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Umatilla National Forest

Draft Environmental Impact Statement

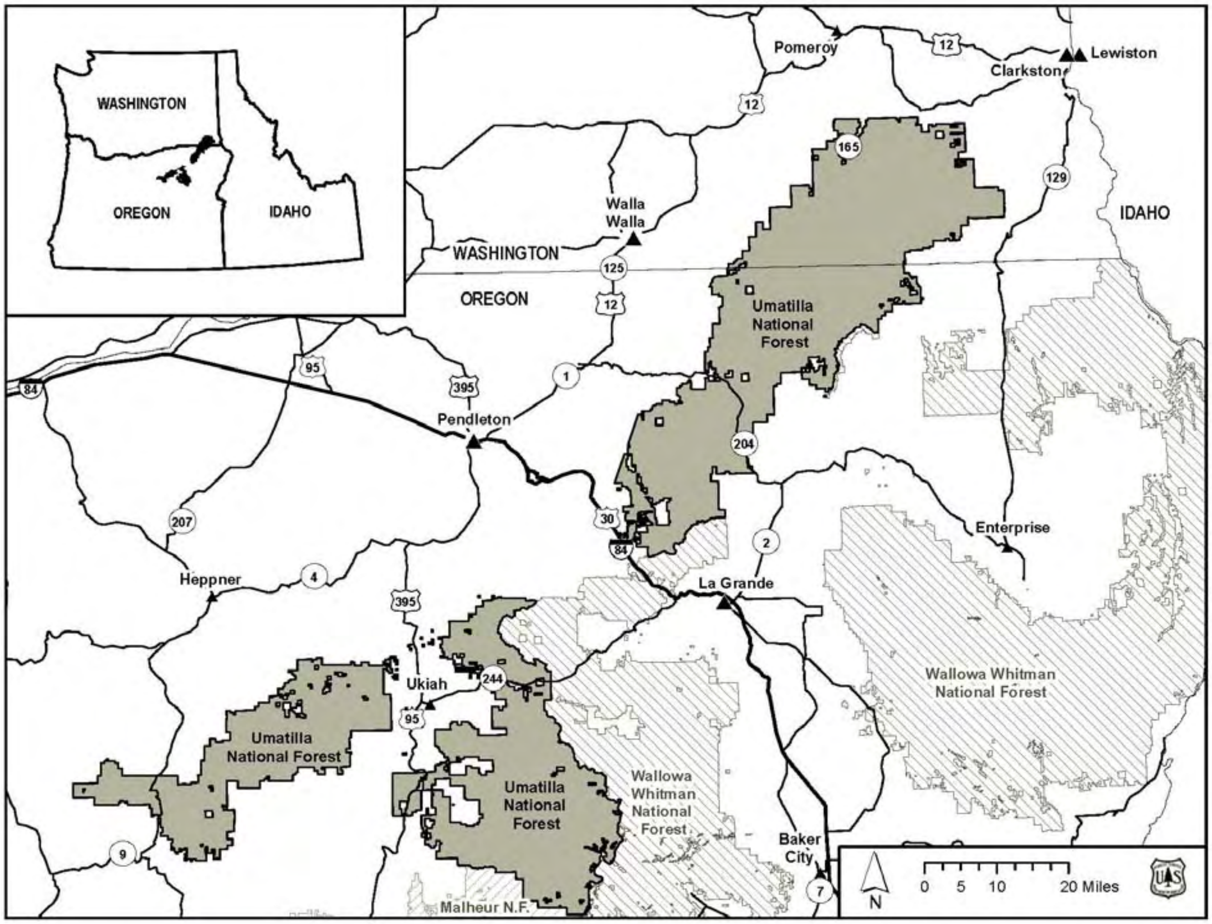
Invasive Plants Treatment Project

Volume I

Counties: Asotin, Columbia, Garfield, and Walla Walla in Washington; Grant, Morrow, Umatilla, Union, Wallowa, and Wheeler in Oregon

Picture Courtesy of Julie Laufman

Umatilla National Forest Vicinity Map



Invasive Plant Treatment Project
Draft Environmental Impact Statement

Asotin, Columbia, Garfield, and Walla Walla Counties in Washington; Grant, Morrow, Umatilla, Union, Wallowa, and Wheeler Counties in Oregon

Lead Agency:	**USDA Forest Service**
Responsible Official:	**Kevin D. Martin, Umatilla National Forest Supervisor**
Information Contact:	**Glen Westlund, Walla Walla Ranger District Planner**
Address Comments To:	**INVASIVE PLANTS** **Umatilla National Forest** **2517 SW Hailey Avenue** **Pendleton, OR 97801**
Electronic Comments Accepted:	**comments-pacificnorthwest-umatilla@fs.fed.us**
Website	http://www.fs.fed.us/r6/uma/projects

This DEIS is made available for a 45-day Comment Period, under the provisions of the National Environmental Policy Act (40 CFR 1500-1508), and Notice, Comment, and Appeal Procedures for National Forest System Projects and Activities, (36 CFR 215). The Forest Service will accept comments as provided in §215.6(a)(4), beginning on the day following the date of publication of the Notice of Availability (NOA) in the **Federal Register**. This day is scheduled to be June 22, 2007. In order to be considered in the Final Environmental Impact Statement, substantive comments must be received within the formal comment period. The official comment period timelines will be posted in the Federal Register, and on the Umatilla National Forest's Web site (http://www.fs.fed.us/r6/uma/projects/).

Comments received in response to this solicitation, including names and addresses of those who comment, will be considered part of the public record on this Proposed Action and will be available for public inspection. Comments submitted anonymously will be accepted and considered; however, those who only comment anonymously will not have standing to appeal the subsequent decision under 36 CFR Part 215. Reviewers must provide the Forest Service with their comments during the review period of this Draft Environmental Impact Statement. This will enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decision-making process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewer's position and contentions. Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 553 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement. City of Angoon, v. Hodel (9th Circuit, 1986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980). Comments on the draft environmental impact statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

Abstract

This Draft Environmental Impact Statement (DEIS) discloses the effects of treating invasive plants on the Umatilla National Forest. Invasive plant species were identified by the Chief of the Forest Service as one of the four threats to forest health (for more information see http://www.fs.fed.us/project/four-threats). Invasive plants are displacing native plants, destabilizing streams, reducing the quality of fish and wildlife habitat; and degrading natural areas.

Strong public concern has been expressed regarding Forest Service response to invasive plants. Several organizations and individuals have offered to cooperate with the Forest Service in this endeavor. The Forest Service is responding to a crucial need for timely containment, control, and/or eradication of invasive plants, including those that are currently known and those discovered in the future. The purpose of this project is to treat invasive plants in a cost-effective manner that complies with environmental standards.

Approximately 24,649 acres are currently estimated to need treatment, including but not limited to spotted and diffuse knapweed, yellow starthistle, hound's tongue, dalmation and yellow toadflax, scotch thistle, and rush skeletonweed. This Draft Environmental Impact Statement (DEIS) also analyzes the effects of treating new infestations and new invasive species presently unknown or non-existent, but discovered during the life of this project. This DEIS includes detailed consideration of four alternatives:

- Alternative A, the No Action Alternative, would continue to implement treatments according to existing plans; no new invasive plant treatments would be approved.
- Alternative B, the Proposed Action Alternative, would apply an initial prescription, along with re-treatment in subsequent years, until the site was restored with desirable vegetation. Herbicide treatments would be part of the initial prescription for most sites, but the use of herbicides would be expected to decline in subsequent entries as populations became small enough to treat manually or mechanically. Ongoing inventories would confirm the location of specific invasive plants and effectiveness of past treatments.

Two action alternatives were developed in response to public issues related to herbicide use:

- Alternative C, No Broadcast Spraying in Riparian Areas, would not allow broadcast applications of herbicides in riparian areas, however; spot spraying or hand applications such as wiping or wicking of herbicides would be allowed. Except for this limitation imposed on broadcast spraying, the features of this alternative are the same as Alternative B. This alternative addresses human health issues associated with contamination of drinking water supplies from herbicide drift, as well as potential impacts to non-target wildlife, plant species, soils, aquatic biota and riparian ecosystems. Alternative C would minimize herbicide impacts, but would increase treatment costs and decrease treatment effectiveness.
- Alternative D, No Aerial Application, would eliminate the option to aerially apply herbicides. This addresses the issues expressed regarding potential effects of herbicide drift to human health through drinking water supplies, also to non-target wildlife and plant species, soils, aquatic biota and riparian ecosystems, both in the area being treated, and areas adjacent to it. Alternative D would minimize herbicide impacts, but would increase treatment costs and decrease treatment effectiveness. Treatment of some sites would not occur due to inaccessibility or because access to the site is determined unsafe. Except for this limitation imposed on aerial spraying, the features of this alternative are the same as Alternative B.

The Forest Service Preferred Alternative is the Proposed Action (Alternative B).

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APHIS	Animal and Plant Health Inspection Service
ATV	All terrain vehicle
BA	Biological Assessment
BE	Biological Evaluation
BECA	Bald Eagle Consideration Area
BEMA	Bald Eagle Management Area
BLM	Bureau of Land Management
BO	Biological Opinion
BPA	Bonneville Power Authority
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
DN	Decision Notice
DO	Dissolved oxygen
DPS	Distinct Population Segments
EA	Environmental Assessment
EEC	Expected exposure concentration
EDRR	Early detection rapid response
EFH	Essential fish habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Ecologically Sustainable Unit
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FOSS	Federal OSHA Safety Standard
FS	Forest Service
FSH	Forest Service Handbook
FSM	Forest Service Manual
FWS	United States Fish and Wildlife Service
GIS	Geographical information system
GLEAMS	Groundwater Loading Affects of Agricultural Management Systems
GPS	Global positioning system
HQ	Hazard quotient
HUC	Hydrologic Unit Codes
ICBEMP	Interior Columbia Basin Ecosystem Management Project
IDT	Interdisciplinary Team
INFISH	Inland Native Fish Strategy
IWM	Integrated weed management
LAU	Lynx analysis units
LCAS	Lynx Conservation Assessment and Strategy
LOAEL	Lowest observed adverse effect level
LOC	Level of concern
LOP	Limited operating period

LRMP	Land and Resources Management Plan
LWD	Large Woody Debris
LWM	Large woody material
MIG	Minnesota IMPLAN Group
MIS	Management Indicator Species
MPI	Matrix of Pathways and Indicators
MSA	Magnuson Stevens Act
NEPA	National Environmental Policy Act
NF	National Forest
NFMA	National Forest Management Act
NFJD	North Fork John Day
NFS	National Forest System
NMFS	National Marine Fisheries Service
NOA	Notice of Availability
NOAEL	No observed adverse effect level
NOEC	No observable effect concentration
NOI	Notice of Intent
NPE	Nonylphenol Polyethoxylate
NVUM	National Visitors Use Monitoring
ODA	Oregon Department of Agriculture
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
OHV	Off-highway vehicles
OR	Oregon
ORV	Off-road vehicles
PA	Proposed Action
PACFISH	Pacific Native Fish Strategy
PCE	Primary Constituent Elements
PDF	Project design feature
PETS	Proposed Endangered Threatened and Sensitive
PNV	Present Net Value
PNW	Pacific Northwest
POEA	Polyoxyethylene alkylamine
PVG	Potential vegetation groups
R6	Forest Service Region Six
RHCA	Riparian Habitat Conservation Area
RM	River mile
RMO	Riparian management objective
ROD	Record of Decision
SERA	Syracuse Environmental Research Associates, Inc
SOLI	Species of local interest
SRI	Soils Resource Inventory
TAC	Technical Advisory Committee
TCP	trichloro-2-pyridinol
TDS	Total dissolved solids
TES	Threatened, Endangered and Sensitive
TMDL	Total maximum daily load
TNC	The Nature Conservancy
USDA	United States Department of Agriculture

USDI	United States Department of Interior
USFS	United States Forest Service
USGS	United States Geological Survey
WA	Washington
WDFW	Washington Department of Fish and Wildlife
WSDOA	Washington State Department of Agriculture
WQMP	Water Quality Management Plan
WSR	Wild and Scenic River

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Draft Environmental Impact Statement
Umatilla National Forest
Invasive Plants Treatment Project

Summary

Land managers for the Umatilla National Forest propose to treat invasive plants and restore treated sites (seeding/mulching/planting). Invasive species were identified by the Chief of the Forest Service as one of the four threats to forest health (for more information see http://www.fs.fed.us/projects/four-threats). Invasive plants are displacing native plants and degrading natural areas, potentially destabilizing streams and reducing the quality of fish and wildlife habitat. Our integrated weed management program includes a) herbicide and non-herbicide treatment of existing infestations, b) early detection and rapid response to new infestations, c) restoration of treated sites, d) reducing the rate of spread of invasives through adopting prevention practices, and e) interagency and public education and coordination.

The focus of this Draft Environmental Impact Statement (DEIS) is on the part of our program related to treatment and restoration of invasive plant sites on the Umatilla National Forest. New invasive plant management direction has recently been approved by the Pacific Northwest (R6) Regional Forester, allowing for a wider range of herbicide options and specific treatment and restoration standards (USDA 2005b, the Pacific Northwest Invasive Plant Program Record of Decision, referred to herein as the R6 2005 ROD).

With this project, the Forest Service is responding to the need for timely containment, control, and/or eradication of invasive plants, including those that are currently known and those discovered in the future. Strong public concern has been expressed regarding Forest Service response to invasive plants. Several organizations and individuals have offered to cooperate with the Forest Service in this endeavor.

The purpose of this project is to treat invasive plants in a cost-effective manner that complies with the new management direction. Proposed treatment methods include a limited amount of aerial spraying, herbicide broadcast along roadsides, and spot and selective herbicide treatments that target individual invasive plants in combination with manual, mechanical and cultural (fertilization, soil amendments, and/or competitive planting) treatments. Biological control is an ongoing process.

Treatments are proposed for existing or unpredictable new infestations including new plant species that currently are not found on the Forest. Project Design Features (PDFs) would be applied to new infestations that occur within treatment areas, or in similar sites outside treatment areas, to ensure that treatments are within the scope of this EIS.

Four alternatives are considered: The No Action (also referred to as Alternative A), the Proposed Action (also referred to as Alternative B), and two additional action alternatives, Alternative C, which restricts broadcast spraying of herbicides in riparian areas, and Alternative D, which does not allow aerial spraying anywhere.

In the No Action Alternative (Alternative A), no new treatments beyond those previously approved in the 1995Umatilla National Forest Environmental Assessment for the Management of Noxious Weeds would be implemented. Under the 1995 EA, invasive plant treatments would be limited to approximately 2,771 acres.

The "95 EA" approved use of herbicides on 587 sites (1391 acres) on the Umatilla National Forest (USDA 1995). Amendments to this decision added an additional 59 sites (383 acres) approved for chemical treatments (USDA 1998). The total area identified for treatment using all methods was 3154 acres. The total number of sites approved for chemical treatments represents 36 percent of the total number of sites presently mapped. New infestations have been and would continue to be treated with manual and mechanical methods. The 1995 EA (as amended) allowed for biological treatments on 1,339 acres, manual treatments on approximately 41 acres, and a combination of manual, chemical, and cultural methods on an estimated 1,744 acres. Herbicide applications would utilize spot or ground based broadcast methods utilizing Glyphosate, Dicamba, or Picloram. However, the 2005 Regional Invasive Plant FEIS ROD does not allow the use of Dicamba, so herbicide use is limited to the other two chemicals listed. Aerial application of herbicides is not allowed under the current program.

Current inventory indicates there are approximately 25,000 acres of invasive plant infestations on the Forest in 2,069 invasive plant sites. The Proposed Action (Alternative B) is the Forest Service Preferred Alternative, and would approve an effective range of treatment methods according to Project Design Features that minimize the risk of adverse effects from herbicide and other types and methods of treatment (Tables 6, 7, 8 and 9 in Chapter 2).

Proposed treatments include chemical, physical and biological methods. Potential treatments based on existing mapped sites (See Figures 3-6 in Chapter 2) include:

- Approximately 3,915 acres treated with biological or physical methods
- Approximately 17,301 acres of uplands would utilize chemical, physical, or biological methods
- Approximately 3,392 acres of riparian areas would be treated with chemical, physical, or biological methods
- Physical methods only would treat 41 acres

Of these acres, 675 acres are proposed for aerial chemical application (See Figure 7 in Chapter 2 for treatment sites proposed for aerial application).

There is concern that detrimental effects could occur from broadcast spraying herbicide chemical in riparian areas. Alternative C (See Chapter 2 for a full description) would not allow broadcast applications of herbicides in riparian areas. However, spot spraying, or hand applications like wiping or wicking of herbicides would be allowed.

There is concern that aerial application of herbicides could cause detrimental effects to areas targeted, and to adjacent areas where chemical drift could impact non-target environments. Alternative D (See Chapter 2 for a full description) would eliminate this concern by eliminating the option to aerially apply herbicides.

The analysis in the DEIS considers a range of treatments applied to a range of conditions throughout the road systems and other areas that are vectors of invasive plant spread. Project Design Features (Table 6 in Chapter 2) have been developed to limit the potential for adverse effects associated with treatments. Buffers (Tables 7, 8, and 9 in Chapter 2) would limit herbicide selection and method application to ensure exposures are below thresholds of concern for people and the environment.

This DEIS focuses on treatment of invasive plants and restoration of treated sites. It is tiered to the broader scale *Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants FEIS* (Regional Invasive Plant Program EIS), April 2005 along with its *Record of Decision*

(ROD) for Invasive Plant Program Management on October 11, 2005 (Regional Invasive Plant Program EIS, ROD), which addresses other aspects of the invasive plant management program including preventing invasive plant spread during land uses and management activities.

This project in no way attempts to diminish or modify other Umatilla National Forest programs. Each Forest program is responsible to manage activities in ways that will minimize the potential for invasives plants to become established and spread. With this understanding it is our firm belief that the result of this project acting in the context of past, present and foreseeable future actions will reduce the influence of invasive species. This would improve native plant communities, their ecologic functions and thereby improve overall forest health.

Chapter 1 - Purpose and Need for Action

1.1 Background

The Umatilla National Forest (See Vicinity Map above), located in the Blue Mountains of northeast Oregon and southeast Washington covers 1.4 million acres of diverse landscapes and plant communities. The lands are in Grant, Morrow, Umatilla, Union, Wallowa, and Wheeler Counties of Oregon, and Asotin, Columbia, Garfield, and Walla Walla Counties of Washington. The Forest has some mountainous terrain, but consists mostly of v-shaped valleys separated by narrow ridges or plateaus. The landscape also includes heavily timbered slopes, grassland ridges and benches, and bold basalt outcroppings. Elevation ranges from 1,600 to 8,000 feet above sea level.

