 | 9207 |
| CANYON CREEK | 170703010908 | 28.16 | 4 | 0.91 | 59 | 272.31 | 21068 |
| ABBOT CREEK | 170703010909 | 2.13 | 3 | 0.06 | 23 | 233.92 | 6391 |
| CANDLE CREEK | 170703010910 | 0.00 | 0 | 0.00 | 10 | 61.97 | 10957 |
| MIDDLE METOLIUS RIVER | 170703011003 | 27.31 | 11 | 0.81 | 33 | 279.77 | 21208 |
| UPPER FLY CREEK | 170703011004 | 1.62 | 2 | 0.00 | 2 | 10.35 | 16406 |
| LOWER FLY CREEK | 170703011005 | 0.00 | 0 | 0.03 | 41 | 129.55 | 16227 |
| JUNIPER CREEK | 170703011006 | 0.00 | 0 | 0.00 | 1 | 0.10 | 15088 |
| LOWER METOLIUS RIVER | 170703011007 | 12.85 | 7 | 0.40 | 31 | 185.91 | 24301 |
| | **Totals** | 157.16 | 60 | 4.84 | 555 | 2533.22 | 215997 |

All of these larger sites except for the 15-01 site are in the Upper Lake Creek subwatershed or the Fly Creek Subwatershed. Sites in Upper Lake Creek subwatershed currently contain no threatened or endangered fish but reintroduction of salmon and bull trout is likely to occur in Link Creek between Blue and Suttle Lakes. Mapped invasive plant sites are located higher in the watershed well upstream of Blue Lake. No listed fish have been found or are historically documented in Fly Creek. Fish migration to perennial sections of Fly Creek would be difficult because of a small 8-10 foot waterfall and the intermittent nature of the stream in the lower 4.4 miles (Dachtler 1998). Mapped invasive plant sites total 74.6 acres in 32 locations within 100 feet of perennial waterbodies (Table 9). Actual acres of invasive plants to be treated in these 74.6 acres is less than this because they are not all filled with invasive plants, exactly how much less is not known.

**Table H-9.** Acres and number of locations invasive plant sites occur within specified buffers for perennial streams, rivers, lakes, and springs by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 10' of perennial water | Number of areas 10' from perennial water | Acres within 100' of perennial water | Number of areas 100' from perennial water | Acres within 300' of perennial water | Number of areas 300' from perennial water |
|---|---|---|---|---|---|---|---|
| DRY CREEK | 170703010901 | 0.00 | 0 | 0.00 | 0 | 0 | 0 |
| CACHE CREEK | 170703010902 | 0.00 | 0 | 0.00 | 0 | 0 | 0 |
| UPPER LAKE CREEK | 170703010903 | 0.66 | 7 | 7.56 | 18 | 34.48 | 24 |
| LOWER LAKE CREEK | 170703010904 | 0.12 | 2 | 3.78 | 6 | 33.7 | 11 |
| HEADWATERS METOLIUS RIVER | 170703010905 | 117.47 | 267 | 120.51 | 213 | 124.83 | 172 |
| FIRST CREEK | 170703010906 | 0.54 | 15 | 4.74 | 9 | 13.29 | 12 |
| JACK CREEK | 170703010907 | 0.00 | 0 | 0.00 | 0 | 2.22 | 1 |
| CANYON CREEK | 170703010908 | 1.54 | 8 | 14.92 | 18 | 51.41 | 28 |
| ABBOT CREEK | 170703010909 | 0.00 | 0 | 0.00 | 0 | 0.29 | 2 |
| CANDLE CREEK | 170703010910 | 0.09 | 1 | 2.54 | 3 | 8.68 | 4 |
| MIDDLE METOLIUS RIVER | 170703011003 | 1.09 | 7 | 7.25 | 10 | 19.16 | 11 |
| UPPER FLY CREEK | 170703011004 | 0.00 | 0 | 0.00 | 0 | 0 | 0 |
| LOWER FLY CREEK | 170703011005 | 1.72 | 9 | 16.31 | 21 | 37.83 | 19 |
| JUNIPER CREEK | 170703011006 | 0.00 | 0 | 0.00 | 0 | 0 | 0 |
| LOWER METOLIUS RIVER | 170703011007 | 0.32 | 10 | 2.80 | 10 | 5.53 | 9 |
| | | | | | | | |
| | **Totals** | 123.54 | 326 | 180.41 | 308 | 331.42 | 293 |

The long distance from these bull trout populations which allows for dilution and breakdown of herbicides, the use of PDFs, and the use of moderate and low risk herbicides would prevent any direct effects to listed fish. The 15-01 site does cross an intermittent stream that leads into Brush Creek but effects to bull trout are not expected for the same reasons as the other large sites. No Hazard Quotient (HQ) calculations for any Metolius River subwatershed exceeded 1.0 using the SERA WCR model worksheets. Effects from smaller invasive plant sites within the Upper and Lower Metolius River Subwatersheds would be similar or less than these larger sites and not expected to have any direct effects.

Under Alternative 2, the treatment of reed canary/ribbongrass (site 15-32) with aquatic glyphosate or aquatic imazapyr along the Metolius River is one of the largest mapped sites (119.3 acres) with 117.5 acres mapped within 10 feet of the river. A survey conducted in 2006 (USFS 2006 data on file) found slightly less than one acre of actual reed canarygrass and ribbongrass plants (Table 10). Most of the infestation occurs from Lake Creek down to the House of Metolius Private Land (2.7 river miles). Below this point there are fewer scattered populations. Under Alternative 3, it would not be possible to effectively treat the populations, because they occur primarily within 10 feet of water.

As discussed in Treatment Effectiveness, pulling the rhizomatous species is not an effective control method.

**Table H-10.** Metolius River ribbongrass infestations and other information collected during the 2006 survey.

| Reach | # of Infesta-tions | Total Area ft² | Total Acres | Length of River Bank ft | % of River Bank | % in Slow Water | % Emergent | % on Bank | % on Island or Wood |
|---|---|---|---|---|---|---|---|---|---|
| Lake Cr to House on the Metolius | 216 | 39,950 | 0.917 | 3,563 | 7.586 | 15.7 | 42.0 | 6.9 | 51.1 |
| Wizard Falls Hatchery to Candle Cr. | 13 | 211 | 0.005 | 60 | 0.132 | 13.3 | 60.0 | 0.0 | 12.2 |

Application methods will include spot spraying for plants on the bank and hand application with a dripless wick for emergent plants along the water's edge and plants on islands. These methods should keep most of the herbicide out of the water but it is possible some drift could enter the river some drops could drip from the plants into the water. Glyphosate breaks down fairly rapidly but if a thunderstorm occurred after application residue could also wash into the water. The Metolius is a large flowing waterbody and dilution should prevent any direct effects to fish in the main stem and in areas with moderate velocities. Discharge measured below the Camp Sherman Bridge in September of 1999 was 358 cfs (Dachtler 2000). The only area where direct effects might occur would be in alcove and backwater rearing areas that young of the year bull trout and redband often inhabit. These areas are located along the margins, are often shallow and have slow velocities that can be poorly mixed with the other water in the river. The fish habitat survey done in by Dachtler (2000) on the upper Metolius River counted 27 alcove and backwater pool habitats in the section from Gorge Campground to Lake Creek. These totaled 13,244 $ft^2$ of habitat with an average depth of 1.0 ft and an average volume of 560 $ft^3$ (15.86 $m^3$). The following calculation was used to determine what the concentration in of glyphosate would be in the water and how could this potentially effect bull trout or redband trout. If a patch of reed canarygrass and ribbongrass the same size as the average alcove was treated adjacent to the alcove and all of the applied glyphosate entered the alcove.

Application rate = lbs of active ingredient/acre
Aquatic toxicity level is in mg/L

Calculations:

*Step 1.* (lbs of active ingredient/acre) x (mg/lb) x acre = __mg

Average aquatic glyphosate application rate
= 2 lbs/acre = 907,200 mg /acre x 0.0129 acres = 11,703 mg

*Step 2.* Alcove: ($m^2$ x m) / (1000 liter/ 1 $m^3$) = __Liter

For an average alcove: If average alcove volume is 15.86 $m^3$
15.86 $m^3$ x (1000 liters/ $m^3$) = 15,860 liters

*Step 3.* Divide Mg by liters to get Mg/L

11,703 Mg/15,860 Liters = 0.74 Mg/L

*Step 4.* Multiply by potential herbicide plant wash off fraction (SERA 2003), for aquatic glyphosate = 0.5

*Step 5.* Compare 0.37 Mg/L to toxicity threshold used in the USFS Regional BA (USFS 2005d)

Acute NOEC for Aquatic Glyphosate = 0.1 mg/L (1/20$^{th}$ LC50)

This analysis shows a worst case scenario where the Acute NOEC for aquatic glyphosate is slightly exceeded but it is highly unlikely that all applied glyphosate would enter the alcove at one time because the dripless wick application method would apply glyphosate to the grass and much of it would not reach the ground or water. This also assumes that the alcoves would have no water flowing through them and although they are fairly slow moving there is usually some mixing that occurs with the main river.

The following analysis similar to the previous one was calculated for aquatic imazapyr following the same assumptions.

Application rate = lbs of active ingredient/acre
Aquatic toxicity level is in Mg/L

Calculations:

*Step 1.* (lbs of active ingredient/acre) x (mg/lb) x acre = __Mg

Average aquatic imazapyr application rate
= 0.45 lbs/acre = 204,117 Mg /acre x 0.0129 acres = 2,633 Mg

*Step 2.* Alcove: ($m^2$ x m) / (1000 liter/ 1 $m^3$) = __Liter

For an average alcove: If average alcove volume is 15.86 $m^3$

15.86 $m^3$ x (1000 liters/ $m^3$) = 15,860 liters

*Step 3.* Divide Mg by liters to get Mg/L

2,633 Mg/15,860 Liters = 0.17 Mg/L

*Step 4.* multiply by potential herbicide plant wash off fraction (SERA 2004), for aquatic imazapyr = 0.9

0.17 Mg/L x 0.9 = 0.15 Mg/L

*Step 5.* Compare 0.15 Mg/L to toxicity threshold used in the USFS Region 6 BA (USFS 2005d)

Acute NOEC for aquatic imazapyr = 0.5 Mg/L (USFS 2005d)

This analysis shows that the Acute NOEC for aquatic imazapyr is not exceeded and it is unlikely that all applied imazapyr would enter the alcove at one time because the dripless wick application method would apply imazapyr to the grass and much of it would not reach the ground or water. This also assumes that the alcoves would have no water flowing through them and although they are fairly slow moving there is usually some mixing that occurs with the main river.

Triclopyr, a high risk herbicide, would be used to treat Scotch broom at one site (15-31) in the Candle Creek subwatershed. This species would be treated with spot spray or wiping on cut stumps. Site 15-31 is mapped to be 100.4 acres but the professional estimate of actual weed infestation on the ground is only 0.95 acres. The 0.95 acres is a mix of scotch broom and four other weed species. Some of this mapped site is adjacent to Candle Creek but the actual small amount of scotch broom present, the selective application method, the use of the PDFs and large volume of water in Candle Creek for dilution if any triclopyr did reach the water would prevent any direct effects to bull trout.

Summer low flow measurements from the most recent fish habitat survey on Candle Creek was 72 cfs measured in August of 1995 (Houslet and Lovtang 1996).

Indirect effects to fish from aquatic plants or algae being affected by the use of sulfometuron and aquatic glyphosate could occur but the amount should be minimal as it is unlikely that large enough amounts of these herbicides will reach the stream because of selective application methods and PDFs that will minimize the risk for water contamination.

SERA (2004) risk assessments found exposure levels to fish for sulfometuron, metsulfuron and clopyralid to be below levels of concern for Forest Service programs. Some non aquatic formulations of glyphosate contain surfactants which are highly toxic to fish but the U.S. EPA/OPP (1993c in SERA 2003) classified technical grade glyphosate as non-toxic to practically non-toxic in freshwater fish (SERA 2003). Triclopyr has a salt/acid formulation that is approved for aquatic use. It is slightly toxic to fish but exceeds the level of concern for coldwater salmonids at the typical application rate (SERA 2003). The salt formulation is highly soluble in water, which allows for increased runoff and leaching potential.

Cumulative effects to fish populations downstream for herbicides would not be measurable because most of the land in these watersheds are forest service lands, there are no major agricultural activities in the watershed and most herbicide application on private lands most likely occur on a small scale to treat weeds around private residences. The actual amount used on private lands is unknown. Cumulative effects from other forest service weed sites in the watershed should be low to non-existent because of the types of herbicides that will be used and the protective methods and PDFs that will be applied in relation to aquatic resources. Past treatments of weeds under the DNF 1998 EA should be mostly broken down by now and these sites were small and located away from waterbodies.

There is a remote possibility glyphosate and aquatic imazapyr could enter an alcove and have sublethal effects on juvenile bull trout or redband trout, although this is unlikely. The benefits of removing ribbongrass and replacing it with native vegetation for the aquatic invertebrates, winter fish habitat, and the Metolius River riparian ecosystem outweigh the slight possibility of effecting a few juvenile fish.

**Whychus Creek Subwatersheds (HUC – Upper Whychus Creek 170703010802, Middle Whychus Creek 170703010808, Lower Whychus Creek 170703010809)**

Bull trout inhabit the lower mile of Whychus Creek below Alder Springs and redband trout and are found up to near the wilderness boundary. Steelhead and Chinook historically used the creek and steelhead reintroductions are expected to occur within the next five years. Invasive plants in this area are located along road systems, the stream and surrounding uplands. Invasive plants in the six project areas proposed for herbicide treatment are spotted knapweed, diffuse knapweed, Canada thistle, and medusahead. Some large infestations occur of primarily medusahead and diffuse knapweed. Manual and herbicide methods will be used to treat these species. First choice herbicides for treating these species are clopyralid and sulfometuron. These herbicides are low to moderate risk to fish and aquatics. Herbicide and sedimentation effects to fish bearing streams will only be addressed because these are the only two habitat indicators that could effect these fish populations.

**Manual Methods (Sedimentation)**

In most project areas hand pulling will be used on small patches of invasive plants, where there are only a few scattered individuals distributed over a large area or in sensitive areas where the potential effects of hand pulling outweigh the potential effects of herbicide application. Hand pulling will mostly be in areas away from waterbodies but some individual plants may be pulled next to perennial streams or in the intermittent channel.

Pulling could occur at 1-2 times yearly over all the entire invasive plant populations. The effect of pulling scattered plants in the uplands and even within the riparian areas would leave small patches of bare soil until covered with organics from the surrounding vegetation or new vegetation sprouted which could take 1-3 years depending on location. Pulling could occur at anytime during the spring summer or fall in most project areas. Amounts of sediment produced from pulling would be very small and immeasurable against all of the other actions that have occurred in the watershed. Pulling invasive plants in these subwatersheds will have a no effect or impact on bull trout, reintroduced steelhead or salmon or redband trout.

Cumulative effects of sedimentation to fish populations from hand pulling would be immeasurable against the already high amounts of sedimentation produced by past agricultural practices, grazing, timber harvest, development and roads in these subwatersheds.

**Herbicide Application (Chemical Contamination**)

Herbicides would be applied to sites using broadcast, patch broadcast or hand spray application. This would be done once a season, generally in the spring or summer. Although the invasive plant polygons show 746 acres (Table 11) for the three subwatersheds the professional estimate of actual acres of invasive plants on the ground is less than this. Most of the invasive plant acres and acres within 300 feet of perennial fish bearing streams are located in the lower Whychus Subwatershed (Table 12).

The largest site 75-56 has 647 acres of mapped invasive plants but the professional estimate of actual invasive plants on the ground is 143 acres consisting of mainly medusahead and diffuse knapweed. SERA risk assessments found exposure levels to fish for sulfometuron, and clopyralid to be far below levels of concern for forest service programs. This large site located in Lower Whychus Creek has the potential for more sediment and herbicide delivery because of the sparse vegetation and steeper slopes that are associated with the canyon walls. Although flows above alders springs have been higher in recent years due to more water purchased from irrigators for instream flows they are still well below what would naturally be in the stream and can get below approximately 15 cfs in this section. Because of the potential for increased herbicide delivery and potentially low summer flows for dilution of herbicides should they reach water herbicide application should be restricted to no more than 10 acres of treated per year where slopes exceed 10 % within the Whychus Creek canyon and adjacent intermittent canyons and in areas within 300 feet of perennial streams.

**Table H-11.** Acres and number of locations invasive plant sites occur within specified buffers for intermittent (Int.) streams by subwatershed and total acres and number of invasive plant sites by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 100' of Int. Streams | Number of areas 100' from Int. Streams | Acres on Int. Stream Channels | Number of Infested Weed Sites | Total Weed Acres in HUC6 | Total Sub-watershed Acres |
|---|---|---|---|---|---|---|---|
| UPPER WHYCHUS CREEK | 170703010802 | 0.00 | 0 | 0.00 | 9 | 44.21 | 18291 |
| MIDDLE WHYCHUS CREEK | 170703010808 | 0.00 | 0 | 0.00 | 1 | 47.50 | 14980 |
| LOWER WHYCHUS CREEK | 170703010809 | 62.12 | 5 | 1.99 | 15 | 654.00 | 20237 |
| | **Totals** | 62.12 | 5.00 | 1.99 | 25.00 | 745.71 | 53508 |

**Table H-12.** Acres and number of locations invasive plant sites occur within specified buffers for perennial streams, rivers, lakes, and springs by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 10' of perennial water | Number of areas 10' from perennial water | Acres within 100' of perennial water | Number of areas 100' from perennial water | Acres within 300' of perennial water | Number of areas 300' from perennial water |
|---|---|---|---|---|---|---|---|
| UPPER WHYCHUS CR. | 170703010802 | 0.48 | 3 | 4.71 | 3 | 11.38 | 5 |
| MIDDLE WHYCHUS CR. | 170703010808 | 0.00 | 0 | 0.00 | 0 | 0 | 0 |
| LOWER WHYCHUS CR. | 170703010809 | 7.59 | 8 | 58.34 | 8 | 111.42 | 7 |
| | **Totals** | 8.07 | 11.00 | 63.05 | 11.00 | 122.80 | 12.00 |

There are 11.4 acres of mapped invasive plants within 300 ft of perennial water within the Upper Whychus Subwatershed but this area has more vegetation than on the Grassland because it is in a forested setting and the stream is much larger above the irrigation diversions. Average annual flow in Whychus Creek above the irrigation diversions is 105 cfs (USDA 1998). The use of low to moderate risk herbicides and the large volume of water for dilution should some herbicides enter the stream would negate any direct effects to fish. Following the PDFs will protect aquatic algae and macrophytes from small amounts of herbicides entering the water that could have measurable effects on fish. SERA (2004) risk assessments found exposure levels to fish for sulfometuron and clopyralid to be below levels of concern for Forest Service programs.

Indirect effects to fish from aquatic plants or algae by the use of sulfometuron could occur but the amount should be minimal as it is unlikely that large enough amounts of this herbicide will reach the stream because of selective application methods and PDFs that will minimize the risk for water contamination.

Cumulative effects to fish populations downstream from herbicides are not expected. There are some agricultural activities and private residences in the watershed with herbicide application occurring on private lands but amounts and types of herbicides used is unknown. Cumulative effects from other forest service weed sites in the watershed should be low to non existent because of the types of herbicides that will be used and the protective methods and PDFs that will be applied in relation to aquatic resources.

No high risk herbicides will be used and first choice herbicides have a very low probability of directly or effecting fish through the use of protective PDFs and selective application methods. There is a slight chance that short term immeasurable indirect effects could occur to aquatic algae and macrophytes.

**Lake Billy Chinook Subwatersheds (HUC – Stevens Canyon 170703011101, Carcass Canyon 170703011102, Geneva 170703011103 and Round Butte Dam 170703011104**)

Bull trout and redband trout inhabit Lake Billy Chinook (LBC) and the Deschutes River within the Round Butte Dam subwatershed. Only intermittent streams and some small ponds are present in the other three watersheds. Salmon and Steelhead may be reintroduced this section of the Deschutes River in the next five years. Invasive plant infestations in this area are all 300 feet or more away from perennial and fish bearing streams except in the Carcass Canyon subwatershed where one site (75-43) is adjacent to some private ponds. Invasive plant sites are mainly located atop the uplands and are hundreds to thousands of feet away from the river and reservoir. Invasive plants in the ten project areas are spotted knapweed, diffuse knapweed, and medusahead.

Manual and herbicide methods will be used to treat these species. First choice herbicides for treating these species are clopyralid and sulfometuron. These two herbicides are low to moderate risk to fish and aquatics, respectively. Herbicide and sedimentation effects to fish bearing streams will only be addressed because these are the only two habitat indicators that could effect this population in the Lake Billy Chinook Watershed.

**Manual Methods (Sedimentation**)

In most project areas hand pulling will be used on small patches of invasive plants, where there are only a few scattered individuals distributed over a large area or in sensitive areas where the potential effects of hand pulling outweigh the potential effects of herbicide application. Hand pulling will mostly be in areas away from waterbodies but some individual plants may be pulled next to or in the interim.

Pulling could occur at 1-2 times yearly over all the entire invasive plant populations. The effect of pulling scattered plants in the uplands and even within the riparian areas would leave small patches of bare soil until covered with organics from the grasslands or new vegetation sprouted which could take 1-3 years depending on location. Pulling could occur at anytime during the spring summer or fall in most project areas. Amounts of sediment produced from pulling would be very small and immeasurable against all of the other actions that have occurred in the watershed. Pulling invasive plants in these subwatersheds will have no effect or impact on bull trout or redband trout.

Cumulative effects of sedimentation to fish populations would be immeasurable against the already high amounts of sedimentation produced by agricultural practices, grazing and roads in these subwatersheds.

**Herbicide Application (Chemical Contamination)**

Herbicides would be applied to sites using broadcast, patch broadcast or hand spray application. This would be done once a season, generally in the spring or summer. Although the infested invasive plant polygons show 733 acres for these subwatersheds (Table 13) the professional estimate of actual acres of invasive plants on the ground was 159 acres and this is mostly medusahead. Larger medusahead sites will be treated to contain the infestation by treating along travel routes and edges of the population to reduce spread. All infested weed sites are 300 feet or more away from perennial waterbodies except for a medusahead site in the Carcass Canyon Subwatershed that is adjacent to some private ponds (Table 14). SERA (2004) risk assessments found exposure levels to fish for sulfometuron, and clopyralid to be far below levels of concern for forest service programs. This should be true for invasive plant sites treated in these two subwatersheds because they are all located 300 feet or more from the Deschutes River and LBC. The large size of the Deschutes River and LBC in this location will also help to dilute any herbicides should they reach the water which is unlikely, there would be no effect or impact to bull trout, redband trout, or future salmon or steelhead reintroductions or aquatics species because of the distance to perennial water and the use of PDFs to protect aquatic resources.

**Table H-13.** Acres and number of locations invasive plant sites occur within specified buffers for intermittent (Int.) streams by subwatershed and total acres and number of invasive plant sites by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 100' of Int. Streams | # of areas 100' from Int. Streams | Acres on Int. Stream Channels | Number of Infested Weed Sites | Total Weed Acres in HUC6 | Total Sub-watershed Acres |
|---|---|---|---|---|---|---|---|
| STEVENS CANYON | 170703011101 | 0.00 | 0 | 0.00 | 3 | 10.87 | 17612 |
| CARCASS CANYON | 170703011102 | 47.30 | 3 | 1.42 | 12 | 677.38 | 16128 |
| GENEVA | 170703011103 | 0.72 | 2 | 0.00 | 4 | 27.20 | 9393 |
| ROUND BUTTE DAM | 170703011104 | 0.00 | 0 | 0.00 | 4 | 17.41 | 18583 |
| | Totals | 48.01 | 5.00 | 1.42 | 23.00 | 732.86 | 61716 |

**Table H-14.** Acres and number of locations invasive plant sites occur within specified buffers for perennial streams, rivers, lakes, and springs by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 10' of perennial water | # of areas 10' from perennial water | Acres within 100' of perennial water | Number of areas 100' from perennial water | Acres within 300' of perennial water | # of areas 300' from perennial water |
|---|---|---|---|---|---|---|---|
| STEVENS CANYON | 170703011101 | 0.00 | 0 | 0.00 | 0 | 0 | 0 |
| CARCASS CANYON | 170703011102 | 0.00 | 0 | 0.49 | 1 | 3.83 | 1 |
| GENEVA | 170703011103 | 0.00 | 0 | 0.00 | 0 | 0 | 0 |
| ROUND BUTTE DAM | 170703011104 | 0.00 | 0 | 0.00 | 0 | 0 | 0 |
| | **Totals** | 0.00 | 0.00 | 0.49 | 1.00 | 3.83 | 1.00 |

**Odell Subwatersheds (HUC - Odell Lake 170703010201, Odell Creek 170703010202, Moore Creek 170703010203, and Davis Lake 170703010204)**

Bull trout and redband trout have been documented in Trapper Creek, Crystal Creek, Fire Creek, Odell Creek, Maklaks Creek and two unnamed tributaries to Odell Creek. Redband trout are also present in Ranger Creek. Trapper Creek is the primary spawning and rearing stream for Odell Lake bull trout. Invasive plant infestations in this area are located along Highway 58 and the railroad which run along the North and South shores of Odell Lake, respectively. In the Moore Creek subwatersheds invasive plant sites proposed for herbicide treatment are mainly located in old timber sale units and are all more than 300 ft from Moore Creek. Moore Creek contains introduced brook trout in the upper end and goes intermittent before reaching Davis Lake.

Invasive plant species in the three project areas proposed for herbicide treatment are spotted knapweed, diffuse knapweed, Canada thistle, Dalmation toadflax, St Johnswort, butter and eggs, tansy ragwort, bull thistle and Scotch thistle. Manual and herbicide methods will be used to treat these species. First choice herbicides for treating these species are clopyralid, metsulfuron and picloram. These herbicides are low risk to fish except for picloram which is high risk. Herbicide and sedimentation effects to fish bearing streams will only be addressed because these are the only two habitat indicators that could affect these fish

**Manual Methods (Sedimentation**)

In most project areas hand pulling will be used on small patches of invasive plants, where there are only a few scattered individuals distributed over a large area or in sensitive areas where the potential effects of hand pulling outweigh the potential effects of herbicide application. Hand pulling will mostly be in areas away from waterbodies but some individual plants may be pulled next to lakes and streams or in intermittent channels.

Pulling could occur at 1-2 times yearly over all the entire invasive plant populations. The effect of pulling scattered plants in the uplands and even within the riparian areas would leave small patches of bare soil until covered with organics from the grasslands or new vegetation sprouted which could take 1-3 years depending on location. Pulling could occur at anytime during the spring summer or fall in most project areas. Amounts of sediment produced from pulling would be very small and immeasurable against natural processes or all of the other actions that have occurred in the watershed. Pulling of invasive plants in these subwatersheds will have a no effect or impact on bull trout or redband trout.

Cumulative effects of sedimentation to fish populations from hand pulling would be immeasurable against the sedimentation produced by past timber harvest, development, roads, highways and railroads in these subwatersheds.

**Herbicide Application (Chemical Contamination)**

Herbicides would be applied to sites using broadcast, patch broadcast or hand spray application. This would be done once a season, generally in the spring or summer. Although the infested invasive plant polygons show 372 acres (Table 15) for all the subwatersheds the professional estimate of actual acres of invasive plants on the ground is less than this.