Interstate Highway 84 divides the Forest roughly in half. The north half is bordered partially on the west by the Umatilla Indian Reservation and flanked by the Wallowa-Whitman National Forest to the southeast. The south half is bordered on the east by the Wallowa-Whitman National Forest and on the south by the Malheur National Forest. The headwaters of four large drainage basins are on the Forest: The Umatilla, John Day, Walla-Walla and Grande Ronde Rivers.

Umatilla National Forest proposes to contain, control and eradicate Invasive plant infestations across the Forest. Nearly 25,000 acres of invasive plant infestations have been identified and mapped. Invasive plants are defined as “non-native plants whose introduction do or are likely to cause economic or environmental harm or harm to human health” (Executive Order13122). Dale Bosworth (Then Chief of the Forest Service), declared invasive species as one of the four main threats to ecosystem health (USDA 2003). The threat is considered serious because invasive plants have the potential to displace or alter native plant communities, and can increase fire hazards, degrade fish and wildlife habitat, eliminate rare and endangered plants, impair water quality and watershed health, and adversely affect a wide variety of other resource values such as recreational opportunities.

An extensive, thorough inventory of invasive plant infestations was completed by the Umatilla National Forest staff in 2006. The inventory, conducted district by district, compiled all known weed infestations, and includes those documented in the1990 inventory completed for the 1995 EA, the districts’ annual monitoring since then and an inventory completed in 2006 that completed a database of all known infestations (see Table 1 in this section and Figures 3-6 in Chapter 2). At present, 24 different invasive plant species are known to occur within the boundaries of the Forest. Species of greatest concern include spotted and diffuse knapweed, yellow starthistle, hound’s tongue, dalmation and yellow toadflax, scotch thistle, and rush skeletonweed, among others. Our ability to prevent or minimize the adverse impacts to native plant communities by these and other invasive plants is greatest if populations can be treated while they are small and in the early stages of invasion. Many of our current infestations occupy small areas, less than an acre. Treatment options and the likelihood of their success are greater for small or new invasive populations and can be controlled at lower costs than once the infestation becomes large.

Table 1 - Invasive Plants Identified on the Umatilla NF and Number of Sites by District

Scientific Name	Common Name	Districts No. of sites[1]			
		Heppner	Pomeroy	North Fork John Day	Walla Walla
Articum minus	Lesser burdock	7	1	3	6
Cardaria draba	Whitetop		2	6	1
Carduus nutans	Musk thistle			2	3
Centaurea biebersteinii	Spotted knapweed	1	54	63	98
Centaurea diffusa	Diffuse knapweed	442	151	131	463
Centaurea repens	Russian knapweed				1
Centaurea solstitialis	Yellow starthistle		22	2	18
Chondrilla juncea	Rush skeletonweed				3
Cirsium arvense	Canada thistle	15	48	26	240
Cynoglossum officinale	Houndstongue	10	26	110	154
Cytisus scoparius	Scotch broom	3			2
Daucus carota	Wild carrot				1
Euphorbia esula	Leafy spurge			2	53
(Hieracium pratense 0	Yellow hawkweed				4
Hieracium aurantiacum	Tall hawkweed			1	
Hypericum perforatum	St John's wort	242	36	36	247
Lathyrus latifoliis	Everlasting peavine			1	
Linaria dalmatica	Dalmation toadflax	82	29	7	6
Linaria vulgaris	Butter and eggs	4	1	8	1
Onopordum acanthium	Scotch thistle	6	19	8	6
Phalaris arundinacea	Reed canary grass				1
Potentilla recta	Sulphur cinquefoil		2	88	62
Senecio jacobaea	Tansy ragwort	3	7	11	70
Taeniatherum caput-medusae	Medusahead			4	15
Total (individual species occurrences)		**815**	**398**	**509**	**1455**

[1] Since some sites have multiple invasive species, the total number of sites in this table exceeds the actual number of sites inventoried. That is, this table totals 3177 sites because of the multiple species overlap. The actual number of sites inventoried and mapped is 2069.

The Pacific Northwest Region published the programmatic *Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants FEIS* (Regional Invasive Plant Program EIS), April 2005 along with its *Record of Decision (ROD) for Invasive Plant Program Management* on October 11, 2005 (Regional Invasive Plant Program EIS, ROD). This decision amended all Forest Plans in the Region, adding new direction for the control or elimination of invasive plant species using prevention and restoration practices, various mechanical and hand treatments, and an updated list of herbicides for effectively responding to invasive plant threats. The new herbicides approved or use offer many advantages over the more limited set allowed previously, including greater selectivity, less harm to desired vegetation, reduced application rates, and lower toxicity to animals and people. The ROD and Regional Invasive Plant Program EIS required that prior to the use of these new herbicides, site-specific treatment prescriptions for both new and previously analyzed invasive plant sites on the Forest need to be developed based on the updated herbicide tools and management direction.

This EIS will focus on developing these methods including the use of herbicides aimed at controlling, eradicating, or containing invasive plants, and the effects of such treatments on the forest landscape

The Umatilla National Forest has been treating invasive plants under direction found in the 1995 decision implementing the *Umatilla National Forest Environmental Assessment (EA) for the Management of Noxious Weeds*. The recommended treatment methods took a conservative approach, requiring years of manual or mechanical treatments on a site prior to the use of herbicides. Within that decision three herbicides were approved for use, Glyphosate, Dicamba, and Picloram. It did not provide the ability to respond quickly to new infestations because the process covered only those sites known at the time of the 1995 decision.

Ten years of monitoring shows that the slow approach to the application of herbicides has not successfully reduced the impact and spread of invasive species (1991-2000 annual monitoring reports)(USDA 2001). The strategy is labor intensive sometimes requiring multiple visits to sites each year, and the budget was not always adequate to extensively control or eradicate target infestations. The limited funds were used to control weeds along major National Forest system roads, providing funds to county weed boards for treatment costs. The Regional FEIS also provides evidence that using herbicides only as a tool of last resort is much less effective than allowing them to be used whenever they are effective, needed, and applied according to forest plan standards and label direction (USDA 2005). The dashed line in Figure 2 of Chapter 2 shows the predicted exponential spread of weeds under the existing 1995 decision (No Action Alternative).

The Umatilla National Forest staff acknowledges the need for a new strategy that would 1) treat known infestations safely and effectively, and 2) identify and treat new infestations. This EIS analyzes the effects of a project proposal that would achieve those two purposes.

1.2 Desired Future Conditions

The desired condition is: Maintain or improve the diversity, function, and sustainability of desired native plant communities and other natural resources that can be adversely impacted by invasive plant species. Containment, control, or eradication strategies are applied to invasive plant infestations using rapid, comprehensive, and effective methods for invasive plant management.

The Forest (1) implements treatment actions to contain and reduce the extent of invasive plants at existing inventoried sites, and (2) rapidly responds to new or expanded invasive plant sites as they may occur in the future. By treating infested areas, the spread of invasive plants onto neighboring lands is reduced or eliminated.

1.3 Purpose and Need

Weed infestations are one of the greatest ecological threats to public lands in the United States. Sizeable infestations can displace or alter native plant communities and cause long-lasting economic and ecological problems within and outside the National Forests. Weeds can spread rapidly across the landscape to noninfested areas, unimpeded by ownership or administrative boundaries, because of their strong reproductive and competitive abilities. There is a need to safely and effectively contain, control or eradicate nearly 25,000 acres of Invasive plant infestations that have been inventoried and mapped on the Umatilla National Forest. Further, there is a need to detect new infestations (including new species) soon after they appear on the landscape and treat them quickly while they are still small. This EIS is being prepared to allow the Umatilla National Forest to begin this process using Forest Plan direction as amended by the ROD for the Regional Invasive Plant Program EIS. A large number of new and existing invasive plant populations on the Umatilla National Forest require analysis to implement new, more effective and cost-efficient treatment actions, which includes the use of the updated list of herbicides as analyzed in the Regional Invasive Plant Program EIS.

The weed infestations on the Umatilla National Forest are broadly distributed, often occurring in areas of high spread potential (e.g., along roads and trails). There are probable additional invasive plant sites that have not yet been identified and these, as well as known sites, will continue to expand and spread every year that effective treatment is not applied.

The Purpose of this action is to provide a rapid and more comprehensive up to date approach to the containment, control, and eradication of invasive plants that occur on National Forest system lands. The purpose of controlling or eradicating weed infestations is to maintain or improve the diversity, function, and sustainability of desired native plant communities and other natural resources that can be adversely impacted by invasive plant species. Specifically, there is an underlying need on the Forest to: (1) implement treatment actions to contain, control and eradicate the extent of invasive plants at existing inventoried sites, and (2) rapidly respond to new or expanded invasive plant sites as they may occur in the future. Without action, invasive plant populations will become increasingly difficult and costly to control and will further degrade forest and grassland ecosystems. Untreated infested areas will also contribute to the spread of invasive plants onto neighboring lands.

1.4 Proposed Action

Invasive plants would be contained, controlled, or eradicated using chemical, physical, and biological treatment methods. Proposed treatments would be used on existing and new infestations; including potential new plant species that currently are not inventoried on the Forest. The preferred treatment method would be determined using the Treatment Decision Tree process (Figure 8, Chapter 2), which is based on priority plant species and site location. Treatment methods could be adjusted based on the management objective.

For example: A site determined to use herbicide could use any of the other non-herbicide methods too. The priority species would vary by District and could change at a later time. Species priority is based on the historic investments made to control the species, its invasive nature, its location and whether it is a new species on the Forest. New species of invasive plants or a new invasive plant infestation may demand an immediate response using an Early Detection Rapid Response strategy. Proposed methods and strategies to determine how invasive plant infestations would be treated are detailed in Chapter 2.

Weeds can and do occur almost anywhere on the landscape. Common sites of weed infestations include rangelands, timber harvest areas, along roads and road rights-of-way (including decommissioned roads), along trail routes, at dispersed and developed recreation sites, and on other disturbed sites (i.e. burned over areas, lands flooded, and rock quarries). When needed to facilitate natural plant recovery, weed treatments may include low impact site rehabilitation such as competitive seeding with native grass and forbs species. Since it is hard to determine if any sites would require extensive mechanical scarification at this time; such sites would require their own NEPA analysis and decision documentation for the rehabilitation portion of the project. This EIS is being done to determine the type of treatment a site should receive to control, contain or eradicate the invasive plant and the effects of such treatments.

1.5 Management Direction

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 Umatilla 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 Pacific Fish Strategy (PACFISH) (1995) where appropriate, and the Regional Invasive Plant Program EIS and ROD (2005).

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 (USDA Forest Service 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.

The Forest Service Guide to Noxious Weed Prevention Practices provides management guidance in the form of goals along with prevention practices (USDA Forest Service 2001).

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.

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. The Chief's strategy 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.

1.5.1 Regional Direction

Forests in Region Six follow management direction introduced to all Land and Resource Management Plans by the Record of Decision (ROD) for Managing Competing and Unwanted Vegetation (1988 ROD), and the subsequent1989 Mediated Agreement. 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.

The recently published *Pacific Northwest Region Invasive Plant Program – Preventing and Managing Invasive Plants Final Environmental Impact Statement* and the accompanying Record of Decision (2005) currently supersedes direction from those documents to provide invasive plant management direction to the Forests in Region Six.

This EIS tiers to the Regional FEIS for direction on invasive plant treatments for the Umatilla National Forest. The 2005 R6 ROD added goals, objectives, and standards for invasive plant management to the Umatilla National Forest's LRMP (See Forest Direction section), and replaces the requirements of the 1989 Mediated Agreement dealing with the treatment of invasive plants. All other vegetation management activities on the Forest will still be bound by the 1989 Mediated Agreement.

1.5.2 Forest Direction

Current management direction for the treatment of invasive plants on the Umatilla National Forest considers the following sources:

- The Umatilla National Forest Land and Resource Management Plan (Forest Plan as amended by the Pacific Northwest Region Invasive Plant Program, Record of Decision 2005)
- Environmental Assessment for the Management of Noxious Weeds (April 1995), as amended

Specific Standards and Guidelines from the Forest Plan that apply to this project can be reviewed in Appendix A.

The best available science is considered in preparation of this EIS. However, what constitutes best available science might vary over time and across scientific disciplines as new science is brought into play. We show consideration of the best available science when we insure the scientific integrity of the discussions and analyses in the project NEPA document. Specifically, this EIS and the accompanying Project Record identifies methods used, references reliable scientific sources, discusses responsible opposing views, and discloses incomplete or unavailable information, scientific uncertainty, and risk (See 40 CFR, 1502.9 (b), 1502.22, 1502.24).

The Project Record references all scientific information considered: papers, reports, literature reviews, review citations, academic peer reviews, science consistency reviews, and results of ground-based observations to validate best available science. 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. The Project Record is located at the Umatilla National Forest Office in Pendleton, Oregon.

Analysis was completed for botany, wildlife, hydrology and soils, fisheries, recreation, range, cost effectiveness, and human health. Information from these reports has been summarized in Chapters 3. Separate biological evaluations and/or biological assessments were completed for botanical species, aquatic species, and terrestrial wildlife species for this analysis or as part of the consultation process with the National Marine Fisheries Service and the US Fish & Wildlife Service. Specific goals and objectives for invasive plant management added to the Forest Plan by the R6 2005 ROD are listed below. Specific Standards and Guidelines from the R6 2005 ROD that apply to this project can be reviewed in Appendix A.

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 disturbances 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.

1.6 Decision Framework

The Forest Supervisor will make the following decisions based on the interdisciplinary analysis:

- Whether to select the proposed invasive plant treatments with any modifications from public scoping or comments or as described in an alternative
- What Project Design Features (PDFs) are needed
- What monitoring is required

1.7 Tribal Involvement

1.7.1 Introduction

The proposed Invasive plant treatments occur within areas ceded to the United States government by the following recognized tribes: the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) by the TREATY WITH THE WALLA WALLA, CAYUSE, ETC.,1855; the Nez Perce Tribe by the TREATY WITH THE NEZ PERCE, 1855; and the Confederated Tribes of the Warm Springs Reservation in the TREATY WITH THE TRIBES OF MIDDLE OREGON, 1855. The Forest Service, through the Secretary of Agriculture, is vested with statutory authority and responsibility for managing resources of the National Forests. No sharing of administrative or management decision-making power is held with any other entity. However, commensurate with authority and responsibility to manage is the obligation to consult, cooperate, and coordinate with recognized Indian Tribes in developing and planning management decisions regarding resources on National Forest system (NFS) lands that may affect tribal rights established by treaty or Executive Order.

As a result of the treaties and Executive Orders, elements of Indian culture, such as tribal welfare, land, and resources were entrusted to the United States government. The Forest Service shares in the Federal government's overall trust responsibility where treaty, laws, Executive Orders, case law or other legally defined rights apply to National Forest system (NFS) lands. Trust responsibilities resulting from the Treaties or Executive Order dictate, in part, that the United States government facilitates the execution of treaty rights and traditional cultural practices of recognized tribes. The Forest Service assists with this shared responsibility by working with the tribes on a government-to-government basis and in a manner that attempts a reasonable accommodation of their needs, without compromising the legal positions of the Tribe or the Federal government.

Tribes have expressed rights reserved in the treaties. The treaties state "That the exclusive right of taking fish in the streams running through and bordering said reservation is hereby secured to said Indians; and at all other usual and accustomed stations, in common with citizens of the United States, and of erecting suitable houses for curing the same; also the privilege of hunting, gathering roots and berries, and pasturing their stock on unclaimed lands, in common with citizens, is secured to them." (TREATY WITH THE TRIBES OF MIDDLE OREGON and TREATY WITH THE WALLAWALLA, CAYUSE, ETC. The TREATY WITH THE NEZ PERCE has similar language.) It is the responsibility of the Forest Service to take into account cultural resources when managing the Forest's natural resources and to address tribal interests when managing and restoring habitat to support healthy, sustainable, and harvestable populations of culturally significant vegetative floral and faunal species.

Utilization of NFS lands for all Federally recognized Tribes is protected by American Indian Religious Freedom Act, Executive Order 13007 – Sacred Sites, Executive Orders 13084 & 13175 – Consultation and Coordination with Indian Tribal Governments, and Executive Order 12898 – Environmental Justice and the National Historic Preservation Act which includes protections for properties of traditional religious and cultural importance.

1.7.2 Tribal Issues Identified

Letters were sent to Tribal leaders of the Nez Perce, Confederate Tribes of the Umatilla Indian Reservation (CTUIR), and Confederate Tribes of the Warm Springs Reservation in April of 2006. None of tribes responded to the letter. The Forest had meetings with various tribal resource staff. During these meetings the tribes were supportive of the Forest's efforts to treat invasive plants and being able to use all the tools/methods described in the proposed action. The experience of the CTUIR using aerial treatments for yellowstar thistle is decribed as successful when intergrated with other land owners. The Nez Perce felt that biological treatments should be an intergrated approach used on the landscape. All tribes have a concern about coordinating herbicide treatments with traditional gathering activities and areas. A process will be developed for notifying each tribe when herbicides are being used as required by the Project Design Features in Table 6 of Chapter 2.

The Forest has incorporated concerns voiced by the tribes in the past into this project. These concerns include:

- The Forest Service has Federal Trust Responsibility to take into account the Tribes' treaty rights when decisions are made such that cultural practices can be exercised and that treaty related resources are protected. Actions should not hinder the ability of the tribes to access traditional use areas. There is concern that traditional uses would not be able to continue or the use of herbicides would contaminate traditional gathering areas. Conflicts with the timing of herbicide use and gathering activities would be avoided by having a method for the Forest to contact the tribes prior to using herbicides each year. The proposed invasive plant treatments do not close roads or change existing access to National Forest system lands.
- There is also concern about the use of herbicides in riparian areas and its potential impact to water quality that may interfere with recovery efforts for anadromous fish, a traditional economic resource. The CTUIR have spent years reestablishing salmon in the Umatilla River and Meacham Creek systems and have made efforts in the Walla Walla River and Lookingglass Creek in the Grande Ronde basin. They feel that protection of pristine riparian and upland habitat is important to the recovery of fish populations. There is support the Northwest Power Planning Council's approach to Subbasin planning that focuses on connecting areas of high quality habitat and working toward population goals through both natural and hatchery production. This concern has been incorporated into Project Design Features in Chapter 2 and effects disclosed in Chapter 3.
- The CTUIR expresses its concern for managing resources through the cultural aspects of First Foods and their importance on the land that sustains their culture. First Foods – water, salmon, deer, cous, and huckleberry - represent groupings of similar species that are served in their Longhouse and represent a healthy environment that is important to their cultural traditions.
- The Nez Perce has focused management actions in the uplands for provide quality habiat for game and cultural plant species. Biological control methods are important to them and they have developed insect control methods.