**Table H-15.** Acres and number of locations invasive plant sites occur within specified buffers for intermittent (Int.) streams by subwatershed and total acres and number of invasive plant sites by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 100' of Int. Streams | Number of areas 100' from Int. Streams | Acres on Int. Stream Channels | Number of Infested Weed Sites | Total Weed Acres in HUC6 | Total Sub-watershed Acres |
|---|---|---|---|---|---|---|---|
| ODELL LAKE | 170703010201 | 0.00 | 0 | 0.00 | 49 | 219.90 | 23170 |
| ODELL CREEK | 170703010202 | 0.00 | 0 | 0.00 | 16 | 56.09 | 13830 |
| MOORE CREEK | 170703010203 | 0.00 | 0 | 0.00 | 6 | 13.59 | 14748 |
| DAVIS LAKE | 170703010204 | 0.00 | 0 | 0.00 | 4 | 82.00 | 22505 |
| | **Totals** | 0.00 | 0.00 | 0.00 | 75.00 | 371.57 | 74254 |

Most of the invasive plant acres and acres within 300 feet of perennial fish bearing streams are located in the Odell Lake subwatershed (Table 16). Sites 12-02 and 12-16 are located along cross several streams that enter the lake and in several areas come within 300 feet of Odell Lake. Sites 12-02 and 12-16 where estimated to contain 31 and 11 acres of actual weeds but are mapped to be 128 and 125 acres, respectively.

**Table H-16.** Acres and number of locations invasive plant sites occur within specified buffers for perennial streams, rivers, lakes, and springs by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 10' of perennial water | Number of areas 10' from perennial water | Acres within 100' of perennial water | Number of areas 100' from perennial water | Acres within 300' of perennial water | Number of areas 300' from perennial water |
|---|---|---|---|---|---|---|---|
| ODELL LAKE | 170703010201 | 0.95 | 14 | 10.67 | 27 | 68.87 | 34 |
| ODELL CREEK | 170703010202 | 0.30 | 5 | 2.77 | 7 | 7.15 | 9 |
| MOORE CREEK | 170703010203 | 0.00 | 0 | 0.00 | 0 | 0 | 0 |
| DAVIS LAKE | 170703010204 | 0.00 | 0 | 0.00 | 0 | 0 | 0 |
| | **Totals** | 1.25 | 19.00 | 13.44 | 34.00 | 76.02 | 43.00 |

SERA (2004) risk assessments found exposure levels to fish for metsulfuron and clopyralid to be below levels of concern for Forest Service programs so treatment of species with these herbicides should have no direct effects on redband or bull trout. Site 12-16 is located approximately 270 feet from Trapper Creek the primary spawning and rearing stream for bull trout and it does not cross any intermittent tributaries that feed into it. Calculations using the SERA WCR model worksheets indicated that because of the high rainfall rates and porous soils there was a greater risk for direct effects to fish from the use of picloram in the Odell Lake subwatershed. Because of the soil permeability in this area, the high precipitation rates and the low numbers of individuals in this bull trout population, picloram will not be allowed for use in this watershed. The 2$^{nd}$ choice herbicide for butter and eggs and Dalmation toadflax is chlorsulfuron and this is less of a risk to directly affecting fish but could have greater localized indirect effects on aquatic plants and algae which are expected to be short term.

Indirect effects to fish from reducing amounts of aquatic plants or algae by the use of sulfometuron or metsulfuron could occur but the amount should be minimal as it is unlikely that large enough amounts of these herbicides will reach the stream because of selective application methods and PDFs that will minimize the risk for water contamination.

Cumulative effects to fish populations downstream for herbicides is not expected to be measurable because all lands are National Forest System, and no other herbicide applications are known to be occurring. Cumulative effects from other forest service weed sites in the watershed should be low to non existent because of the low and moderate risk types of herbicides that will be used and the protective methods and PDFs that will be applied to protect aquatic resources.

Herbicide application in the Odell and Davis Lake subwatersheds would have no direct effects to bull trout and redband trout because no high risk herbicides will be used and first choice herbicides have very little probability of directly effecting fish through the use of protective PDFs and selective application methods. Some short term immeasurable indirect effects may occur to aquatic algae and macrophytes.

## LOWER CROOKED RIVER WATERSHED

### Crooked River National Grassland and Lower Crooked River Valley Subwatersheds - (HUC - 1707030511 and 1707030510)

Bull trout inhabit the Crooked River below Opal Springs Dam, redband trout and other fish are found throughout the river. Both species rear in Lake Billy Chinook. Salmon and steelhead may be reintroduced to Crooked River tributaries in the next five years with passage provided at Opal Springs Dam.

Invasive plant infestations in this area are all 300 feet or more away from perenial and fish bearing streams. Invasive plant sites are located atop the flatter mesas and are hundreds to thousands of feet away from the river. Invasive plants in the five project areas are spotted knapweed, diffuse knapweed, Dalmation toadflax, and medusahead. Manual and herbicide methods will be used to treat these species. First choice herbicides for treating these species are clopyralid, sulfometuron, and picloram. These herbicides are low to moderate risk to fish and aquatics except for picloram which is high risk. Herbicide and sedimentation effects to fish bearing streams will only be addressed because these are the only two habitat indicators that could effect this population.

### Manual Methods (Sedimentation)

In most project areas hand pulling will be used on small patches of invasive plants, where there are only a few scattered individuals distributed over a large area or in sensitive areas where the potential effects of hand pulling outweigh the potential effects of herbicide application. Hand pulling will mostly be in areas away from waterbodies but some individual plants may be pulled next to or in the intermittent channel.

Pulling could occur at 1-2 times yearly over all the entire invasive plant populations. The effect of pulling scattered plants in the uplands and even within the riparian areas would leave small patches of bare soil until covered with organics from the grasslands or new vegetation sprouted which could take 1-3 years depending on location. Pulling could occur at anytime during the spring summer or fall in most project areas. Amounts of sediment produced from pulling would be very small and immeasurable against all of the other actions that have occurred in the watershed. Pulling invasive plants in these subwatersheds will have no effect or impact on bull trout, redband trout or introduced salmon or steelhead.

Cumulative effects of sedimentation to fish populations would be immeasurable against the already high amounts of sedimentation produced by agricultural practices, grazing and roads in these subwatersheds.

### Herbicide Application (Chemical Contamination)

Herbicides would be applied to sites using broadcast, patch broadcast or hand spray application. This would be done once a season, generally in the spring or summer. Although the invasive plant polygons show 212 acres for both subwatersheds (Table 17) the professional estimate of actual acres of on the ground is much less. All infested weed sites are 300 feet or more away from perennial waterbodies.

**Table H-17**. Acres and number of locations invasive plant sites occur within specified buffers for intermittent (Int.) streams by subwatershed and total acres and number of invasive plant sites by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 100' of Int. Streams | Number of areas 100' from Int. Streams | Acres on Int. Stream Channels | Number of Infested Weed Sites | Total Weed Acres in HUC6 | Total Sub-watershed Acres |
|---|---|---|---|---|---|---|---|
| UPPER CROOKED RIVER GORGE | 170703051101 | 4.68 | 1 | 0.00 | 5 | 47.94 | 42566 |
| LOWER CROOKED RIVER GORGE | 170703051102 | 3.63 | 4 | 0.00 | 11 | 164.19 | 20254 |
| | **Totals** | 8.30 | 5.00 | 0.00 | 16.00 | 212.13 | 62820 |

SERA (2004) risk assessments found exposure levels to fish for sulfometuron and clopyralid to be below levels of concern for Forest Service programs. Picloram is moderately toxic to aquatic animals, particularly some species of fish. There is substantial variability in the toxicity of picloram to aquatic species. While this variability adds uncertainty to the dose-response assessment, it has no substantial impact on the risk characterization. None of the hazard indices for fish, aquatic invertebrates, or aquatic plants exceed a level of concern (SERA 2003).

Invasive plant sites treated in these two subwatersheds are all located 300 feet or more from the Crooked River. The large size of the crooked river will also help to dilute any herbicides should they reach the water which is unlikely. Picloram is toxic to fish and may be used to treat Dalmation toad flax at site 75-08. This site is over a mile from the Crooked River and the professional estimate of actual weeds on the ground was 0.2 acres for three invasive plant species. Even if the entire 0.2 acres was treated with picloram there would be no effect to bull trout, redband trout or aquatics species because of the long buffer distance to perennial water and the use of PDFs to protect aquatic resources.

Cumulative effects of sedimentation to fish populations would be immeasurable against the already high amounts of sedimentation produced by agricultural practices, grazing and roads in these subwatersheds.

### McKay Creek and Allen Creek Subwatersheds (HUC –170703050501 and 170703050502)

McKay Creek currently contains redband trout but once supported steelhead. Reintroduction efforts for steelhead are expected to occur within the next few years and will most likely occur during the life of this document so they will be analyzed in anticipation of this.

Weed species in the five project areas proposed for herbicide treatment are spotted knapweed, diffuse knapweed, whitetop, field bindweed, houndstongue, St. Johnswort, sulphur cinquefoil, blessed milkthistle, medusahead and scotch broom. Manual and herbicide methods will be used to treat these species. First choice herbicides for treating these species are clopyralid, chlorsulfuron, metsulfuron, sulfometuron, triclopyr, and picloram. These herbicides are low to moderate risk to fish and aquatics except for picloram and triclopyr which are high risk. Herbicide and sedimentation effects to fish bearing streams will only be addressed because these are the only two habitat indicators that could effect this population.

**Manual Methods (Sedimentation**)

In most project areas hand pulling will be used on small patches of invasive plants, where there are only a few scattered individuals distributed over a large area or in sensitive areas where the potential effects of hand pulling outweigh the potential effects of herbicide application. Hand pulling will mostly be in areas away from waterbodies but some individual plants may be pulled next to or in the intermittent channel.

Pulling could occur at 1-2 times yearly over all the entire invasive plant populations. The effect of pulling scattered plants in the uplands and even within the riparian areas would leave small patches of bare soil until covered with organics or new vegetation sprouted which could take 1-3 years depending on location. Pulling could occur at anytime during the spring summer or fall in most project areas. Amounts of sediment produced from pulling would be very small and immeasurable against all of the other actions that have occurred in the watershed. Pulling invasive plants in these subwatersheds will have a no effect or impact on redband trout or future steelhead reintroductions.

Cumulative effects of sedimentation to fish populations would be immeasurable against the already high amounts of sedimentation produced by logging, grazing and roads in these subwatersheds.

**Herbicide Application (Chemical Contamination**)

Invasive plant infestations in these subwatersheds are primarily along road systems that run up the valley bottoms of McKay Creek, Little McKay Creek and Allan Creek. There are 17.9 acres of infested weed sites with 13 of these acres within 300 feet of fish bearing streams (Tables 18 and 19). These sites are scattered in 221 small infestations that range in size from 0.002 acres to 0.19 acres. Herbicides would be applied to invasive plant populations using broadcast, patch broadcast or hand spray application. Application method would depend on species treated, location and size of infestation. Herbicide treatment would be done once a season, generally in the spring or summer.

**Table H-18.** Acres and number of locations invasive plant sites occur within specified buffers for intermittent (Int.) streams by subwatershed and total acres and number of invasive plant sites by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 100' of Int. Streams | Number of areas 100' from Int. Streams | Acres on Int. Stream Channels | Number of Infested Weed Sites | Total Weed Acres in HUC6 | Total Sub-watershed Acres |
|---|---|---|---|---|---|---|---|
| UPPER MCKAY CREEK | 170703050501 | 0.43 | 8 | 0.02 | 216 | 17.43 | 20472 |
| ALLEN CREEK | 170703050502 | 0.00 | 0 | 0.00 | 5 | 0.48 | 18251 |
| | Totals | 0.43 | 8.00 | 0.02 | 221.00 | 17.91 | 38723 |

**Table H-19.** Acres and number of locations invasive plant sites occur within specified buffers for perennial streams, rivers, lakes, and springs by subwatershed. Results represent sites proposed for herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 10' of perennial water | Number of areas 10' from perennial water | Acres within 100' of perennial water | Number of areas 100' from perennial water | Acres within 300' of perennial water | Number of areas 300' from perennial water |
|---|---|---|---|---|---|---|---|
| UPPER MCKAY CREEK | 170703050501 | 0.33 | 21 | 5.41 | 92 | 12.72 | 148 |
| ALLEN CREEK | 170703050502 | 0.00 | 0 | 0.07 | 2 | 0.28 | 3 |
| | Totals | 0.33 | 21.00 | 5.48 | 94.00 | 13.00 | 151.00 |

SERA risk assessments found exposure levels to fish for sulfometuron, metsulfuron, clopyralid and sulfometuron to be below levels of concern for forest service programs.

Although sites are near fish bearing streams sites are small and scattered throughout the subwatersheds the majority of sites on USFS lands are in the Upper McKay subwatershed. The scattered nature of these small infestations, the herbicides used and the PDFs to protect aquatic resources should prevent any direct effects to fish population.

SERA (2004) risk assessments found exposure levels to fish for chlorsulfuron, sulfometuron, metsulfuron and clopyralid to be below levels of concern for Forest Service programs. Triclopyr has a salt/acid formulation that is approved for aquatic use. It is slightly toxic to fish but exceeds the level of concern for coldwater salmonids at the typical application rate (SERA 2003). The salt formulation is highly soluble in water, which allows for increased runoff and leaching potential. Picloram is moderately toxic to aquatic animals, particularly some species of fish. There is substantial variability in the toxicity of picloram to aquatic species. While this variability adds uncertainty to the dose-response assessment, it has no substantial impact on the risk characterization. None of the hazard indices for fish, aquatic invertebrates, or aquatic plants exceed a level of concern (SERA 2003).

Triclopyr may be used to treat and Scotch broom. Picloram may be used to treat field bindweed and sulphur cinquefoil. These three invasive plant species are found at 13 sites with each site less than 0.1 acres. One site that has Scotch broom that is proposed to be treated with triclopyr, it is 0.03 acres in size and plants will most likely be spot sprayed or cut and then painted with herbicide. This site is approximately 1,700 feet away from a perennial stream

Indirect effects to fish from aquatic plants or algae being affected by the use of sulfometuron and chlorsulfuron could occur but the amount should be minimal as it is unlikely that large enough amounts of these herbicides will reach the stream to effect the food chain for fish because of selective application methods and PDFs that will minimize the risk for water contamination.

Cumulative effects to fish populations downstream for herbicides would not be measurable because most of the land in the Upper McKay subwatershed is forest service lands while most of the land in the Allan Creek Subwatershed is private timberlands. There are no major agricultural activities in the watershed and most herbicide application on private lands most likely occurs on a small scale to treat weeds around private residences or tree plantations. The actual amount used on private lands is unknown. Cumulative effects from other forest service weed sites in the watershed should be low to non existent because of the types of herbicides that will be used and the protective methods and PDFs that will be applied in relation to aquatic resources.

The sites that are to be treated with high risk herbicides are small and scattered therefore effects should be negated with the use of PDFs and application methods. It is very unlikely that amounts of picloram and triclopyr should they reach a stream would be at high enough level to directly affect fish. The small size of invasive plant site and PDFs would help reduce likelihood of adverse effects from herbicide treatment. There could be from possible indirect effects fish from effects to aquatic algae and macrophytes. These effects are not expected to be long lasting or large enough to affect fish populations' size or structure.

## LOWER JOHN DAY SUBBASIN

### Bridge Creek Watershed

### (6TH HUC - Headwaters Bridge Creek 170702040301, Upper Bridge Creek 170702040303, Upper Bridge Bear Creek 170702040304, West Branch Bridge Creek 170702040302)

Streams in this watershed contain steelhead and redband trout. Invasive plant sites are located upstream of known steelhead use. Invasive plants proposed for herbicide or manual treatments are spotted knapweed, yellow starthistle, sulphur cinquefoil, medusahead, St. Johnswort, field bindweed, houndstongue and lesser burdock. First choice herbicides for treating these species are clopyralid, sulfometuron, metsulfuron and picloram. Picloram should only be used on sulphur cinquefoil as that is the only effective herbicide to really treat this species (Dave Langland, Oregon Dept. of Agriculture, pers. comm.). Picloram is a high risk herbicide to fish while the other herbicides are low to moderate risk to fish and aquatics. Invasive plant sites are primarily located along roads with project areas crossing and running near streams. Herbicide and sedimentation effects to fish in perennial streams will only be addressed because these are the only two habitat indicators that could affect fish with these weed species and treatment methods.

### Manual Methods (Sedimentation)

In most project areas hand pulling will be used on small patches of invasive plants, where there are only a few scattered individuals distributed over a large area or in sensitive areas where the potential effects of hand pulling outweigh the potential effects of herbicide application. Hand pulling will mostly be in areas away from waterbodies but some individual plants may be pulled next to perennial streams or in intermittent channels.

Pulling could occur at 1-2 times yearly over all the entire invasive plant populations. The effect of pulling scattered plants along roadsides and even within the riparian areas would leave small patches of bare soil until covered with organics from the forest or new vegetation sprouted which could take 1-3 years depending on location. Pulling could occur at anytime during the spring summer or fall in most project areas. Amounts of sediment produced from pulling would be very small and immeasurable against the other actions that have occurred in the watershed. Pulling invasive plants in these subwatersheds will have no effect or impact on steelhead or redband trout.

Cumulative effects of sedimentation to fish populations from hand pulling invasive plants would be immeasurable against sediments produced by timber harvest, grazing, roads and past fires in these subwatersheds.

### Herbicide Application (Chemical Contamination)

Herbicides would be applied to sites using patch broadcast or hand spray application. This would be done once a season, generally in the spring or summer. There are 13 project areas that contain 94 invasive plant polygons totaling 290 acres (Table 20). Mapped invasive plant sites total 19 acres in six locations within 100 feet of perennial waterbodies (Table 21). Actual acres of invasive plants to be treated in these 74.6 acres is less than this because they are not all filled with invasive plants, exactly how much less is not known. The largest site (71-16) at 243 acres was professionally estimated to have only 9.8 acres of actual invasive plants. It crosses two perennial streams with known steelhead use approximately 1.3 miles downstream. It contains houndstongue which is typically treated with metsulfuron. The other two sites (71-10 and 71-32) over 10 acres were professionally estimated to have only 5.5 and 4.5 acres of actual weed plants. Site 71-10 is approximately 650 ft to a non fish bearing perennial stream. It has yellow starthistle and medusahead and will be treated with clopyralid and metsulfuron. Site 71-32 crosses a non fish bearing perennial stream that is located approximately 1.3 miles upstream of a stream used by steelhead. It has houndstongue and will be treated with metsulfuron.

Thirteen sites contain sulphur cinquefoil and one site has field bindweed, each site is less than 0.1 acre in size and all total 1.3 acres. The 1st choice herbicide for these species is picloram, which is known to be toxic to fish. Some of these sites are located along upper Bear Creek and NF Bear Creek a redband trout stream, the closest site to known steelhead usage downstream is approximately 1.4 miles away.

**Table H-20.** Acres and number of locations invasive plant sites occur within specified buffers for intermittent (Int.) streams by subwatershed and total acres and number of invasive plant sites by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 100' of Int. Streams | Number of areas 100' from Int. Streams | Acres on Int. Stream Channels | Number of Infested Weed Sites | Total Weed Acres in HUC6 | Total Sub-watershed Acres |
|---|---|---|---|---|---|---|---|
| HEADWATERS BRIDGE CREEK | 170702040301 | 0.00 | 0 | 0.00 | 4 | 1.23 | 28608 |
| WEST BRANCH BRIDGE CREEK | 170702040302 | 6.46 | 1 | 0.23 | 76 | 257.41 | 25399 |
| UPPER BRIDGE CREEK | 170702040303 | 0.43 | 1 | 0.01 | 3 | 26.84 | 25978 |
| UPPER BRIDGE BEAR CREEK | 170702040304 | 0.10 | 3 | 0.00 | 35 | 2.33 | 16850 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MIDDLE BRIDGE BEAR CREEK | 170702040305 | 0.00 | 0 | 0.00 | 21 | 1.71 | 21537 |
| | **Totals** | 6.99 | 5.00 | 0.24 | 139.00 | 289.52 | 118373 |

**Table H-21.** Acres and number of locations invasive plant sites occur within specified buffers for perennial streams, rivers, lakes, and springs by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 10' of perennial water | Number of areas 10' from perennial water | Acres within 100' of perennial water | Number of areas 100' from perennial water | Acres within 300' of perennial water | Number of areas 300' from perennial water |
|---|---|---|---|---|---|---|---|
| HEADWATERS BRIDGE CREEK | 170702040301 | 0.00 | 0 | 0.00 | 0 | 0.10 | 1 |
| WEST BRANCH BRIDGE CREEK | 170702040302 | 1.71 | 6 | 18.37 | 9 | 58.86 | 20 |
| UPPER BRIDGE CR. | 170702040303 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |
| UPPER BRIDGE BEAR CREEK | 170702040304 | 0.00 | 0 | 0.50 | 10 | 1.71 | 27 |
| MIDDLE BRIDGE BEAR CREEK | 170702040305 | 0.00 | 0 | 0.00 | 0 | 0.16 | 2 |
| | **Totals** | 1.71 | 6.00 | 18.87 | 19.00 | 60.83 | 50.00 |

The small size of the sites to be treated with picloram and long distance between them and steelhead streams should prevent any direct adverse effects to fish in these streams. Both intermittent and perennial streams would have buffers depending on herbicide and application method. The buffer distance between these fish populations and the invasive plant sites would allow time for the herbicides to break down and bind to soils. Because of the small size of the picloram sites and because they are spread throughout the subwatersheds even if a thunderstorm event occurred a few days after application the amounts of herbicide reaching the stream would likely not be at high enough levels to harm or effect fish living downstream.

SERA (2004) risk assessments found exposure levels to fish for chlorsulfuron, sulfometuron, metsulfuron and clopyralid to be below levels of concern for Forest Service programs. Picloram is moderately toxic to aquatic animals, particularly some species of fish. There is substantial variability in the toxicity of picloram to aquatic species. While this variability adds uncertainty to the dose-response assessment, it has no substantial impact on the risk characterization. None of the hazard indices for fish, aquatic invertebrates, or aquatic plants exceed a level of concern (SERA 2003).

Cumulative effects to fish populations downstream on private lands would be difficult to detect against herbicides and pesticides used on private agricultural lands in the watershed. All lands upstream are Forest Service lands. Cumulative effects from past treatments under the 1998 ONF weed EA are unlikely because these herbicide should be mostly broken down by now and these sites were small and located away from waterbodies.

## UPPER JOHN DAY WATERSHEDS

### Mountain Creek, Rock Creek, Upper Middle John Day, and the Lower South Fork Watersheds (HUC - 1707020113, 1707020114, 1707020112, 1707020105)

Streams in this watershed contain steelhead and redband trout. Infested weed sites are located upstream of known steelhead use. Weed species identified for herbicide or manual treatments are spotted knapweed, yellow starthistle, sulphur, medusahead, St. Johnswort, field bindweed, houndstongue and lesser burdock. First choice herbicides for treating these species are clopyralid, sulfometuron, metsulfuron and picloram. Picloram should only be used on sulphur cinquefoil as that is the only effective herbicide to really treat this species (Dave Langland, Oregon Dept. of Agriculture, personal communication). Picloram is high risk to fish while the other herbicides are low to moderate risk to fish and aquatics. Weed infestations are primarily located along roads with project areas crossing and running near streams. Herbicide and sedimentation effects to fish in perennial streams will only be addressed because these are the only two habitat indicators that could affect fish with these weed species and treatment methods.

### Manual Methods (Sedimentation)

In most project areas hand pulling will be used on small patches of invasive plants, where there are only a few scattered individuals distributed over a large area or in sensitive areas where the potential effects of hand pulling outweigh the potential effects of herbicide application. Hand pulling will mostly be in areas away from waterbodies but some individual plants may be pulled next to perennial streams or in intermittent channels.

Pulling could occur at 1-2 times yearly over all the entire invasive plant populations. The effect of pulling scattered plants along roadsides and even within the riparian areas would leave small patches of bare soil until covered with organics from the forest or new vegetation sprouted which could take 1-3 years depending on location. Pulling could occur at anytime during the spring summer or fall in most project areas. Amounts of sediment produced from pulling would be very small and immeasurable against the other actions that have occurred in the watershed. Pulling invasive plants in these subwatersheds will have no effect or impact on steelhead or redband trout.

Cumulative effects of sedimentation to fish populations from hand pulling invasive plants would be immeasurable against sediments produced by timber harvest, grazing, roads and past fires in these subwatersheds.

### Herbicide Application (Chemical Contamination)

Herbicides would be applied to sites using patch broadcast or hand spray application. This would be done once a season, generally in the spring or summer. There are 13 project areas that contain 79 invasive plant polygons that total 22.3 acres (Table 22). Mapped invasive plant sites total 12.2 acres in 23 locations within 100 feet of perennial waterbodies (Table 23). Actual acres of invasive plants to be treated in these is less than this because they are not all filled with invasive plants, exactly how much less is not known. The largest site (71-16) at 243 acres was estimated to have only 9.8 acres of actual plants. It crosses two perennial streams with known steelhead use to occur approximately 1.3 miles downstream. It contains houndstongue which is typically treated with metsulfuron. The other two sites (71-10 and 71-32) over 10 acres were estimated to have only 5.5 and 4.5 acres of actual invasive plants. Site 71-10 is approximately 650 ft to a non fish bearing perennial stream. It has yellow starthistle and medusahead and will be treated with clopyralid and metsulfuron. Site 71-32 crosses a non fish bearing perennial stream that is located approximately 1.3 miles upstream of a stream used by steelhead. It has houndstongue and will be treated with metsulfuron. Thirteen sites contain sulphur cinquefoil and one site has field bindweed, each site is less than 0.1 acre in size and all total 1.3 acres. The 1$^{st}$ choice herbicide for these species is picloram, which is known to be toxic to fish. Some of these sites are located along upper Bear Creek and North Fork Bear Creek, a redband stream; the closest site to known steelhead usage downstream is approximately 1.4 miles away.

The small size of the sites to be treated with picloram and buffer distances between them and the streams should prevent any direct adverse affects to fish in these streams. Both intermittent and perennial streams would have buffers depending on herbicide and application method. The buffer distance between these fish populations and the invasive plant sites would allow time for the herbicides to break down and bind to soils. Because of the small size of the picloram sites and because they are spread throughout the subwatersheds even if a thunderstorm event occurred a few days after application the amounts of herbicide reaching the stream would not be at high enough levels to harm or effect fish living downstream.

SERA (2004) risk assessments found exposure levels to fish for sulfometuron, metsulfuron and clopyralid to be below levels of concern for Forest Service programs. Picloram is moderately toxic to aquatic animals, particularly some species of fish. There is substantial variability in the toxicity of picloram to aquatic species. While this variability adds uncertainty to the dose-response assessment, it has no substantial impact on the risk characterization. None of the hazard indices for fish, aquatic invertebrates, or aquatic plants exceed a level of concern (SERA 2003).

It is unlikely detectable amounts of herbicide would reach the stream. If they did levels would not be high enough to cause direct harm to fish. Herbicide application in the Bridge Creek Watershed may have some short term effects to algae and aquatic macrophytes; however, this is not expected to result in adverse effects to redband trout or steelhead.

Cumulative effects to fish populations downstream on private lands would be difficult to detect and would not add significantly to herbicides and pesticides used on private agricultural lands in the watershed. Upstream use of herbicides would be limited to this project. Herbicides used under the ONF 98 EA should be broken down and undetectable by the time this project is implemented.

**Table H-22.** Acres and number of locations invasive plant sites occur within specified buffers for intermittent (Int.) streams by subwatershed and total acres and number of invasive plant sites by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 100' of Int. Streams | Number of areas 100' from Int. Streams | Acres on Int. Stream Channels | Number of Infested Weed Sites | Total Weed Acres in HUC6 | Total Sub-watershed Acres |
|---|---|---|---|---|---|---|---|
| WIND CREEK | 170702010501 | 0.00 | 0 | 0.00 | 6 | 0.49 | 17589 |
| CORNER CREEK BLACK PINE CR. | 170702010502 | 0.10 | 1 | 0.00 | 15 | 9.31 | 18746 |
| BLACK CANYON CR. | 170702010503 | 0.00 | 0 | 0.00 | 13 | 2.30 | 20826 |
| JACKASS CREEK | 170702010504 | 0.00 | 0 | 0.00 | 3 | 2.69 | 17621 |
| COTTONWOOD CR. | 170702011202 | 0.00 | 0 | 0.00 | 7 | 1.46 | 19363 |
| UPPER MOUNTAIN CR. | 170702011301 | 0.00 | 0 | 0.00 | 8 | 1.05 | 26402 |
| MIDDLE MOUNTAIN CR. | 170702011302 | 0.00 | 0 | 0.00 | 7 | 1.99 | 34850 |
| UPPER ROCK CR. | 170702011401 | 0.12 | 2 | 0.00 | 20 | 2.98 | 31271 |
| | **Totals** | 0.22 | 3 | 0.00 | 79 | 22.27 | 186668 |

**Table H-23**. Acres and number of locations invasive plant sites occur within specified buffers for perennial streams, rivers, lakes, and springs by subwatershed. Results represent sites proposed for some form of herbicide treatment.

| HUC6 Name | HUC6 Number | Acres within 10' of perennial water | Number of areas 10' from perennial water | Acres within 100' of perennial water | Number of areas 100' from perennial water | Acres within 300' of perennial water | Number of areas 300' from perennial water |
|---|---|---|---|---|---|---|---|
| WIND CREEK | 170702010501 | 0.00 | 0 | 0.01 | 1 | 0.20 | 2 |
| CORNER CREEK BLACK PINE CREEK | 170702010502 | 2.80 | 9 | 9.00 | 11 | 9.21 | 14 |
| BLACK CANYON CR. | 170702010503 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |
| JACKASS CREEK | 170702010504 | 1.21 | 10 | 2.51 | 7 | 2.69 | 3 |
| COTTONWOOD CR. | 170702011202 | 0.03 | 1 | 0.47 | 1 | 0.75 | 1 |
| UPPER MOUNTAIN CR. | 170702011301 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 |
| MIDDLE MOUNTAIN CR. | 170702011302 | 0.01 | 1 | 0.10 | 1 | 0.85 | 2 |
| UPPER ROCK CREEK | 170702011401 | 0.00 | 0 | 0.10 | 2 | 0.30 | 4 |
| | **Totals** | 4.05 | 21 | 12.19 | 23 | 14.00 | 26 |

**Table H-24.** Road miles in RR/RHCA and in invasive plant treatment area by subwatershed.

| Watershed Name | Subwatershed Unit Name | Miles of Road |
|---|---|---|
| MIDDLE SOUTH FORK JOHN DAY | PINE CREEK | 0.3 |
| MIDDLE SOUTH FORK JOHN DAY | SUNFLOWER CREEK | 7.6 |
| LOWER SOUTH FORK JOHN DAY | WIND CREEK | 3.7 |
| LOWER SOUTH FORK JOHN DAY | CORNER CREEK/BLACK PINE CREEK | 0.2 |
| LOWER SOUTH FORK JOHN DAY | BLACK CANYON CREEK | 0.6 |
| MOUNTAIN CREEK | MIDDLE MOUNTAIN CREEK | 1.2 |
| ROCK CREEK | UPPER ROCK CREEK | 3.3 |
| BRIDGE CREEK | HEADWATERS BRIDGE CREEK | 1.4 |
| BRIDGE CREEK | WEST BRANCH BRIDGE CREEK | 7.1 |
| BRIDGE CREEK | UPPER BRIDGE CREEK | 0.5 |
| BRIDGE CREEK | UPPER BRIDGE BEAR CREEK | 14.8 |
| BRIDGE CREEK | MIDDLE BRIDGE BEAR CREEK | 0.0 |
| CRANE PRAIRIE | SODA CREEK | 1.9 |
| CRANE PRAIRIE | QUINN CREEK | 0.8 |
| CRANE PRAIRIE | ELK LAKE | 1.6 |
| CRANE PRAIRIE | LAVA LAKES | 3.5 |
| CRANE PRAIRIE | CULTUS CREEK | 0.5 |
| CRANE PRAIRIE | DEER CREEK | 0.5 |
| CRANE PRAIRIE | CULTUS RIVER | 0.7 |
| CRANE PRAIRIE | CHARLTON CREEK | 0.5 |
| CRANE PRAIRIE | CRANE PRAIRIE | 0.3 |
| WICKIUP | ODELL LAKE | 5.0 |
| WICKIUP | ODELL CREEK | 1.7 |
| WICKIUP | DAVIS LAKE | 1.4 |
| WICKIUP | BROWNS CREEK | 0.6 |
| WICKIUP | DAVIS CREEK | 0.2 |
| WICKIUP | WICKIUP | 0.5 |
| FALL RIVER | DUTCHMAN CREEK | 2.1 |
| FALL RIVER | SPRING RIVER | 0.4 |
| FALL RIVER | FALL RIVER | 0.7 |
| FALL RIVER | PRINGLE FALLS | 1.5 |
| FALL RIVER | BATES BUTTE | 0.5 |
| PILOT BUTTE | COYOTE SPRING | 4.2 |
| PILOT BUTTE | BENHAM FALLS | 2.1 |
| PILOT BUTTE | BESSIE BUTTE | 0.1 |
| PILOT BUTTE | LAVA ISLAND FALLS | 1.5 |
| TUMALO CREEK | UPPER TUMALO CREEK | 3.1 |
| TUMALO CREEK | LOWER TUMALO CREEK | 1.8 |
| DEEP CANYON | THREE CREEK | 1.3 |
| DEEP CANYON | TRIANGLE HILL | 0.2 |
| SQUAW CREEK | UPPER SQUAW CREEK | 2.1 |
| SQUAW CREEK | UPPER TROUT CREEK | 1.9 |
| SQUAW CREEK | UPPER INDIAN FORD | 0.3 |
| SQUAW CREEK | LOWER TROUT CREEK | 0.3 |

| Watershed Name | Subwatershed Unit Name | Miles of Road |
|---|---|---|
| SQUAW CREEK | LOWER INDIAN FORD | 0.5 |
| SQUAW CREEK | LOWER SQUAW CREEK | 1.5 |
| UPPER METOLIUS RIVER | DRY CREEK | 0.7 |
| UPPER METOLIUS RIVER | CACHE CREEK | 0.5 |
| UPPER METOLIUS RIVER | UPPER LAKE CREEK | 11.6 |
| UPPER METOLIUS RIVER | LOWER LAKE CREEK | 3.3 |
| UPPER METOLIUS RIVER | HEADWATERS METOLIUS RIVER | 3.9 |
| UPPER METOLIUS RIVER | FIRST CREEK | 11.6 |
| UPPER METOLIUS RIVER | JACK CREEK | 4.0 |
| UPPER METOLIUS RIVER | CANYON CREEK | 6.9 |
| UPPER METOLIUS RIVER | ABBOT CREEK | 2.8 |
| UPPER METOLIUS RIVER | CANDLE CREEK | 0.6 |
| LOWER METOLIUS RIVER | UPPER METOLIUS RIVER | 6.2 |
| LOWER METOLIUS RIVER | MIDDLE METOLIUS RIVER | 5.9 |
| LOWER METOLIUS RIVER | UPPER FLY CREEK | 0.6 |
| LOWER METOLIUS RIVER | LOWER FLY CREEK | 3.0 |
| LOWER METOLIUS RIVER | LOWER METOLIUS RIVER | 4.7 |
| LAKE BILLY CHINOOK | STEVENS CANYON | 0.0 |
| LAKE BILLY CHINOOK | CARCASS CANYON | 0.4 |
| LAKE BILLY CHINOOK | GENEVA | 0.1 |
| UPPER LITTLE DESCHUTES RIVER | LITTLE ODELL CREEK | 0.1 |
| UPPER LITTLE DESCHUTES RIVER | BUNNY BUTTE | 1.1 |
| UPPER LITTLE DESCHUTES RIVER | GILCHRIST JUNCTION | 0.2 |
| CRESCENT CREEK | LOWER BIG MARSH CREEK | 0.1 |
| CRESCENT CREEK | CRESCENT LAKE | 3.3 |
| CRESCENT CREEK | COLD CREEK | 2.5 |
| CRESCENT CREEK | MIDDLE CRESCENT CREEK | 1.5 |
| LITTLE WALKER MOUNTAIN | NORTH PAUNINA | 0.3 |
| LONG PRAIRIE | BEAL | 0.1 |
| LOWER LITTLE DESCHUTES RIVER | UPPER PAULINA CREEK | 0.4 |
| LOWER LITTLE DESCHUTES RIVER | LOWER PAULINA CREEK | 0.2 |
| SOUTH FORK BEAVER CREEK | LOWER SOUTH FORK BEAVER CREEK | 0.0 |
| UPPER BEAVER CREEK | BEAVERDAM CREEK | 1.5 |
| UPPER BEAVER CREEK | POWELL CREEK | 2.4 |
| UPPER BEAVER CREEK | SUGAR CREEK | 0.5 |
| PAULINA CREEK | UPPER PAULINA CREEK | 8.9 |
| PAULINA CREEK | DRY PAULINA CREEK | 5.7 |
| LOWER BEAVER CREEK | NORTH WOLF CREEK | 0.9 |
| LOWER BEAVER CREEK | WOLF CREEK | 13.1 |
| CROOKED RIVER ABOVE NORTH FORK | MAURY CREEK | 1.7 |
| CAMP CREEK | INDIAN CREEK | 2.1 |
| CAMP CREEK | LOWER CAMP CREEK | 0.1 |
| UPPER NORTH FORK CROOKED RIVER | GRAY CREEK | 0.0 |
| UPPER NORTH FORK CROOKED RIVER | ELLIOTT CREEK | 1.7 |
| UPPER NORTH FORK CROOKED RIVER | HOWARD CREEK | 6.6 |

| Watershed Name | Subwatershed Unit Name | Miles of Road |
|---|---|---|
| UPPER NORTH FORK CROOKED RIVER | JOHNSON CREEK | 2.9 |
| UPPER NORTH FORK CROOKED RIVER | HEADWATERS NORTH FORK CROOKED RIVER | 0.1 |
| UPPER NORTH FORK CROOKED RIVER | PETERSON CREEK | 0.1 |
| UPPER NORTH FORK CROOKED RIVER | PORTER CREEK | 0.2 |
| UPPER NORTH FORK CROOKED RIVER | LOWER BIG SUMMIT PRAIRIE | 4.1 |
| DEEP CREEK | JACKSON CREEK | 8.9 |
| DEEP CREEK | LITTLE SUMMITT PRAIRIE CREEK | 9.9 |
| DEEP CREEK | LOWER DEEP CREEK | 11.8 |
| LOWER NORTH FORK CROOKED RIVER | UPPER NORTH FORK CANYON | 4.7 |
| UPPER CROOKED RIVER | LOST CREEK | 1.6 |
| UPPER CROOKED RIVER | DRAKE CREEK | 2.1 |
| UPPER CROOKED RIVER | PINE CREEK | 2.9 |
| UPPER CROOKED RIVER | NEWSOME CREEK | 9.0 |
| UPPER CROOKED RIVER | UPPER HORSE HEAVEN CREEK | 0.4 |
| BEAR CREEK | HEADWATERS BEAR CREEK | 9.0 |
| BEAR CREEK | UPPER BEAR CREEK | 0.1 |
| BEAR CREEK | LITTLE BEAR CREEK | 1.1 |
| UPPER OCHOCO CREEK | HEADWATERS OCHOCO CREEK | 14.0 |
| UPPER OCHOCO CREEK | UPPER MARKS CREEK | 13.1 |
| UPPER OCHOCO CREEK | LOWER MARKS CREEK | 15.4 |
| UPPER OCHOCO CREEK | DUNCAN CREEK | 6.2 |
| MILL CREEK | UPPER MILL CREEK | 5.1 |
| MILL CREEK | LOWER MILL CREEK | 5.7 |
| LOWER OCHOCO CREEK | VEASIE CREEK | 0.1 |
| MCKAY CREEK | UPPER MCKAY CREEK | 14.8 |
| MCKAY CREEK | ALLEN CREEK | 0.7 |
| BADLANDS | KOTZMAN | 0.1 |
| CROOKED RIVER VALLEY | LONE PINE CREEK | 2.5 |
| CROOKED RIVER VALLEY | MCALLISTER SLOUGH | 0.4 |
| CROOKED RIVER GRASSLAND | UPPER CROOKED RIVER GORGE | 0.2 |
| CROOKED RIVER GRASSLAND | LOWER CROOKED RIVER GORGE | 0.2 |
| HEADWATERS DESCHUTES RIVER | LAKE SIMTUSTUS | 0.0 |
| WILLOW CREEK | UPPER WILLOW CREEK | 0.1 |
| WILLOW CREEK | RIMROCK SPRING | 2.1 |
| WILLOW CREEK | MIDDLE WILLOW CREEK | 2.2 |
| WILLOW CREEK | DRY CANYON | 2.5 |
| WILLOW CREEK | LOWER WILLOW CREEK | 0.2 |
| UPPER TROUT CREEK | OPAL CREEK | 2.5 |
| UPPER TROUT CREEK | FOLEY CREEK | 3.4 |
| UPPER TROUT CREEK | HEADWATERS TROUT CREEK | 7.2 |
| MUD SPRINGS CREEK | UPPER MUD SPRINGS CREEK | 3.5 |
| MUD SPRINGS CREEK | SAGEBRUSH CREEK | 0.6 |
| | **Total** | **380.2** |

**Table H-25.** Number of stream crossings by roads within infested invasive plant treatment sites on class 1, 2 and 3 TES fish steam.

| HUC | XING WITHOUT TES | XING WITH TES | TOTAL XINGS |
|---|---|---|---|
| 170702010304 - SUNFLOWER CREEK | 3 | 12 | 15 |
| 170702010501 - WIND CREEK | | 5 | 5 |
| 170702010503 - BLACK CANYON CREEK | 2 | 1 | 3 |
| 170702011302 - MIDDLE MOUNTAIN CREEK | 2 | 1 | 3 |
| 170702011401 - UPPER ROCK CREEK | | 4 | 4 |
| 170702040301 - HEADWATERS BRIDGE CREEK | 3 | 1 | 4 |
| 170702040302 - WEST BRANCH BRIDGE CREEK | 13 | | 13 |
| 170702040304 - UPPER BRIDGE BEAR CREEK | 18 | 6 | 24 |
| 170703010101 - SODA CREEK | 6 | | 6 |
| 170703010102 - QUINN CREEK | 4 | | 4 |
| 170703010103 - ELK LAKE | 2 | | 2 |
| 170703010104 - LAVA LAKES | | 5 | 5 |
| 170703010105 - CULTUS CREEK | | 2 | 2 |
| 170703010106 - DEER CREEK | | 2 | 2 |
| 170703010107 - CULTUS RIVER | | 1 | 1 |
| 170703010108 - CHARLTON CREEK | 1 | | 1 |
| 170703010201 - ODELL LAKE | 15 | 2 | 17 |
| 170703010202 - ODELL CREEK | 1 | 1 | 2 |
| 170703010205 - BROWNS CREEK | 1 | | 1 |
| 170703010207 - WICKIUP | | 1 | 1 |
| 170703010306 - BATES BUTTE | | 1 | 1 |
| 170703010402 - COYOTE SPRING | 1 | | 1 |
| 170703010501 - UPPER TUMALO CREEK | | 5 | 5 |
| 170703010802 - UPPER SQUAW CREEK | 2 | | 2 |
| 170703010803 - UPPER TROUT CREEK | 1 | 1 | 2 |
| 170703010807 - LOWER INDIAN FORD | | 2 | 2 |
| 170703010809 - LOWER SQUAW CREEK | | 2 | 2 |
| 170703010903 - UPPER LAKE CREEK | 6 | | 6 |
| 170703010904 - LOWER LAKE CREEK | | 2 | 2 |
| 170703010905 - HEADWATERS METOLIUS RIVER | 2 | 4 | 6 |
| 170703010906 - FIRST CREEK | | 1 | 1 |
| 170703010907 - JACK CREEK | | 2 | 2 |
| 170703010908 - CANYON CREEK | 7 | 3 | 10 |
| 170703010909 - ABBOT CREEK | | 2 | 2 |
| 170703011003 - MIDDLE METOLIUS RIVER | 1 | 2 | 3 |
| 170703011005 - LOWER FLY CREEK | 1 | 1 | 2 |
| 170703020105 - GILCHRIST JUNCTION | 1 | | 1 |
| 170703020204 - CRESCENT LAKE | | 1 | 1 |
| 170703020205 - COLD CREEK | 3 | 4 | 7 |
| 170703020206 - MIDDLE CRESCENT CREEK | | 2 | 2 |
| 170703020703 - LOWER PAULINA CREEK | 1 | | 1 |
| 170703030801 - BEAVERDAM CREEK | | 1 | 1 |
| 170703030802 - POWELL CREEK | 1 | 6 | 7 |
| 170703030803 - SUGAR CREEK | 1 | 1 | 2 |
| 170703030901 - UPPER PAULINA CREEK | 24 | 3 | 27 |
| 170703030902 - DRY PAULINA CREEK | 3 | 6 | 9 |
| 170703031001 - NORTH WOLF CREEK | 1 | 2 | 3 |
| 170703031002 - WOLF CREEK | | 11 | 11 |
| 170703040103 - MAURY CREEK | | 3 | 3 |

| | | | |
|---|---|---|---|
| 170703040201 - INDIAN CREEK | 6 | 1 | 7 |
| 170703040302 - ELLIOTT CREEK | 2 | 3 | 5 |
| 170703040303 - HOWARD CREEK | 5 | 8 | 13 |
| 170703040304 - JOHNSON CREEK | | 11 | 11 |
| 170703040308 - LOWER BIG SUMMIT PRAIRIE | 1 | 2 | 3 |
| 170703040401 - JACKSON CREEK | 1 | 5 | 6 |
| 170703040402 - LITTLE SUMMITT PRAIRIE CREEK | 1 | 5 | 6 |
| 170703040403 - LOWER DEEP CREEK | 5 | 10 | 15 |
| 170703040501 - UPPER NORTH FORK CANYON | | 4 | 4 |
| 170703040601 - LOST CREEK | | 1 | 1 |
| 170703040602 - DRAKE CREEK | 5 | 2 | 7 |
| 170703040603 - PINE CREEK | 3 | 1 | 4 |
| 170703040604 - NEWSOME CREEK | 2 | 7 | 9 |
| 170703040605 - UPPER HORSE HEAVEN CREEK | 2 | 1 | 3 |
| 170703040701 - HEADWATERS BEAR CREEK | 8 | 7 | 15 |
| 170703050201 - HEADWATERS OCHOCO CREEK | 8 | 25 | 33 |
| 170703050203 - UPPER MARKS CREEK | 13 | 18 | 31 |
| 170703050204 - LOWER MARKS CREEK | 17 | 20 | 37 |
| 170703050205 - DUNCAN CREEK | 7 | 13 | 20 |
| 170703050301 - UPPER MILL CREEK | 3 | 7 | 10 |
| 170703050302 - LOWER MILL CREEK | 2 | 3 | 5 |
| 170703050501 - UPPER MCKAY CREEK | 5 | 15 | 20 |
| 170703050502 - ALLEN CREEK | | 1 | 1 |
| 170703051004 - LONE PINE CREEK | 1 | | 1 |
| 170703051005 - MCALLISTER SLOUGH | 2 | | 2 |
| 170703060201 - UPPER WILLOW CREEK | | 1 | 1 |
| 170703060202 - RIMROCK SPRING | 2 | | 2 |
| 170703060203 - MIDDLE WILLOW CREEK | 7 | | 7 |
| 170703060204 - DRY CANYON | 3 | | 3 |
| 170703070101 - OPAL CREEK | 4 | 2 | 6 |
| 170703070102 - FOLEY CREEK | 3 | 3 | 6 |
| 170703070103 - HEADWATERS TROUT CREEK | 10 | 8 | 18 |
| **Totals** | **255** | **296** | **551** |

**Table H- 26.** Subwatersheds with infested weed sites 300 feet or greater distance from Class 1, 2, or 3 streams and perennial lakes and ponds and reservoirs.

| WATERSHED NAME | SUBWATERSHED NAME | HUC6 |
|---|---|---|
| LONG PRAIRIE | BEAL | 170703020605 |
| UPPER BEAVER CREEK | BEAVERDAM CREEK | 170703030801 |
| PILOT BUTTE | BESSIE BUTTE | 170703010406 |
| PINE | BIG HOLE | 171200050601 |
| WICKIUP | BROWNS CREEK | 170703010205 |
| UPPER LITTLE DESCHUTES RIVER | BUNNY BUTTE | 170703020104 |
| MC CARTY | BUTTE WELL | 171200050504 |
| LAKE BILLY CHINOOK | CARCASS CANYON | 170703011102 |
| DEVILS GARDEN | CHINA HAT | 171200050701 |
| UPPER CROOKED RIVER | CONANT CREEK | 170703040608 |
| LITTLE WALKER MOUNTAIN | CORRAL SPRINGS | 170703020501 |
| WICKIUP | DAVIS LAKE | 170703010204 |
| DEEP CANYON | DEEP CANYON | 170703010604 |
| DEVILS GARDEN | DOME | 171200050702 |
| UPPER METOLIUS RIVER | DRY CREEK | 170703010901 |
| MC CARTY | DRY CREEK | 171200050503 |
| FALL RIVER | DUTCHMAN CREEK | 170703010301 |
| CRANE PRAIRIE | ELK LAKE | 170703010103 |
| UPPER NORTH FORK CROOKED RIVER | ELLIOTT CREEK | 170703040302 |
| SQUAW CREEK | FOURMILE BUTTE | 170703010804 |
| LAKE BILLY CHINOOK | GENEVA | 170703011103 |
| UPPER LITTLE DESCHUTES RIVER | GILCHRIST | 170703020106 |
| LONG PRAIRIE | GREEN BUTTE | 170703020602 |
| PILOT BUTTE | GREEN MOUNTAIN | 170703010405 |
| SQUAW CREEK | HEADWATERS SQUAW CREEK | 170703010801 |
| UPPER LITTLE DESCHUTES RIVER | HEMLOCK CREEK | 170703020102 |
| UPPER DRY RIVER | HORSE RIDGE | 170703050709 |
| LOWER DRY RIVER | HUNTER | 170703050803 |
| LONG PRAIRIE | IPSOOT BUTTE | 170703020604 |
| LOWER METOLIUS RIVER | JUNIPER CREEK | 170703011006 |
| LOWER LITTLE DESCHUTES RIVER | KAWAK BUTTE WEST | 170703020705 |
| BADLANDS | KOTZMAN | 170703050604 |
| HEADWATERS DESCHUTES RIVER | LAKE SIMTUSTUS | 170703060103 |
| LOWER LITTLE DESCHUTES RIVER | LAPINE | 170703020704 |
| BEAR CREEK | LITTLE BEAR CREEK | 170703040705 |
| UPPER LITTLE DESCHUTES RIVER | LITTLE ODELL CREEK | 170703020103 |
| LITTLE WALKER MOUNTAIN | LITTLE WALKER MOUNTAIN | 170703020504 |
| CAMP CREEK | LOWER CAMP CREEK | 170703040205 |
| CROOKED RIVER GRASSLAND | LOWER CROOKED RIVER GORGE | 170703051102 |
| LONG PRAIRIE | LOWER LONG PRAIRIE | 170703020609 |
| SOUTH FORK BEAVER CREEK | LOWER SOUTH FORK BEAVER CR | 170703030704 |
| WILLOW CREEK | LOWER WILLOW CREEK | 170703060205 |
| BRIDGE CREEK | MIDDLE BRIDGE BEAR CREEK | 170702040305 |
| UPPER DRY RIVER | MILLICAN EAST | 170703050706 |
| LONG PRAIRIE | MOFFITT BUTTE | 170703020603 |
| PILOT BUTTE | MOKST BUTTE WEST | 170703010401 |
| WICKIUP | MOORE CREEK | 170703010203 |
| UPPER BEAVER CREEK | NORTH FORK BEAVER CREEK | 170703030804 |
| LITTLE WALKER MOUNTAIN | NORTH PAUNINA | 170703020503 |
| BADLANDS | OBSERVATORY RIDGE | 170703050606 |
| PINE | OOSKAN BUTTE | 171200050603 |
| LONG PRAIRIE | PAULINA PEAK SOUTH | 170703020608 |
| UPPER NORTH FORK CROOKED RIVER | PETERSON CREEK | 170703040306 |

| WATERSHED NAME | SUBWATERSHED NAME | HUC6 |
|---|---|---|
| PINE | PINE LAKE | 171200050604 |
| UPPER DRY RIVER | PINE MOUNTAIN | 170703050707 |
| DEVILS GARDEN | PORCUPINE | 171200050704 |
| UPPER NORTH FORK CROOKED RIVER | PORTER CREEK | 170703040307 |
| BADLANDS | POTHOLES | 170703050605 |
| LOWER DRY RIVER | REYNOLDS POND | 170703050805 |
| DEVILS GARDEN | SIXTEEN BUTTE | 171200050703 |
| CRANE PRAIRIE | SODA CREEK | 170703010101 |
| FALL RIVER | SPRING RIVER | 170703010303 |
| LAKE BILLY CHINOOK | STEVENS CANYON | 170703011101 |
| LOWER DRY RIVER | STOOKEY | 170703050804 |
| LOWER LITTLE DESCHUTES RIVER | SUGAR PINE BUTTE | 170703020706 |
| LONG PRAIRIE | SURVEYORS LAVA FLOW | 170703020607 |
| UPPER DRY RIVER | TEEPEE DRAW | 170703050708 |
| DEEP CANYON | THREE CREEK | 170703010601 |
| DEEP CANYON | TRIANGLE HILL | 170703010602 |
| BRIDGE CREEK | UPPER BRIDGE CREEK | 170702040303 |
| CROOKED RIVER GRASSLAND | UPPER CROOKED RIVER GORGE | 170703051101 |
| LOWER METOLIUS RIVER | UPPER FLY CREEK | 170703011004 |
| MOUNTAIN CREEK | UPPER MOUNTAIN CREEK | 170702011301 |
| MUD SPRINGS CREEK | UPPER MUD SPRINGS CREEK | 170703070401 |
| PRINEVILLE RESERVOIR | UPPER PRINEVILLE RESERVOIR | 170703040801 |
| SALT CREEK/WILLAMETTE RIVER | UPPER SALT CREEK | 170900010301 |
| LOWER OCHOCO CREEK | VEASIE CREEK | 170703050402 |
| LOWER LITTLE DESCHUTES RIVER | WICKIUP JUNCTION | 170703020701 |