Tribal concerns have been incorporated into all alternatives through the use of Project Design Features (See Table 6 in Chapter 2). Concerns voiced about potential impacts to plants, animals, and fish are similar to those heard from the public during scoping. The analysis incorporated uncertainty of potential effects by placing restrictions on herbicide use such that effects become immeasurable and much less than disclosed in research.

Project Decision Features requires the Forest Service to notify the Tribes of areas proposed for treatments each year. The Public Notification Plan requires areas proposed for treatment to be mapped, information shared and posted, and warning signs posted at the locations treated with herbicides. Water quality and fisheries habitat is also protected through the use of Project Design Features that restrict herbicide use in riparian and near stream areas. The proposed invasive plant treatments do not close roads or change existing access to National Forest system lands. Herbicide treatments may cause plants to not be available for a season, depending on when the treatment occurs.

Because of the Project Design Features, all alternatives are responsive to Tribal cultural needs. The differences between alternatives are the amount and methods of broadcast herbicide treatments.

1.8 Public Involvement

1.8.1 Scoping

Scoping began officially on April 6, 2006 when the Notice of Intent (NOI) to Prepare an Environmental Impact Statement was published in the Federal Register Volume 71, No. 66/April 6, 2006 on pages 17435-17437. The scoping proposal was also posted on the Forest website at the following address: http://www.fs.fed.us/r6/uma/projects/readroom/invasive-plants/. A scoping letter, dated April 3, 2006, was mailed to 128 individuals and organizations. The letter was signed by Forest Supervisor, Kevin D. Martin.

1.9 Issues and Concerns

Public Issues Identified

During scoping two email comments and five comment letters were received. All comments were considered, and public issues were identified based on these scoping comments.

Specific issues or concerns presented by commenter that would not be addressed by the Proposed Action, became “significant issues”. The significant issues are the basis of two alternatives to the Proposed Action that are discussed in Chapter 2 of this EIS as well as six alternatives considered but not developed in detail. The resulting range of alternatives, including the No-Action Alternative, provides a broad basis for alternative comparison.

Some issues were addressed by the analysis of the Proposed Action, and are referred to as “other concerns.” Other concerns are those that were addressed through adherence to standards and guidelines and the appropriate laws and regulations, consistency with decisions made in the Invasive Plant ROD (2005), or development of Project Design Features (See Table 6 in Chapter 2). Other concerns are generally of high interest to the public, and are tracked throughout the document.

Significant Issues and Other Concerns

The following section summarizes the significant issues and other concerns within the following broad resource categories.

- Human health
- Treatment effectiveness
- Social and economic
- Non-target terrestrial plant and animal species
- Soils, water quality and aquatic organisms

1.9.1 Human Health

Significant Issue: There is concern by members of the public that exposure to herbicides may have serious human health consequences. Of particular concern is toxic chemical exposure and chemical contamination of water and aquatic ecosystems. It is perceived that those at greatest risk are:

- Workers applying herbicides
- All publics recreating in areas treated with herbicides
- Those who use forest plants and materials that may have come in contact with chemicals

Response: *The alternatives cannot directly relieve the inherent anxiety about chemical herbicide use; however all alternatives share precautions designed to protect the public. By strict adherence to chemical labels, following all safety precautions for the handling and application of chemicals, and* *applying Forest Plan treatment restoration standards 15-23 (from the Regional ROD) little exposure and maximum public protection is expected. Additional Project Design Features (PDFs detailed in section 2.3.3) further reduce risk. Any herbicide exposure to workers or public from proposed treatments treating invasives at typical application rates would be below any levels considered to pose a serious human health consequence. All publics recreating or using forest plants and materials would not be exposed to any herbicide levels considered to be a serious human health consequence when applied at the typical application rate, and PDF's would limit exposure if maximum rates were applied. Public water systems and aquatic ecosystems would be protected by applying PDFs and standards and guides outlined in the regional ROD.*

- Unit of Measurement –
  - The comparitive subjective sense of how well alternatives would prevent exposure and the perceived hazard of herbicide exposure (See the four points below).

1. Hazard Characterization	What are the dangers inherent with the chemical?
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

Refer to Chapter 3.7 for more information about the effects of herbicide use on workers and the public.

1.9.2 Treatment Effectiveness

Significant Issue: There is a concern that the spread of invasive species will increase if all available treatment methods are not utilized. (All herbicides, including new ones; aerial spraying, livestock grazing, ODA approved bio-control agents, etc.) *Response: Alternatives B, C and D utilize a broad compliment of invasive treatment methods to control the spread and reduce the influence of invasive species.*

- Unit of Measurement:
  - Estimated rate of invasive species spread and how effective alternatives are at retarding or reversing that spread rate.
  - Acres treated by method to contain, control and eradicate invasive species

Significant Issue: There is a concern that herbicides should be used only as a last resort when other methods fail. (Modified No Action Alternative covering all sites) *Response: The current program (alternative A) addresses this concern by using herbicides only as a last resort. The effectiveness of this program will be analyzed and compared to the three action alternatives.*

- Unit of Measurement:
  - Acres of non-herbicide treatment to determine the effectiveness on containing, controlling or eradicating invasives.
  - Estimated rate of invasive species spread based on comparison of treatment strategies of the alternatives.

Significant Issue: There is a concern that not using herbicides will result in the continued spread of invasive plants, resulting in the loss of ecosystem function and wildlife habitat loss. *Response: To meet the desired condition, all alternatives use herbicides to one degree or another. Relative effectiveness of each alternative will be compared and contrasted in this EIS analysis.*

- Unit of Measure:
  - Estimated rate of invasive species spread measured as rate of spread

Other Concern: There is a concern that emphasis on herbicide treatments would minimize application of prevention and restorative methods. *Response: Prevention techniques, as directed by the Forest Plan, would be applied to all Forest Actions. Effectiveness of prevention measures for all projects undertaken on the Forest would be determined during the individual project NEPA analyses. This project, however, emphasizes direct reduction of invasive plants using a full compliment of tools to treat existing and future infestations and thereby increase the effectiveness of prevention measures*

Other Concern: There is a concern that once weeds are treated without proper restoration more invasive plants will move in. There is a desire that restoration planning be done as part of this EIS effort and that restoration techniques be aggressively applied. *Response: The effects analysis will evaluate and identify restoration strategies as project design features. Minor ground disturbing restoration is included as a part of the treatment prescriptions. Major ground disturbing restoration actions will require additional NEPA and decision document.*

Other Concern: There is a concern that new invasive weed infestations may not be detected or treated in a timely manner. *Response: Early detection and rapid response (EDRR) is part of the Proposed Action. The effects, effectiveness and circumstances under which EDRR would be applied will be analyzed for all alternatives except the No-Action Alternative.*

The No-Action Alternative does not allow for chemical treatment of infestations not previously identified in the 1995 weed program EAs.

Other Concern: There is a concern that lack of coordination with other land owners/managers will not lead to effective control of invasive weeds. *Response: Project Design Features and analysis will address coordination with other federal, state, local and private landowners and managers. Cooperation of non Forest Service partners is desirable but cannot be guaranteed.*

1.9.3 Social and Economic

Other Concern: There are concerns that the surrounding community should be informed of activities and economic costs of the project. *Response: All action alternatives incorporate Treatment Restoration Standard 23 (Umatilla Forest Plan as amended) from the Region-6 ROD (USDA 2005), that requires timely public notification of treatment activities. Costs for each alternative will be evaluated and compared in the EIS.*

1.9.4 Non-target Species

Significant Issue: There is a concern that herbicide exposure, particularly when applied through aerial or broadcast spraying, may harm terrestrial wildlife species. Herbicide drift, primarily from broadcast applications of herbicides could cause harm to non-target animals. *Response: This issue is specifically addressed in the R6 2005 ROD through adherence to invasive plant treatment standard 19. Additional Project Design Features listed in chapter 2 of this EIS would be implemented for Alternatives B, C and D to avoid such impacts. Alternatives C and D limit broadcast applications of herbicides further reducing the potential for harm to non-target species.*

Significant Issue: There is a concern that herbicide exposure, particularly when applied through aerial or broadcast spraying, may harm non-target plants. *Response: same as above.*

- Unit of Measure for both issues above:
  - Acres of broadcast and aerial spraying
  - Herbicides with high risk of harm to non-target plants.

Other Concern: There are concerns that effects of herbicide applications on non-target plant and animal species, and native ecosystems be properly analyzed. *Response: Analysis of all alternatives will evaluate the direct, indirect and cumulative effects of herbicides to all non-target species by appropriate use of local analysis, tiering to the Regional FEIS and in compliance with NEPA, Endangered Species Act and/or PACFISH management requirements.*

1.9.5 Soil, Water Quality, Aquatic Biota

Significant Issue: There is a concern that there may be potential adverse effects of herbicide treatment on soils. *Response: Project Design Features have been developed to reduce potential effects from specific herbicides that can combine with soil or leach into ground water.*

- Unit of Measure:
    - Acres of treatment by method (herbicide, mechanical, manual, etc.)

Significant Issue: There is a concern that there may be potential adverse effects of herbicide treatment on riparian areas adversely impacting water quality and aquatic ecosystems. Specifically some believe herbicide application in riparian areas could contaminate water and cause mortality to fish, organisms that support fish and other aquatic species. Fish and other aquatic organisms may also be impacted by manual and mechanical treatments, which may change dissolved oxygen levels, nutrients, water temperature, turbidity, fine sediment, and riparian structure. *Response: Chapter 2 describes the Project Design Featuresand the buffers intended to avoid herbicide delivery to water and eliminate risk of concentrations of concern to water quality and fish, domestic water sources and other aquatic organisms. Alternatives C and D, described in Chapter 2, give additional protection for concerns about water, fish, and aquatic ecosystem exposure to toxic chemicals. Chapter 3 explains why the potential for adverse effects are relatively low in all alternatives. Listed fish are protected under the standards developed by PACFISH. This project will be consistent with applicable PACFISH standards and guidlines and not retard or prevent attainment of riparian management objectives.*

Unit of Measure:

- Acres of broadcast herbicide application within riparian areas
- Acres of treatment within riparian by method (herbicide, mechanical, manual, etc.)
- Estimated miles of roads in riparian and also in proposed treatment sites

Other Concern: There is a concern that the direct, indirect and cumulative effects on soil, soil organisms and soil productivity of proposed herbicide use be analyzed thoroughly. *Response: The appropriate analysis will be done including tiering to existing analyses.*

Other Concern: There are concerns that the direct, indirect and cumulative effects on water quality be thoroughly analyzed. The appropriate analysis will be done including tiering to existing analyses.

1.9.6 Non-Significant Issues

The Council of 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 EIS
- Already decided by law, regulation, Forest Plan, or other higher level decision
- Not clearly relevant to the decision to be made
- Conjectural and not supported by good scientific or factual evidence

The following issues fit in one or more of the non-significant categories. Issues are identified and an explanation of why they are not significant is given.

Some comments suggested adding aspects of the project covered by other programs. Such suggestions are outside the scope of this project. An example is:

- Roads are a major weed vector. The analysis must consider closing or revegetating unneeded roads. No new road should be constructed if you are serious about controlling weeds. Decisions to build, open, or close roads are made in the transportation management program and individual projects that require access.

Some comments made speculative or unsupportable claims. Because such comments are not supported in peer-reviewed literature, they are considered non-significant issues. Examples include:

- herbicide spraying causes all kinds of cancer
- herbicide spraying destroys essential ecosystem functions

Some comments made requests that were outside the scope of the proposed project. While some such requests might be a good idea, they do not fit within this project's purpose and need nor are they related or connected to the decision to be made. Examples include:

- Stop all logging. Stop all grazing, which is harmful and brings in invasive weeds, as does logging.
- Have an independent contractor study the effectiveness of past Forest Service chemical and non-chemical control types in each district, including adequacy of timing and repetition of control types and publicly disclose the results.
- Do a feasibility study of the effectiveness needs for further research and logistical parameters for non-chemical alternative control methods for each invasive plant at issue, and make this available to all district offices.

Some comments raised issues about complying with laws. These were mostly reminders to complete tasks that are already part of the process of completing an EIS. Examples include:

- The National Forest Management Act requires the Forest Service to "provide for diversity of plant and animal communities." 16 U.S.C. § 1604(g)(3)(B
- Note that pursuant to Section 7 of the ESA, the Forest Service has an independent duty to conserve and protect the threatened and endangered species that depend on the public lands it is charged with managing and ensure it does not jeopardize species or adversely modify critical habitat.
- This project must comply with the Clean Water Act, which may require a NPDES permit for the herbicide application.

1.10 What This Proposal Does Not Include

This action does not include experimental trials of herbicides conducted by the U.S. Environmental Protection Agency (EPA) to test new products.

This document will not provide additional prevention measures than what is already included in Appendix E of the Regional Invasive Plant Program EIS and ROD. Only minor site restoration actions are covered in this EIS. Restoration that involves extensive mechanical scarification would require its own analysis and decision documentation for the rehabilitation portion of the project.

This action does not include activities that could influence invasive plant populations but are covered under other programs. Such programs include transportation planning, timber management, livestock grazing, etc. Weed prevention and treatment activities are incorporated into individual projects carried out under regulation and guidance of these programs.

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Chapter 2 - Alternatives

2.1 Introduction

Chapter 2 describes and compares the alternatives considered for invasive plant treatments on the Umatilla National Forest in the states of Oregon and Washington, including the No Action Alternative, the Proposed Action Alternative, and two additional action alternatives. This Chapter also summarizes the effects of implementing these alternatives, and displays how they are responsive to the Purpose and Need for action and issues identified during scoping.

The Forest staff proposes to control, contain, or eradicate invasive plants on approximately 25,000 acres of inventoried weed sites, and on future weed sites that are presently nonexistent or as yet undiscovered. The project is planned to last 10 to 15 years.

A thorough, forestwide invasive plant inventory was completed in 2006. It includes 2,069 invasive plant sites widely distributed across the four Forest Districts, and accounts for approximately 95 percent of the invasive plant infestations on the Forest.

Each weed site has been mapped and assigned a treatment method based on a complex decision analysis. Figure 1 in this section is an example of one of those maps, and shows some known weed infestations and their proposed treatment methods. Such maps exist for all 2069 weed sites and can be viewed at the Umatilla Forest Website (www.fs.fed.us/r6/uma/projects/readroom/invasive-plants/).

Treatments to control invasive plants would include a variety of chemical, physical, and biological methods. Treatments are proposed for existing or new infestations including new plant species that currently have not been found on the Forest. Treatment methods were developed using *Common Control Measures Invasive Plants of the Pacific Northwest Region* (Mazzu, 2005) and in accordance with USDA Forest Service Handbook (FSH) 2109.14 – Pesticide-Use Management and Coordination Handbook (USDA Forest Service, 1994c). Treatment priorities, methods, and strategies are tiered to the *Pacific Northwest Region Invasive Plant Program – Preventing and Managing Invasive Plants Final Environmental Impact Statement* (Invasive Plant FEIS) (USDA Forest Service, 2005a).

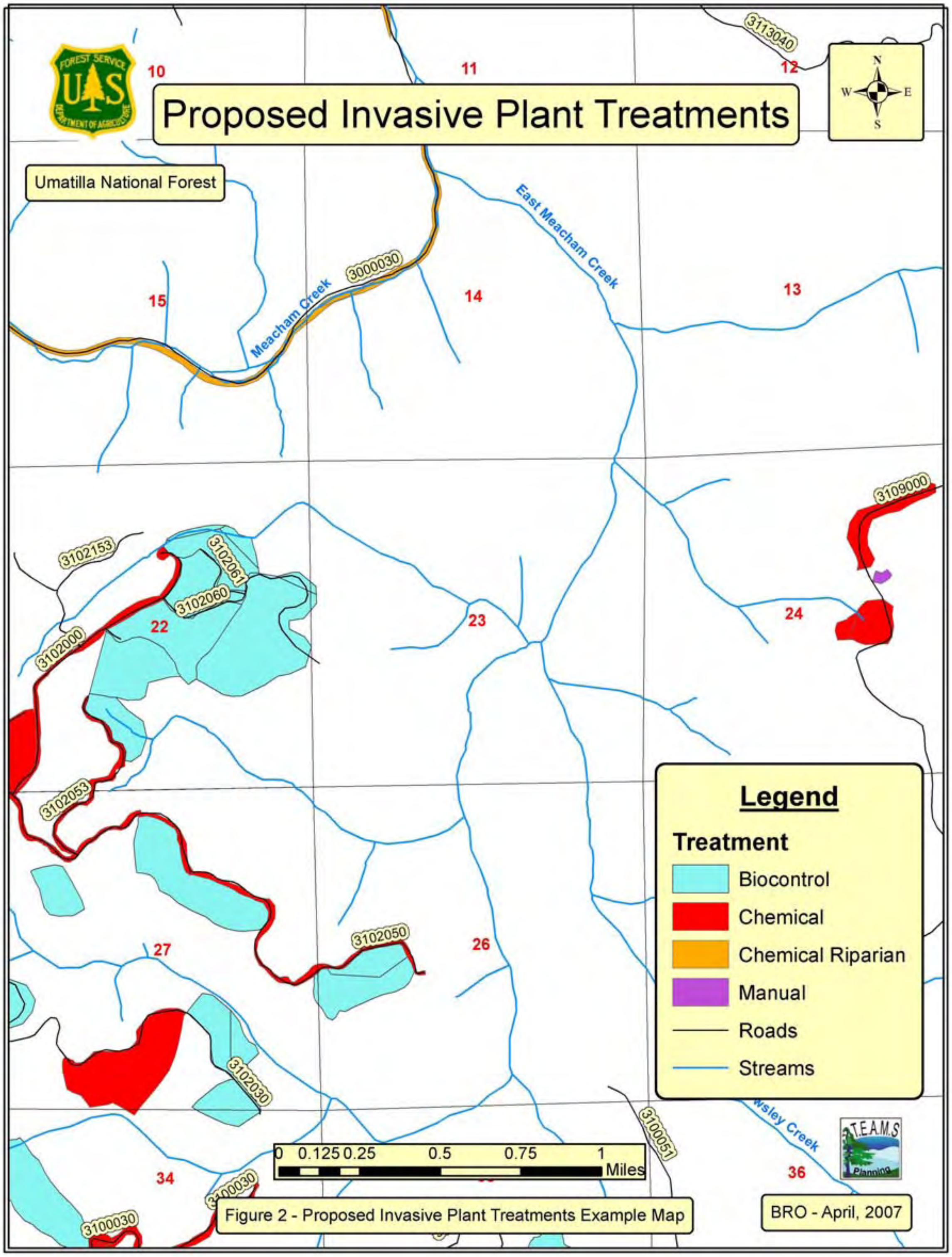

Figure 1 – Proposed Invasive Plant Treatments Example Map

2.2 Alternatives Considered in Detail

2.2.1 Alternative Development Process

This EIS evaluates four alternatives for invasive plant treatment, including No Action (Alternative A) and the Proposed Action (Alternative B). No Action (Alternative A) is defined as the treatments that would currently be approved under existing NEPA decisions on the Umatilla National Forest. The Proposed Action would use chemical, physical, and biological methods to treat known and unknown future infestations of invasive plants. All action alternatives have been designed to satisfy the Purpose and Need (see Chapter 1 - Purpose and Need).