**Table H-27.** Infested weed site acres and high risk road crossing sites for class 1, 2 and 3 streams, perennial lakes ponds and reservoirs by subwatershed. Subwatersheds with TE steelhead or bull trout are in bold.

| Subwatershed Number and Name | Acres Within 100 ft of Class 1 Streams | Acres Within 100 ft of Class 2 Streams | Acres Within 100 ft of Class 3 Streams | Acres Within 100 ft Lakes | Acres 300 ft Around Road xings | Total Weed Site Acres in Aquatic Influence Zone | Total Acres of Subwatershed | Total Weed Acres in the Subwatershed | % of Subwatershed in Weed Acres |
|---|---|---|---|---|---|---|---|---|---|
| 170702010303 - PINE CREEK | | | 0.0 | | | | 21107.0 | 0.6 | 0.00 |
| 170702010304 - SUNFLOWER CREEK | | 0.1 | 0.3 | | | 0.4 | 18546.5 | 11.8 | 0.06 |
| 170702010501 - WIND CREEK | | | | | | | 17588.6 | 0.5 | 0.00 |
| 170702010502 - CORNER CREEK/BLACK PINE CREEK | 7.5 | | | | | 7.5 | 18745.7 | 9.3 | 0.05 |
| 170702010504 - JACKASS CREEK | 2.3 | | | | | 2.3 | 17620.7 | 2.7 | 0.02 |
| 170702011202 - COTTONWOOD CREEK | 0.5 | | | | | 0.5 | 19363.0 | 1.4 | 0.01 |
| 170702011302 - MIDDLE MOUNTAIN CREEK | | 0.1 | | | | 0.1 | 34850.4 | 2.0 | 0.01 |

| Subwatershed Number and Name | Acres Within 100 ft of Class 1 Streams | Acres Within 100 ft of Class 2 Streams | Acres Within 100 ft of Class 3 Streams | Acres Within 100 ft Lakes | Acres 300 ft Around Road xings | Total Weed Site Acres in Aquatic Influence Zone | Total Acres of Subwatershed | Total Weed Acres in the Subwatershed | % of Subwatershed in Weed Acres |
|---|---|---|---|---|---|---|---|---|---|
| 170702011401 - UPPER ROCK CREEK | | 0.1 | 0.0 | | | 0.1 | 31271.1 | 2.9 | 0.01 |
| 170702040301 - HEADWATERS BRIDGE CREEK | | | | | 0.1 | 0.1 | 28608.4 | 1.2 | 0.00 |
| 170702040302 - WEST BRANCH BRIDGE CREEK | | 6.1 | 11.6 | | 12.5 | 30.1 | 25399.0 | 257.3 | 1.01 |
| 170702040304 - UPPER BRIDGE BEAR CREEK | 0.1 | 0.4 | 0.1 | | 0.2 | 0.7 | 16850.0 | 2.2 | 0.01 |
| 170703010101 - SODA CREEK | | | | 0.0 | | | 23332.7 | 5.6 | 0.02 |
| 170703010102 - QUINN CREEK | | | | 0.8 | | 0.8 | 13257.7 | 3.3 | 0.02 |
| 170703010104 - LAVA LAKES | 2.5 | | | 14.4 | 0.1 | 17.1 | 26874.7 | 31.2 | 0.12 |
| 170703010105 - CULTUS CREEK | 0.4 | | | | 0.7 | 1.1 | 22651.9 | 1.1 | 0.00 |
| 170703010107 - CULTUS RIVER | 0.1 | | | | 0.2 | 0.3 | 13289.4 | 0.8 | 0.01 |
| 170703010108 - CHARLTON CREEK | | 0.6 | | 2.1 | | 2.7 | 18940.4 | 10.6 | 0.06 |
| 170703010109 - CRANE PRAIRIE | 0.3 | | | 22.4 | | 22.7 | 25284.9 | 25.8 | 0.10 |
| 170703010201 - ODELL LAKE | | 8.4 | 0.8 | 1.5 | 13.9 | 24.6 | 23170.1 | 219.9 | 0.95 |
| 170703010202 - ODELL CREEK | 1.8 | 1.0 | | | 3.6 | 6.4 | 13830.3 | 56.1 | 0.41 |
| 170703010206 - DAVIS CREEK | | | | 4.3 | | 4.3 | 17638.7 | 50.6 | 0.29 |
| 170703010207 - WICKIUP | 0.5 | | | 8.1 | | 8.6 | 26963.6 | 11.8 | 0.04 |
| 170703010305 - PRINGLE FALLS | 4.7 | | | | | 4.7 | 16854.9 | 21.5 | 0.13 |
| 170703010306 - BATES BUTTE | 0.2 | | | | 0.5 | 0.7 | 11243.5 | 1.5 | 0.01 |
| 170703010402 - COYOTE SPRING | 0.3 | | | | | 0.3 | 15537.2 | 120.2 | 0.77 |
| 170703010403 - BENHAM FALLS | 0.2 | | | | | 0.2 | 22900.0 | 73.4 | 0.32 |
| 170703010406 - BESSIE BUTTE | | | | 0.0 | | | 47956.4 | 151.7 | 0.32 |
| 170703010407 - LAVA ISLAND FALLS | 0.1 | | | | | 0.1 | 29267.4 | 132.9 | 0.45 |
| 170703010501 - UPPER TUMALO CREEK | 2.2 | 0.1 | | | 0.6 | 2.9 | 20744.1 | 5.7 | 0.03 |
| 170703010502 - LOWER TUMALO | 0.1 | | | | | 0.1 | 16967.5 | 3.6 | 0.02 |

| Subwatershed Number and Name | Acres Within 100 ft of Class 1 Streams | Acres Within 100 ft of Class 2 Streams | Acres Within 100 ft of Class 3 Streams | Acres Within 100 ft Lakes | Acres 300 ft Around Road xings | Total Weed Site Acres in Aquatic Influence Zone | Total Acres of Subwatershed | Total Weed Acres in the Subwatershed | % of Subwatershed in Weed Acres |
|---|---|---|---|---|---|---|---|---|---|
| CREEK | | | | | | | | | |
| 170703010802 - UPPER SQUAW CREEK | | | 4.7 | | 0.7 | 5.5 | 18290.5 | 44.2 | 0.24 |
| 170703010803 - UPPER TROUT CREEK | | 10.3 | | | 1.0 | 11.3 | 12105.0 | 44.8 | 0.37 |
| 170703010807 - LOWER INDIAN FORD | | 4.6 | | | 3.6 | 8.3 | 23659.9 | 276.1 | 1.17 |
| 170703010809 - LOWER SQUAW CREEK | 55.9 | | | | 4.1 | 60.0 | 20237.0 | 654.0 | 3.23 |
| 170703010903 - UPPER LAKE CREEK | | 3.0 | 2.3 | 1.1 | 2.5 | 8.8 | 11136.1 | 270.5 | 2.43 |
| 170703010904 - LOWER LAKE CREEK | | 1.3 | | 2.5 | 1.8 | 5.6 | 10965.4 | 244.2 | 2.23 |
| 170703010905 - HEADWATERS METOLIUS RIVER | 116.9 | 3.2 | 1.5 | | 2.8 | 124.4 | 15501.3 | 435.4 | 2.81 |
| 170703010906 - FIRST CREEK | 4.7 | | | | 0.8 | 5.5 | 13177.3 | 122.1 | 0.93 |
| 170703010908 - CANYON CREEK | 3.8 | 1.7 | 0.1 | | 3.8 | 9.4 | 21068.4 | 272.3 | 1.29 |
| 170703010910 - CANDLE CREEK | 3.3 | | | | | 3.3 | 10956.7 | 62.9 | 0.57 |
| 170703011002 - UPPER METOLIUS RIVER | 10.8 | | 1.0 | | | 11.8 | 31553.5 | 184.0 | 0.58 |
| 170703011003 - MIDDLE METOLIUS RIVER | 3.6 | | 2.8 | | 4.0 | 10.4 | 21208.1 | 279.8 | 1.32 |
| 170703011005 - LOWER FLY CREEK | 6.0 | 10.3 | | | 0.5 | 16.8 | 16226.5 | 129.5 | 0.80 |
| 170703011007 - LOWER METOLIUS RIVER | | 2.8 | | 0.0 | | 2.8 | 24301.0 | 185.7 | 0.76 |
| 170703011102 - CARCASS CANYON | | | | 0.5 | | 0.5 | 16128.0 | 677.4 | 4.20 |
| 170703020202 - LOWER BIG MARSH CREEK | 0.4 | | | | | 0.4 | 19535.8 | 2.7 | 0.01 |
| 170703020204 - CRESCENT LAKE | 2.2 | | | 44.7 | 0.9 | 47.8 | 17589.5 | 176.4 | 1.00 |
| 170703020205 - COLD CREEK | 3.9 | 6.3 | | | 9.8 | 20.1 | 13435.5 | 133.3 | 0.99 |
| 170703020206 - MIDDLE | 2.0 | | | | 2.3 | 4.3 | 18051.4 | 120.3 | 0.67 |

| Subwatershed Number and Name | Acres Within 100 ft of Class 1 Streams | Acres Within 100 ft of Class 2 Streams | Acres Within 100 ft of Class 3 Streams | Acres Within 100 ft Lakes | Acres 300 ft Around Road xings | Total Weed Site Acres in Aquatic Influence Zone | Total Acres of Subwatershed | Total Weed Acres in the Subwatershed | % of Subwatershed in Weed Acres |
|---|---|---|---|---|---|---|---|---|---|
| CRESCENT CREEK | | | | | | | | | |
| 170703020702 - UPPER PAULINA CREEK | | | | 5.2 | | 5.2 | 13290.2 | 5.6 | 0.04 |
| 170703020703 - LOWER PAULINA CREEK | 1.3 | | | | 0.6 | 1.9 | 19554.1 | 11.9 | 0.06 |
| 170703030802 - POWELL CREEK | | 2.0 | 0.7 | | 2.7 | 5.4 | 20096.6 | 11.2 | 0.06 |
| 170703030803 - SUGAR CREEK | 2.0 | | | | 0.5 | 2.5 | 10351.6 | 5.0 | 0.05 |
| 170703030901 - UPPER PAULINA CREEK | | 14.2 | 113.1 | 6.5 | 12.7 | 146.6 | 18083.0 | 616.0 | 3.41 |
| 170703030902 - DRY PAULINA CREEK | | 8.2 | 9.7 | 1.5 | 2.0 | 21.3 | 15860.2 | 222.2 | 1.40 |
| 170703031002 - WOLF CREEK | 0.6 | 4.1 | | | 0.2 | 4.9 | 21525.3 | 22.6 | 0.10 |
| 170703040103 - MAURY CREEK | | 0.2 | | | | 0.2 | 19195.8 | 2.3 | 0.01 |
| 170703040201 - INDIAN CREEK | | 0.3 | | | | 0.3 | 12414.2 | 1.6 | 0.01 |
| 170703040303 - HOWARD CREEK | | 0.2 | | | | 0.2 | 11706.2 | 0.6 | 0.01 |
| 170703040304 - JOHNSON CREEK | | 0.5 | | | 0.1 | 0.5 | 18399.1 | 0.6 | 0.00 |
| 170703040306 - PETERSON CREEK | | | | 0.4 | | 0.4 | 16814.7 | 22.0 | 0.13 |
| 170703040401 - JACKSON CREEK | | 0.1 | | | | 0.1 | 24237.6 | 27.2 | 0.11 |
| 170703040402 - LITTLE SUMMITT PRAIRIE CREEK | 0.1 | | 0.1 | | | 0.2 | 16601.1 | 1.0 | 0.01 |
| 170703040403 - LOWER DEEP CREEK | 0.8 | 0.6 | 0.3 | | 0.2 | 1.8 | 14577.7 | 23.6 | 0.16 |
| 170703040501 - UPPER NORTH FORK CANYON | | 0.1 | | | | 0.1 | 19690.8 | 8.4 | 0.04 |
| 170703040601 - LOST CREEK | | 0.1 | | | | 0.1 | 20388.0 | 0.2 | 0.00 |
| 170703040602 - DRAKE CREEK | | 3.4 | | | 2.1 | 5.6 | 10346.7 | 33.5 | 0.32 |
| 170703040603 - PINE CREEK | | 0.1 | | | | 0.1 | 29909.0 | 0.4 | 0.00 |
| 170703040604 - NEWSOME | | 0.3 | | | | 0.3 | 21125.3 | 6.2 | 0.03 |

| Subwatershed Number and Name | Acres Within 100 ft of Class 1 Streams | Acres Within 100 ft of Class 2 Streams | Acres Within 100 ft of Class 3 Streams | Acres Within 100 ft Lakes | Acres 300 ft Around Road xings | Total Weed Site Acres in Aquatic Influence Zone | Total Acres of Subwatershed | Total Weed Acres in the Subwatershed | % of Subwatershed in Weed Acres |
|---|---|---|---|---|---|---|---|---|---|
| CREEK | | | | | | | | | |
| 170703040605 - UPPER HORSE HEAVEN CREEK | | | 1.4 | | 2.1 | 3.5 | 18731.2 | 43.6 | 0.23 |
| 170703040701 - HEADWATERS BEAR CREEK | | 0.5 | 0.2 | | 0.2 | 1.0 | 23377.2 | 3.2 | 0.01 |
| 170703050201 - HEADWATERS OCHOCO CREEK | 0.2 | 0.3 | 0.0 | | 0.5 | 0.9 | 16124.6 | 8.0 | 0.05 |
| 170703050203 - UPPER MARKS CREEK | 0.3 | 0.1 | | | 0.1 | 0.4 | 20560.6 | 6.3 | 0.03 |
| 170703050204 - LOWER MARKS CREEK | 0.6 | 0.1 | | | 0.1 | 0.8 | 18236.2 | 6.5 | 0.04 |
| 170703050205 - DUNCAN CREEK | | | 0.1 | | 0.9 | 1.0 | 22510.0 | 9.1 | 0.04 |
| 170703050301 - UPPER MILL CREEK | 0.4 | 0.3 | 0.1 | | 0.1 | 0.9 | 21460.0 | 1.2 | 0.01 |
| 170703050302 - LOWER MILL CREEK | 0.1 | | 0.0 | | 0.2 | 0.3 | 24540.2 | 1.5 | 0.01 |
| 170703050501 - UPPER MCKAY CREEK | 1.0 | 4.1 | 0.3 | | 0.7 | 6.1 | 20471.6 | 16.8 | 0.08 |
| 170703050502 - ALLEN CREEK | | 0.1 | | | 0.2 | 0.3 | 18251.5 | 0.5 | 0.00 |
| 170703051005 - MCALLISTER SLOUGH | | | 22.1 | | 8.1 | 30.2 | 34276.0 | 734.6 | 2.14 |
| 170703060201 - UPPER WILLOW CREEK | | 0.6 | | | 0.4 | 0.9 | 30758.3 | 49.6 | 0.16 |
| 170703060202 - RIMROCK SPRING | | 0.8 | 33.0 | 2.4 | 7.5 | 43.7 | 11085.2 | 1374.5 | 12.40 |
| 170703060203 - MIDDLE WILLOW CREEK | | | 25.3 | | 11.8 | 37.1 | 20726.4 | 181.6 | 0.88 |
| 170703060204 - DRY CANYON | | 7.5 | | 5.0 | 4.6 | 17.0 | 34023.1 | 146.4 | 0.43 |
| 170703070101 - OPAL CREEK | | 0.1 | | | | 0.1 | 11425.6 | 0.3 | 0.00 |
| 170703070102 - FOLEY CREEK | | 0.1 | | | | 0.1 | 22008.7 | 0.6 | 0.00 |
| 170703070103 - HEADWATERS TROUT CREEK | 0.2 | | 0.1 | | 0.4 | 0.7 | 16662.2 | 4.6 | 0.03 |
| Total Weed Site Acres in Aquatic Zone | 244.5 | 109.2 | 231.8 | 123.4 | 130.2 | 839.1 | 1731178.7 | 9145.6 | 0.53 |

# APPENDIX I

## Response to Comments

# Appendix I: Response to Comments

The objective of this section is to display all of the public comments received by the Forest Service regarding the Draft EIS and to provide responses to them. The substantive comments were used to update, improve, clarify, and finalize the analysis in the Final EIS, and to help the responsible officials select an alternative.

## Comment Period

Notification of the availability of the Draft EIS was published in the Federal Register on February 2, 2007, initiating the formal 45-day comment period, which ended March 19, 2007. Approximately 65 hardcopies of the document, 50 CD-ROMs, and 35 notification letters were mailed to individuals, organizations, government agencies, and interested Tribes (see FEIS Section 4.3). The document was also made available on a Forest Service web site (http://www.fs.fed.us/r6/invasiveplant-eis/site-specific), and *The Bulletin* published an article and notice on February 3, 2007.

## Responding to Comments

During the public comment period, 17 responses were received (see Table I-1). Consistent with the National Environmental Policy Act, 40 CFR 1503.4(b), this volume addresses substantive comments on the DEIS. Substantive comments include those which challenge the information in the DEIS as being inadequate or inaccurate, or which offer specific information that may have a bearing on the decision. Non-substantive comments are those that express opinions or position statements without any accompanying factual basis or rationale to support the opinion. All comments and response are part of the administrative record for this EIS, and have been considered during the decision-making process.

Consistent with NEPA, 40 CFR 1503.4a, possible responses to substantive comments include:

1. Modify alternatives including the proposed action.
2. Develop and evaluate alternatives not previously given serious consideration by the agency.
3. Supplement, improve, or modify its analyses.
4. Make factual corrections.
5. Explain why the comments do not warrant further agency response, citing the sources, authorities, or reasons which support the agency's position, and, if appropriate, indicate those circumstances which would trigger agency reappraisal or further response.

**Table I-1. List of Respondents to the DEIS**

| Letter | Author, Title | Organization/Agency |
|---|---|---|
| 1 | Todd Pfeiffer, Klamath Co. Vegetation Manager | Klamath County Weed Control |
| 2 | Ed Sink | |
| 3 | Barbara K. McAusland | |
| 4 | Brenda Pace | |
| 5 | Lydia Garvey | |
| 6 | Pete Schay | Friends of the Metolius |
| 7 | Laurie Solomon | |
| 8 | Paul Stell | Deschutes County Weed Advisory Board |

| | | |
|---|---|---|
| 9 | Berta Youtie, Restoration Ecologist | Eastern Oregon Stewardship Services Corporation |
| 10 | Debra Bunch | Crooked River Weed Management Area |
| 11 | Doug Heiken | Oregon Wild |
| 12 | Scott Hartung, President | Sunriver Owners Association |
| 13 | Richard Breese, Chairman | Crook County Soil & Water Conservation District |
| 14 | Gary Young, Owner | Blue Mountain Ranch |
| 15 | Elaine Somers | Environmental Protection Agency, Region 10 |
| 16 | Lisa Hanson, Deputy Director, ODA | Oregon Department of Agriculture<br>Oregon Department of Forestry<br>Oregon Department of Environmental Quality |
| 17 | Karen Coulter | League of Wilderness Defenders, Blue Mountains Biodiversity Project |

## Comments and Responses

The comments have been arranged by topic. The number in parantheses following each comment indicates the source of the comment (e.g. 1.2 is comment letter 1, second statement).

### Species / Treatment Areas / Early Detection/Rapid Response

> *"The Klamath County Weed Control does contract work for other agencies within the Deschutes National Forest boundary and the inability to use herbicides greatly hampers our efforts. Some of our areas of concern that we would like listed as weed sites are County and Public Road Rights-of Way, Power Line Rights-of-Way, and Gas Line Rights-of-Way." (1.2)*

**Response: The current EIS considers treatment of inventoried invasive plant sites. Many inventoried sites along roads and within rights of way are included in this project. If sites of concern are not included, additional sites and species can be treated using the early detection/rapid response strategy.**

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> *"I applaud the EIS programmatic approach enabling an early response system to new or newly discovered infestations. I'm going to buy a GPS to be able to better alert Forest Service personnel about the location of invasive plants." (4.4)*

**Response: The Forest Service welcomes information on invasive plants on National Forest System land.**

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*"The infestation of yellowflag iris located in the Metolius Basin should be included on the priority species list for both the Sisters Ranger District and the Crooked River National Grasslands (CRNG)." (8.14, 9.14)*

*"Listing the species as a target will increase the potential for successful control. There is a high probability that left unchecked in the Metolius River system, impacts to the listed bull trout, and potentially any reintroduced salmonid species, could be significant." (8.16, 9.16))*

*"Yellow Flag Iris (Iris pseudacorus) should be a priority species identified in this document. The tri-county Yellow Flag Iris working group is implementing control efforts along the Deschutes, Crooked, and Metolius Rivers. The infestation on the Metolius River is located on federal and private land. The Crooked River National Grassland has sites of this weed on irrigation canals. The population does not extend past Lake Billy Chinook and control efforts are having positive results." (10.8)*

*"Yellow Flag Iris (Iris pseudacorus) should be a priority species identified in this document. The Forest Service should work closely with the tri-county Yellow Flag Iris working group in implementing control efforts." (13.6)*

**Response: The yellow flag iris was included in the list of species that occur on the Forest (DEIS Table 9). It is known to occur within Project Area Unit 15-32 and the inventory has been updated to reflect that. If sites of concern are not included in a Project Area Unit, they can be treated using the EDRR.**

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*"I am the permittee on the Roba Allotment, Ochoco National Forest. During the past decade, the invasive weed houndstongue has shown a rapid expansion of infested area and seriously affected the management of this allotment." (14.1)*

*"While the Forest Service has mapped the increasing [houndstongue] infestation and had summer crews hand-pulling or digging individual plants, it has had little or no effect at reducing the rate of expansion." (14.2)*

*"Chemical treatment is needed to deal with this growing threat to the health of the land and the economic opportunities for my use of the National Forest." (14.3)*

**Response: There are numerous Project Area Units within the Roba Allotment (e.g. 72-03, 72-14, 72-15, 72-17, 72-18, 72-19, 72-20, 71-25, and more). As the comment notes, manual treatment in this area has been unsuccessful (DEIS p. 94); Alternative 2 proposes to use a more effective herbicide to treat houndstongue than we have been able to use in the past, which is believed to be the most effective option for sites that are too large or too dense for manual treatment (DEIS p. 98; Appendix B-6).**

**EDRR would be available to quickly treat new sites that fall within the scope of the analysis included in the EIS.**

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> *"ODA is pleased to see an early detection rapid response approach has been included in the DEIS and strongly supports this approach for invasive species management. Our experience has shown for effective protection of natural resources and the maximum benefit of noxious weed control is achieved through early detection and treatment for new invaders. An early detection rapid response approach can provide a 33:1 benefit to cost ratio for the control of new invading weeds." (16a.3)*

**Response: This information has been added to the economics section of the FEIS.**

## Range of Alternatives

> *"I feel that this DEIS presents an insufficient range of alternatives, failing to use alternatives to toxic chemical herbicides, especially within riparian reserves and riparian habitat conservation areas, as well as the most obvious, municipal watersheds." (7.1)*

> *"There are many alternatives that have been offered, during the public comment period, but not recognized in this DEIS as being valid alternatives. Such alternatives include increasing the focus on education and prevention of invasive plant introduction and dispersal, and prohibiting the use of exotic biocontrols." (7.2)*

> *"The Forest Service presents an insufficient range of alternatives (DEIS pp. 55-58) failing to analyze and consider, despite public comments in favor of these: using methods other than herbicides; restricted herbicide use across the planning area through using herbicides as a tool or last resort or using herbicides only on highest priority sites that are considered suitable for herbicide use; not using herbicides within riparian reserves or riparian habitat conservation areas; not using herbicides in municipal watersheds (re: drinking water poisoning); prohibiting the use of exotic biocontrols; maximizing worker jobs through hand-pulling and manual management; focusing more on education and prevention of invasive plant introduction and dispersal (more prevention is especially needed for livestock and off road vehicle dispersal as well as for traffic on roads and highways)." (17.1)*

> *"We advocate for no herbicide use in riparian zones; among TES-listed plant species; within critical habitat for TES-listed wildlife species; within municipal watersheds or high recreational use area; within known areas of cultural, commercial or recreational food and plant medicine collection; within Sage grouse habitat and critical Neotropical songbird habitat; within Survey and Manage species habitat and critical habitat for rare or declining Management Indicator Species; within 300 feet of all water sources (including wells, springs,*

*livestock tanks, etc.) and within banks of intermittent streams and ephemeral draws." (17.31)*

**Response: Issues raised by the public during project development have been addressed and primarily resolved through the PDFs. Alternative 3 was developed to provide an even more cautious approach to invasive plant treatment within the riparian areas (DEIS p.19). The DEIS considered the other alternatives listed in the comment (see DEIS pp 55-58); however, they were not fully developed because they would not resolve issues any better than the other action alternatives, are not necessary to meet environmental standards, would substantially reduce the effectiveness of the project, and therefore do not meet the purpose and need. The reasons they were not analyzed in detail are discussed further in Chapter 2.**

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*"The two action alternatives are so similar as not to offer much choice and both rely on exceptionally heavy use of herbicides (see Table 18, p. 59)." (17.2)*

*"Your 2 alternatives are so similar & inappropriately destructive – there is no choice at all." (5.1)*

**Response: Herbicide use in both alternatives is designed to minimize or eliminate adverse effects. Neither involves exceptionally heavy use.**

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*"Alternative 3 is only marginally better than alternative 2 because it would not: allow herbicide use within 10 feet of water bodies; allow triclopyr, picloram, and sethoxydim within 300 feet of perennial water bodies; allow herbicide use in intermittent channels when dry. Yet the Forest Service, while acknowledging these water contamination hazards, still chooses alternative 2 as its preferred alternative!" (17.5)*

**Response: The DEIS describes the differences between alternatives and trade offs between risk and cost-effectiveness. The DEIS acknowledges that Alternative 2 is more likely than Alternative 3 to result in delivery of herbicide to streams. Because Alternative 3 was designed to address the issue of treatment effects to water quality and fisheries, the difference in treatment options reveals a great difference in the expected effectiveness at those sites (see section 3.3).**

## Alternative Preference – No Response Required

*"I am in support of Alternative 2." (1.1)*

*"Having visited the web site and reading through the information I concur with the FS recommendation of following action proposal #2. This appears to be the most cost effective of the proposals to deal with the weed menace." (2.1)*

*"Having reviewed the DEIS the Friends of the Metolius support the preferred alternative (alternative 2). This alternative allows for the control*

*of noxious weeds within riparian and aquatic habitats which are critical to the natural functioning of ecosystems on the watershed scale." (6.1)*

*"We need to get the upper hand on noxious weeds and alternative 2 takes us in the right direction." (6.3)*

*"We also think that the alternative does a good job of establishing sideboards on herbicide use to avoid accidental applications that may have adverse effects on fish, wildlife, or water quality. We support the proposed action, Alternative 2." (9.6)*

*"The Sunriver Owners Association (SROA) supports Alternative 3 as described within the Invasive Plant Treatments, Draft Environmental Impact Statement (EIS), Deschutes and Ochoco National Forests, Crooked River Grassland, January 2007. The SROA Environmental Committee and the Environmental Services Department have reviewed the EIS in detail and believe this alternative addresses community concerns regarding invasive plants." (12.1)*

*"Alternative 3 allows for timely response to newly identified infested areas within the Deschutes National Forest, located adjacent to Sunriver. This alternative also allows active management of the native ecosystem, utilizes treatment methods that reduce impact on riparian areas, and meets state water quality standards." (12.3)*

*"Although the FS believes that activities under the Preferred Alternative (Alternative 2) would be more effective in reducing invasive plants on the Forests, this Alternative has more potential to impact water quality than would Alternative 3. Since waterbody buffers under Alternative 3 would range from 150-300 ft., we believe that Alternative 3 offers more protection to aquatic resources, meets the proposed project's purpose and need, and responds to public concerns about water quality and fish more so than the Preferred Alternative (Alternative 2). We therefore recommend that the FS consider selection of Alternative 3 or a combination of Alternatives 2 and 3 as the Preferred Alternative for implementation." (15.7)*

*"ODA strongly supports the proposed action, Alternative Number 2 that is less restrictive of the uses of herbicide and is more effective at controlling and reducing invasive weed infestations while promoting and restoring healthy native communities and their natural functions. In order to implement effective weed control projects and to make best use of limited funding and resources it is critical to have a full complement of integrated management options available." (16a.2)*

*"The Oregon Department of Forestry (ODF) strongly supports efforts to prevent and control infestations of invasive weeds. The department agrees with ODA's comments on the DEIS, including support for Alternative Number 2. The alternative helps further the following strategy and action described in the 2003 Forestry Program for Oregon (FPFO), which documents the Oregon Board of Forestry's strategic plan for Oregon's forests:*

- *Strategy F: Protect, maintain, and enhance the health of Oregon's forest ecosystems, watersheds, and air sheds within a context of natural disturbance and active management.*
- *Action F.3. (one of the actions to accomplish Strategy F): The board will encourage state and federal agencies to closely monitor and aggressively act to prevent and mitigate the adverse effects of air pollution and invasive, non-native species on Oregon's forests." (16b.1)*

**Response: Alternative 2 was identified as the Forest Service's preferred alternative. A final decision will be based on how each alternative meets the purpose and need and the manner in which the alternative responds to the issues and public responses received.**

## Treatment Methods / Project Design Features

> *"At many places where trampling along the riverbank occurs [Deschutes], spotted knapweed doesn't bolt but stays flat and acts as a mat covering the soil. Without a stalk, it can't usually be pulled. It can be dug causing great disturbance to the soil or the flowers can be removed in the hope that we can outlast the lifespan of the plant. Where there is a significant density of plants, manual pulling disturbs the soil a great deal. These locations are often soon filled with cheatgrass or storksbill. For both of these instances, a suitable spray for very specific application would be a great benefit." (4.1)*

**Response: The Forests recognize the difficulty of treating plants in these types of situations (see DEIS p. 94). Areas such as this that have been manually treated for several years with no progress are proposed for chemical control with the herbicides now approved for use on the Forests (see for example Appendix A, Project Area 11-71).**

**The density of plants is one factor used in determining whether manual pulling would be an effective treatment. Monitoring during and after treatment will determine if active restoration is required to keep the area from being reinvaded. Clopyralid, a very selective herbicide, is the preferred herbicide for spotted knapweed populations.**

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> *"ODOT does not appear to spray outside their highway easement. Often, clearly visible plants that are in the forest along highways such as Century Drive are not sprayed. Therefore, control within the highway easement is not always resulting in control of the species." (4.6)*

**Response: Project Area Unit 11-07 is located along Century Drive. Treatment and post-treatment monitoring will be employed to determine if site objectives are being met. If additional areas of concern occur outside these PAUs, they can be treated under the early detection/rapid response strategy.**

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*"While FoM generally does not favor the use of herbicides for management of vegetation, we recognize that without judicial application of effective and safe chemicals, control and/or eradication of such highly invasive species, such as ribbongrass in the Metolius River, would be impossible. In addition, knapweed species and other weeds are spreading even after years of manual pulling." (6.2)*

**Response: The choice of what treatment method to apply to a particular invasive plant site is based on several factors as described on p. 28 of the DEIS. The DEIS acknowledged the difficulties that have been encountered with manual treatment of particular species such as knapweed (p. 91).**

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*"Both action alternatives rely too heavily on heavy use of herbicides to deal with invasive plant species, which will inevitably increase herbicide resistance in some species, while decimating others." (7.3)*

**Response: Herbicides would be used according to integrated treatment practices and Project Design Features (PDFs) that limit the potential for killing beneficial organisms, developing herbicide resistance, or contamination of the environment. Herbicide resistance can develop in some plants if repeated application of a single herbicide occurs continuously; most often resistance develops in croplands (USFS 2005a). Herbicide resistance is less of a concern when there is a larger toolbox to choose from and when non-herbicide methods are used in combination.**

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*"Both action alternatives, 2 & 3, would raise herbicide use from 2% of inventoried invasive plant sites to 95% of inventoried sites, in the first year of control. Apparently only 5% of sites would be approached with non-chemical management in the first year although many if not most invasive species can be controlled with hand-pulling and other non-chemical methods – especially with small new infestations." (7.4, 17.3))*

**Response: As the DEIS explained, manual control is mostly effective on small populations of annuals or biennials. The current use of herbicides is limited to those invasive plant sites that were proposed and analyzed for herbicide use in 1998. Since 1998, the inventory of new invasive plant sites has grown, as has the size of some invasive plant populations that have not been effectively controlled by hand pulling. The preferred method for control is based on many factors (DEIS p. 28 and Appendix B). If field review indicates a site can be controlled with hand-pulling, it will be (DEIS p. 29).**

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*"The treatment(s) chosen for any specific weed population should have the highest probability of success. Success should be defined by achievement of measurable objectives, not by acres treated in a given year or what type of treatment is implemented. Weed treatment plans often focus too heavily on acres treated and not on whether or not those acres were restored to a better condition." (9.8)*

*"The DEIS has in many places put restrictions on specific chemical applications, beyond those specified in the EPA-approved label. Some of these restrictions seem unwarranted and may lead to undesirable outcomes." (8.11, 9.11)*

*"Before any pesticide is allowed to be sold in the United States it undergoes stringent testing by the EPA. This testing is designed to assess the impacts to the environment, which then are translated to allowable application rates, methods, buffers, and target species. By restricting the label further there is a risk of increasing the impacts to the environment. For example, treating an infestation with less than label recommended rate may result in poor control which then necessitates additional application(s). This can translate into more chemicals on the ground, which is what restricting the label was trying to avoid in the first place." (8.12, 9.12)*

*"I am concerned that the Forest Service is limiting pesticide use more than would be required by the EPA approved label instructions. It is evident in reviewing the environmental effects that these limited treatments will be less effective and more costly with little or no gain in environmental protection." (14.5)*

*"Also by imposing further restrictions there is a potential to create confusion at the applicator level. Potentially there are two "labels" that need to be followed, the herbicide label and the EIS restrictions. The herbicide label is on the container and available in the field if questions arise, the EIS restrictions may or may not be available in the field. The label is the law, make your job easy by having only one label to follow." (8.13, 9.13)*

**Response: The PDFs are intended to show specifically how the Forest Service will implement label advisories, comply with standards and guidelines, and protect sensitive resources. For example, a label may say "do not contaminate water when cleaning equipment"; then our PDFs show *how* we are avoiding contamination of water. This specificity is necessary for conducting effects analysis as required by NEPA.**

**Use of herbicides will follow label instructions (DEIS p. 41). Although some application rates would be limited, the rate would not be below the rate that is necessary for effective control as advised on the label.**

**One purpose of implementation planning (see Appendix F) is to avoid confusion and ensure all appropriate measures are taken when it comes time to treat a site. Annual implementation planning will involve coordination with the applicators and completing form FS2100-2 (required by FSM 2150), as outlined in Appendix F.**

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*"Care must be taken when using any mechanical approach as this usually has a disturbance associated with the technique, which can sometimes create the unnecessary microhabitats necessary for invasive species establishment." (8.18, 9.18)*

**Response: Mechanical treatment in this project is primarily limited to weed whacking, see Appendix A, p. 44. The need for active restoration or revegetation will be re-assessed during post-treatment monitoring at sites.**

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*"The Forest Service is overly reliant on chemical treatments and overly dismissive of non-chemical methods. More than 90% of the treated area (13,000+ of 14,000+ acres) will involve chemical treatments. The Forest Service should have considered non-chemical alternatives (and strictly limited chemical alternatives) even if such methods were thought to be less effective because 1) the Forest Service needs to conduct the NEPA analysis before they conclude that the non-chemical treatments are not effective, (2) the Forest Service needs to compare and disclose the effects of the chemical and no-chemical methods so they are fully informed of the trade-offs, and (3) non-chemical treatments and no-action are not the same thing." (11.12)*

**Response: The Forest Service considered a no-herbicide alternative as well as several alternatives that would in some way restrict the use of herbicides. Except for Alternative 3, these alternatives were dropped from further analysis because they did not meet the purpose and need for this project (see Section 2.5).**

**Appendix B, Treatment Options is based on current information such as Common Control Measures for Pacific Northwest Invasive Plants (Mazzu 2005), as well as information from area weed specialists. These studies and monitoring data helped formulate the treatments proposed in this project. They also inform the analysis of effectiveness of the treatments as the alternatives are analyzed in section 3.3 of this NEPA document.**

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*"We promote IPM strategy because it is a prudent approach to understanding and dealing with environmental concerns that may result from invasive plant treatments. The IPM approach does not blindly embrace new technology nor does it reject technology. Instead, the strategy promotes a thoughtful awareness of the pest management inherent in natural systems through an understanding of pest life cycles, and through the use of beneficial organisms, cultural modifications, physical barriers and other mechanical controls. IPM does not rule out judicious use of herbicides."* (15.2)

*"The State of Oregon supports an integrated weed management approach and believes in utilizing all tools available including chemical, mechanical, and biological control methods as well as prescribed fire for control projects." (16.3)*

*"The Board has also noted in its administrative rules that pesticide use is a key element in an integrated pest management program, to be used in an environmentally and economically sound manner to meet site-specific objectives." (16b.2)*

**Response: Thank you for your comments.**

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*"DEQ believes that use of non-chemical control, such as biological and cultural control should be considered first for treating widely spread invasive species infestations and within riparian areas." (16c.17)*

**Response: The preferred method for control is based on many factors (DEIS p. 28 and Appendix B). Manual treatment is used first on small populations of species effectively pulled. Biological control can be used in situations where the size of an invasive plant population needs to be reduced before other methods can be utilized (DEIS p. 90), but it is not appropriate for all species. The cultural control method of covering invasive plants with black plastic has been considered for use, but can be problematic because it will kill all of the underlying vegetation, can sterilize the soil, and is unsightly in areas where the scenery is important.**

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> *"The ecological values at risk, particular biology of invasive plants, proximity of infestations to water and sensitive species, size of infestation and control objective considerations should weigh against the desirability of applying toxic chemicals on 95% of inventoried sites the first year—especially with many of those sites being subject to repeated herbicide applications for up to the next five years or more, which is admitted in various sections of the DEIS."* (17.9)

**Response: The preferred method for control is based on many factors such as those listed in the comment (DEIS p. 28 and Appendix B). The budget and personnel would not be available to complete treatments on 95% of the invasive plant sites, so they would not all be treated in the same year. Sites that remain small enough to control manually will be initially treated by hand.**

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> *"Application of toxic chemicals in the majority of inventoried sites initially or perpetually does not follow integrated weed management principles of effectiveness with minimum adverse impacts to non-target organisms, species and site specific determination of control method/plan, and integration with a combination of treatment methods*." (17.11)

**Response: The project would follow IWM principles. Integrated weed management strives to achieve optimum management goals and objectives in coordination with other resource management activities. This project applies that approach and our PDFs insure compliance with the standard that requires us to minimize or eliminate adverse effects to non-target species.**

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> *"Herbicides are the control method that most threatens the values stated in Goal 4 of Regional direction: '—protect sensitive ecosystem components, and maintain biological diversity and function within ecosystems' as well as 'minimizing adverse effects from treatment project.' DEIS p. 15." (17.12)*

**Response: All alternatives comply with the standards in the R6 FEIS. Sensitive ecosystem components and biological diversity would be protected (see sections 3.4, 3.7, 3.9).**

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> *"Immediately sharply increasing herbicide use as planned is contrary to the Region 6 Objective 3.2: "Reduce reliance on herbicide use over time in Region Six" DEIS p. 15 –especially as this DEIS follows the 2005*

*Region 6 EIS in time and the current status quo on these forests and grassland for herbicide use is far less than proposed."* (17.13)

**Response: Pages 88 to 89 of the DEIS described the invasive plant treatment projects approved in 1998 (more than 1,000 acres across the two National Forests). The current proposed action is based on the current inventory, which has grown substantially since 1998. Newer and relatively safe chemical options have become available. The Forest Service expects herbicide use to decline over time given effective treatments proposed in this EIS. Herbicide use at treated sites has declined because of successful control (DEIS p. 93-94). For instance, spraying has been reduced from broadcast to spot application on Hwy 26 as a result of effective treatment. Treatments will be followed by either active or passive restoration, and the restoration would be monitored over time. The restoration is aimed at establishing native plant communities, which would reduce and eliminate the need to use herbicides over time.**

**Treatment of invasive source populations and implementing the planned rapid response plan would also serve to reduce long-term herbicide use.**

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*"Economic efficiency as a purpose and need objective biases the Forest Service decision toward herbicide use because the Forest Service has not been very creative in recruiting volunteers and adjacent residents to implement manual control of invasive plants, making herbicides appear to be a cheap and easy fix if long term costs to the environment and human health are externalized and ignored, as is the case with this DEIS." (17.15)*

**Response: Economic analysis in the R6 FEIS showed that non-herbicide methods can be more costly than herbicide applications. The Common Control Measures (appendix B) shows that combinations of herbicide and non-herbicide treatments are often most effective. This project is not predicted to result in impacts to human health. Impacts to the environment are described; no monetary costs are associated with impacts to people or the environment as a result of this project. Also, more discussion on the use of volunteers has been added to various sections of the FEIS.**

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*"Escalating from an average of 275 acres controlled annually with herbicide under existing NEPA documents to proposed herbicide use on up to 13,814 acres of herbicide use in the first year is an extreme increase in herbicide use, rendering years of subsequent herbicide use as high increases, rather than reductions, in herbicide use over current levels." (17.17)*

**Response: Pages 88 to 89 of the DEIS described the invasive plant treatment projects approved in 1998 (more than 1,000 acres across the two National Forests). The current proposed action is based on the current inventory, which has grown substantially since 1998. Newer herbicide options, which pose a relatively low risk to people and non-target organisms, have become available. The Forest Service expects herbicide use to decline over time given effective treatments proposed in this**

**EIS. Herbicide use at treated sites has declined because of successful control (DEIS p. 93-94). For instance, spraying has been reduced from broadcast to spot application on Hwy 26 as a result of effective treatment. Treatment of invasive source populations and implementing the planned rapid response plan would also serve to reduce long-term herbicide use.**

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> *"13,814 acres of potential herbicide use as compared to only 732 ½ acres for proposed non-chemical methods without herbicide use reveals an extreme bias toward the use of toxic chemicals." (17.18)*
>
> *"There is also heavy reliance on herbicides in riparian areas proposed despite public concern expressed over this: 3,004 acres of herbicide use in riparian areas as compared to 98 ½ acres not using herbicides in riparian areas (table 6, p. 29)." (17.19)*

**Response: The DEIS explains how herbicides would be used in combination with non-herbicide methods to increase treatment effectiveness (Table 10, Appendix B). The analysis assumes that herbicides would be used as part of the initial prescription for most sites. This provides a threshold for effects analysis. Not all sites proposed for herbicide use would be treated at once, nor would all necessarily include herbicides. However, herbicides are appropriate for most riparian, as well as upland sites. For instance, streamside, rhizomatous species such as reed canarygrass and ribbongrass would not be effectively controlled by hand pulling alone.**

**PDFs and buffers would be applied in riparian areas to minimize or eliminate risk of adverse effects to water quality and/or aquatic organisms.**

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> *"High risk of human, pet and horse, mule or llama exposure along trails should mandate manual or mechanical controls there rather than herbicide use." (17.22)*

**Response: Exposure of people, pets and livestock to herbicides would be managed through public notification, signing and/or temporary closures. The herbicides proposed for use according to PDFs would not likely harm people, or their pets or livestock. For more information, see (DEIS pp. 277-281, 361-362).**

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> *"It's outrageous that the bare minimum riparian protections specified in alternative 3 are not automatically adopted in the preferred/proposed alt. 2." (17.23)*

**Response: The DEIS compares the risks and costs of two action alternatives, both of which minimize the risk of adverse effects to water quality and the aquatic environment. The additional measures specified for Alternative 3 exceed minimum requirements as described on pp. 78-80 of the DEIS. The Record of Decision will consider the additional protections afforded by Alternative 3 in relation to its cost-effectiveness and rationale for the final selection of alternative.**

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*"It would not be difficult to find enough volunteers to handle the 260 acre difference by hand and we volunteer to help in that effort." (17.24)*

**Response: The options for control of an invasive plant population are determined by factors such as the site conditions, invasive plant biology, and size and density of the infestation (DEIS p. 28, 33; Appendix B). The analysis discloses that in some situations, larger groups of people pulling and digging in riparian vegetation could cause sedimentation (DEIS pp. 57, 194, 250). In particular, ribbongrass along the Metolius River is rhizomatous and difficult to remove by pulling or digging. Closer to the water where it roots in the gravels it pulls out easier – but people near and along the shoreline can impact juvenile bull trout and redband trout – which constitutes a negative effect that would be amplified with large groups of people working on the streambanks.**

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*"Volunteer labor to cut costs could come from AmeriCorps, environmental groups (we have been offering to help but have been ignored), recreation groups, Native Plant Society members, civic groups, highway trash collection volunteers and many others." (17.16)*

**Response: The FEIS has been amended to include the finding that volunteer labor could offset a portion of implementation costs. The common control measures demonstrate that some non-herbicide methods may be effective and favored if volunteer labor is available.**

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*"Some targeted invasive plants such as St. Johnswort and Blessed milkthistle, have commercial value to herbalists and could be hand-removed by them without herbicide use. We offer to help with this re: St. Johnswort on the Deschutes and were ignored." (17.27)*

**Response: The action alternatives allow manual methods where they would be cost-effective. Herbalists have informed the Forest that they are not interested in the species that grow near the highways because they are not pristine (Pajutee 2007). Again, the options for control of an invasive plant population are determined by factors such as the site conditions, invasive plant biology, and size and density of the infestation (DEIS p. 28, 33; Appendix B).**

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*"There is no substantiation for numerous statements in the DEIS that herbicide use is necessary or the only effective means of control." (17.37)*

**Response: The Common Control Measures document prepared for the R6 2005 FEIS (and refined to reflect conditions on the Deschutes and Ochoco National Forests) provides citations to substantiate our contention that herbicides are needed for effective treatments for many target species. Prescription considerations include cost, treatment effectiveness, and potential environmental impact.**

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*"Since the majority (76%) of known sites are smaller than one acre and most new infestations are small, why isn't there more emphasis on manual control? Smaller infestations are more amenable to manual control, which poses less risk to the environment and human health." (17.49)*

**Response: Manual control is an option in both action alternatives. The factors involved in determining an appropriate course of action at a particular site include the location of the invasive plants, the number and density of plants, the species and its characteristics. Experience with similar sites is also considered. See DEIS p. 28, 33-34, and Appendix B.**

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*"The Forest Service has failed to show that past failures in manual and mechanical control methods were not due to lack of adequate follow through." (17.46)*

**Response: The DEIS points out instances where invasive plant sites have been repeatedly treated with manual or mechanical means. In some cases the treatment has been successful and in other cases not (DEIS pp. 94, 97). The Common Control Measures document prepared for the R6 2005 FEIS provides citations to substantiate our contention that herbicides are needed for effective treatments of many target species. The Common Control Measures were reviewed, annotated with information for the Deschutes and Ochoco, and included in the EIS as Appendix B. Prescription considerations include cost, treatment effectiveness, and potential environmental impact. Herbicides would be used as part of an integrated weed management prescription that would also include non-herbicide methods.**

## Toxicity of Herbicides

*"NIX heavy use of herbicides! They are toxic to humans, wildlife, soil, fish & water (includes human drinking water watersheds)." (5.2)*

*"Both action alternatives (2 & 3) would use all ten herbicides approved by Region 6 even though some of these, such as picloram, triclopyr, and sethoxydim, pose higher toxicity risks to humans and wildlife and could more readily contaminate water, threatening drinking water supplies and fish." (17.4)*

**Response: Many layers of caution are built in to the project (see DEIS pp. 78-80). Our analysis relies on scientifically credible and peer reviewed risk assessments that have been prepared for the herbicides proposed for use (DEIS section 3.2). The risk assessments indicate that the formulations proposed for use would not be detrimental to people, drinking water, and/or flora and fauna. Project Design Features (PDFs) ensure the project complies with Forest Plan standards to minimize or eliminate negative adverse impacts to non-target plants, animals, and water.**

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*"Herbicide use could preclude the use of non-chemical controls later, such as hand-pulling in the same year or with persistent chemicals or prescribed burning, which in some cases releases toxic products of combustion." (17.10)*

**Response: Manual follow-up treatments are not precluded by the use of herbicides. Although the risk assessments considered hazards associated with burning, this project does not propose to burn any vegetation after it has been treated with herbicides.**

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*"This is already a compromise position on our part as we would prefer that there be no toxic chemical use at all on public lands (or poisoning of any ecosystem) but also recognize the threat to native biodiversity by invasive plants and the increase in infestations. However some of the herbicides proposed for use pose much greater threats than others and simply shouldn't be used, just as DDT was eventually banned and Region 6 is now prohibiting the use of 2,4-d and Dicamba because of toxicity concerns. These higher risk chemicals are obvious from a close reading of this DEIS and Region 6 risk assessments and include Picloram, Triclopyr, formulas with NPE surfactants, formulas with POEA surfactants and broadcast use of the sulfonylurea herbicides and imazapyr." (17.33)*

**Response: The R6 2005 Record of Decision approved the use of the list of 10 herbicides (Table 12, p. 36) because they are likely to treat all situations known in the Region and because they pose relatively low risk to people and the environment (USFS 2005b, p. 9). These herbicides are considered necessary to treat known infestations within the project area. Layers of caution, including PDFs and buffers, reduce the risks further.**

**Broadcast treatment would not occur except when necessary, according to PDFs and buffers. No broadcasting of higher risk herbicides would occur near streams, water bodies, sensitive plants, and some wildlife habitat (PDFs 29, 54, 64, 65, 66, 78, 81, 89, 92, 94, Table 15).**

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*"Sethoxydim and clopyralid also raise some concerns, the latter because of its contamination with Hexachlorobenzene, a carcinogen that bioaccumulates." (17.34)*

**Response: HCB is a ubiquitous industrial contaminant. However, exposures of HCB from the use of herbicides in this project would be far below any level of concern because the rate and extent of application is very low. Further information on HCB is in the Risk Assessments and R6 2005 FEIS. Design features specific to clopyralid are included, such as the rate at which NPE may be applied is limited and application is prohibited in certain areas (e.g. within 100 feet of water; in spotted frog habitat; in pygmy rabbit habitat).**

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*"No observable effects does not take into account hidden cancers or reproductive failure that may be developing." (17.42)*

*"Despite a considerable body of data on acute exposure effects from the proposed list of herbicides, it is important to recognize that the chronic and sublethal risks are not yet well characterized. The historical record of pesticide toxicology reveals many cases of serious and unexpected adverse effects associated with pesticides that were not predictable from standard acute toxicity tests." (16c.4)*

**Response: The no observable adverse effect level (NOAEL) is based on laboratory tests including organ/tissue examination/dissection and observation of behavioral changes or non-lethal impacts such as weight loss. The terminology is defined in Chapter 3.2. The use of the NOAEL in determining toxicity indices and the effects to wildlife is described in Chapter 3.9.2 of the FEIS. Data gaps do exist, and are disclosed in the Risk Assessment for each herbicide proposed for this project.**

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*"Existing thresholds are not fool-proof; chronic effects are largely unknown for most herbicides; and there's always the danger of drift, spills, erroneous application to listed and native plants, public ingestion of contaminated plants, etc. So not exceeding industry-determined "thresholds of concern" could still lead to acute and chronic poisonings, cancers, reproductive failures, loss of listed plant species, etc. Another analysis flaw is assuming that a "low" level of risk is protective. A low level of risk is not the same as being below a threshold of concern. How significant are the effects that could be experienced? If the effects are significant, the risk may still be of significant concern and may not be acceptable to the public or the viability of the ecosystem." (17.43)*

**Response: The Risk Assessments characterize risk of adverse effects to non-target organisms using laboratory and field studies of toxicity, exposure, and environmental fate (DEIS p. 77) and address concerns about acute and chronic exposures, risk of cancer, reproductive failures, etc. Risks from accidental spills and accidental ingestion are also included in the risk assessments. The thresholds of concern were reduced in the R6 2005 FEIS to account for risk to federally listed species, following protocol used by the EPA. Uncertainties are addressed through the Project Design Features that limit the type and method of herbicide application to eliminate exposure scenarios that would cause concern (p. 79).**

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*"Many of the harms caused by invasive plants are also caused by herbicides, plus herbicides cause other additional significant ecological and human health impacts such as toxicity, reproductive failure, cancers, contamination of water supplies, etc." (17.48)*

**Response: The adverse impacts that invasive plants can cause to the environment are discussed throughout the DEIS (see for example, p. 81, 127,157-158, 233, 325, 355, 361). These impacts are not similar to the impacts described for the cautious use of herbicides in the proposed action. This project is intended to restore ecological integrity and protect human and environmental health.**

## Effects to Soil

> *"There is insufficient analysis and many data gaps regarding effects of herbicides to soils. Picloram, sulfometuron methyl and triclopyr have the highest toxicity to soils according to the available science used, and should not be used or used only as a last resort with wick application." (17.52)*

> *"Impacts of repeated applications of herbicides to soils have not been assessed. Site-specific analysis should be included." (17.53)*

**Response: The DEIS described the factors that would be considered in prescriptions, including cost, effectiveness, and risk of adverse effects. The PDFs and buffers compensate for the inherent hazards of individual chemicals.**

**Where herbicide and soil characteristics would combine to create a hazard (such as toxicity to microbes, measurable losses to productivity, or conveyance of herbicide residues to surface or ground water resources), project design features were developed to minimize these effects (DEIS p. 161). For example, picloram is not allowed to be used on a site more than once per year. Detectable soil accumulation would not occur (p. 167).**

## Effects to Water Quality / Riparian Areas

> *"In general, we agree with the proposed invasive plant treatments to improve resource conditions in the project area. However, we are concerned about the project's potential to further degrade water quality within a number of water bodies that are already on 303(d) list due primarily to temperature exceedences and other water quality criteria." (15.3)*

> *"Water quality degradation is one of EPA's primary concerns. Section 303(d) of the Clean Water Act (CWA) requires the State of Oregon (and Tribes with approved water quality standards) to identify water bodies that do not meet water quality standards and to develop water quality restoration plans to meet established water quality criteria and associated designated uses. The draft EIS must disclose which waters may be impacted by the project, the nature of potential impacts, and specific pollutants likely to impact those waters. It should also report those water bodies potentially affected by the project that are listed on the State's and Tribe's most current EPA approved 303(d) list." (15.6)*