Public and interagency issues centered on cost efficiency, treatment effectiveness, toxicity of herbicides, and the potential adverse effects of herbicides on humans and the natural environment. Alternatives C and D were developed to respond to public issues while effectively treating invasive plants according to the management direction in the 2005 R6 Invasive Plant ROD. The action alternatives vary in the following ways:

- The amount of herbicide use allowed
- The location of herbicide use allowed
- The methods of herbicide application allowed
- The likelihood that invasive plant infestations will be controlled and sites restored
- The relative monetary costs to eradicate, control or contain invasive plants
- The perceived risks related to herbicide use and biocontrol agents

Alternatives C does not allow ground-based broadcast herbicide application, and Alternative D does not allow aerial spraying because of public concerns voiced about potential risk of adverse effects to humans, and the potential delivery of herbicides to surface or ground water,. Alternatives B, C and D would treat weed infestations expected to be found in the future using the same methods as analyzed in this EIS. This Early Detection Rapid Response (EDRR) strategy addresses public and interagency issues about long-term effectiveness of restoring native plant communities by reducing weed infestations.

The decision process to select treatment methods favors non-herbicide treatment methods first, but recognizes that most sites will require herbicide treatments initially and perhaps multiple times. The project proposal strives to reduce herbicide use over time, yet the EIS analyzes the effects of primarily herbicide treatments.

Besides the alternatives listed above several other alternatives were developed to address issues raised by the public. These alternatives were designed to resolve public concerns, but were dismissed from detailed study because they would not reasonably meet the Purpose and Need for action. Those alternatives included:

- High potential for spread areas or priority 1 and 2 species (more detail can be found section 2.3.1
- Invasive plants addressed through natural processes (R6 EIS 2-33) (EIS section 2.3.2)
- No Herbicides (R6 EIS 2-34) (EIS section 2.3.3)
- 1995 Guidelines applied Forest-wide (modified no action) (EIS section 2.3.4)
- Restricted Use – No herbicides in riparian or special areas (EIS section 2.3.5)
- Deviations from existing approved herbicide list. (R6 EIS 2.35) (EIS section 2.3.6)

2.2.2 Alternative A – No Action

Description

The Umatilla National Forest has been treating invasive plants under direction found in the 1995 decision implementing the *Umatilla National Forest Environmental Assessment for the Management of Noxious Weeds* (1995*)*. This program would continue under the No Action Alternative. The recommended treatment methods took a conservative approach, requiring years of manual or mechanical treatments on a site prior to the use of herbicides. It did not have the ability to respond aggressively to any new or unrecorded infestations or species. Herbicides could only be used on those sites known at the time of the 1995 decision or additional sites that had site-specific analysis completed before treatment was done.

Under the 1995 EA, invasive plant treatments would be limited to approximately 2,771 acres. The "95 EA" approved use of herbicides on 587 sites (1391 acres) on the Umatilla National Forest (USDA 1995). Amendments to this decision added an additional 59 sites (383 acres) approved for chemical treatments (USDA 1998). The total area identified for treatment using all methods was 3154 acres. The total number of sites approved for chemical treatments represents 36 percent of the total number of sites presently mapped. New infestations have been and would continue to be treated with manual and mechanical methods. The 1995 EA (as amended) allowed for biological treatments on 1,339 acres, manual treatments on approximately 41 acres, and a combination of manual, chemical, and cultural methods on an estimated 1,744 acres. Herbicide applications would utilize spot or ground based broadcast methods utilizing Glyphosate, Dicamba, or Picloram. However, the 2005 Regional Invasive Plant FEIS ROD does not allow the use of Dicamba, so herbicide use is limited to the other two chemicals listed. Aerial application of herbicides is not allowed under the current program.

Under this program invasive plant infestations would likely continue to expand (see figure 2 below). The 1995 EA that authorized the present treatment program identified 773 sites totaling 2771 acres needing invasive plant treatments. This inventory, as reported in the EA, was the result of "systematic surveys" that had been ongoing since 1991 (USDA 1995, pg 3). While there may likely have been other infestations unaccounted for in the 1995 inventory, clearly the present inventory of nearly 25,000 acres of weed infestations suggest an alarming expansion of invasives despite the efforts of the existing weed program.

The ID Team reviewed comments and concerns received from the public during the scoping process. From those concerns, issues about the proposed project were identified. Among those, the following issues would be addressed by this alternative:

Human Health:

- There is a concern that herbicides should be used only as a last resort when other methods fail (herbicides are used only as a last resort in this alternative compared to the PA)

Treatment Effectiveness:

- Herbicides as a last resort requires that herbicides be used only if other methods prove ineffective

Non-target Species:

- There is a concern that herbicide exposure, particularly when applied through aerial or broadcast spraying, may harm terrestrial wildlife species (reduced exposure compared to the PA – fewer acres treated than under the PA)

- There is a concern that herbicide exposure, particularly when applied through aerial or broadcast spraying, may harm non-target plants (reduced exposure compared to the PA – fewer acres treated than the PA)

Soil, Water Quality, Aquatic Biota:

- There is a concern that there may be potential adverse effects of herbicide treatment on soils (fewer acres treated than the PA);
- There is a concern that there may be potential adverse effects of herbicide treatment on riparian areas adversely impacting water quality and aquatic ecosystems (fewer acres treated than the PA).

2.2.3 Alternative B – Proposed Action

Description

Alternative B proposes to satisfy the Purpose and Need by using chemical, physical and biological treatment methods to control, contain, or eradicate existing or newly discovered invasive plant infestations. Treatments are proposed for existing or new infestations including new invasive plant species that currently are not found on the Forest. It is believed that the locations for ninety five percent of invasive plant infestations proposed for treatment are known, and only about 5 percent are as yet undiscovered, because of an extensive invasive plant inventory that was completed in 2006, and the thorough compilation of past infestation sites. The strategy to treat presently unknown sites or new invasive species that may invade the Forest in the future is called Early Detection Rapid Response (EDRR) and is described in this section. Current inventory indicates there are approximately 25,000 acres of invasive plant infestations on the Forest in 2,069 invasive plant sites.

Unlike the present weed treatment program, (No-Action Alternative) this alternative would expect to reduce the acreage and influence of invasive plant populations over time. Approximately 4,000 of the 25,000 acres of weeds could be treated annually given expected budget levels. Evidence shows that untreated infestations would likely expand their populations at a rate of 8 to 12 percent each year (USDA Forest Service, 1999). The expansion in population size includes natural plant spread and spread caused by vectors such as wind, water, animals, and human activities where they are present. This alternative would overcome weed expansion because the herbicide treatments, expected to be the vast majority of the average annual treatment of 4000 acres, are anticipated to be 80 percent efficient in their initial treatments. While this alternative would reduce weed populations over time, as Figure 2 illustrates, the expansion of untreated infestations and need to retreat some areas makes successfully reducing the forestwide influence of weeds a long-term endeavor. With all factors considered and assuming adequate funding for the life of the project, it is believed that this alternative would successfully contain, control or eradicate the majority of weeds on the Forest.

The rest of this section defines and describes the treatments, strategies for treatment, and the prescriptions that would be used to accomplish this alternative. Included are specific Common Control Measures proposed for each target invasive species, as well as Project Design Features (PDFs). Although the Regional ROD (USDA 2005b), the Forest Plan, and chemical product labels provide direction to protect people and the natural environment during this project, additional Project Design Features have also been added to minimize potential for adverse effects.

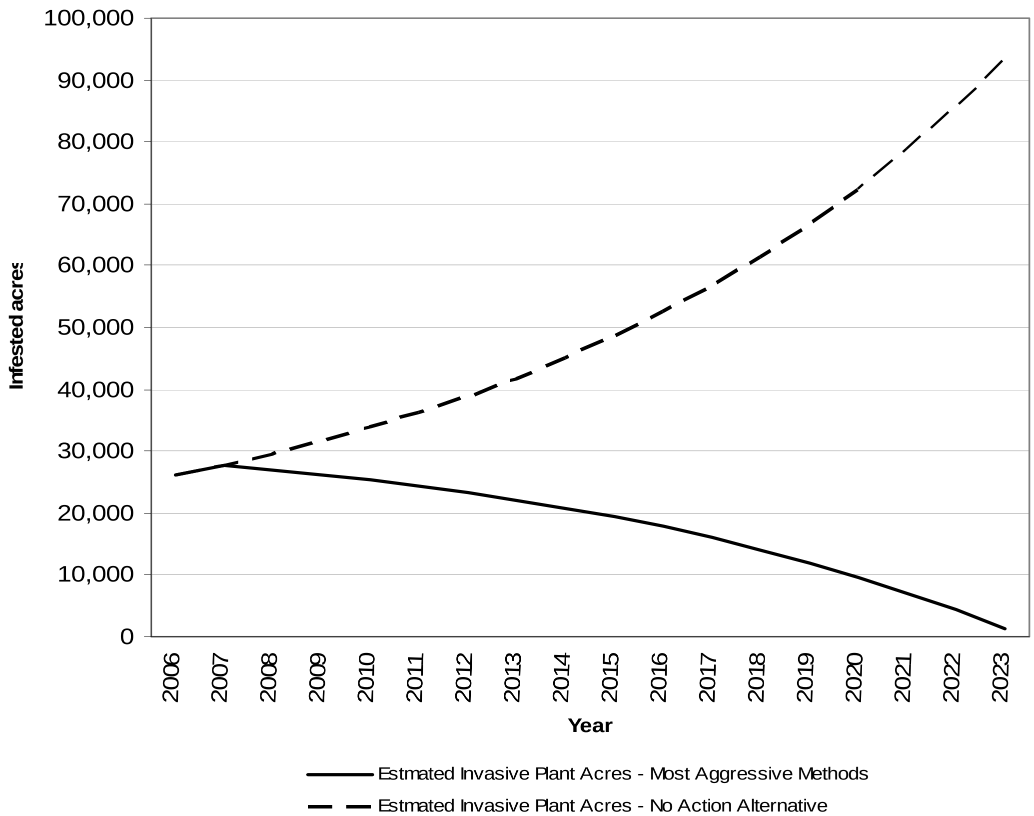

Figure 2 – Estimated Invasive Species Spread - Assumptions include 25% and 80% effectiveness with No Action Alternative and Proposed Action Alternative, respectively.

The ID Team reviewed comments and concerns received from the public during the scoping process and identified issues about the proposed project. The issues raised are thoroughly discussed in Section 1.9 of Chapter 1. The following summarizes the key issues raised regarding this project.

Human Health:

- There is concern by members of the public that exposure to herbicides may have serious human health consequences

Treatment Effectiveness:

- There is a concern that the spread of invasive species will increase if all available treatment methods are not utilized

Non-target Species:

- There is a concern that herbicide exposure, particularly when applied using aerial or broadcast spraying, may harm terrestrial wildlife species
- There is a concern that herbicide exposure, particularly when applied through aerial or broadcast spraying, may harm non-target plants

Soil, Water Quality, Aquatic Biota:

- There is a concern that there may be potential adverse effects of herbicide treatment on soils
- There is a concern that there may be potential adverse effects of herbicide treatment on riparian areas adversely impacting water quality and aquatic ecosystems

The Regional ROD (USDA 2005b), Forest Plan, and herbicide product labels address these issues and concerns. In addition, the ID team developed Project Design Features (PDFs) to further minimize the risk of adverse effects primarily from the use of herbicides. The PDFs are part this alternative and listed, in detail, in Table 6.

Treatment Methods

Proposed treatments include chemical, physical, and biological, methods. This section defines each method and identifies where and how many acres will be treated by each method.

Potential treatments based on existing mapped sites (See Figures 3-6 in this section) include:

- Approximately 17,301 acres of uplands would utilize chemical, physical, or biological methods
- Approximately 3,392 acres of riparian areas would be treated using chemical, physical, or biological methods
- Approximately 3,915 acres would be treated using biological or physical methods
- 41 acres would be treated using physical methods only

Of these acres 675 acres are proposed for aerial chemical application (See Figure 7, in this section for treatment sites proposed for aerial application).

Detailed, 1:24,000 scale maps of all known existing treatment sites are available on the Umatilla National Forest website at www.fs.fed.us/r6/uma/projects/readroom/invasive-plants/). To clarify the location of proposed treatment sites and methods, the following figures were mapped showing sites and methods within each Ranger District. However, the analysis was not completed by Ranger District, but rather depicts treatment methods and resources affected in each geographic location where treatments would occur. Table 2 shows acres proposed for treatment by method by Forest District.

Table 2 – Acres of treatment methods by Ranger District

Treatment Method	Ranger District				
	Heppner	Pomeroy	North Fork John Day	Walla Walla	Total
Biological only	89	46	47	3734	3915
Chemical Physical or Biological	4699	3138	3933	5531	17301
Chemical/Riparian Physical or Biological	839	1130	621	802	3392
Manual/Physical	2	6	26	6	41
Total	**5629**	**4320**	**4625**	**10075**	**24649**