> *"The draft EIS identifies impaired waters in the Project area (p. 170-175) and indicates that no Total Maximum Daily Loads (TMDLs) have been finalized for 303(d) listed water bodies. We noted that the EPA-approved 2002 303(d) list referred to in the draft EIS is outdated. The most current 303(d) list approved by EPA is the 2006 list and we recommend that the final EIS include information from the most current 303(d) list, note any differences between the two 303(d) lists i.e., 2002 and 2006 lists for*

*relevant parameters and water bodies in the project area, and discuss analyses and conclusions that may be affected by the more recent information." (15.7)*

**Response: For streams on the 303(d) list, the water quality parameters that could be affected by invasive plant treatments are discussed (DEIS pp 186 – 202). The latest 303(d) list was recently made available and the FEIS has been updated to reflect the new information. Invasive plant treatments will not further degrade these water bodies.**

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*"The analyses presented in the draft EIS indicate that waters within various parts of the project area do not currently meet Oregon State water quality criteria, including temperature (70 streams/stream reaches), sediment (10 streams), turbidity (1 stream reach), Ph and Chlorophyll a (3 lakes, 1 stream), and dissolved oxygen (1 lake, 1 stream) (p. 173). Planned activities under the Preferred Alternative (Alternative 2), such as, vegetation removal, burning and scarification would more likely further degrade water quality with respect to these parameters, especially where treatments would occur within 10 ft. of 303(d) listed waters (p. 59)." (15.8)*

**Response: One should look to Table 39 of the DEIS for 303(d) listed streams that would have invasive plant sites proposed for treatment within 100 feet of the stream's edge. This information has been updated in the FEIS to reflect the latest 303(d) list.**

**Neither alternative is expected to further degrade water quality with respect to the listed parameters, because implementation will follow all required precautions and because of the use of project design features developed specifically to minimize or eliminate adverse effects.**

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*"In the Dry Paulina Creek, for example, burning and harrowing could result in increased sediment delivery until it is seeded and vegetation is re-established (p. 194). When roads and livestock management activities are added (p. 199) to invasive treatments, cumulative sediment delivery impacts could also be significant." (15.9)*

**Response: Table 15 of the DEIS shows that in the Dry Paulina Creek watershed, the scarification, burning, or fire line construction would not be allowed within 50 feet of the intermittent channels. A 50 foot buffer would also be left between the channel and an existing skid trail will help to filter potential sediment. The discussion on page 194 of the DEIS concludes that because of the small area to be treated and the low intensity of the ground disturbance, and the use of buffers near the stream, sediment would be negligible and would not result in any measurable increase in turbidity.**

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*"Further, we recommend that the FS continue to coordinate with ODEQ as water quality restoration plans, including TMDLs, are developed and implemented to meet water quality standards. The final EIS should therefore include information regarding agreements in the 2002 MOU and*

*any recent amendments thereof to assure the public that water quality conditions within 303(d) listed waters would be protected and restored as the proposed project activities are implemented." (15.11)*

*"TMDLs should be established for the Deschutes Basin before impacts are allowed. No further water quality impairment is allowed for 303(d)-listed streams under the Oregon Clean Water Act. The only way to make sure this standard is met is to not allow toxic herbicides in or near water." (17.54)*

**Response: Forest Service responsibilities under the Clean Water Act are clarified in the Water Quality section of the FEIS. The Forest Service is actively participating with ODEQ in the development of TMDLs for 303(d) listed streams on National Forest System lands. ODEQ indicates that priority for the development of TMDLs will move to the Deschutes Basin in 2008 but will take at least a year to complete (Bonnie Lamb, personal communication 2007).**

**TMDLs are developed for the 303(d) listed parameters. There are no waterbodies listed for chemicals in the project area. Both action alternatives are consistent with "Forest Chemical Management" in Appendix F of the Memorandum of Agreement between the State and the Forest Service and would meet the State of Oregon water quality standards for toxic substances.**

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*"The proposed project has the potential to impact the Confederated Tribes of Warm Springs' Indian Reservation resources. The boundary of this Indian Reservation includes portions of the Deschutes and Metolius Rivers, Lake Billy Chinook, and Lake Simtustus. The southern part of the Reservation is adjacent to the project area and waters originating from the Forests, such as Metolius, Deschutes, and Crooked Rivers are shared with the Tribes. In particular, Deschutes River serves as a source of drinking water for the Tribes and the Metolius River is a sacred place for the Tribes. Although not discussed in the draft EIS, these water bodies may not be meeting current Confederated Tribes of Warm Springs water quality standards, which were approved by EPA in 2003 and reviewed in 2006. Recently, EPA also reached agreement with ODEQ and the Tribes to develop and implement TMDLs for the Deschutes River basin." (15.12)*

**Response: The FEIS addresses the CTWS water quality standards (Chapter 3.6). The primary difference between ODEQ water quality standards and CTWS standards affecting the action alternatives in this EIS relate to water temperatures. The analysis determined there would be no measurable increase in water temperatures.**

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*"The State asks the USFS to minimize negative effects on the environment by considering site-specific criteria in developing decisions for the use of the most effective tools. In all cases, impact on water quality must be considered to avoid surface and ground water contamination and to protect the beneficial uses." (16.4)*

**Response: In compliance with Standards # 19 & 20, the interdisciplinary team utilized site-specific information to design effective treatments and criteria to minimize or eliminate adverse effects.**

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> *"One of the pesticides on the proposed list, trichlopyr, was detected in surface waters during the USGS National Ambient Water Quality Assessment (NAWQA) studies of the Willamette Basin (http://pubs.usgs.gov/circ/circ1161/nawqa91.d.html). In addition, a few other pesticides proposed to be used in the DEIS were likely detected in other parts of the country as part of the NAWQA study. The number and frequency of detections of various herbicides found in the NAQWA study suggests that standard application practices may result in presence of herbicides in streams at detectable levels. These results emphasize the need to minimize use of chemical herbicide controls whenever feasible to limit inadvertent discharge of herbicides to waterbodies. It should also be noted that the occurrence in Oregon waters of some of these pesticides, such as chlorsulfuron, imazapic, imazapyr, metsulfuron methyl, sethoxydim, and sulfometuron methyl is unknown because of a lack of water quality data." (16c.6)*

**Response: Project Design Features, listed in section 2.4 of the DEIS are aimed at minimizing or eliminating detrimental effects to water quality and are more restrictive than standard use practices.**

**The referenced USGS National Ambient Water Quality Assessment (NAWQA) studies of the Willamette Basin classifies National Forests and Grasslands as undeveloped. The majority of pesticides identified in the study were found in basins draining predominately agricultural or urban areas. The report states that "Only Atrazine and deethylatrazine were detected in streams draining forested basins (greater than 90 percent forest, by area), and these compounds were present at extremely low concentrations (0.002 to 0.004 µg/L)" (Wentz et al, 1998). Neither of these herbicides is proposed for use with this project.**

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> *"As a result of a lawsuit filed against the Environmental Protection Agency (EPA) by the Washington Toxics Coalition (2002), a federal judge ordered that "buffer zones" be placed around salmon bearing streams for the application of certain pesticides. The buffers include a 20 yard no application zone adjacent to salmon bearing waters when specific pesticides are being applied by ground methods, and a 100 yard buffer during aerial applications. Of the 26 pesticides still being investigated for their potential affects on threatened and endangered salmon species, triclopyr is proposed for use on national forests. DEQ asks that USFS keep these restrictions in mind during the potential application of these pesticides. More information and maps of the affected areas can be found at: http://www.epa.gov/espp/wtc/maps.htm." (16c.7)*

**Response: Of the herbicides discussed in the cited lawsuit, triclopyr is the only herbicide proposed for use in this project. The court order does not apply to**

**Deschutes, Klamath, or Lake Counties), and where it does apply (salmon-supporting waters in Jefferson, Crook, Wheeler, and Grant Counties), it excludes noxious weed programs when certain routine safeguards are employed. See map at http://www.epa.gov/oppfead1/endanger/wtc/maps.htm#wtc. These safeguards are incorporated into the Project Design Features of this project.**

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> *"High reliance on herbicides along roadside streams increases toxicity risks to water quality, aquatic organisms and fish from contaminated runoff and surface flow into streams." (17.21)*

**Response: The FEIS and Fisheries Biological Assessment have been updated to better address potential effects to aquatic organisms from proposed herbicide use. Adverse effects are minimized due to PDFs and buffers that limit the application method, rate and herbicide selection near streams and other water bodies.**

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> *"Herbicide use on the Ribbongrass along the Metolius River especially concerns us due to the Metolius River's high water quality and significance to bull trout, redband trout, reintroduced salmon, etc. and high use by recreationalists who could be exposed to the herbicides." (17.25)*

**Response: Considerable effort has been made to design an effective treatment of the ribbongrass on the Metolius River that will preserve the water's quality and its many beneficial uses. There is a serious risk of losing these beneficial uses to the invasive plants if they are not taken care of while the infestations are still relatively small. Risks to aquatic organisms would be minor and short-lived, and public health would not be adversely affected.**

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> *"Due to its high toxicity problems (cited in numerous parts of the DEIS), Picloram also has very high leaching and runoff potential and has contaminated wells." (17.29)*

**Response: Appendix D lists the properties, risks and design features for each herbicide. Picloram would not be used on certain soil types due to its potential mobility and longevity in ground water. Restrictions on application rates, method and frequency of use along with stream, well and spring buffers provide adequate layers of caution to prevent water contamination.**

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> *"Sulfometuron methyl poses high risks of water contamination and soil accumulation and should not be used." (17.35)*

**Response: Appendix D lists the properties, risks and design features for each herbicide. Sulfometuron methyl would not be used on certain soil types due to its potential mobility and longevity in soils Restrictions on application rates, method and frequency of use along with stream, well and spring buffers provide adequate layers of caution to prevent water contamination and/or accumulation in soils.**

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*"Why is there so much proposed back-sliding from more stringent water quality protection felt to be necessary in 1998 on the Deschutes National Forest?" (17.55)*

**Response: The need for action is based on the current inventory of invasive plants. The 1998 project does not sufficiently address treatment of riparian species such as reed canarygrass and ribbongrass. Treatment in these areas will follow all label requirements, standards and guidelines, and PDFs for the protection of water quality.**

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*"There is no real discussion of the potentially harmful effects of herbicides in riparian zones though these are areas with some of the highest biodiversity. Yet there is substantial acreage of proposed toxic chemical use within 100 feet of streams, RHCAs, lakes, wetlands, springs and Riparian Reserves." (17.56)*

**Response: Effects of using herbicides in these areas is disclosed in Sections 3.4 (Native Vegetation), 3.5 (Soils), 3.6 (Water Quality), and 3.7 (Fisheries & Aquatics), and 3.9 (Wildlife). The potential for herbicides to adversely affect riparian areas have been minimized by the PDFs and buffers near streams and lakes. The PDFs and buffers limit the extent, rate, application method and herbicide selection sufficiently to minimize the risk of herbicides reaching water over a level of concern.**

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*"We are concerned by the heavy use of picloram proposed for riparian areas and by the toxicity to fish of aquatic formulations of glyphosate and other herbicides. Targeted plants are amenable to hand-pulling. Table 58 reveals lots of reasons for concern regarding herbicide impacts to aquatic macrophytes, aquatic invertebrates, algae and fish (for fish re: picloram and sethoxydim)." (17.57)*

**Response: The mobility and toxicity of picloram has been addressed through buffers and PDFs. Delivery of picloram to surface water bodies would be avoided. Herbicide use on National Forests was estimated at 3 percent of total herbicide use in Oregon and Washington (USFS 2005a), and On the Deschutes and Ochoco National Forests, the use of picloram is limited to those species where no other effective herbicide is known (pp. 36 and 51). It also is not allowed within 50 feet of water (p. 52).**

**The discussion of the Risk Assessments and GLEAMS model has changed in the FEIS: the analysis for water concentration does not rely solely on the risk assessment predictions; rather, a site-specific analysis was conducted using local variables. Because of this, the ecotype analysis discussion and DEIS table 58 were not kept in the FEIS.**

## Effects to Drinking Water

*"While DEQ recognizes that the application of herbicides is one of the most effective ways to control unwanted vegetation, DEQ thinks that the non-herbicidal options for addressing the vegetation should be*

*considered in areas that potentially impact public water supplies. As acknowledged in the DEIS, herbicides could negatively impact the water quality in streams and groundwater serving as public water supply sources." (16c.10)*

**Response: The DEIS acknowledged that the use of herbicides near public water supplies could potentially impact them; therefore, project design features have been applied in such situations. PDFs direct that broadcast spraying would not occur in municipal watersheds without the consent of the water agency/association and that any treatments other than manual or biological would be coordinated with the municipal department in charge of the water system. (see PDFs 27, 28, 29 30; and p. 198-199).**

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*"DEQ recognizes that protecting water quality is a high priority for public land management, and within the municipal watersheds, this also includes protecting human health. Within the mission, budget, and legal authority, DEQ asks that the USFS consider local drinking water protection priorities when developing management plans for federal lands and facilities. Implementing protective actions and land use decisions can be very effective in providing clean source water to public intakes and wells. This will preserve the use of public funds that would otherwise be spent to upgrade treatment facilities to remove contaminants downstream." (16c.8)*

**Response: The project has been designed to reduce or eliminate potential detrimental effects to water quality. The water quality analysis includes a discussion of potential effects and there are no expected adverse effects to drinking water.**

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*Most herbicides are not monitored at the intakes or wells for public water supplies as part of the routine requirements to meet federal drinking water standards. Most communities and public water providers do not have the resources to increase their monitoring capabilities when significant areas are sprayed adjacent to or upstream of their intake or well. (16c.11)*

**Response: The project does not propose the spraying of significant areas adjacent to or upstream of community wells (see Table 52 of the DEIS).**

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*"When the vegetation is removed from areas in close proximity to public water supply streams, an increase in erosion and sedimentation could also occur in the downstream reaches. Increased sedimentation can directly impact the public water system treatment operation, increasing maintenance costs, and increasing the risks of exposure to contaminants that adsorb onto the sediments." (16c.12)*

**Response: None of the proposed treatments would remove vegetation along any public water supply streams to the point where erosion would impact public water**

**supplies (section 3.6). In areas where devegetation could cause erosion, erosion-control measures and revegetation would be implemented.**

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*"To prevent or minimize the impacts of herbicides and suspended sediments to public water supplies in Oregon, DEQ and DHS can provide more specific suggestions for site-specific best management practices that can be effective in protecting the drinking water for public intakes and wells. As with all of our state and federal partners, DEQ requests the USFS to select a treatment of invasive species in the municipal watersheds/aquifers to support the overall goal of providing the highest quality water possible to downstream intakes and wells." (16c.13)*

**Response: The analysis identified areas where invasive plant sites overlapped municipal watersheds, wellhead protection areas, and identified recharge areas to facilitate implementation of appropriate PDFs. Both action alternatives are consistent with "Forest Chemical management" in Appendix F of the MOU between the Forest Service and ODEQ and both meet Oregon's water quality standards for toxic substances.**

## Effects to Wildlife

*"We are especially concerned about herbicide impacts to: Bald eagle and wolverine (re: hexachlorobenzene in picloram & clopyralid), pygmy rabbits, horned and red-necked grebes, bufflehead and harlequin ducks, yellow rail, greater sage grouse, American peregrine falcon (re: HCB), gray flycatcher, tricolored blackbird, Oregon and Columbia Spotted frogs, Crater Lake tightcoil snail and management indicator species raptors and owls, as well as MIS great blue heron, other waterfowl, woodpeckers and elk." (17.59)*

**Response: Impacts to these species are discussed in the Wildlife Report, BA and EIS. The PDFs and buffers are adequate to reduce the potential for exposure so that adverse effects are unlikely.**

## Effects to Non-Target Plants

*"How would native St. Johnswort be avoided in control?" (17.28)*

**Response: The DEIS acknowledges some common non-target plants may be killed, but effects would be small and short lived. Non-target vegetation will be protected from herbicide control whenever practical (PDF #5). Rare plants would be protected by barriers and buffers (PDFs 64, 65).**

**The majority of native St. Johnsworts (bog St. Johnswort and Scouler's St. Johnswort) occur in more pristine wetlands dominated by native vegetation. These native usually do not occur in the dense stands of reed canarygrass that are**

**proposed for treatment. Reducing reed canarygrass is expected to protect and help restore native wetland habitats, thereby benefiting the native St. Johnswort species.**

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> *"We are concerned that there are no estimates given for sensitive plant or survey and manage plant population numbers or their viability thresholds and that there is no guarantee that proposed herbicide use assumed to result in MIIH might not instead result in uplisting and loss of viability in violation of the ESA and FSM 2600 and FSM 2670.22. See handwritten comments for more detail and other concerns re: native and listed or survey and manage plants." (17.51)*

**Response: The Oregon Natural Heritage Information Center (March 2007) ranks all rare, threatened, and endangered species (and their populations) in Oregon from a global perspective. The Forest Service uses this framework to estimate status. Currently, there are no federally-listed plants on the Deschutes or Ochoco National Forest, or Crooked River National Grassland; therefore, there would be no violation of the ESA.**

**For Forest Service Sensitive species, the Forest Service Manual directs an analysis of the significance of potential adverse effects on a population or its habitat with the area of concern and on the species as a whole. (FSM 2670.32). An impact must not result in loss of species viability or create significant trends toward federal listing. This analysis was completed for every Project Area Unit that involved Sensitive or Survey/Manage species in the vicinity of target invasive plants (EIS Section 3.4).**

**The analysis of effects to sensitive plant species considers the known locations of the plants as well as suitable habitat. The number of individual plants in a population is not readily known and not a critical factor in determining the effect of invasive plant treatments. PDFs would be applied to avoid any adverse effects to sensitive plants; therefore, the determination that individuals could be harmed is based on the assumption that where non-selective herbicides are needed to treat an invasive, there is potential for overspray or drift – but that is limited to individuals within the immediate vicinity of the invasives being treated.**

**Results of surveys for sensitive and survey/manage plant species were completed and results were disclosed in the DEIS (pp. 114-116 and Botany Report). The PDFs and buffers have been designed to avoid impacts on sensitive or survey/manage plants and these sites would be monitored. Buffers would be increased or additional mitigation employed if damage to non-target plants was detected (see Post-treatment Monitoring, Appendix F). Potential for effects to these species are thoroughly discussed in the Native Vegetation section of the EIS. There is ample evidence that invasive plants alter and deteriorate native plant habitats; careful treatment of invasive plants will protect sensitive plants in the long term.**

## Effects to Air Quality

*"Air quality may also be impacted in the short term due to access roads use, prescribed burning, and herbicide applications activities; and in the longer term due to traffic on dirt roads, emissions from vehicles and on-site operations, and cumulative impacts from surrounding activities such as agriculture and fire. Since the proposed action includes prescribed fire and the project area may include areas with sensitive populations, the final EIS should provide an overview of the smoke management program that would be followed to avoid public health impacts and potential ambient air quality exceedences. The smoke management program for the proposed project may include a number of elements discussed in Section VI of the Interim Air Quality Policy on Wildland and Prescribed Fires by EPA (see http://www.epa.gov/EPA-AIR/1998/May/Day-21/a13616.htm)." (15.14)*

*"It will also be important to monitor air quality and take corrective action if air quality standards are not met. Monitoring strategies should be tailored to local conditions because localized air quality impacts can be substantial, even though area-wide and/or long term monitoring may show compliance with air quality standards." (15.5)*

**Response: A discussion of smoke management and air quality impacts has been added to Chapter 3 of the FEIS.**

## Analysis / Data

*"The EIS should weigh the effects of the treatment on the environment against the effects of not treating the infestation. Not treating an infestation due to short-term impacts of the treatment ignores the long-term effects of the infestation." (8.10, 9.10)*

*"The EIS should weigh short-term and long-term effects of noxious weeds and the various treatment methods. The lack of effective treatment can produce serious long-term ecological effects that should be taken into account." (10.7, 13.5)*

**Response: The DEIS considers the consequences of taking No Action. And although some of the invasive plant sites that have previously been authorized for treatment under earlier NEPA documents could continue to be controlled where necessary, the DEIS shows that the majority of inventoried sites would go untreated.**

**The consequences of taking no action are discussed throughout the EIS. The environmental harm that invasive plant species can cause in the long-term are discussed (e.g. loss of native plant habitats including Sensitive species p. 128; habitat losses for wildlife p. 325; adverse effects to Wilderness values p. 376).**

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*"The Forest Service should fully disclose the environmental impacts of the so-called "inert" ingredients in the herbicide formulations they proposed to use." (11.8)*

*"Inert ingredients are a huge blind-spot in the decision-making process which violates the letter and spirit of NEPA's mandate for full-disclosure and informed decision-making." (11.10)*

*"There are also significant data gaps for use of the newer herbicides and for some herbicide formulations and toxic 'inerts'." (17.36)*

**Response: The risk assessments are considered the best available scientific information. Uncertainties are discussed at length in the R6 2005 FEIS. While in some cases inert ingredients are confidential, their toxicity was considered as part of the risk assessments. See section 3.2 of this FEIS.**

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*"The Source Water Assessments required by the 1996 Safe Drinking Water Act Amendments provide a database of information about the watersheds and aquifers that supply public water systems in Oregon. USFS can rely on state agency partners (DEQ and the Department of Human Services—Public Health) to access this information. USFS should consult with DEQ to ensure that the GIS shape files of the 5th-field watersheds and aquifer recharge areas are included in the USFS GIS data in this area." (16c.14)*

*"In addition, DEQ is able to provide the GIS shape files on the most sensitive zones within those areas to supplement USFS data and coverages. The sensitive zones within the watersheds and recharge areas were identified by the state as part of the Source Water Assessment process. These areas can be used to prioritize protective actions within the 5th-field watersheds and recharge areas." (16c.15)*

**Response: Information on the location of domestic water sources and recharge areas was obtained from Oregon Dept. of Environmental Quality (Drinking Water Protection Program), Forest Service special use permits, and Forest recreation specialists. The analysis shows PAUs that intersect wellhead protection areas (for wells and springs), municipal watersheds, and community water source areas. PDFs will apply in these areas to protect drinking water sources.**

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*"There are also many ill-defined and vague, unquantified terms used, such as "relatively minimal" or "low" level of risk. (17.40)*

**Response: Quantitative analysis has been provided where possible. Qualitative terminology is defined throughout the FEIS.**

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*"For instance, how are "thresholds of concern" defined and what ensures that they are sufficiently protective?" (17.41)*

**Response: A definition of the term threshold of concern was located on p. 78 of the DEIS. This definition has been clarified in the FEIS. Thresholds of concern are based on peer reviewed toxicological studies and are considered the best available science. Project design features adds layers of caution to account for uncertainty.**

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> *"Although this purports to be a site-specific EIS, we think it would be advisable to create a more detailed site-level plan for each treatment area and allow for public comment before implementation. (11.13)*

**Response: Appendix A lists the invasive plant sites present within each Project Area Unit, the site type, and the proposed treatment for that site.**

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> *"There should be significant attention and analysis in this DEIS as to whether the cumulative harms of herbicide use outweigh the benefits." (17.47)*

**Response: The layers of caution and design features for this project are intended to avoid significant cumulative impacts from herbicide use. The consequences of taking no action are analyzed and compared with the impacts of treatment throughout the EIS; cumulative effects analysis was conducted and no adverse cumulative effects are expected to occur.**

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> *"The GLEAMS model seems highly suspect since it is not calibrated with field data from forest and high desert natural ecosystem settings. The model is admitted not to take into account several significant factors (see DEIS p 228). This is not accurate science. Many assumptions seem biased and questionable." (17.58)*

**Response: Risk assessments and models are used to predict potential exposures and compare them to scientifically derived thresholds of concern. The layers of caution integrated into this project go well beyond the model results to reduce the likelihood of adverse effects. SERA worksheets were completed for higher risk sites using site specific information such as soil type, average annual rainfall, herbicide type, and herbicide application rate. The results of the worksheets are described in the FEIS, Chapter 3.7.**

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> *"Because of these unknown risks, DEQ encourages use of non-chemical alternatives with known risks wherever feasible, especially within riparian areas." (16c.5)*

> *"There are simply too many scientific data gaps, too weak of regulation on the part of the Environmental Protection Agency (which gives licenses to pollute and serves as a revolving door job agency for corporate executives of polluting companies) and too much exacting precision required in strict adherence to PDFs, label requirements, Region 6 guidelines, monitoring, etc. to give any assurance that harm will not happen to TES listed plant and wildlife species that would be sufficient to cause their uplisting or loss of viability or that water quality, human health, MIS and S&M species, soil fertility, etc. would not be significantly harmed." (17.32)*

**Response: Uncertainty was addressed throughout Chapter 3 of the R6 2005 ROD. The Forest Service Risk Assessments were used to develop standards that go beyond EPA-regulated label requirements. Many layers of caution have been added to**

**respond to uncertainty. While there are no assurances that there would be no effect to individual TES listed species, the PDFs eliminate the potential for extensive or substantial risks (see DEIS pp. 132-133).**

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> *"Accidental spills are always possible—especially in boating or wading to invasive plant sites on river islands and applications on slippery or steep banks. The effects of larger accidental spills from tank trucks and mixing chemicals should have been thoroughly analyzed in this DEIS as worst case scenarios." (17.26)*

**Response: This proposal does not involve the direct application of herbicides to water—deliberately or accidentally. However, the Forest Service considered the potential for accidental spill when herbicides are used in the vicinity of water and built in layers of caution to minimize the risk of accidents and reduce potential for adverse effects from accidental spills. For example, the PDFs limit the daily quantity of herbicides to be transported to treatment sites and specify how herbicides would be carried across water. Additionally, Forest Service Handbook requires the use of a handling safety and spill response plan by the applicator.**

## New Herbicides

> *"The EIS should also provide a mechanism to add new herbicides as they become available. There is already a new herbicide available for weeds such as Russian knapweed that requires a lower application rate than others on the market." (10.10)*

**Response: Standard #16 of the R6 ROD states that "Additional herbicide mixtures may be added in the future at either the Forest Plan or project level through appropriate risk analysis and NEPA/ESA procedures." When Risk Assessments are completed on new chemicals, the Forest Service then determines if the chemical should be used on National Forest System lands. A site-specific supplement to an existing NEPA document, a new project-level NEPA document, or an amendment to the Forest Plan would be required to implement use of the new chemical.**

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> *"The impacts of newly approved herbicides post-dating this DEIS would not have been analyzed in this EIS, so this EIS can't approve their use, as per the NEPA." (17.8)*

**Response: All herbicides proposed for use in this project have been analyzed in the EIS. New herbicides would go through appropriate NEPA procedures prior to use.**

## Revegetation / Restoration

> *"Table A-3 identifying areas of active revegetation does not identify any upland projects where seeds of local, native plant material is utilized.*

*Although "Guidelines for Revegetation of Invasive Weed Sites and Other Disturbed Areas on National Forest and Grasslands in the Pacific Northwest" is referenced and included in Appendix E, it looks as if no attempt is being made to follow these guidelines. We appreciate the fact that high quality sites are of the highest priority for action, but would recommend some mention of the utilization of native plant materials that your Forests are in the process of developing. Perhaps a demonstration area could be proposed." (9.7)*

**Response: Regional LRMP standard #13 requires native plant materials to be the first choice where active revegetation is necessary. The Forests and Grassland have been actively collecting and propagating seeds of native shrubs, grasses, and forbs and using these materials in revegetation projects. For example, in 2006, 50,000 native basin wild rye grass plugs were planted on approximately 130 acres of the Grassland; 965 lbs. of native grass seed were harvested and purchased by Paulina District as a result of seed propagation contracts; and 473 lbs. of native grass seeds were produced by seed growers for the Deschutes NF. Seeds and seedlings of native plants are used in a variety of revegetation projects aimsed to restore native plant habitats.**

## Adaptive Management / Monitoring

*"The treatment chosen for any specific weed population should have the highest probability of success. Success should be defined by achievement of measurable objectives, not by acres treated in a given year or what type of treatment is implemented. Weed treatment plans often focus too heavily on acres treated and not on whether or not those acres were restored to a better condition." (8.7)*

*"Clearly stated objectives (i.e. desired future condition) allow for adaptive management, where the local manager can modify the treatment approach to reflect lessons learned. If the treatment techniques are too specific, adaptive management cannot be applied, and the success of the project may suffer." (8.8)*

*"The EIS should be goal based, where the local manager has the ability to use all the available techniques." (8.9)*

*"Clearly stated objectives (i.e. desired future conditions) allow for adaptive management, where the local manager can modify the treatment approach to reflect lessons learned. If the treatment techniques are too specific, adaptive management cannot be applied, and the success of the project may suffer. The EIS should be goal based, where the local manager has the ability to use all the available techniques." (9.9)*

*"The EIS should identify measurable results. Listing the number of acres treated per year does not give an accurate picture of the success of the project. Measurable objectives such as percent reduction in plant numbers or ounces of herbicide used allow for adaptive management to improve the probability of project success." (10.9)*

**Response: Effectiveness of each alternative was compared using number of sites that could be treated and the number of tools available. The fewer acres that are effectively treated at one time will likely lead to greater total acres needing to be treated due to spread. So although acres treated gives a numerical value to the alternatives, it is the conclusion of effectiveness (such as on p. 96 of the DEIS) that provides the difference between the alternatives.**

**Ultimately, success of the project (whether or not objectives are being met) will be measured during treatment and post-treatment monitoring. Implementation planning and monitoring forms shown in Appendix F have been improved so that site objectives and desired future condition information is recorded.**

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> *"Where there is recreational heavy use, the plants are usually underneath the bitterbrush. In many cases, the manual removal crews brought in by the Forest Service fail to investigate these locations." (4.5)*

**Response:** The EIS recognizes the difficulty of these site types (see PAU 11-62 in Appendix A for example). Manual treatments may not be practical is some of these instances and the action alternatives provide more choices of herbicides such as clopyralid, which will affect the spotted knapweed that commonly grows under bitterbrush without affecting the bitterbrush (DEIS p. 122). Additionally, treatment and post-treatment monitoring will be used to determine if objectives are being met at a site.