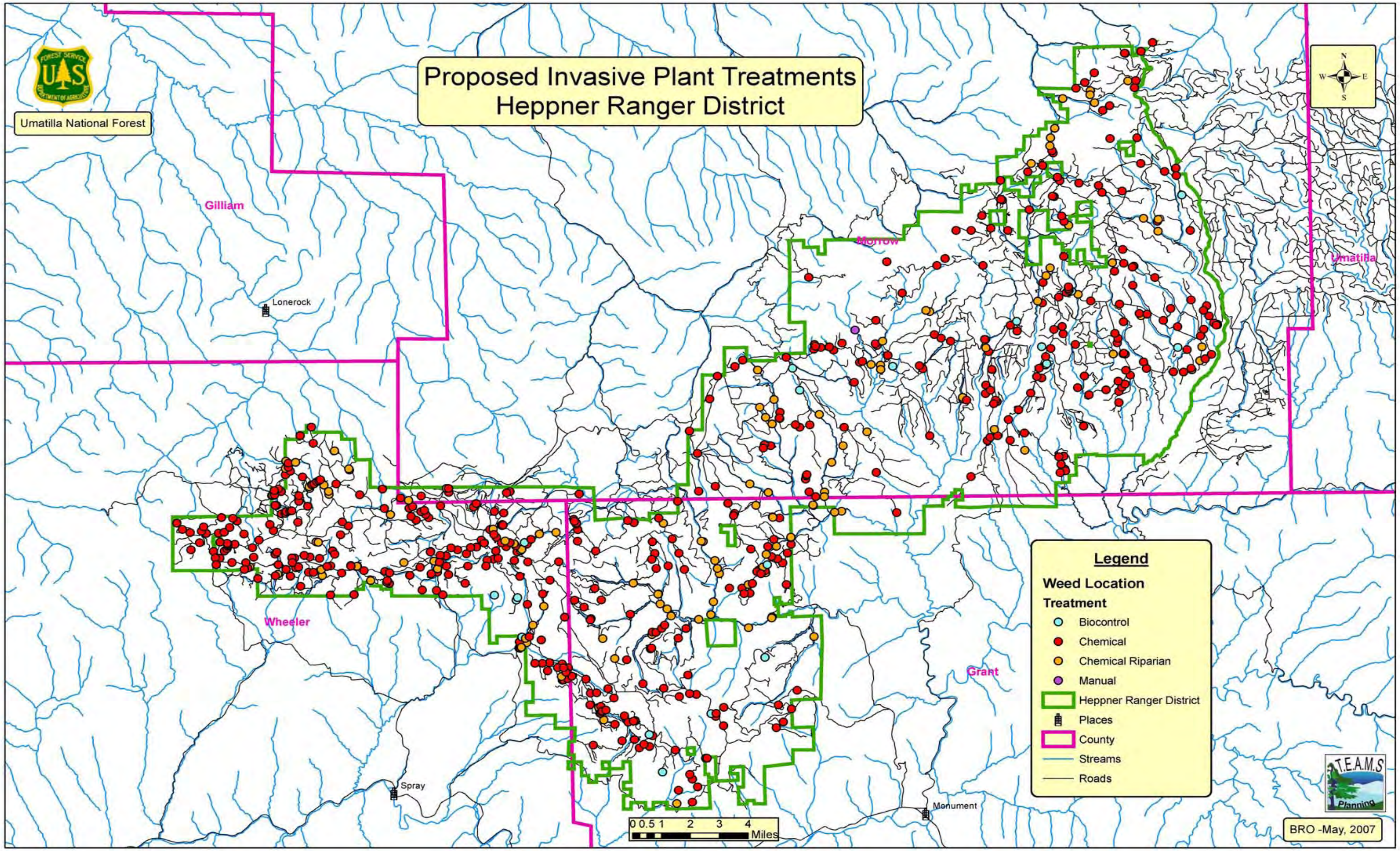

Figure 3 – Heppner Ranger District Proposed Invasive Plant Treatments

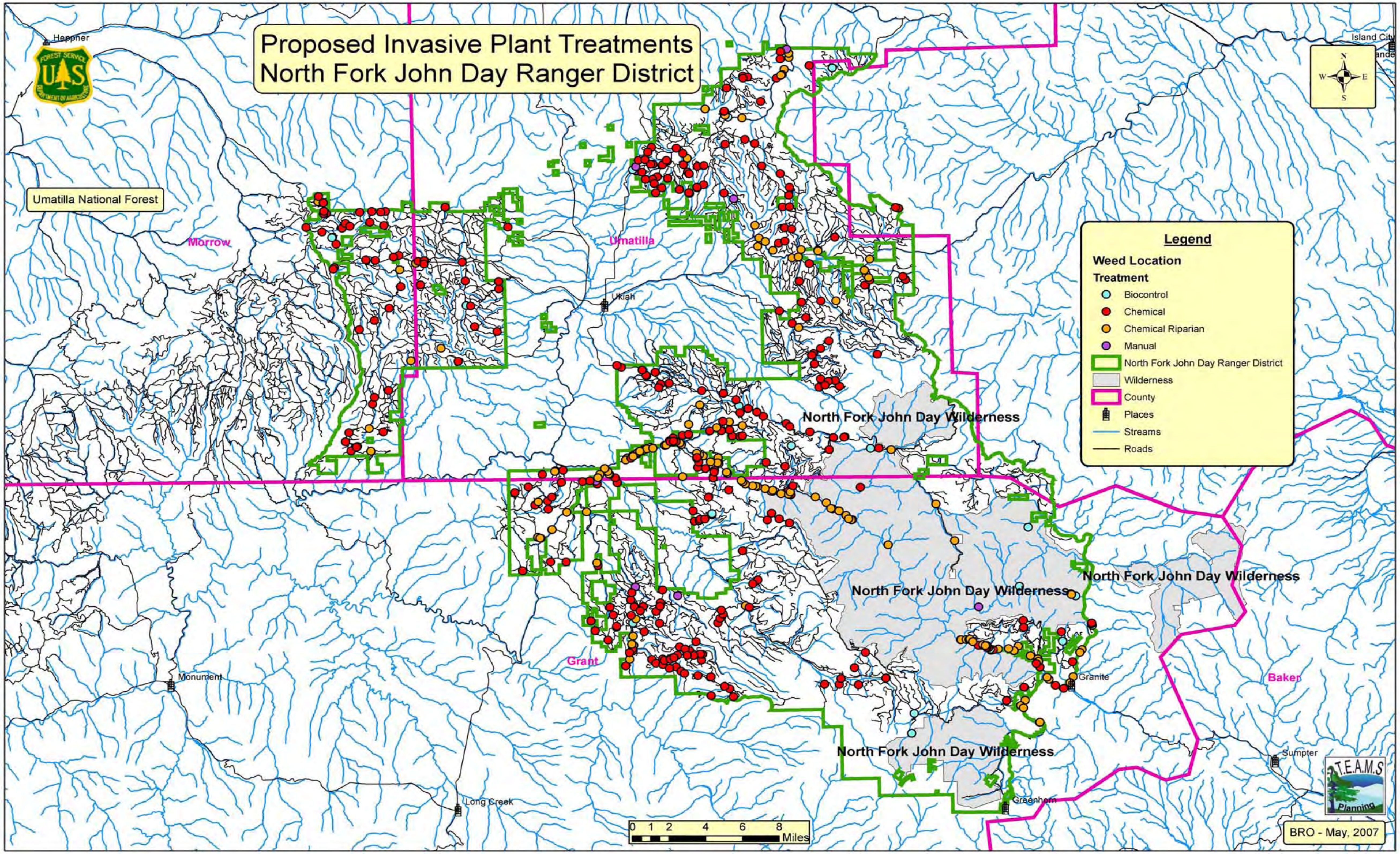

Figure 4 – North Fork John Day Ranger District Proposed Invasive Plant Treatments

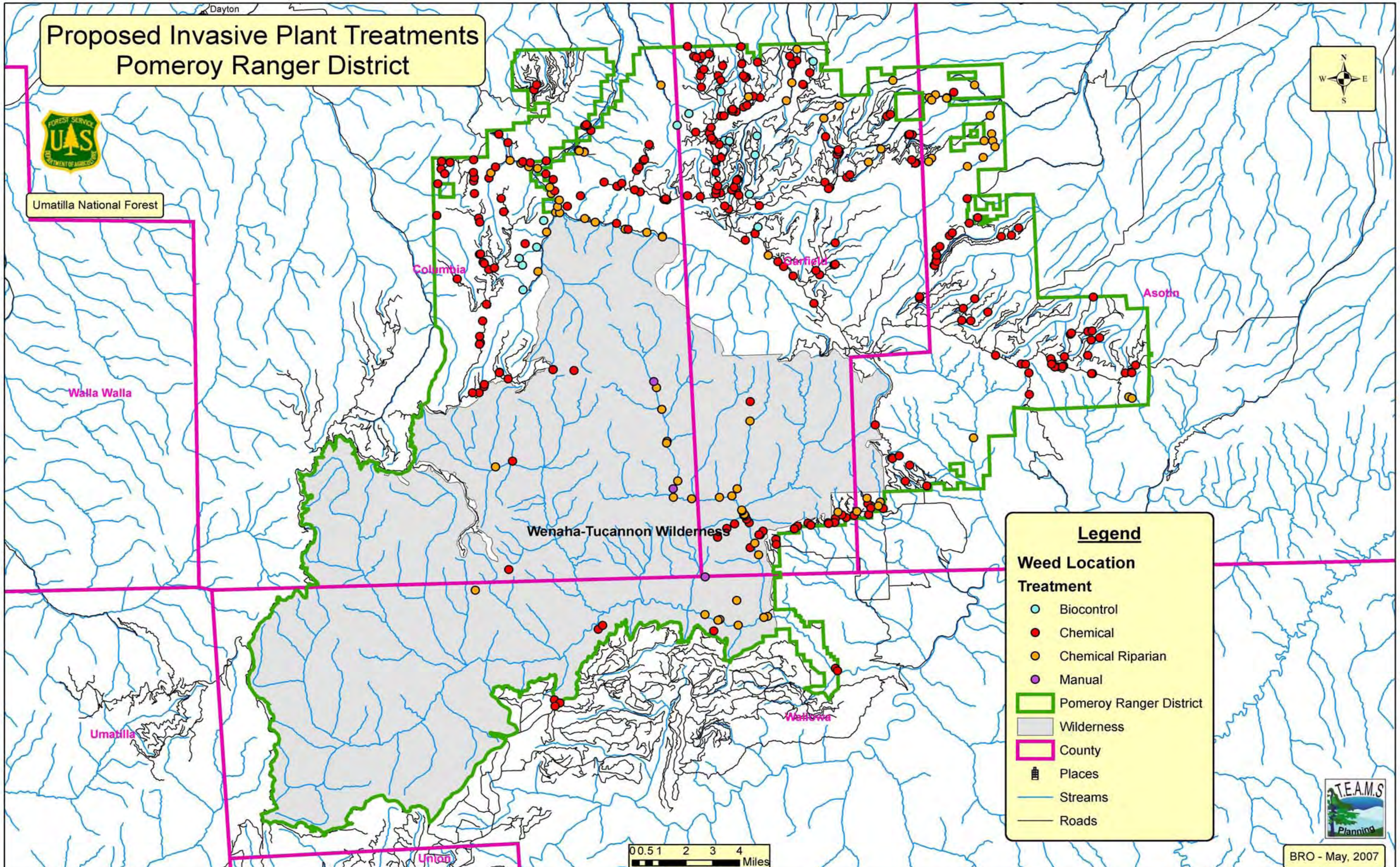

Figure 5 – Pomeroy Ranger District Proposed Invasive Plant Treatments

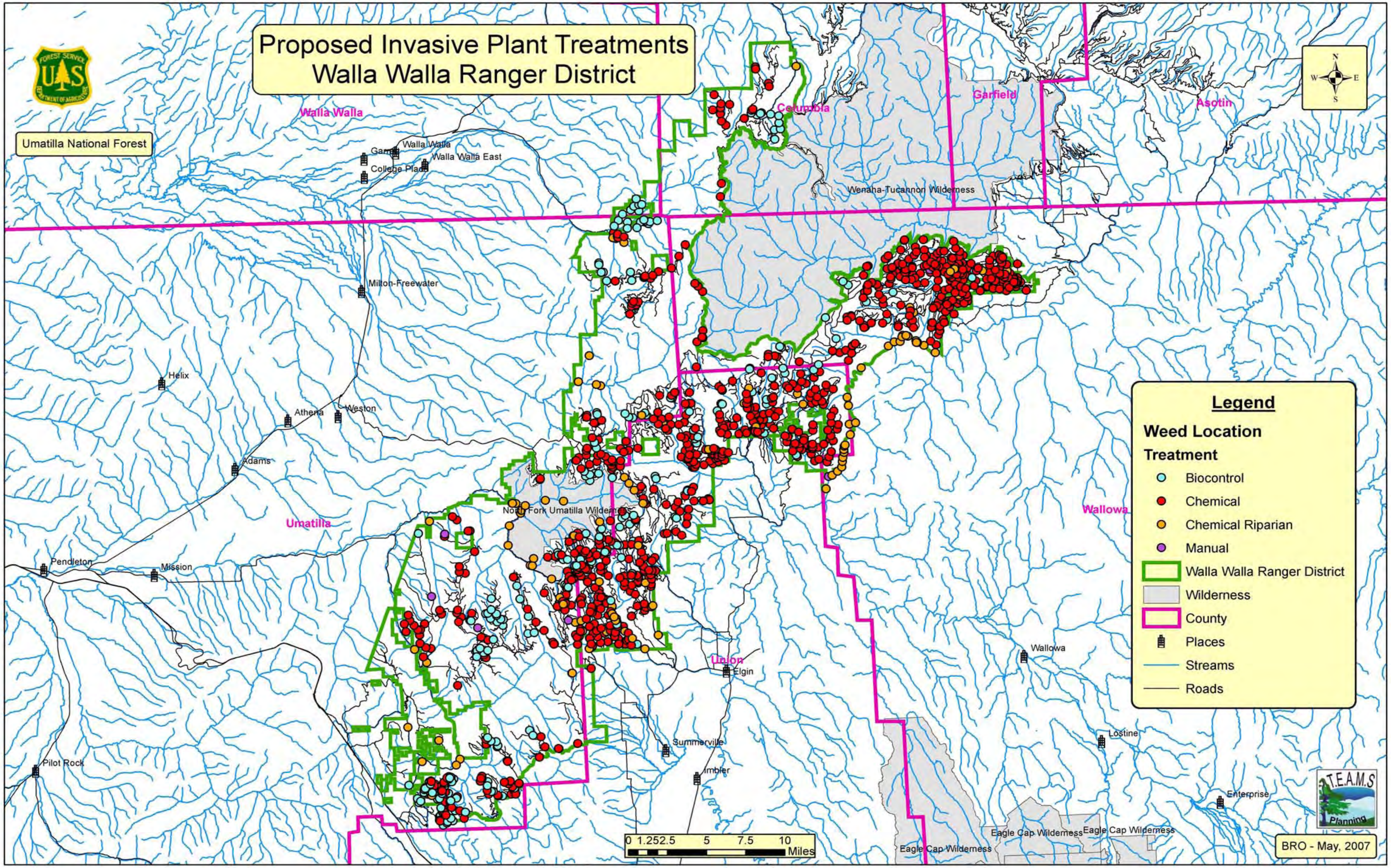

Figure 6 – Walla Walla Ranger District Proposed Invasive Plant Treatments

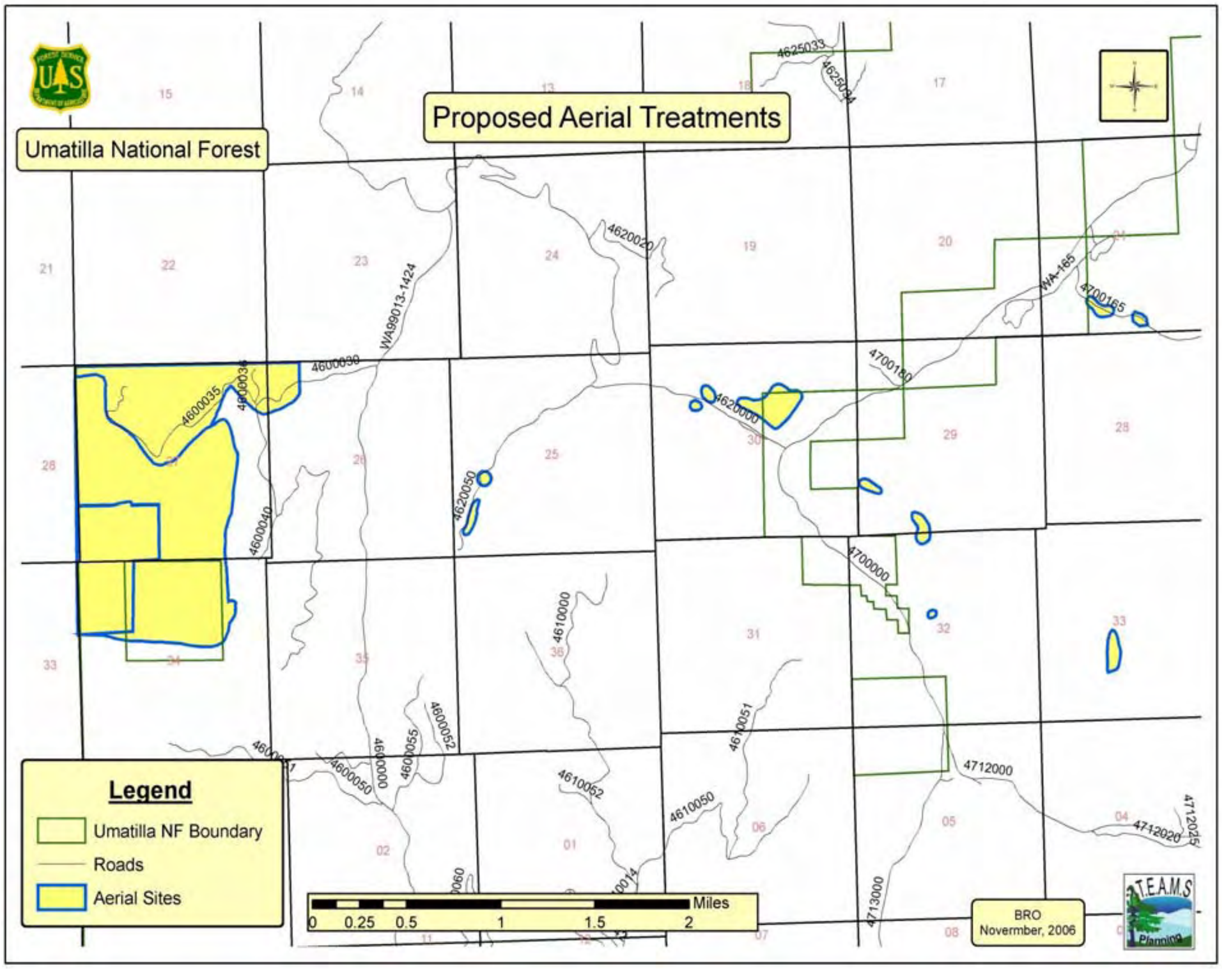

Figure 7 – Acres Proposed for Aerial Application of Herbicide on the Pomeroy Ranger District

Chemical Methods

Methods of ground-based or aerial application of herbicides would be used based on accessibility, topography, the size of treatment area, and the expected efficiency and effectiveness of the method selected. The following are examples of the proposed methods of application:

Spot spraying – This method targets individual plants and is usually applied with a backpack sprayer. Spot spraying can also be applied using horse mounted spray tanks with pumps, or a hose off a truck-mounted or ATV-mounted tank.

Wicking – This hand method involves wiping a sponge or cloth that is saturated with chemical over the plant. This is used in sensitive areas, such as near water, to avoid getting any chemical on the non-target vegetation, soil, or water.

Stem injection – A new hand application technique currently is being used on Japanese knotweed in western Oregon and Washington.

Hand broadcast – Herbicide would be applied by hand using a backpack or hand spreader to cover an area of ground rather than individual plants.

Boom broadcast – This 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 in areas where invasive plants occupy a large percentage of cover on the site and the area to be treated makes spot spraying impractical.

Aerial broadcast – This involves herbicide being applied from a helicopter with a nozzle attached. Typically, this method is used where sites are too steep or otherwise inaccessible.

When herbicide use occurs in close proximity to sensitive areas, specific PDFs would be applied so that vegetation treatments do not have an adverse impact on non-target plants or animals. Herbicides approved for use within or outside riparian areas are listed in the *Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants FEIS*, April 2005 (USDA 2005), and accompanying ROD (USDA 2005a).

Herbicide formulations and mixtures can contain one or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. Additional herbicides may be added in the future at either the Forest Plan or project level through appropriate risk analysis and NEPA/ESA procedures.

The application rates depend on the density and size of the target species, presence and composition of non-target vegetation and wildlife areas nearby, soil type, the distance to open water sources, riparian areas, special status plants, and requirements of the herbicide label.

Applications would be scheduled and designed to minimize the potential impacts to non-target plants and animals (USDA 2005a, appendix 1-5, 1-6) by applying Project Design Features. Monitoring of treated sites would determine what follow-up treatments would be needed, if treatment methods need to be changed, or if a more effective herbicide should be used.

Some alternatives would also allow treating invasive plant infestations that have not yet been discovered or do not yet exist. Though the invasive plant inventory was thorough, it is reasonable to assume not all weeds have been located and mapped. Invasive plants are often easily and quickly dispersed and can be expected to spread and establish in unknown locations in the future. Therefore, ongoing monitoring of treated sites would also look for new infestations. Newly discovered infestations would likely receive a high priority for treatment (See Figure 8 – Treatment Decision Tree) to eradicate the invasive plants while the infestation is small and easily treatable. This strategy of detecting and treating new infestations is called Early Detection Rapid Response (EDRR). Such treatments would be done under the same guidance of the Regional FEIS, Forest Plan Standards, product labels and PDFs used for known treatment areas.

Table 3 displays herbicides proposed for use in the Proposed Action (PA) and a range of application rates for each chemical. Effects analysis assumes that typical rates would be applied; however the actual effective rate would vary depending on application method, target species, and PDFs. Broadcast applications would never exceed typical label rates shown in

Table 3. Non-broadcast methods such as spot, wicking or wiping may be applied at rates greater than typical but that would happen infrequently and only where necessary to be effective.

Table 3 - High, Typical, and Low Application Rates for Herbicides

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

Additives and Impurities

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). For example, surfactants are one type of adjuvant that makes the herbicide more effective by increasing absorption into the plant. Project Design Features have been developed to reduce potential impacts from adjuvants.

Inert compounds are those that are intentionally added to a formulation, but have no herbicidal activity and do not affect the herbicidal activity. Inert additives facilitate the herbicide's handling, stability, or mixing.

Impurities are inadvertent contaminants in the herbicide, usually present as a result of the manufacturing process.

Aerial Applications

In areas where physical features, such as topography, raise applicator safety concerns or where the cost of ground application is prohibitive, invasive plants may be treated with the use of helicopters. Aerial application of herbicide would occur on the Pomeroy District covering approximately 675 acres on 17 sites ranging in size from 1 to 290 acres.

Monitoring of treated sites would determine if follow-up treatments would be needed. For sites treated with herbicides, follow-up treatment could include herbicide application and or manual treatments. However, the goal is to become progressively less dependent on herbicides and to use more of the alternative control methods for continued treatment if a site requires it.

Physical Methods

Physical treatment type includes manual and mechanical control methods.

Manual Control Methods: These include non-mechanized approaches, such as hand pulling or using hand tools (e.g., grubbing), to remove plants or cut off seed heads. Manual treatments are labor intensive, effective only for relatively small areas, and require repeated treatments several times throughout the growing season or in future years depending on the species.

Manual treatments can be effective for annual and tap-rooted weeds, but are less effective against perennial weeds with deep underground stems or roots, or fine rhizomes that can be easily broken and left behind to re-sprout.

Manual treatments are typically used to treat selected plants, small infestations, and sensitive areas to avoid potential negative impacts to non-target species or water quality. Where sites are small or there are few individual target species, handsaws, axes, shovel, rakes, machetes, grubbing hoes, mattocks, brush hooks, and hand clippers may all be used to remove invasive plant species. Axes, shovels, grubbing hoes, and mattocks are also used to dig up and cut below the surface to remove the main root of plants. To meet control objectives or reduce the risk of activities spreading invasive plants, seed heads and flowers are removed and disposed of properly. Other manual methods could include mulching, hot water steaming, foaming, or solarization techniques such as using black plastic to cover invasive species in order to shade out and kill pieces of roots (i.e. rhizomes). These techniques could be used in specific areas where there is a desire to minimize herbicide use such as areas with an abundance of sensitive wildlife or plant species.

Mechanical Control Methods: This method uses hand power tools and includes such actions as mowing, weed whipping, road brushing, root tilling methods, or foaming, steaming, infrared and other techniques using heat to reduce plant cover and root vigor. Choosing the appropriate treatment depends on the characteristics of undesired species present (for example, density, stem size, brittleness, and sprouting ability); the need for small scale, less than 100 square feet (Forest Plan Standard for Detrimental Soil Condition), seedbed preparation and revegetation; the sites location, inside or outside a riparian area; and soil or topographic considerations. These activities would typically occur along roadsides, rock sources, or other confined disturbed areas and dispersed use areas.

Mowing and cutting would be used to reduce or remove above ground biomass. Seed heads and cut fragments of species capable of re-sprouting from stem or root segments may be collected and properly disposed of to prevent them from spreading into uninfested areas.

Biological Methods

USDA Animal and Plant Health Inspection Service (APHIS) and State approved insects or plant pathogens that are proven control agents of specific weed species would be released to selectively suppress, inhibit, or control herbaceous and woody target species.

The insect or plant pathogen attacks and weakens the targeted weed species and reduces its ability to compete or reproduce. Biological control release would be used when the target species occupies extensive portions of the landscape, other methods of control are prohibitive based on cost and location, and an effective biological control regime exists. Biological weed control activities typically include the release of plant-feeding, host specific insects, mites, nematodes and pathogens. Presently, insects are the primary biological control agent in use. Treatments do not eradicate the target species but rather reduce target plant densities and competition with desired plant species for space, water and nutrients.

Biological control activities may include collection of insects, development of insect colonies for collection, transporting, and establishing insects in new locations and supplementing stocking of existing populations. Bio-control agents are transported in containers that safely enclose the agent until release.

In some situations, a suite of biological control agents is needed to reduce weed density to a desirable level.

As an example; a mixture of five or more biological control agents may be needed to attack flower or seed heads, foliage, stems, crowns and roots all at the same time or during the plant's life cycle. Typically, it is expected that 15 to 20 years are needed to bring about a successful control level.

The treated areas would continue to be inventoried and monitored to determine the success of the treatments and when the released bio-control agents have reached equilibrium with the target species. Repeat visits may need to be made several times a season, and over a series of years to determine if additional releases are needed or if a different agent needs to be released.

Treatment Methods Considered but not Included

Additional invasive plant treatment methods exist but are not being considered for this project. They include:

- Prescribed burning
- Plowing/Tilling/Digging with Heavy Equipment
- Grazing
- Flooding/Drowning

Projects proposed to utilize one or more of these methods would require separate, project-specific NEPA analysis.

Treatment Strategies

Based on the invasive plant species and site-specific conditions such as ease of access, land allocation, location near special areas, restrictions due to other sensitive resources, or invasiveness of the plant in a specific habitat, each weed infestation site is assigned a treatment strategy. Once initial treatment is complete, future potential treatment is reevaluated based on the current condition compared to the desired conditions.

Strategies include eradication, control or containment of invasive plants. Treatment cost estimates and assumptions vary by strategy. For instance, treatments of infestations with a strategy to eradicate would tend to be the most costly and labor intensive, and may require more recurring treatments. Another example of strategy would be Early Detection Rapid Response (EDRR) of new weed species or new weed sites discovered during the life of this project.

- **Eradicate:** Totally eliminate an invasive plant species from a site. This objective generally applies to small infestations of aggressive species such as yellow starthistle, spotted knapweed, leafy spurge, and hawkweed; and/or higher priority treatment areas. At some point, larger infestations can become impossible to eradicate.
- **Control:** Reduce the size of the infestation over time; some level of infestation would be acceptable. This objective applies to target species such as Russian knapweed and whitetop.
- **Contain:** Prevent the spread of the weed beyond the perimeter of patches or infestation areas mapped from current inventories.
- **Early Detection Rapid Response (EDRR):** EDRR refers to treatments of newly inventoried invasive plant infestations, including previously undiscovered invasive plant infestations or new infestations that would occur during the life of this project. Ongoing inventory and monitoring would look for new infestations of invasive plants, or new locations of existing weeds. Newly discovered infestations would likely receive a high priority for treatment to eradicate the invasive plants while they are small and easily treatable (See Treatment Decision Tree, Figure 8).

Such treatments cost less, can be successfully treated using a greater variety of treatment methods and abbreviates the potential adverse impacts of the invasive plants. Because the current inventory of weed sites thoroughly covered the Forest, treatment under the EDRR strategy is expected to be small; probably 5 percent or less.

This strategy is needed because: 1) the precise location of individual target plants is subject to rapid and/or unpredictable change; and 2) presently known infestations may grow during the time it typically takes to complete the NEPA process.

Invasive plant sites that are discovered subsequent to the invasive plant inventory completed in 2006 would require evaluation to determine that the invasive plant treatments and environmental impacts are consistent with those analyzed in this EIS.

Therefore, EDRR treatments may occur across the Forest and may include invasive species that are not analyzed in this EIS because sites with common characteristics and common potential environmental effects from treatment have been analyzed.

If the sites and impacts are found to be consistent, then these new infestations could be treated under this NEPA document. The EDRR is based on the premise that the impacts of similar treatments are predictable, even though the precise location or timing of the treatment may be unpredictable. If the proposed EDRR treatments are not consistent with this EIS, new NEPA analysis and disclosure would be required. Examples of when new NEPA would be required include:

- Conducting invasive plant treatments that could not be fully mitigated using the PDFs
- Aerial spraying herbicides on, as yet, undiscovered infestations (this EIS only authorizes the 675 acres of known, mapped aerial treatment sites)
- Using prescribed burning, tilling, plowing, or cattle grazing as invasive plant treatment methods
- Applying herbicides not analyzed in this EIS to newly discovered weed sites

Besides treatment strategies of individual weed sites, there is a broader strategy covering invasive plant management. In this broader context there are several topics covered in this EIS that are discussed more thoroughly in section 3.2.4 and include the following:

- **Integrated Weed Management (IWM):** It is recognized that a single weed treatment may not succeed at containing, controlling or eradicating target infestations. IWM combines various treatment methods, timing of treatments, and monitoring to achieve management success for the long term.
- **Cooperation with Public and Private Landowners, and Other Agencies:** By partnering with other landowners and agencies involved with invasive weed control, treatment effectiveness can be optimized. Recognizing this, the Umatilla Forest staff has, and will continue to cooperate with others regardless of what alternative is adopted.
- **Prevention:** Weed prevention practices are outlined by the regional FEIS and adopted by the Forest Plan. Furthermore, other programs sponsored by the Umatilla National Forest have adopted weed prevention practices, especially addressing site-disturbing activities.

Process and Determination of Treatment Prescriptions

After determining the appropriate treatment strategy, a treatment prescription is developed for each weed infestation. Given adequate funding, approximately 4,000 acres could receive treatment with chemical, physical or biocontrol methods annually. The treatments would occur over approximately 10 to 15 years. The invasive plant treatment prescriptions follow the IWM approach described in the previous section. All herbicide treatments require the completion of the Pesticide-Use Proposal Form FS-2100-2 (Appendix E of the R6 FEIS) to document the use of pesticides on National Forest system lands. All recommended treatment methods would be documented and approved by the appropriate responsible official(s).

To develop a treatment prescription for each weed infestation requires consideration of many factors. First, The Umatilla National Forest compiled extensive information on each site including:

- Invasive plant species and its relative spread and invasiveness characteristics; that is, how aggressively it displaces native plant composition and/or the deleterious effects of the species on native plants and animals
- Location and approximate size of the infestation
- The density of the invasive species coverage within the infestation site
- The location of weeds in relation to important landscape and resource features such as water and riparian areas, sensitive or T & E plants, critical habitat of T & E species
- The location of weeds in relation to manmade improvements where weeds can be spread by human activity such as roads, rock quarries, campgrounds, constructed trails and trailheads
- The location of weeds in relation to designated important areas such as designated wilderness, wild and scenic rivers, or municipal watersheds

This and other cataloged information is known for each of the 2069 weed sites. Utilizing the site information and following the process described herein, a treatment prescription and relative priority of treatment is established. The final decision on treatment priority will be made locally on each Ranger District. Priorities would change over time based on treatment effectiveness and changes occurring on invasive plant sites.

Armed with the cataloged information and local knowledge about effective treatments, the second step was to prescribe treatment methods for each weed site. This was done by applying the specific weed site information to the Treatment Decision Tree (Figure 8 this section).

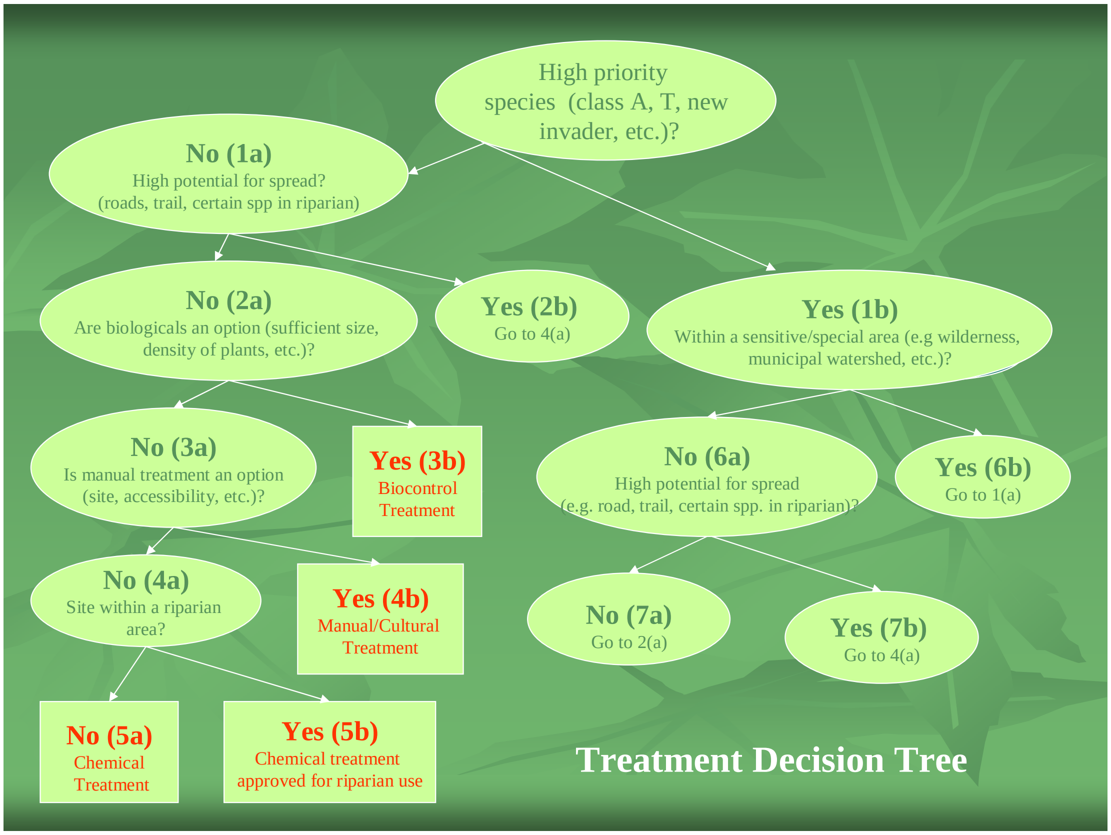

Figure 8 – Treatment Decision Tree

The majority (90 percent) of the treatments assigned allowed the use of herbicides because of the location of the site, the aggressive nature of the plants, and the local knowledge that hand treatments of the past have not been effective. Table 4 shows the results of this process of assigning treatment methods for Alternative B.

Table 4 – Acres of Treatment Methods for Alternative B

Treatment Methods	Alternative B Proposed Action
Upland Areas	**Acres**
Manual, mechanical and/or ground based chemical	14,456
Treatment in Riparian Habitat Conservation Areas 1	
Manual, mechanical ground-based broadcast and/or ground based chemical spot treatment	3,022
Manual, mechanical, and/or chemical ground based spot treatment only (including wicking and wiping), no broadcast allowed	2,538
All areas	
Bio-Control only	3,917
Manual only	41
Aerial only	675
Total Acres Treated	**24,649**

[1]Riparian Habitat Conservation Areas (RHCA) as designated under PACFISH, INFISH

As stated before most infestations will be treated using herbicide application(s). The third step in the process is to prescribe the appropriate chemical and herbicide application method to each site. The Common Control Measures, discussed below, consider the most current science available for the 10 chemicals approved for use by the Forest Plan and The Regional FEIS (USDA 2005) to assign appropriate, effective herbicide treatments for each target invasive species in each infestation site. These measures have been further refined to address conditions on the Umatilla National Forest.

The final step is assuring that all treatments are properly managed to minimize risk and potential adverse effects. Application instructions on herbicide labels would be followed, and treatments would conform to Forest Plan standards adopted from the Regional ROD (USDA 2005b). In addition to this and the Common Control Measures, Project Design Features (PDFs) have been developed to specifically reduce the risk of potential adverse effects of invasive plant treatments. PDFs are listed in Table 6 of this section. Biological control methods are ongoing, once started the control method is maintained by residual populations of bio-agents and acres managed using this type of control would vary across the forest over time.

Through monitoring and updating information after initial treatment, future treatments of each infestation may be required, and may be the same or a different treatment method depending on current status of the weed site. The eventual goal is to reduce dependence on herbicide applications and maintain sites using non-herbicide methods.

Future EDRR sites will be evaluated and assigned a prescription in the same way the presently known sites were addressed. Once discovered, an EDRR site would be inventoried, the information evaluated using the Decision Tree and a treatment method prescribed. EDRR sites would likely have a high priority for treatment if a new species is identified, or if a small infestation in an area that did not contain invasive plants in the past is discovered. The one additional step with EDRR sites is to ensure that the inventory information and prescribed treatment method is consistent with the analyses done in this EIS. If it is, then treatment can proceed. If it is not, then appropriate NEPA analysis must be done to evaluate that site and treatment.

Implementation planning outlines the process that would be used to ensure the selected alternative is properly implemented. The method follows Integrated Weed Management principles (R6 2005 FEIS, 3-3) and satisfies pesticide planning requirements at FSH 2109.14. It applies to currently known and new sites found during ongoing inventory. Detailed information about the implementation planning process is found in Appendix B of this EIS.

Common Control Measures for Alternatives B, C, and D

Common Control Measures for the Umatilla National Forest are displayed in Table 5. The table includes summary prescriptions that would be used as a starting point for all action alternatives. It is adapted from the Regional FEIS Treatment Restoration Standards to target species known or suspected to occur on Umatilla National Forest system lands. Aerial application of herbicides follow the Regional FEIS Standards 16, 21, and 22 in addition to Project Design Features listed in this section. PDFs are additional protective measures designed to minimize potential impacts from treating invasive plants. The Common Control Measures reflect current information and are subject to change depending on new research and adaptive management. This table was developed for the Regional FEIS and prepared by Linda Mazzu (BLM Botanist) and updated by Vicky Erickson (Invasive Weed Specialist) Julie Laufmann (TEAMS Botanist), Jean Wood (Forest Botanist), with incorporated comments from M. Porter (Wallowa Resources, Enterprise, OR) D. Sharratt (Oregon Department of Agriculture), Pacific Northwest's Least Wanted List: Invasive Weed Identification and Management, Oregon State University Extension Service, EC1563, 2003),and Nature Serve (www.natureserve.org).