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> *"DEQ supports establishment of native plant communities and functions at the impacted sites to achieve system potential vegetation in riparian buffers. In order to minimize short term impacts and avoid unintended consequences, DEQ asks the USFS to evaluate and monitor individual project as well as cumulative impacts. DEQ asks the USFS to be cautious especially where the invasive plant infestations are within riparian buffers adjacent to waterbodies on the 303(d) list." (16c.2)*

**Response: Treatment and post-treatment monitoring is proposed for assessing accomplishment of site objectives and determining if PDFs are effective as predicted in reducing adverse effects. The R6 monitoring protocol is described in Appendix F.**

## Forest Plan Amendment

> *"There should be no Forest Plan amendment changes! No analysis is given as to reasons for the current standards, which protect the values this DEIS professes to want to protect (wildlife, fisheries, water quality, ecological functioning, biodiversity, human health, soil productivity, etc.) from toxicity hazards. There is also no justification given for changing these standards that outweighs the value of their protection. Such precautions are consistent with the Region 6 goals (see above) and the Region 6 DEIS emphasis on prevention and the stated goal of reducing herbicide use over time (as explained above)." (17.30)*

**Response: As described on p. 40 of the DEIS, the proposed amendments are intended to make the Ochoco LRMP consistent with and complementary to the R6 2005 ROD and allow use of the tools made available for the treatment of invasive plants according to the standards. The R6 2005 ROD anticipated these types of amendments: "Inconsistencies between new and existing standards will be reconciled on a Forest-by-Forest basis…" (R6 2005 ROD pg 3). Project-specific analysis is included on p. 385 of the DEIS.**

## Laws, Regulations, Policy

> *"How does this proposal comply with Executive Order 13112, and Linda Goodman's direction on prevention of October 1, 2004?" (11.14)*

**Response: The Executive Order 13112 of 1999 places certain duties on federal agencies in the prevention and control of invasive species. In response to the order, the Forest Service prepared a National Strategy to guide Forest Service Invasive Plant programs. That strategy involves four categories of effort: 1) prevention; 2) early detection and rapid response; 3) control and management; and 4) rehabilitation and restoration. Based on that strategy and needs specific to the Pacific Northwest, Region 6 prepared the R6 2005 FEIS which provides management direction for prevention and treatment of invasive plant sites.**

**This project complies with direction in the R6 2005 ROD. It also addresses three of the four program elements of the national strategy: control and management, early detection/rapid response, and rehabilitation. In these ways it complies with the Executive Order.**

**Prevention practices were adopted by the Deschutes & Ochoco NFs and Crooked River Grassland in response to the Regional Forester's direction of 2004 (included in the EIS, Appendix G).**

## Tribal Consultation

> *"Executive Order (EO) 13175 (Consultation and Coordination with Indian Tribal Governments) requires agencies of the U.S. government "to work with Indian tribes on a government-to-government basis to address issues concerning Indian tribal self-government, trust resources, and Indian tribal treaty and other rights." The final EIS should include a discussion about the consultations FS has had with the Tribes, their concerns, and a discussion of how issues raised in the consultations with the tribes were addressed, especially impacts to water quality and air quality due to smoke from burning activities." (15.13)*
>
> *"The FS should also work with the Confederated Tribes of Warm Springs to address their water quality issues, if any. The final EIS should also include additional information as explained in our comments that follow." (15.13)*

**Response: Chapter 4 includes information on the consultation that has taken place with the Confederated Tribes of the Warm Springs.**

## Miscellaneous

*"One of the proposed actions for Canada Thistle is mechanical treatment. Suppression and control of Canada thistle populations using mechanical methods can be effective if combined with chemical treatments. However, studies have shown that mechanical treatments can also backfire. Careful planning, scheduling and implementing of treatments will increase the effectiveness of the treatments." (8.17, 9.17)*

**Response: The treatment prescribed is actually mechanical/chemical as described on p. 44, Appendix A. This is clarified in Table A-1 Project Area Summary Report.**

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*"Houndstongue is carried back and forth across the Forest boundary onto adjacent lands by cattle, and also by the many species of wildlife; particularly elk and deer. We have personally observed herds of elk with numerous houndstongue seeds hanging on their lower bodies." (14.6)*

**Response: The DEIS recognizes that cattle as well as wildlife can spread invasive plants (pp. 87, 354).**

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*"Because of concerns about water quality and missing information, we have assigned a rating of EC-1 (Environmental Concerns - Adequate) to the draft EIS. This rating and a summary of our comments will be published in the Federal Register." (15.8)*

**Response: The FEIS includes additional information, as noted in previous responses, to respond to environmental concerns.**

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*"We also incorporate by reference as part of these comments our enclosed comments written on pages of the DEIS to elaborate on concerns in more detail and contextualize comments." (17.7)*

**Response: Handwritten comments were reviewed by the interdisciplinary team when responding to these comments and finalizing the EIS.**

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*"We request copies (hard copies by mail) of all specialist reports related to this EIS and related technical documentation in the project record for botany, water quality, fisheries, soils, wildlife, human health, range, cost effectiveness, etc. and all biological assessments pertinent to the Deschutes and Ochoco National Forests and the Crooked River National Grassland (CRNG) for this project." (17.14)*

**Response: Information request**

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*"In general, NEPA procedural concerns in regard to reaching a well informed decision include: not much difference in project design and outcomes offered by the two action alternatives, insufficient and biased cumulative effects analysis, insufficient analysis of the impacts of herbicide use in most sections of the DEIS, failure to include analysis of a worst case scenario herbicide spill, failure to disclose relevant information and science in parts of the analysis, and an insufficient range of alternatives." (17.38)*

**Response: These statements have been addressed in previous responses.**

## Prevention / Education

*"Prevention is the most cost-effective method of dealing with noxious weeds. Every Forest Service employee should receive training to identify key noxious weed species and sites at risk to invasions. Fire and timber crews, especially, work in remote areas where timely identification of new weed sites is critical." (10.5, 13.4)*

*"As a central part of the integrated weed management program we urge the Forest Service to explicitly consider avoiding and/or limiting activities that increase the risk of invasive species including activities that disturb soil (e.g. logging, OHVs, livestock grazing, road activities, etc.), activities that open the canopy and increase the availability of light, water, and nutrients for the growth of invasive species (e.g. logging, fuel reduction, brush control), and activities that provide vectors for the spread of weed seeds (e.g. roads, OHVs, logging, grazing)." (11.2)*

*"We should nevertheless continue to strive to avoid human-induced environmental modifications that increase the risk of weed spread: soil disturbance, native canopy removal, and seed dispersal vectors." (11.7)*

*"Further, DEQ encourages the use of prevention standards in October 2005 Record of Decision for Preventing and Managing Invasive Plants to avoid infestation of new invasive species population on national forests. DEQ also encourages the USFS to consider implementing additional preventive measures such as limiting OHV uses and closing or restricting access to non-essential roads." (16c.3)*

*"They don't address the root of the problem—invasive plant introduction and dispersal vectors." (17.45)*

**Response: Forests is Region 6 are required under the 2005 R6 ROD to address invasive plant introduction, establishment and spread during project planning (standard #1). The ROD includes other prevention standards as well. In addition to these standards, the Central Oregon Forests have adopted a list of invasive species prevention practices that will minimize the introduction, establishment, and spread of invasives. These prevention practices are includes in the EIS as Appendix G to give the public a fuller picture of the invasive plant program. Prevention is an**

**ongoing consideration in managing national Forests, regardless of the decision resulting from this EIS.**

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*"Heavy reliance on herbicides along roadways ignores the problems of continued dispersal of invasives from vehicles (the root cause) and higher risks of human exposure to toxins along roadways. Herbicide use would likely continue there indefinitely as long as vehicle vectors are not controlled and road shoulders are not re-vegetated with native plants." (17.20)*

**Response: Prevention is part of the Forests and Grassland strategy for reducing the rate of spread of invasive plants along roads. Passive and active revegetation with non-invasive plants would occur. For instance, some sections of Hwy 97 were naturally revegetated three years after initial treatment (p. 38 DEIS). Herbicides would be used along with prevention and revegetation, rather than to their exclusion.**

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*"There should be site-specific plans for prevention of invasives identified and analyzed in this EIS. There is no other NEPA process opportunity for focused and detailed site-specific prevention strategizing to take place and be part of integrated decision-making to determine appropriate control measures." (17.50)*

**Response: Prevention must be considered in all site-specific project assessments as per the R6 2005 ROD. All activities on National Forest lands are subject to the prevention standards. These are not connected actions because treatments of invasive plants would be needed regardless of the site-specific prevention measures taken. The relationship between prevention and treatment was fully explored in the R6 2005 FEIS to which our analysis is tiered.**

## Partnerships / Coordination / Cooperation

*"Currently there is a tri-county yellowflag iris control effort being implemented along the Deschutes, Crooked and Metolius Rivers. The Metolius River infestation is located on both Federal and private lands. The CRNG area has this species using the irrigation canals as a transport system. Currently this population does not extend past Lake Billy Chinook, it is relatively small and at the present time control efforts appear to be having positive results." (8.15, 9.15)*

*"Cooperation and partnerships with agencies, organizations, and private landowners have a significant impact on the spread of noxious weeds between land ownerships. The Deschutes and Ochoco National Forests and Crooked River National Grassland should encourage these partnerships when possible." (10.6, 13.3)*

*"DEQ supports USFS' project design features (PDF) 7 and 8 to establish communication and to coordinate with the public water system operator and community downstream of the USFS land management areas. DEQ also supports (PDF 26) the USFS' intent to follow municipal watershed agreements and encourages the USFS to develop them with water system operators where there is not one. Further, there are no requirements to develop or implement "drinking water protection plans" in Oregon, but many communities elect to move forward voluntarily. DEQ encourages USFS to be involved in the planning process and protection of that source area." (16c.9)*

*"The Deschutes and Ochoco National Forests and the Crooked River National Grassland are essential partners in addressing Oregon's invasive noxious weed problems." (16.2)*

*"While I can manage my cattle to be out of the houndstongue infested areas after the seed hardens and can be transferred by animal hair, elk and other wildlife are moving through the area year around. The only way to limit spread and reduce infested areas is through aggressive treatment in partnership with private landowners and the County weed district." (17.7)*

*"Some of the worst infestations are on private land adjacent to the national forest. Deschutes County has a weed specialist who is still encouraging landowners to control their weeds. As a Deschutes County Planning Commissioner, I am concerned that no fines have been levied against some landowners. I would appreciate working with the Forest Service to encourage the Deschutes County Commissioners to require penalties for the worst offenders. I believe that the County Commissioners need to hear about the severity of this problem." (4.8)*

**Response: The Forest Service recognizes the importance of partnerships and cooperation with local agencies and organizations to address invasive plant and noxious weed problems. The Forests work with the Oregon Department of Agriculture, the various county weed departments, Bureau of Land Management, the Native Plant Society, and others. We intend to continue to coordinate with other agencies and groups during implementation of this project.**

## Outside the Scope of the EIS

*"An interest of our Road Dept. is the spraying of County Road Shoulders for total vegetation control and also spraying brush and small trees within our right-of-ways to help maintain visibility and to maintain the integrity of the road and road shoulder. Using herbicides to clear right-of-way is much more cost effective than mechanical means such as mowing." (1.3)*

**Response: The treatment of unwanted vegetation is not part of the current project and is outside the scope of this analysis. Use of herbicides to control unwanted**

**vegetation, such as for maintaining visibility would have to be addressed in a separate environmental analysis.**

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> *"I would like to add to your noxious weed list one of the worst and least noticed weeds: tumbleweed, Russian thistle….It can be found on the roadside and moving into hay fields literally all the way between Bend and Sisters. It is on most of the unused disturbed ground in Bend, even down by the Southern River Crossing. No one is paying attention. I called the county weed man but have seen no effort taken yet." (3.1)*

**Response: The treatment of invasive plants is not limited to those listed in this EIS. However, treatment of invasive plant sites outside of National Forest System lands is outside the scope of this project.**

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> *"Additional national forest road closures would be very helpful in the control of invasive species. Many of the existing roads in our area are merely duplicates of others that reach the same point." (4.7)*

> *"But we have to treat the causes and not just the symptoms… most of the identified weed sites are located along roads which have chronic soil disturbance, limited canopy of native plants, and chronic seed dispersal vectors. After these treatments the FS should prioritize closing the roads that pose the greatest problems." (11.3)*

**Response: The DEIS recognizes that vehicles on roads are a source of invasive plant introduction and spread. However, road closures are outside the scope of this analysis. The R6 2005 ROD added a standard to Forest Plans that requires the consideration of invasive plants and their spread during project planning; so as the Forest Service implements the new travel management rule (by designating roads, trails, and areas that will remain open to motor vehicle use), invasive plants will be addressed. Also see response to 11.2 (prevention).**

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> *"You also need to look at your future program of work. Fuel reduction presents a significant and growing threat of invasive weeds because it creates ideal conditions for weeds – it's a widespread and chronic activity that disturbs soil, increases light and water availability, and increases weed vectors. The same could be said of OHVs. The DEIS fails to incorporate these old, new, and emerging threats into a comprehensive NEPA analysis." (11.4)*

**Response: This EIS is limited in scope to the treatment of invasive plant sites. As stated in response to 11.2, Forests are required to consider invasive plants during all project planning. For this project, the EIS includes Project Design Features to prevent the spread of invasives during treatment activities (DEIS p. 41).**

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*"We think that climate change will increasingly disturb and displace native vegetation, lengthen growing seasons, and increase the risk of weeds in the coming decades. Let's avoid a situation in the future when we may find ourselves throwing tons of chemicals at waves of "invasives" that are unstoppable because of the overwhelming influence of climate change." (11.5)*

*"Let's try to distinguish between "new arrivals" from the south and from lower elevations (which would be expected due to climate change) versus "true invaders" from other continents." (11.6)*

**Response: The focus of this project is on invasive plants which are defined as an alien plant species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112). The use of an early-detection/rapid response strategy may become increasingly important for dealing with new invasions quickly while the populations are small.**

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*"Keep workers out of areas that have hazardous trees and snags that may pose a safety hazard. If you can't make that promise, please disclose the cumulative impacts of lost snag habitat across 14,000 acres and surrounding hazard zones." (11.11)*

**Response: Snag removal is not part of the invasive plant treatment proposal.**

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*"The draft EIS invasive plant inventory did not document the existence of aquatic invaders. As a result, the document does not address invasive plants floating or submerged in water. Because aquatic invasives are an emerging issue on National Forest land and elsewhere, EPA encourages the Forest Service to include at-risk water bodies (such as those used for recreational purposes) in future monitoring and inventory efforts. If there are infestations of aquatic invasive plants (floating or submerged in water) on the Forests, we recommend that the final EIS include information about such infestations and how they would be treated to prevent deterioration of water quality within waterbodies found on the Forests." (15.6)*

**Response: The EIS is focused on treatment tools made available by the R6 2005 FEIS, which did not address floating or submerged invasives. Thus, treatment of infestations of floating and submerged aquatic invasive plants is outside the scope of this EIS. Aquatic invasives are not currently known to threaten streams or lakes on the Forests or Grassland. If such species were to become established on the Deschutes or Ochoco NF, or Crooked River National Grassland, additional NEPA would be required to allow treatment.**

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*"We incorporate by reference as part of these comments our comments on and appeal of the Region 6 Invasive Plant Program Final Environmental Impact Statement (USFS 2005a), for which our concerns were not resolved and to which much of the analysis for this DEIS is tiered." (17.6)*

**Response: The comment does not state which concerns were not resolved in the appeal of the regional document. The 2005 ROD was affirmed after a "deliberative and extensive review process." (August 15, 2006 Appeal Decision, http://www.fs.fed.us/emc/applit/includes/woappdec/r6_ipp_decision.pdf.).**

## General Statements about the Purpose and Need – No Response Necessary

*"Further, we think the tools the Forest Service is currently authorized to use to fight invasive plants are woefully insufficient to win the battle to effectively control and manage weed infestations in wildland environments." (8.2, 9.2)*

*"The Crooked River Weed Management Area agrees that noxious weeds are a major threat to our forests and grasslands." (10.1)"*

*The tools and funding available to the Forest Service until now have been inadequate to even slow the spread of noxious weeds." (10.2)*

*"Invasive plants have displaced native vegetation in areas of Sunriver and the neighboring community." (12.2)*

*"DEQ recognizes that invasive species present significant risks to ecosystem health and effective control mechanisms are needed to protect and restore national forests. It is DEQ's understanding that the purpose of the proposed projects is to eradicate, contain, and control invasive plant infestations, and to reverse the negative impacts caused by invasive plants." (16c.1)*

*"The state of Oregon believes it is essential to protect the state's natural resources from invasive plants and noxious weeds. Invasive noxious weeds are causing significant environmental impacts and are costing Oregon millions annually in economic losses." (16.1)*

**Response: Thank you for your comment.**

## General Statements about the DEIS / No Response Necessary

*"The state also supports the Early Detection/ Rapid Response (EDRR) strategy in order to aggressively control new invasive species in a timely manner in effort to minimize both of the invasive weeds and of herbicide use across the landscape." (16.5)*

*"The Oregon Department of Agriculture (ODA) Noxious Weed Control Program has partnered and worked with the Deschutes and Ochoco National Forests and the Crooked River National Grassland to address noxious weeds on National Forest System Lands in central Oregon. ODA believes it is essential to protect the natural resources of the state from invasive plants and noxious weeds. ODA also believes that an integrated*

*approach is fundamental for success in controlling invasive noxious weeds to restore healthy natural communities." (16a.1)*

*"I do endorse the actions to take care of weeds that displace native plants." (3.2)*

*"I appreciate this opportunity and please know that I am thoroughly supportive of your efforts." (4.9)*

*"Don't poison our wildlands! Do your job – protect our public lands, water and wildlife!" (5.3)*

*"The focus for the USFS should be on decreasing the risks presented by the potential contaminant sources on national forests. (16c.16)*

*"Please continue to keep me informed of the progress with your EIS as I am looking forward to its completion." (1.5)*

*"The Weed Board wholeheartedly agrees that invasive plants are a major threat to the ecological integrity of our forests and grasslands in Central Oregon, and we commend the Forest Service for taking this matter seriously and making it a high priority." (8.1, 9.1)*

*"Again, we applaud your efforts to proactively address the serious problem of invasive plant spread in the forests and grasslands of Central Oregon and we appreciate the opportunity to comment on your proposed strategies. We look forward to your finalizing of this EIS and moving quickly to the implementation phase. Effective implementation of the proposed action is critical and we look forward to working with you on this important endeavor."* (8.19)

*"We agree that invasive plants are one of the major threats to the ecological integrity of our forests and grasslands in Central Oregon, and we commend the Forest Service for taking this matter seriously and making it a high priority." (9.1)*

*"Yet we also recognize and appreciate the environmental concerns regarding herbicide use and the need to be cautious and judicious in applying them." (9.3)*

*"The Draft EIS is well written, thorough, and contains ample amounts of relevant information." (9.4)*

*"The new treatment strategies in the proposed action alternative for addressing invasive plant infestations on National Forest lands is a major step forward in the battle with weeds. If implemented, it should provide local land managers with some key tools that are required to have a realistic chance of effectively controlling weed populations in remote, wildland environments." (9.5)*

*"This document was a long time coming, but we want to praise your ID Team members for such an excellent, comprehensive draft EIS. We applaud the efforts to proactively address the serious problem of invasive plant spread in the forests and grasslands of Central Oregon." (9.19)*

*"We share the Forest Service's concern about the spread of invasive species. We should do all we can to protect the integrity of native plant communities." (11.1)*

*"Sunriver supports the reduction of invasive species on federal lands and the protection of water quality, sensitive plant species, and identified fish and wildlife." (12.4)*

*"I strongly support the preferred alternative, and believe it provides the range of tools needed to handle houndstongue and other noxious and invasive species." (14.4)*

*"Thank you for the opportunity to comment. I urge you to complete the EIS by the planned date of June 15 in order to bring certainty to future treatment opportunities." (14.8)*

*"EPA understands the risks invasive plants may pose to resources within the Forests, if these were not treated. Thus, we appreciate FS planning efforts for this project, especially the consideration of public scoping comments in the development of this EIS and incorporation of Integrated Pest Management (IPM) principles in the project plan." (15.1)*

*"The Crook County SWCD serves as the Weed Board for Crook County. The SWCD understands that noxious weeds are a major threat to our forests and grassland. The alternative proposed in the Draft EIS will provide important tools in the battle with noxious weeds." (13.1)*

*"The DEIS identifies well thought out treatment strategies to deal with noxious weed sites currently identified and provides an opportunity to treat newly identified sites when control or eradication is relatively easy and cost-efficient. The Draft EIS also thoroughly addresses concerns regarding the use of herbicides." (13.2)*

*"We recommend that the FS continue to work with Oregon Department of Environmental Quality (ODEQ) to assure that the state water quality standards will be met." (15.4)*

*"Although TMDLs for 303(d) listed waters within the project area are not yet available, we recognize that ODEQ and FS have made significant progress in reaching agreement on working cooperatively to meet State and Federal water quality rules and regulations (Memorandum of Understanding (MOU), 2002). EPA supports decisions that have been reached between the two agencies, especially the FS commitment to manage National Forest System lands to protect, restore and maintain water quality so that Federal and state water quality laws and regulations are met or exceeded to support designated uses." (15.10)*

*"We also recognize and appreciate the environmental concerns regarding herbicide use and the need to be cautious and judicious in applying them." (8.3)*

*"Overall, we think the Draft EIS is well written, thorough, and contained ample amounts of relevant information." (8.4)*

*"The treatment strategies in the proposed action alternative for addressing invasive plant infestations on National Forest lands is a major step forward in the battle with weeds. If implemented, it should provide local land managers with some key tools that are required to have a realistic chance of effectively controlling weed populations in remote, wildland environments." (8.5)*

*"We also think that the alternative does a good job of establishing sideboards on herbicide use to avoid accidental applications that may have adverse effects on fish, wildlife, or water quality." (8.6)*

*"The alternative proposed in the Draft EIS will provide important tools in the battle with noxious weeds. The Draft EIS identifies well thought out treatment strategies to deal with noxious weed sites currently identified and provides an opportunity to treat newly identified sites when control or eradication is relatively easy and cost-efficient." (10.3)*

*"The DEIS also thoroughly addresses concerns regarding the use of herbicides." (10.4)*

*"For all we know, these herbicide companies are laundering hazardous waste through the inert ingredient stream." (11.9)*

*"Herbicides should not be seen as a panacea; instead they are worse than just patching up symptoms (invasive plant appearance) with bandaids because they cause significant harm themselves." (17.44)*

*"Inaccurate and unprofessional science is also suggested by many highly questionable assumptions and biased assumptions throughout." (17.39)*

**Response: Thank you for your comment.**

## Government Agency Comment Letters

Letters from federal, state, and local government agencies are reproduced here per FSH 24.1.1(b). All comment letters are available in the project file in the Deschutes National Forest headquarters office, Bend, Oregon.

Theodore R. Kulongoski, Governor

March 19, 2007

Leslie Weldon, Forest Supervisor, Deschutes NF
Deschutes National Forest Headquarters
1001 SW Emkay Drive
Bend OR 97702

Dear Ms. Weldon:

The State of Oregon appreciates the opportunity to provide comments on the Draft Environmental Impact Statement (DEIS) Site Specific Invasive Plant Treatments for Deschutes and Ochoco National Forests and the Crooked River National Grassland.

The state of Oregon believes it is essential to protect the state's natural resources from invasive plants and noxious weeds. Invasive noxious weeds are causing significant environmental impacts and are costing Oregon millions annually in economic losses. The Deschutes and Ochoco National Forests and the Crooked River National Grassland are essential partners in addressing Oregon's invasive noxious weed problems.

The state of Oregon supports an integrated weed management approach and believes in utilizing all tools available including chemical, mechanical, and biological control methods as well as prescribed fire for control projects. The State asks the USFS to minimize negative effects on the environment by considering site-specific criteria in developing decisions for the use of the most effective tools. In all cases, impact on water quality must be considered to avoid surface and ground water contamination and to protect the beneficial uses.

The state also supports the Early Detection/ Rapid Response (EDRR) strategy in order to aggressively control new invasive species in a timely manner in effort to minimize both of the invasive weeds and of herbicide use across the landscape.

The following are specific comments from three state natural resource agencies that include: Oregon Department of Agriculture, Noxious Weed Control Program (ODA), Oregon Department of Forestry (ODF) and the Oregon Department of Environmental Quality (DEQ).