Table 5 - Common Control Measures

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides[1,2]	When/How to treat with Herbicides
Spotted knapweed (CEBI2) (*Centaurea biebersteinii*) **Diffuse knapweed** (CEDI) (*Centaurea diffusa*) **Meadow knapweed** (CEDE5) (*Centaurea debeauxii*) *Tap rooted Biennials or Perennials*	Hand pull or dig small populations or when regular volunteers are available. Multiple entries per year are required. Manual Disposal: Remove entire root system from the site, as re-growth can occur. Mowing is possible, but timing is critical. These treatments may take up to ten years due to long term seed viability. If chemicals are used, manual treatments could be used for follow- up. Relative amounts of herbicide to manual treatments would decline over time. Biocontrols available (see Appendix B) Revegetate with desirable species, at high priority sites when possible.	**Upland:** 1 -Clopyralid, or Picloram 2- Glyphosate **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table:** Aquatic labeled Glyphosate (will require the most repeated treatments)	**Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Boom or hand broadcast spray in dense cover, where dominant plant community is non-native invasives. Spot spray whenever possible, especially in areas with good native plant cover. **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Spot spray to target individual plants. Follow PDFs they may require a less impacting choice **Timing**: Preferred treatment is spring before bud stage or early summer so use less herbicide. **Notes:** Yearly revisits will be necessary; the number of which is dependent on the chemical used and the seedbank.
Dalmation Toadflax (LIGEDA) *(Linaria. genistifolia* ssp *dalmatica)* **Butter 'n'**	Hand pull or dig small, easily accessible populations. Ensure all plant parts are completely removed. Multiple entries per year are required. Plants can be left on site, but may reduce germination of desirable species due to	**Upland:** 1. Picloram 2. Chlorsulfuron 3. Imazapic (Use in native grass stands; fall application only)	**Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Boom or hand broadcast spray in dense cover, where dominant plant community is non-native. However, this species tends to be scattered, so spot spraying

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides[1,2]	When/How to treat with Herbicides
Eggs (LIVU) *(Linaria vulgaris)* *Rhizomatous Perennials*	mulching effect. Success will depend on consistent labor for each growing season until plants are eradicated. Mowing stands in spring or early summer will eliminate plant reproduction, but not the infestation. These treatments may take up to ten years due to long term seed viability. Biocontrols available (See Appendix B) If chemicals are used, manual treatments could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time. Revegetate with desirable species at high priority sites when possible. Plant communities in good condition may recover without replanting.	**High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table** Aquatic labeled Glyphosate	(backpack or on OHV) is usually more appropriate. **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Spot spray to target individual plants. Follow PDFs they may require a less impacting choice **Timing**: Apply during active growth in spring before bloom or in late summer or fall during re-growth. **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.
Leafy Spurge (EUES) *Euphorbia esula* *Rhizomatous perennial*	Requires combination of techniques for successful control. Multiple entries per year are required. Repeated mowing or hand cutting can control seed production but must be used with herbicides for adequate control of the site. Repeated mowing could reduce competitive ability of desirable species. Biocontrols available (See Appendix B) Some success has been found with using biological control (flea beetle) with fall herbicide treatments.	**Upland:** 1. Picloram 2. Glyphosate or Imazapic **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table** Aquatic labeled Glyphosate	**Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Spot spray whenever possible. Boom or hand broadcast spray in dense cover, where dominant plant community is non-native and leafy spurge population is large. **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Wick application to target individual plants. Follow PDFs they may require a less impacting choice
Russian Knapweed (ACRE3) (*Acroptilon repens)* *Perennial with*	Hand-pulling 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.	**Upland:** 1. Chlorsulfuron 2. Clopyralid 3. Clopyralid + Triclopyr (Redeem) 4. Glyphosate, Imazapic, or	**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

Target Species - Common Name and Growth Habit	**General Prescription**	**Documented Effective Herbicides[1,2]**	**When/How to treat with Herbicides**
adventitious shoots	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 (at least 3 times/year) to control existing top growth; re-emerging plants will be smaller in size and lower in vigor. Discing or plowing produces broken root fragments that spread quickly and resprout. Russian knapweed is poisonous to horses. Livestock will graze, but it is usually avoided. In most situations, Russian knapweed cannot be effectively managed by herbicides alone. Lasting control requires an integration of techniques (mechanical, manual, chemical, and possibly biological control), proper land management, and revegetation to out compete the thistle. Biocontrol available, however not effective in region (See appendix B). Competitive plantings are usually necessary.	Metsulfuron **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table** Aquatic labeled Glyphosate	native plant cover. **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Spot spray or wick application with manual follow-up treatments to target individual plants. Follow PDFs they may require a less impacting choice **Notes:** Late fall/early winter application is critical for Picloram and Clopyralid
Yellow starthistle (CESO3) *(Centaurea solstitialis)* Annual	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). Mowing can be useful but timing is critical (before viable seed production, but too early can result in rapid regrowth),	**Upland:** 1 – Clopyralid or Picloram 2 - Glyphosate **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table**	**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. **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Spot spray or wick application to target individual plants. Follow PDFs they may require a less impacting choice **Timing:** **Notes:** Yearly revisits will be necessary; the number of which is

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides[1,2]	When/How to treat with Herbicides
	Mazzu (2005) discusses biological control. Biological control insects can reduce seed production by 90 to 100 percent. (Wilson et al. 2003, Biology and Biological Control of Yellow Starthistle).Variable success results reported from eastern Oregon releases(Appendix B). Revegetate high priority sites if needed with desirable species if possible.		dependent on the chemical used and the seedbank.
Scotch Thistle (ONAC) *Onopordum acanthium* *Biennial*	Cutting and mowing can be effective when combined with revegetation of native species. Repeated mowing, in combination with other management methods, often is necessary for long-term control. Manual removal is effective when entire aboveground plant growth is removed. Herbicide treatment is the most effective control.	**Upland:** 1 – Picloram or Clopyralid 2 – Chlorsulfuron 3 - Metsulfuron **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table** 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. **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Spot spray or wick application to target individual plants. Follow PDFs they may require a less impacting choice **Timing:** Spray in the spring before plants bolt or during the fall on the rosettes.
Canadian thistle (CIAR4) (*Cirsium arvense*) Perennial-rhizomatous	The only manual technique would be hand cutting of flower heads, which only suppresses seed production. Mowing may be effective in rare cases if done monthly (this intensity would damage native species). Covering with plastic tarp may also work for small infestations. Herbicide treatment is most effective. Re-vegetate with desirable species.	**Upland:** • Clopyralid, Picloram, Glyphosate or Chlorsulfuron	**Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Boom spray in dense cover, where dominant plant community is non-native invasive. • Backpack spray whenever possible. **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Spot spray or wick application to target individual plants. Follow PDFs they may require a less impacting choice **Timing:** Apply in spring before to rosettes and prior to flowering. • Or apply in fall to rosettes; season is dependent upon herbicide used. **Notes:** Yearly revisits will be

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides[1,2]	When/How to treat with Herbicides
			necessary; the number of which is dependent on the herbicide used and the seed bank.
Musk thistle (CANU4) (*Carduus nutans*) Biennial	Use manual, mechanical or herbicide control or a combination. Any manual method that severs the root below the soil surface will kill these plants. Effective control requires cutting at the onset of blooming. Treatment before plants are fully bolted results in re-growth. Repeated visits at weekly intervals over the 4 to 7 week blooming period provide most effective control. • Mowing should be specifically conducted close to full flower stage (within 2 days). Biological controls may be helpful to suppress populations in combination with other methods (see Appendix B).	**Upland:** 1. Picloram or Clopyralid 2. Metsulfuron methyl 3. Glyphosate 4. Chlorsulfuron **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table**	**Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Boom spray in dense cover, where dominant plant community is non-native. • Backpack spray whenever possible. **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Spot spray or wick application to target individual plants. Follow PDFs they may require a less impacting choice. **Timing:** Apply in spring before to rosettes and prior to flowering. • Or apply in fall to rosettes; season is dependent upon herbicide used. • **Notes:** Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank. .
Tansy ragwort (SEJA) (*Senecio jacobaea*) Biennial or short-lived perennial	Hand pulling is effective if done in moist soils. This is most effective after the population has been brought under control. Mowing is the most common technique and is effective if done prior to flowering. • These treatments may take up to ten years due to long term seed viability. Biocontrols available (Appendix B). Ensure biological controls are present nearby or request their introduction. Re-vegetate with desirable species. Is toxic to horses and cattle and causes severe liver damage.	**Upland:** 1. Clopyralid 2. Chlorsulfuron 3. Picloram 4. Glyphosate **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table**	• **Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Boom spray in dense cover, where dominant plant community is non-native. Spot application in patchy areas. **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Follow PDFs they may require a less impacting choice **Timing:** During active growth, up through flowering stage. **Notes:** Revisits will be necessary; the number of which is dependent on the herbicide used and the se
Hounds tongue (CYOF) (*Cynoglossum officinale*)	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). These	**Upland:** 1. Metsulfuron methyl 2. Chlorsulfuron 3. Picloram 4. Imazapic	• **Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Boom spray in dense cover, where dominant plant community is non-native. •

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides[1,2]	When/How to treat with Herbicides
Biennial	treatments may take up to five years. Re-vegetate with desirable species.	5. Glyphosate **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table**	**Sensitive Sites or Special Management Areas where more selective treatment is desired:** Spot spray or wick application to target individual plants. Follow PDFs they may require a less impacting choice. **Timing:** Apply during active growth, preferably basal rosette stage. • **Notes:** Revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank.
Common burdock (ARMI2) (Arctium minus) Biennial	Hand pulling and mechanical control may prove to be successful since common burdock cannot tolerate cultivation. When cut down or uprooted, any root fragment that is left behind can grow into an entirely new plant and can contribute to spread. An effective control is to cut off emerging flower buds. The plants will have to be monitored throughout the summer as buds can reform after cutting. If herbicides are used, revisits to the site may be necessary in subsequent years to exhaust the seedbank.	**Upland:** 1. Metsulfuron methyl 2. Clopyralid+Triclopyr 3. Glyphosate **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table**	**Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Boom spray in dense cover, where dominant plant community is non-native. • **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Spot spray or wick application to target individual plants. Follow PDFs they may require a less impacting choice. **Timing:** Apply during active growth, **Notes:** Seeds remain viable for 2 and reported up to 10-20 years.
Scotch Broom (CYSC4) (*Cytisus scoparius*) Perennial woody shrub	Hand pull, cutting, weed wrenching or digging 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. • These treatments may take up to ten years due to long term seed viability. • Biocontrols available (Appendix B), yet only moderate effects noted. Re-vegetate with desirable species.	**Upland:** 1. Triclopyr 2. Picloram 3. Glyphosate **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table**	• **Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Smaller plants: Backpack spray where hand pulling or weed wrenching is not feasible. **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Hand pulling or wick application to target individual plants. Follow PDFs they may require a less impacting choice. **Timing** Apply during active growth preferably in the spring to young plants. • **Notes:** Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank. Mowing prior

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides[1,2]	When/How to treat with Herbicides
			to fruiting and follow up with spot spray to individual plants will reduce herbicide use.
St John's wort (HYPE) *(Hypericum perforatum)* perennial	Hand removal of small populations or isolated stems is possible, but repeated treatments will be necessary as lateral roots give rise to new plants. Pulled or dug plants must be removed from the area and burned. • These treatments may take up to ten years due to long term seed viability. Biocontrols available (Appendix B). Biological controls will most likely not be effective in damp, cool climates. Re-vegetate with desirable species.	**Upland:** 1. Metsulfuron methyl 2. Picloram 3. Glyphosate **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table**	**Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Backpack spray whenever possible. Boom spray larger areas of dense cover, where dominant plant community is non-native. Apply metsulfuron methyl when plants are fully emerged and in active growth. • Apply picloram in early growth stages before bloom. • Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank. **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Hand pulling or wick application to target individual plants. Follow PDFs they may require a less impacting choice. **Timing** Apply during active growth preferably in the spring to young plants. **Notes:** Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank.
Yellow Hawkweed (HICA10) (*Hieracium pratense*) **Tall Hawkweed** (HIPI2) (*Hieracium aurantiacum*) Perennial	Manual treatments are difficult since hawkweeds have stolons and will re-sprout from any fragments. Therefore, pulling must be done during moist soil conditions to get as much of the root as possible. Remove seed heads if control is attempted later in the season to reduce seed spread. Mowing of plants can cause plants to respond by sending up shorter stems and quickly flowering again.	**Upland:** 1. Picloram or Clopyralid **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table**	**Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Backpack spray whenever possible. • Boom spray larger areas of dense cover, where dominant plant community is non-native.Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank. **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Hand pulling or wick application to target individual plants. Follow PDFs they may require a less impacting choice. **Notes:** No indication of a long-lived seed bank, yet yearly visits may be warranted to ensure no resprouting. Herbicides have

Target Species - Common Name and Growth Habit	**General Prescription**	**Documented Effective Herbicides[1,2]**	**When/How to treat with Herbicides**
			been shown to be more effective when combined with fertilizer for grass species.
Sulphur cinquefoil (PORE5) (*Potentilla recta*) Perennial	Hand-pulling is effective on small infestations provided the entire root is removed. Mechanical control by disking shown to be effective if reseeded. Mowing is not effective Make postemergent herbicide application to actively growing plants and in the rosette to flower stage of growth. Seeds remain viable in the seedbank for 1 to 5 years	**Upland:** 1- Picloram 2- Metsulfuron methyl **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table:**	**Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Backpack spray whenever possible. • Boom spray larger areas of dense cover, where dominant plant community is non-native. • Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank. **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Hand pulling or wick application to target individual plants. Follow PDFs they may require a less impacting choice. **Timing:** Apply to actively growing plants or during the rosette to flower stage of growth. **Notes:** Repeated applications are needed to for the first couple of years ensure re-establishment does not occur.
Whitetop (CADR (*Cardaria draba)* *Perennia*l	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 Mowing followed a month later by herbicide may be effective. Mowing must be done during full flowering. In general, manual and mechanical methods are not recommended. Re-vegetate with desirable species.	**Upland:** Metsulfuron methyl, or Chlorsulfuron , or Sulfometuron methyl, or Glyphosate **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table**	**Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Backpack spray whenever possible. • Boom spray in dense cover, where dominant plant community is non-native. • **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Hand pulling or wick application to target individual plants. Follow PDFs they may require a less impacting choice. **Notes:** Multiple applications are probably necessary for control. Handing pulling will stimulate plant growth if all plant parts are not removed.

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides[1,2]	When/How to treat with Herbicides
Everlasting peavine (LALA4) (*Lathyrus latifoliis*) Perennial vine	Hand pulling is most effective if the entire plant is pulled. Care must be taken not to pull desirable vegetation which is often intermingled. If herbicides are used, manual treatments could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time	**Upland:** Glyphosate **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table**	**Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Backpack spray whenever possible. • **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Hand pulling or wick application to target individual plants. Follow PDFs they may require a less impacting choice **Timing:** Yearly revisits will be necessary.
Medusahead (TACA8) (*Taeniatherum caputmedusae*) Annual grass	Repeated cutting/mowing with herbicide treatment is effective. • Manual removal can be effective with small populations. A combination of prescribed fire (in June), herbicide application, and reseeding with native grasses is considered highly effective. Repeated treatments may be needed Active restoration (seeding of a competitive desirable species) is important.	**Upland:** 1 Imazapic 2 Sulfometuron methyl + Chlorsulfuron 3 Sulfometuron methyl 4 Sethoxydim 5 Glyphosate **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table**	**Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Backpack spray whenever possible. • Boom spray in dense cover, where dominant plant community is non-native. **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Hand pulling or wick application to target individual plants. Follow PDFs they may require a less impacting choice. **Timing:** Treatment should be done before seed formation or during the fall through early winter. **Notes:** Off-site drift of 100' or more reported with aerial application.
Reed canarygrass (PHAR3) (*Phalaris arundiacea*)	Use a combination of herbicides and manual, mechanical, cultural or prescribed fire treatments. Manual treatments or mowing are only practical for small stands 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. • Disking or plowing can be effective especially after herbicide treatment. Prescribed burning several weeks after herbicide treatment or in the late fall could also be effective. • Covering populations with black plastic may be effective if shoots are not allowed to grow beyond	**Upland:** Sulfometuron methyl or Glyphosate **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table**	**Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Backpack spray whenever possible. • Boom spray in dense cover, where dominant plant community is non-native. Unlikely area will be in an upland site **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Hand pulling or wick application to target individual plants. Follow PDFs they may require a less impacting choice. **Timing:** Apply in early spring when just sprouting before other wetland species have emerged

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides[1,2]	When/How to treat with Herbicides
	tarps. This technique could take over two years to be effective.		**Notes:** Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank..
Wild carrot (DACA6) (*Daucus carota*) Perennial	Hand-pulling or mowing close to the ground in the first year of growth (7-10 inches high) in mid-to-late summer before seed set can be effective on small patches. It is particularly troublesome when it occurs on railroad and highway rights-of-way with heavy soils where incorrectly timed mowing scatters viable seed for re-establishment. This perennial herb persists in recovering grasslands and prairies, but has been shown to decline on its own.	**Upland:** Metsulfuron methyl or Chlorsulfuron **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table:** Aquatic labeled Glyphosate (not found as effective in the literature	**Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Spot spray whenever possible. **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Follow PDFs they may require a less impacting choice. **Timing:** Wide range of application times from spring treatments of over-wintered plants or seedlings to established plants in the fall. Yearly revisits will be necessary; the number of which is dependent on the chemical used and the seedbank **Notes:** Abundance in sandy soil generally declines on its own as natives become reestablished. It is more persistent in soils with a good clay content, and active management may be necessary in such areas
Rush skeletonweed (CHJU) (*Chondrilla juncea*)	No manual techniques recommended. A 1-cm section of the extensive and deep tap and lateral root system can resprout aerial parts if damaged Frequent mowing of plants infested with gall mites may decrease the rate of spread. • Biocontrols available (See Appendix B) Herbicides can be effective, especially with repeat follow-up Re-vegetate with desirable species.	**Upland:** 1. Clopyralid (late fall or early spring only) or Picloram 2. Metsulfuron methyl **High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table**	**Drier upland sites (Road, Quarries & Upland Forest/Rangeland):** Boom spray in dense cover, where dominant plant community is non-native. Backpack spray whenever possible. • **Sensitive Sites or Special Management Areas where more selective treatment is desired:** Apply to rosette in late fall or up to early bolting stage in spring. • Application may be difficult due to lack of leaf surface. • Plants less than 5 years old respond best. • Aggressive repeated treatments will be necessary. • The number will be dependent on the herbicide used and the seed bank. Follow PDFs they may require a less impacting choice. **Timing:** late fall or early spring only

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides[1,2]	When/How to treat with Herbicides
			Notes: The pappus on each seed allows the seed to be carried up to 20 miles by wind currents. A healthy plant can produce 1500 flower heads with the capability of producing 20000 viable seeds. Where sexual reproduction is prevented, the plant can regrow from root fragments. Some seeds may remain viable up to 5 years in the seed bank.