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**REGION 10**
1200 Sixth Avenue
Seattle, WA 98101

March 19, 2007

Reply To
Attn Of: ETPA-088 07-002-AFS

Leslie Weldon, Supervisor
Deschutes National Forest
1001 SW Emkay Dr.
Bend, OR 97702

Dear Ms. Weldon:

The U.S. Environmental Protection Agency (EPA) has reviewed the draft Environmental Impact Statement (EIS) for the proposed **Invasive Plant Treatments** project (CEQ No. 20070025) within Deschutes and Ochoco National Forests and Crooked River National Grassland in Crook, Deschutes, Jefferson, Grant, Klamath, Lake, and Wheeler Counties, OR. Our review was conducted in accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act. Section 309, independent of NEPA, specifically directs EPA to review and comment in writing on the environmental impacts associated with all major federal actions. Under our policies and procedures, we also evaluate the document's adequacy in meeting NEPA requirements.

The draft EIS evaluates potential environmental effects of a proposal to eradicate, control, suppress, and contain invasive plants on nearly 52,015 acres of the National Forests and Grassland ("Forests"), of which 14,547 acres are currently infested and targeted for treatment in the next 15 years. Invasive plants are spreading at a rate of 8-12% per year and are affecting both public and other lands. The US Forest Service (FS) therefore needs to take action to treat this infestation before their adverse environmental effects to native ecosystem processes become more significant. Before such action can be taken, however, the FS developed and analyzed the following three alternative actions to assess what environmental effects, if any, would be associated with the proposed action.

1. **No action (Alternative 1).** Under this alternative, the FS would continue current invasive plant management, without change. Meanwhile, invasive plants would continue to spread at the current rate of up to 12% per year and to generate associated effects.

2. **Preferred Alternative (Proposed action).** Under this action alternative, the FS would treat invasive plants using a combination of manual, mechanical, biological, and herbicides, and restoration to eradicate, control, suppress, and contain the invasive species. Other treatment methods would include a combination of hand-pulling, cutting, mowing, weed whacking, tilling, assorted biological controls, and selective/hand, spot, and broadcast applications of herbicides. The proposed action would also include Project Area Unit (PAU) designation and Project Design Features

(1)

"Todd Pfeiffer" <tpfeiffer@co.klamath.or.us>

01/30/2007 10:16 AM

To: <comments-pacificnorthwest-deschutes@fs.fed.us>

cc:

Subject: DEIS for Deschutes National Forest

Thank you for sending me a copy of the DEIS for review and comment. I have looked it over and I am in support of Alternative # 2. Fremont and Winema National Forests already have noxious weed spraying in place within Klamath County and I will be glad to see the same in the Deschutes National Forest. The Klamath County Weed Control does contract work for other agencies within the Deschutes National Forest Boundary and the inability to use herbicides greatly hampers our efforts. Some of our areas of concern that we would like listed as weed sites are County and Public Road Right-of-Ways, Power Line Right-of-Ways and Gas Line Right-of-Ways.

An interest of our Road Department is the spraying of County Road Shoulders for total vegetation control and also spraying brush and small trees within our right-of-ways to help maintain visibility and to maintain the integrity of the road and road shoulder. Using herbicides to clear right-of-way is much more cost effective than mechanical means such as mowing.

Please continue to keep me informed of the progress with your EIS as I am looking forward to its completion.

Sincerely,

Todd Pfeiffer
Klamath County Vegetation Manager
Klamath County Weed Control
305 Main Street
Klamath Falls, OR 97601

received 3/10/07

(8)

# Weed Advisory Board

61150 SE 27th St • Bend, Oregon 97702
(541) 322-7135 • FAX (541) 388-2719

Leslie Weldon and Jeff Walters, Forest Supervisors
Deschutes National Forest Headquarters
1001 SW Emkay Drive
Bend, OR 97702

Subject: Comments on the DEIS for Invasive Plants Treatments on the Deschutes and Ochoco National Forests and the Crooked River National Grassland

Dear Ms. Weldon and Mr. Walters:

Thank you for the opportunity to comment on this important issue. The Deschutes County Weed Board is an advisory committee appointed by the County Commissioners that helps set program priorities. They are to assist in increasing public awareness of the spread of noxious weeds and in keeping the Board of Commissioners and budget committees informed of problems regarding funding and management of the noxious weed program.

Mission Statement:

Work cooperatively to promote and implement noxious weed control in Deschutes County; to contain existing weed populations and eradicate new invaders: to raise the value of the land economically and biologically: to improve the health of the community, promote stewardship, preserve natural resources and provide examples and leadership for other counties and states in effective vegetation management.

The Weed Board wholeheartedly agrees that invasive plants are a major threat to the ecological integrity of our forests and grasslands in Central Oregon, and we commend the Forest Service for taking this matter seriously and making it a high priority. Further, we think the tools the Forest Service is currently authorized to use to fight invasive plants are woefully insufficient to win the battle to effectively control and manage weed infestations in wildland environments. Yet, we also recognize and appreciate the environmental concerns regarding herbicide use and the need to be cautious and judicious in applying them. It is with these priorities in mind that we have reviewed your Draft Environmental Impact Statement (DEIS) for Invasive Plants Treatment on the Deschutes and Ochoco National Forests and Crooked River Grassland and have the following comments.

Overall, we think the Draft EIS is well written, thorough, and contained ample amounts of relevant information. The new treatment strategies in the proposed action alternative for addressing invasive plant infestations on National Forest lands is a major step forward in the

(13)

Crook County Soil and Water Conservation District
498 S.E. Lynn Blvd. - Prineville, OR 97754

March 15, 2007

Leslie Weldon, Forest Supervisor, Deschutes NF
Deschutes National Forest Headquarters
1001 SW Emkay Drive
Bend, OR 97702

Subject: Deschutes/Ochoco/Crooked River National Grassland Invasive Plant Draft EIS

Dear Ms. Weldon,

The Crook County Soil and Water Conservation District (SWCD) would like to take this opportunity to comment on the Deschutes and Ochoco National Forests and Crooked River National Grassland Invasive Plant Environmental Impact Statement.

The Crook County SWCD serves as the Weed Board for Crook County. The SWCD understands that noxious weeds are a major threat to our forests and grassland. The alternative proposed in the Draft EIS will provide important tools in the battle with noxious weeds. The Draft EIS identifies well thought out treatment strategies to deal with noxious weed sites currently identified and provides an opportunity to treat newly identified sites when control or eradication is relatively easy and cost-efficient. The Draft EIS also thoroughly addresses concerns regarding the use of herbicides.

The Crook County SWCD would like the following issues to receive more consideration in the final steps of this process:

- Cooperation and partnerships with agencies, organizations and private landowners have a significant impact on the spread of noxious weeds between land ownerships. The Deschutes and Ochoco National Forests and Crooked River National Grassland should encourage these partnerships when possible.
- Prevention is the most cost-effective method of dealing with noxious weeds. Every Forest Service employee should receive training to identify key noxious weed species and sites at risk to invasions.
- The EIS should weigh short-term and long-term effects of noxious weeds and the various treatment methods. The lack of effective treatment can produce serious long-term ecological effects that should be taken into account.
- Yellow Flag Iris (Iris pseudocorus) should be a priority species identified in this document. The Forest Service should work closely with the tri-county Yellow Flag Iris working group in implementing control efforts.
- The EIS should provide a mechanism to add new herbicides as they become available. New herbicides are already available for weeds such as Russian knapweed that require lower application rates than others on the market.

# APPENDIX J

## Watershed Information

**Table J- 1 Watershed Table**

| Field | Area | Name | 6th Field (Subwatersheds) |
|---|---|---|---|
| **1st** | **Region** | **Pacific Northwest** | |
| **2nd** | **Sub-Region** | **Middle Columbia River** | |
| **3rd** | **River Basin** | **John Day River** | |
| ***4th*** | ***Sub-Basin*** | ***Upper John Day River*** | |
| 5th | Watershed | Mdl SFk John Day River | Corral Creek, Izee Falls, Lower Deer Creek, Morgan Creek, Pine Creek, Rosebud Creek, Sunflower Creek |
| | | Lwr SFk John Day River | Black Canyon Creek, Corner Creek/Black Pine Creek, Corral Creek, Jackass Creek, Lower South Fork John Day River, Utley Creek, Venator Creek, Wind Creek |
| | | Upr Middle John Day River | Cottonwood Creek, Franks Creek, Mascal Ranch |
| | | Mountain Creek | Fopiano Creek, Lower Mountain Creek, Middle Mountain Creek, Upper Mountain Creek, Waterman Flat |
| | | Rock Creek | Lower Rock Creek, Middle Rock Creek, Upper Rock Creek |
| ***4th*** | ***Sub-Basin*** | ***Lower John Day River*** | |
| 5th | Watershed | Bridge Creek | Headwaters Bridge Creek, Lower Bridge Bear Creek, Lower Bridge Creek, Middle Bridge Bear Creek, Middle Bridge Creek, Upper Bridge Bear Creek, Upper Bridge Creek, West Branch Bridge Creek |
| **3rd** | **River Basin** | **Deschutes River** | |
| ***4th*** | ***Sub-Basin*** | ***Upper Deschutes River*** | |
| 5th | Watershed | Crane Prairie | Charlton Creek, Crane Prairie, Cultus Creek, Deer Creek, Elk Lake, Lava Lakes, Quinn Creek, Soda Creek |
| | | Wickiup | Browns Creek, Davis Creek, Davis Lake, Moore Creek, Odell Creek, Odell lake, Wickiup |
| | | Fall River | Bates Butte, Dutchman Creek, Fall River, Pringle Falls, Siah Butte, Spring River |
| | | Pilot Butte | Benham Falls, Bessie Butte, Coyote Spring, Green Mountain, Lava Island Falls, Lockit Butte, Mokst Butte West |
| | | Tumalo Creek | Lower Tumalo Creek, Upper Tumalo Creek |
| | | Deep Canyon | Bull Creek, Deep Canyon, Three Creek, Triangle Hill |
| | | Middle Deschutes | Buckhorn Canyon, Big Cove, Chicken Spring Canyon, Cline Falls, Eagle Creek, Horse Cave, Laidlaw Butte, Little Cove, Long Butte, McKenzie Canyon, Nena Creek, Odin Falls, Rice Creek, Steelhead Falls, Wapinitia Creek |
| | | Whychus Creek | Fourmile Butte, Headwaters Whychus Creek, Lower Indian Ford, Lower Whychus Creek, Lower Trout Creek, Middle Whychus Creek, Upper Indian Ford, Upper Whychus Creek, Upper Trout Creek |
| | | Upper Metolius River | Abbot Creek, Cache Creek, Candle Creek, Canyon Creek, Dry Creek, First Creek, |

| Field | Area | Name | 6th Field (Subwatersheds) |
|---|---|---|---|
| | | | Headwaters Metolius River, Jack Creek, Jefferson Creek, Lower Lake Creek, Upper Lake Creek |
| | | Lower Metolius River | Juniper Creek, Lower Fly Creek, Lower Metolius River, Middle Metolius River, Upper Fly Creek, Upper Metolius River, Whitewater River |
| | | Lake Billy Chinook | Carcass Canyon, Geneva, Round Butte Dam, Stevens Canyon |
| ***4th*** | ***Sub-Basin*** | ***Little Deschutes River*** | |
| 5th | Watershed | Upr Little Deschutes River | Bunny Butte, Clover Butte, Gilchrist, Gilchrist Junction, Hemlock Creek, Little Odell Creek |
| | | Crescent Creek | Cold Creek, Crescent Lake, Lower Big Marsh Creek, Lower Crescent Creek, Middle Crescent Creek, Summit Lake, Upper Big Marsh Creek |
| | | Middle Little Deschutes R | Cryder Butte East, Dorrance Meadow, Hamner Butte |
| | | Sellers Creek | Grasswell, Lower Sellers Creek, Sellers Marsh, Upper Sellers Creek |
| | | Little Walker Mountain | Corral Springs, Crescent Butte, Little Walker Mountain, North Paunina, North Walker, South Paunina |
| | | Long Prairie Slough | Beal, Green Butte, Ipsoot Butte, Lower Long Prairie, Moffitt Butte, Paulina Peak South, Stams Mountain, Surveyors Lava Flow, West Long Prairie |
| | | Lower Little Deschutes R | Kawak butte West, LaPine, Lower Paulina Creek, Sugar Pine Butte, Upper Paulina Creek, Wickiup Junction |
| ***4th*** | ***Sub-Basin*** | ***South Fork Crooked R*** | |
| 5th | Watershed | South Fork Beaver Creek | Camp Creek, Freeman creek, Lower South Fork Beaver Creek, Swamp Creek |
| | | Upper Beaver Creek | Beaverdam Creek, North Fork, Beaver Creek, Powell Creek, Sugar Creek |
| | | Paulina Creek | Dry Paulina Creek, Lower Paulina Creek, Upper Paulina Creek |
| | | Lower Beaver Creek | Alkali Creek, Drift Canyon, North Wolf Creek, Wolf Creek |
| ***4th*** | ***Sub-Basin*** | ***Upper Crooked River*** | |
| 5th | Watershed | Crooked River abv North Fk | Kelly Creek, Maury Creek, Watson Creek |
| | | Camp Creek | Clover Creek, Indian Creek, Lower Camp Creek, Middle Fork Camp Creek, West Fork Camp Creek |
| | | Upper NFk Crooked River | Elliot Creek, Gray Creek, Headwaters North Fork Crooked, Howard Creek, Johnson Creek, Lower Big Summit Prairie, Peterson Creek, Porter Creek |
| | | Deep Creek | Jackson Creek, Little Summit Prairie Creek, Lower Deep Creek |
| | | Lower NFk Crooked River | Lower North Fork Canyon, Upper North Fork Canyon |
| | | Upper Crooked R Valley | Conant Creek, Drake Creek, Lost Creek, Lower Horse Heaven Creek, Newsome Creek, Pine Creek, Upper Horse Heaven Creek, Wickiup Creek |
| | | Bear Creek | Headwaters Bear Creek, Little Bear Creek, Lower Bear Creek, Middle Bear Creek, Sage Hollow, Upper Bear Creek |
| | | Prineville Reservoir | Lower Prineville Reservoir, Upper Prineville |

| Field | Area | Name | 6th Field (Subwatersheds) |
|---|---|---|---|
| | | | Reservoir |
| ***4th*** | ***Sub-Basin*** | ***Lower Crooked River*** | |
| 5th | Watershed | Upper Ochoco Creek | Duncan Creek, Headwaters Ochoco Creek, Lower Marks Creek, Upper Marks Creek, Wolf Creek |
| | | Mill Creek | Upper Mill Creek, Lower Mill Creek, |
| | | Lower Ochoco Creek | Lawson Creek, Ochoco Reservoir, Prineville, Veasie Creek |
| | | McKay Creek | Allen Creek, Lower McKay Creek, Upper McKay Creek |
| | | Badlands | Antelope Butte, Cold Camp Creek, Grub Hollow, Indian Creek, Lower Ward Creek, Upper Ward Creek |
| | | Upr Dry River | Badlands WSA, Brothers, Fehrenbacker Reservoir, Hirsch Reservoir, Horse Ridge, Millican East, Pine Mountain, Pine Ridge, Pringle Flat Reservoir, Smith Canyon, Teepee Draw |
| | | Lwr Dry River | Alfalfa, Hunter, North Powell Butte, O'Neil, Reynolds Pond, South Powell Butte, Stookey, West Butte, Williamson Creek |
| | | Lwr Crooked River Valley | |
| | | Crooked River Grassland | Lower Crooked River Gorge, Upper crooked River Gorge |
| ***4th*** | ***Sub-Basin*** | ***Lower Deschutes River*** | |
| 5th | Watershed | Hrwtrs Deschutes River | Box Canyon, Lake Simtustus, Seekseequa Creek |
| | | Willow Creek | Dry Canyon, Lower Willow Creek, Middle Willow Creek, Rimrock Spring, Upper Willow Creek |
| ***4th*** | ***Sub-Basin*** | ***Trout Creek*** | |
| 5th | Watershed | Upper Trout Creek | Amity Creek, Big Whetstone Creek, Board Hollow, Foley Creek, Headwaters Trout Creek, Little Trout Creek, Long Hollow, Opal Creek, Tub Springs Canyon |
| | | Hay Creek | Little Willow Creek, Lower Hay Creek, Upper Hay Creek, Wilson Creek |
| | | Mud Springs Creek | Lower Mud Springs Creek, Sagebrush Creek, Upper Mud Springs Creek |
| **2nd** | **Sub-Region** | **Oregon Closed Basins** | |
| **3rd** | **River Basin** | **Oregon Closed Basins** | |
| ***4th*** | ***Sub-Basin*** | ***Summer Lake*** | |
| 5th | Watershed | Mc Carty | Butte Well, Dry Creek, McCarty Butte, Morehouse Lake, Pasture Rock |
| | | Pine | Big Hole, Ooskan Butte, Pine Lake, Willow Butte |
| | | Devils Garden | Buck Butte, China Hat, Devils Garden, Dome, Harrison Place Well, Hogback Butte, Porcupine, Sixteen Butte, Twin Buttes |
| | | Walker Creek | Lower Walker Creek, Middle Walker Creek |
| **1st** | **Region** | **California** | |
| **2nd** | **Sub-Region** | **Klamath/N California Co** | |
| **3rd** | **River Basin** | **Klamath** | |
| ***4th*** | ***Sub-Basin*** | ***Williamson*** | |
| 5th | Watershed | Klamath Marsh/Jack Cr | Dillon Creek, Jack Creek, Mosquito creek, |

| Field | Area | Name | 6th Field (Subwatersheds) |
|---|---|---|---|
| | | | Skellock Creek, Wildhorse Ridge |
| | | NW of Klamath Lake | Baker Creek, Cottonwood, Deep Creek, Lost Creek, Miller Lake, Shoestring Creek, Tiny/Desert |

# APPENDIX K

## Inventory and Monitoring Framework
**(Appendix 1 from R6 Invasive Plant ROD)**

## Inventory and Monitoring Framework

(APPENDIX M from the Invasive Plant Final EIS)

It is assumed every Forest in Region Six has an invasive plants coordinator and is maintaining an up-to-date invasive plant inventory using NRIS/Terra, the nationally accepted protocol. The inventory will be the primary means to plan and prioritize treatments. The inventory will be used as the main vehicle for tracking treatment effectiveness both regionally and on a site specific basis.

In addition to the monitoring that is already required under various Forest Plans, this inventory and monitoring plan framework is part of all action alternatives in this Environmental Impact Statement (EIS). The framework would guide the development of detailed monitoring plans at the site-specific project scale. Invasive plant treatment and restoration actions are likely to be complex, involve multiple land ownerships and will take years to implement, due to the nature of invasive plant problems. It is likely that a site will be treated multiple times over the years. Tracking these efforts and subsequent progress will be crucial to determining success.

A good monitoring program will be well thought out and have a high probability of detecting change in the resource being monitored (NPS, 2002). The Field Guide to Invasive Plant Inventory, Monitoring and Mapping (USDA FS, 2002) has been developed to guide monitoring efforts in conjunction with NRIS/Terra. It suggests a monitoring regime may start with annual monitoring for the first 3-5 years, decreasing in frequency to every other year for the next 5-10 years and further decreasing monitoring frequency to every 3 years for the next ten years until the seed source has been exhausted (i.e. no new germination taking place).

Monitoring regimes may vary in time and space depending on the species; for example, those that reproduce vegetatively may require a longer span of annual monitoring. The monitoring categories described in this framework (implementation/compliance, and effectiveness (of treatments in meeting project objectives, and effectiveness of protection measures) can be used to implement a long-term adaptive management strategy. By implementing an adaptive management approach, managers will identify and respond to changing conditions and new information on an ongoing basis, and assess the need to make changes to treatment and restoration strategies.

### Implementation/Compliance Monitoring

Implementation/compliance monitoring answers the question, “Did we do what we said we would do?” This question needs to be answered on a Regional scale, because adaptive management strategies require determination that actions are taking place as described in the Invasive Plants EIS.

If an action alternative is selected, each Forest Supervisor will be directed to assess compliance with the Invasive Plant Program EIS Record of Decision as a part of Forest Plan Implementation monitoring. Regional Office staff will periodically aggregate this information as a part of program oversight.

An implementation/compliance checklist database, such as the Pacfish/Infish Biological Opinion Implementation Monitoring module database for the eastside, could be used as a template to input and analyze implementation/compliance monitoring data. The use of a consistent reporting format will allow for aggregation of information at various scales. Such as system will be used to determine patterns of compliance.

**Listed Species** -- An implementation/compliance monitoring database would track invasive plant treatment projects that are the subject of Section 7 consultations under the Endangered Species Act (ESA), generate annual reporting of compliance for use by the Services (NOAA Fisheries, U.S. Fish and Wildlife) and Forest Service (FS), and allow for common reporting of data on individual projects. As a minimum, on each project requiring consultation, reporting will be required on compliance with Standards 16, 18, 19, and 20 in the Invasive Plant EIS. Additional standards could be included, as appropriate, for the individual ecoregions, Forests, or projects. For example, Northwest Forest Plan (NWFP) riparian standards relevant to herbicide use or invasive plant control projects could be included in the database for those Forests in the NWFP-covered areas.

## Effectiveness Monitoring

Effectiveness monitoring, relative to project objectives, answers the question, "Were treatment and restoration projects effective?" This question could be answered on either a regional or a project-level scale. Invasive plant infestations require pre-project inventories to determine how, when, and where treatments are to be applied, and post treatment monitoring to assess the effectiveness (treatment) in meeting project objectives (e.g. restoring structure and composition of native vegetation).

A goal of the Effectiveness Monitoring component in the Regional Invasive Plant Program is to answer the following questions:

> Have the number of new invasive plant infestations increased or decreased in the Region or at the project level?
>
> What changes in distribution, amount and proportion of invasive plant infestations have resulted due to treatment activities in the region or at the project level?
>
> Has the infestation size for a targeted invasive plant species been reduced regionally or at the project level?
>
> Which treatment methods, separate or in combination, are most successful for specific invasive species?
>
> Which treatment methods have not been successful for specific invasive species?

The nation-wide NRIS/Terra database, and the upcoming FACTS database, provide common reporting formats to input information and provide a mechanism for addressing the above questions. In addition, current long-term ecological monitoring networks will assist the FS in determining trends of invasive plant infestations at the Regional level.

The NRIS/Terra database could be sorted to answer the above questions because it tracks size and species of infestations as well as treatment methods. The Forest Inventory and Analysis Network (FIA) or the Forest Health Monitoring plots associated with the FIA network could be used to follow invasion trends. Such networks could be used to track trends in the spread or reduction in spread of the more dominant invasive plants in the region. Monitoring programs developed at the Forest level would answer more project specific questions.

**Listed Species -** Monitoring that addresses the effectiveness of various measures designed to reduce potential adverse effects from the project, including standards in the EIS, “project design criteria”, “design features”, and “protection measures” may also need to be conducted. This type of monitoring will only be required for **a representative sample of** invasive plant treatment projects that pose a “high risk” to federally listed species. “High risk” projects are defined as projects with the potential to affect listed species, in the following situations:

- Any project involving aerial application of herbicide.
- Projects involving the use of heavy equipment or broadcast application of herbicide (e.g. boom spray or backpack spraying that is not limited to spot sprays) that occur in 1) riparian areas (as defined in NWFP, Pacfish, or Infish, as applicable), ditches or water corridors connected to habitat for listed fish; or, 2) proximity to federally listed plants or butterfly habitat.

For the purposes of determining the need for protection measure effectiveness monitoring, invasive plant treatment methods that are **not** considered “high risk” can include, but are not limited to, the following:

- Broadcast application of herbicide and use of heavy equipment that occurs **outside** of, riparian areas, ditches or water corridors connected to water bodies, or, 2) areas in proximity to federally listed plants or butterfly habitat.
- Manual methods including hand-pulling, grubbing, stabbing, pruning, cutting, etc.
- Mechanical methods using small equipment like chainsaws, or equipment rarely used and not often in proximity to listed fish habitat, like flamers, foamers, hot steam, etc.
- Prescribed fire used expressly for invasive plant control and which occurs outside of riparian areas or habitat for federally listed plants or butterflies.
- Herbicide applications using spot spray (used with a shield near listed plant locations)
- with a backpack sprayer, cut stump, injection, wicking wiping, basal bark applications, or other highly selective methods.
- Minor uses of fertilizer to encourage native plant competition or growth.
- Biological controls used in habitat areas for terrestrial wildlife or fish. Use in proximity to listed plants or butterflies should be evaluated on a case-by-case basis.
- Broadcast applications (except aerial) using clopyralid, imazapic, and metsulfuron methyl in proximity to habitat for listed fish or listed terrestrial wildlife.

A collection of several of these low risk projects in close proximity to each other and in proximity to habitat for listed species may constitute a "high risk" project, but this should be evaluated on a case-by-case basis.

Monitoring for "high risk" invasive plant treatments that may affect ESA-listed species or designated critical habitat should determine if standards and/or protection measures were effective at reducing potential effect pathways (e.g. disturbance, sedimentation, exposure to herbicides) and results should be applicable elsewhere. Unique, individual monitoring efforts and protocols have not provided information that is applicable to other areas or projects. Therefore, a Regional approach is outlined in this framework that will help address the needs for protection measure effectiveness at a broader scale. The regional approach will be developed in consultation with other agencies, including but not limited to National Marine Fisheries Service and U.S. Fish and Wildlife Service.

For example, Japanese knotweed is a serious invader of riparian areas and has the potential to alter ecosystems upon which listed salmon depend. The Region may have several Japanese knotweed treatment projects over the next several years and each one may have the potential to adversely affect listed salmon or designated critical habitat if adequate measures are not part of the treatment plan or are not complied with during implementation. Designing consistent monitoring protocol will allow a more efficient and effective evaluation of the project protection measures.

To meet the objective of being able to evaluate standards and measures applied at the Regional, sub-Regional, and project level for protection of ESA-listed species and/or designated critical habitat in "high risk" projects, an interagency monitoring protocol ***and reporting schedule*** will be developed by 2007. The expectation being that this protocol would be applied to high risk projects to determine the effectiveness of Regional EIS standards, and additional standards or protection measures applied at finer scales, in reducing potential effect pathways (e.g. disturbance, sedimentation, exposure to herbicides, etc.) for listed species.

In the interim, information obtained from implementation/compliance monitoring reports for "high risk" projects will be reviewed in 2005 and 2006 to inform the development of a consistent monitoring protocol for ensuring that standards and protection measures were effective. This 2-3 year lag time before protocol are developed and effectiveness monitoring is implemented does not apply to aerial application of herbicides. All projects with aerial applied herbicide will include a monitoring plan to assess the effectiveness of measures in protecting ESA-listed species and/or designated critical habitat.

Until a Regional, interagency effectiveness monitoring protocol for ESA-listed species and/or designated critical habitat is developed (2007), the need for effectiveness monitoring on "high risk" projects will be evaluated by Level 1 or other interagency technical teams during Section 7 consultation.

Recommendations for additional effectiveness monitoring beyond that described in this framework will require that Level 2 or other appropriate interagency management team agree to the recommendations of the technical or Level 1 team for the project. This process will help lead the Region toward efficient and reliable data collection and allow statistical analysis of the data gathered.

**References**

USFS (U.S. Forest Service). 2001. Invasive Plant Management Decisions and Environmental Analysis. USDA Forest Service

USFS (U.S. Forest Service). 2002. Field Guide – Invasive Plant Inventory, Monitoring and Mapping Protocol. USDA Forest Service.

NPS (National Park Service). 2002. Invasive Plants Inventory and Monitoring Guidelines, National Park Service