1Herbicides listed in numerical order represent a preferential order; no numerical listing indicates no preference for control, no chemical listed indicates no information available. If future research indicates that one of our listed chemicals is effective on an invasive species that it is not listed for now, then they could be used. If a new chemical label gets approved that is effective, it can be used after review of the risk assessment and any additional design features incorporated by supplementing this EIS analysis.
2Currently, the available herbicides for use in or near surface water is glyphosate, triclopyr and imazapyr.

Aerial application
STD 16: Cannot use: Chlorsulfuron, metsulfuron methyl, sulfometuron methyl or triclopyr
STD 21: 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
STD 22: Prohibit aerial application of herbicides within legally designated municipal watersheds

Project Design Features

The following Project Design Features (PDFs) minimizes the potential impacts of invasive plant treatments. These PDFs are specific, Forest level measures designed to minimize project effects and provide sideboards for early detection/rapid response in accordance with R6 2005 ROD Standards 19 and 20. The PDFs were developed to respond to the site-specific resource conditions within the treatment areas, including (but not limited to) the current invasive plant inventory, the presence of sensitive species, species of local interest (SOLI) and their habitats, potential for herbicide delivery to water, and the social environment. Implementation of the PDFs would be mandatory to ensure that treatments would have effects within the scope of those disclosed in Chapter 3. The analysis assumes buffers approximate horizontal (map) distances.

Project Design Features are summarized in the following table.

Table 6 - Project Design Features

PDF Reference	Design Features	Purpose of PDF	Source of PDF
A - Pre-Project Planning			
A1	Prior to treatment, confirm species/habitats of local interest, watershed and aquatic resources of concern (e.g. hydric soils, streams, lakes, roadside treatment areas with higher potential to deliver herbicide to water, municipal watersheds, domestic water sources), places where people gather, and range allotment conditions. Apply appropriate PDFs described below and any from the Regional EIS/Forest Plan. For EDRR sites follow the decision tree (see figure 1) to determine the type and method of treatment and apply applicable PDFs.	Ensure project is implemented appropriately.	This approach follows several previous NEPA documents. Pre-project planning also discussed in the previous section.
B - Coordination with Other Landowners/Agencies			
B1	Work with owners and managers of neighboring lands to respond to invasive plants that straddle multiple ownerships. Coordinate treatments within appropriate distances based on invasive species reproductive characteristics, and current use of area	To ensure that neighbors are fully informed about nearby herbicide use and to increase the effectiveness of treatments on multiple ownerships.	A variable distance based on site and species specific characteristics was chosen because it adjusts for various conditions that exist in these areas. All PDFs related to riparian areas and buffer distances will be followed

PDF Reference	Design Features	Purpose of PDF	Source of PDF
C - To Prevent the Spread of Invasive Plants During Treatment Activities			
C1	Ensure vehicles and equipment (including personal protective clothing) do not transport invasive plant materials.	To prevent the spread of invasive plants during treatment activities	Common measure.
D - Wilderness Areas [1]			
D1	For EDRR in wilderness, invasive plants could be treated using non-mechanical hand methods or herbicides. Herbicide treatments may use application methods such as wicking, stem injection, spray bottle, hand pressurized pumps, battery or solar powered pumps and propellant based systems such as those that use pressurized carbon dioxide	To reduce the effects of invasive plant treatments on the untrammeled quality of wilderness character	
E - Non-herbicide Treatment Methods			
E1	Limit the numbers of workers on any one site at any one time while treating areas within 150 feet of creeks.	To minimize trampling protect riparian and aquatic habitats, and prevent potential invasive plant spread via waterway dispersal	The distance of 150 feet was selected because it incorporates the Aquatic Influence Zone for fish bearing streams.
E2	Fueling of gas-powered equipment with tanks larger than 5 gallons would	To protect riparian and aquatic habitats.	The distance of 150 feet was selected because it incorporates

[1] Invasive plant eradication within Wilderness areas meets the "no impact" intent of the Wilderness Act and associated land use policies.

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	not occur inside the RHCA unless there is no other alternative.		the Aquatic Influence Zone for fish bearing streams.
F - Herbicide Applications			
F1	Herbicides would be used in accordance with label instructions, except where more restrictive measures are required as described below. Herbicide applications would 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 (solvents) are limited to water and/or specifically labeled vegetable oil.	To limit potential adverse effects on people and the environment.	Standard 16, 2005 R6 ROD; Pesticide Use Handbook 2109.14

PDF Reference	Design Features	Purpose of PDF	Source of PDF
F2	Herbicide use would comply with standards in the PNW Regional Invasive Plant Program – Preventing and Managing Invasive Plants FEIS (2005), including standards on herbicide selection, restrictions on broadcast use, tank mixing, licensed applicators, and use of adjuvants, surfactants and other additives.	To limit potential adverse effects on people and the environment.	2005 R6 ROD Treatment Standards (see Chapter 1).
F3	POEA surfactants, urea ammonium nitrate or ammonium sulfate would not be used in applications within 150 feet of surface water, wetlands or on roadside treatment areas having high potential to deliver herbicide. See J4a	To protect aquatic organisms.	The distance of 150 feet was selected because it is wider than the largest buffer and incorporates the Aquatic Influence Zone for fish bearing streams.
F4	Lowest effective label rates would be used. No broadcast applications of herbicide or surfactant will exceed typical label rates. NPE surfactant would not be broadcast at a rate greater than 0.5 lbs. a.i./ac (pounds of active ingredient per acre). Favor other classes of surfactants wherever they are expected to be effective. In no case will imazapyr use exceed 0.70 lbs. a.i. /ac.	To eliminate possible herbicide or surfactant exposures of concern to human health, wildlife, and/or fish.	Based on SERA Risk Assessment for imazapyr there would be no exposure concerns

PDF Reference	Design Features	Purpose of PDF	Source of PDF
F5	Herbicide applications would occur when wind velocity is between two and eight miles per hour to reduce the chance of drift. During application, weather conditions would be monitored periodically by trained personnel.	To ensure proper application of herbicide and reduce drift.	These restrictions are typical so that herbicide use is avoided during inversions or windy conditions.
F6	To minimize herbicide application drift during broadcast operations, 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., nozzle diameter to produce a median droplet diameter of 500-800 microns.	To ensure proper application of herbicide and reduce drift.	These are typical measures to reduce drift. The minimum droplet size of 500 microns was selected because this size is modeled to eliminate adverse effects to non-target vegetation 100 feet or further from broadcast sites (see Chapter 3 for details).
F7	Use of sulfonylurea herbicides (Chlorsulfuron, Sulfometuron methyl and Metsulfuron methyl), will require soils to be mapped prior to treatment. Treatment of powdery, ashy dry soil, or light sandy soil can only be treated if rainfall is expected within 24 hrs of treatment.	To avoid potential for herbicide drift.	Label advisory

PDF Reference	Design Features	Purpose of PDF	Source of PDF
F8 Additional Herbicide Design Features Specific to Aerial Applications Also see Appendix F for Aerial Spray Guidelines	Application of herbicide aerially will not be used for treatment of EDRR sites Chlorsulfuron, metsulfuron methyl, sulfometuron methyl and triclopyr will not be applied aerially. 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). Prohibit aerial application of herbicides within Congressional designated municipal watersheds. See B2 for other developed water sources. Inventory and Monitor – Effectiveness Monitoring required for "a representative sample" in project involving aerial application of herbicide All aviation activities shall be in accordance with FSM 5700 (Aviation Management), FSH 5709.16 (Flight Operations Handbook)FSM 2150 (Pesticide	To prevent non-target effects To prevent non-target effects To minimize any impacts to humans To protect water supplied To ensure impacts to non-target species is within tolerance. To ensure all aircraft SS for fleet and contract operators follow all FS safety, training, supervision for natural resource protection activities. To ensure pesticide-use management and coordination follows NF direction and policies. Reduce likelihood that herbicides would enter surface water in levels of concern. To protect SOLIs and reduce non-target effects. To comply with ROD Standards 19 & 20 To prevent non-target effects To ensure proper public notification	Not required for newly discovered small infestation Regional FEIS ROD, 2005 Regional FEIS ROD, 2005 Regional FEIS ROD, 2005 Regional FEIS Appendix 1. FSM 5700, FSM 2150, FSM 5709.16, FSM 2109.14059 Buffers based on SERA risk assessments, label advice., and Berg's 2004 study of broadcast drift and run off to streams; monitoring data from other herbicide application project. Forest Service Manual 2670

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	Use Management and Coordination), FSH 2109.14, 50 (Quality Control Monitoring and Post-Treatment Evaluation),	To ensure grazing animals are not exposed to aerial herbicide applications To ensure proper public notification	and applicable federally listed recovery plans
	Herbicide buffers have been established for perennial and wet intermittent streams, dry streams and lakes and wetlands. These buffers are shown in the tables below. Buffer distances for federally listed SOLIs will follow Recovery Plan recommendations. No aerial application would occur within 300' of non-federally listed SOLIs. Spray cards to monitor drift can be used in conjunction with monitoring and adaptive management to adjust buffers if needed. Aerial spraying of invasive species will not occur in areas with 30% or more live tree canopy cover. For live tree	To ensure non-target effects	Common measure

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	canopy cover between 10-29% an on-site decision whether or not to aerial spray would be based on factors such as target invasive species, herbicides (specificity) proposed for treatment, and potential impacts to non-target tree species present. Aerial spray units (and perennial seeps, ponds, springs, and wetlands in proposed aerial units) will be ground-checked, flagged and marked using GPS prior to spraying to ensure only appropriate portions of the unit are aerially treated. A GPS system will be used in spray helicopters and each treatment unit mapped before the flight to ensure that only areas marked for treatment are treated. Plastic spray cards will be placed out to 350 feet from and perpendicular to perennial creeks to monitor herbicide presence Press releases will be submitted to local newspapers indicating potential windows of treatment for specific areas. Signing and on		

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	site layout will be performed one to two weeks prior to actual aerial treatment. Grazing permittees will be notified at annual permittee meeting that aerial application will be conducted. Permittee will also be notified of specific time frames in which treatment would occur to ensure grazing animals are removed from the area. Enforceable temporary area, trail, and road closures will be used to ensure public safety during aerial spray operations. Constant communications will be maintained between the helicopter and the project leader during spraying operations. Ground observers will have communication with the project leader. Observers will be located at various locations adjacent to the treatment area to monitor wind direction and speed as well as to visually monitor drift and deposition of herbicide.		

PDF Reference	Design Features	Purpose of PDF	Source of PDF
G Herbicide Transportation and Handling Safety/Spill Prevention and Containment An *Herbicide Transportation and Handling Safety/Spill Response Plan* would be the responsibility of the herbicide applicator. At a minimum the plan would: Address spill prevention and containment. Estimate and limit the daily quantity of herbicides to be transported to treatment sites. Require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling. Require a spill cleanup kit be readily available for herbicide transportation, storage and application (minimum FOSS Spill Tote Universal or equivalent). Outline reporting procedures, including reporting spills to the appropriate regulatory agency. Ensure applicators are trained in safe handling and transportation procedures and spill cleanup. Require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition. Address transportation routes so that traffic, domestic water sources, and blind curves are avoided to the extent possible. Specify conditions under which guide vehicles would be required. Specify mixing and loading locations away from water bodies so that accidental spills do not contaminate surface waters. Require that spray tanks be mixed or washed further than 150 feet of surface water. Ensure safe disposal of herbicide containers. Identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft (See H14).		To reduce likelihood of spills and contain any spills.	FSH 2109.14,
H - Soils, Water and Aquatic Ecosystems			
H1	Herbicide use buffers have been established for perennial and wet intermittent steams; dry	To reduce likelihood that herbicides would enter surface waters in concentrations of concern.	* Treatments within RHCAs are allowed if they meet Riparian Management

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	streams; and lakes and wetlands. These buffers are depicted in tables 7, 8, and 9 below. Buffers vary by herbicide ingredient and application method. Tank mixtures would apply the largest buffer as indicated for any of the herbicides in the mixture.		Objectives (RMOs) including avoiding adverse effects to listed fish; therefore, buffers are based on label advisories, SERA risk assessments and Berg's 2004 study of broadcast drift and run off to streams. Buffers are intended to demonstrate compliance with R6 2005 ROD Standards 19 and 20.
H2	No broadcast of high aquatic risk herbicides on roads that have a high risk of delivery to water (generally roads in RHCAs). These herbicides are picloram or non-aquatic triclopyr (Garlon 4), non aquatic glyphosate, and sethoxidim.	To ensure high risk herbicides are not delivered to streams in concentrations that exceed levels of concern.	SERA Risk Assessments, R6 2005 FEIS Fisheries Biological Assessment
H3	In riparian and aquatic settings, vehicles (including all terrain vehicles) used to access invasive plant sites, apply foam, or for broadcast spraying would remain on roadways, trails, parking areas to prevent damage to riparian vegetation, soil, water quality and aquatic habitat.	To protect riparian and aquatic habitats.	Common protection measure
H4	Avoid use of clopyralid on high-porosity soils	To avoid leaching/ground water contamination.	Label advisory.

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	(coarser than loamy sand).		
H5	Avoid use of chlorsulfuron on soils with high clay content (finer than loam).	To avoid excessive herbicide runoff.	Label advisory.
H6	Avoid use of picloram on shallow or coarse soils (coarser than loam.) according to herbicide labels. No more than one application of picloram would be made within a two-year period.	To reduce the potential for picloram to enter surface and/or ground water and/or accumulate in the soil. Picloram has the highest potential to impact organisms in soil and water, and tends to be more persistent than the other herbicides.	SERA Risk Assessment. Based on quantitative estimate of risk from worst-case scenario and uncertainty
H7	Avoid use of sulfometuron methyl on shallow or coarse soils (coarser than loam.) No more than one application of sulfometuron methyl would be made within a one-year period.	To reduce the potential for sulfometuron methyl accumulation in the soil. Sulfometuron methyl has some potential to impact soil and water organisms and is second most persistent.	SERA Risk Assessments. Based on quantitative estimate of risk from worst-case scenario and uncertainty.
H8	Lakes and Ponds – No more than half the perimeter or 50 percent of the vegetative cover within established buffers or 10 contiguous acres around a lake or pond would be treated with herbicides in any 30-day period. This limits area treated within riparian areas to keep refugia habitat for reptiles and amphibians.	To reduce exposure to herbicides by providing some untreated areas for some organisms to use.	SERA Risk Assessments. Based on quantitative estimate of risk from worst-case scenario and uncertainty regarding effects to reptiles and amphibians.

PDF Reference	Design Features	Purpose of PDF	Source of PDF
H9	Wetlands – Wetlands would be treated when soils are driest. If herbicide treatment is necessary when soils are wet, use aquatic labeled herbicides. Favor hand/selective treatment methods where effective and practical. No more than 10 contiguous acres or fifty percent individual wetland areas would be treated in any 30-day period.	To reduce exposure to herbicides by providing some untreated areas for some organisms to use.	SERA Risk Assessments. Based on quantitative estimate of risk from worst-case scenario, uncertainty in effects to some organisms, and label advisories.
H10	Foaming would only be used on invasive plants that are further than 150 feet from streams and other water bodies.	To limit the amount of foam that may be delivered to streams and other water bodies.	No label regulations are associated with this naturally occurring organic compound. The distance of 150 feet was selected because it incorporates the Aquatic Influence Zone for fish bearing streams.
H11	Herbicide use would not occur within 100 feet of wells or 200 feet of spring developments. For stock tanks located outside of riparian areas, use wicking, wiping or spot treatments within 100 feet of the watering source.	Safe drinking water. Also to reduce the potential chance of herbicide delivery to watering systems used for grazing animals.	Label advisories and state drinking water regulations.
H12	When chemicals need to be carried over water by boat, raft or other watercraft, herbicides will be carried in water tight, floatable containers of 1	Lower risk of herbicide being delivered to streams in concentrations that exceed levels of concern.	

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	gallon or less.		
H13	Aerial applications would use typical application rates	Limit herbicide concentrations so that adverse effects are within the scope of analysis	Analyses based on SERA risk assessment worksheets
H14	Treatments above bankfull, within the aquatic influence zone (riparian area), would not exceed 10 acres along any 1.6 mile of a stream	Limits the extent of treatment within the aquatic influence zone so that adverse effects are within the scope of analysis	Analyses based on SERA risk assessment worksheets. Ten acres is based on GLEAM model factors.
I - Vascular and Non-Vascular Plant and Fungi Species of Local Interest (SOLI)			
I1	A USDA Forest Service botanist would use monitoring results/adaptive management to refine buffers in order to adequately protect SOLI (see section on Adaptive Management below)	To prevent any repeated effects to SOLI populations, thereby mitigating any long-term effects. To demonstrate compliance with ROD Standards 19 & 20	Broadcast buffer sizes are based on Marrs, 1989 based on tests on vascular plants. Spot and hand/select buffer distances are based on reports from experienced applicators. Uncertainty about effects on non-vascular plants would be addressed through monitoring (See Implementation Planning Section).

PDF Reference	Design Features	Purpose of PDF	Source of PDF
I2	Botanical surveys may be necessary to identify plant SOLI if suitable habitat is within 300 to1000 feet (see section I5) of planned aerial treatments, 100 feet of planned broadcast treatments, 10 feet of planned spot treatments and/or 5 feet of planned hand herbicide treatments.	To ensure SOLI are protected and survey are conducted when appropriate	Forest Service Manual 2670 and applicable federally listed recovery plans
I3	Botanical SOLI within 100 feet of planned ground based broadcast applications would be covered by protective barrier, or broadcast application would be avoided in these areas (spot or hand herbicide treatment, or non-herbicide methods may be used without covering SOLI plants)	To ensure SOLI are protected and survey are conducted when appropriate	Forest Service Manual 2670 and applicable federally listed recovery plans

PDF Reference	Design Features	Purpose of PDF	Source of PDF
I4	When SOLI are within 10 feet of saturated or wet soils at the time of herbicide application, only hand methods (wiping, stem injection, etc.) would be used. Avoid the use of picloram and imazapyr in this situation, and use aquatic triclopyr with caution as typical application rates can result in concentrations greater than estimated or measured “no observable effect concentration” to aquatic plants (R6 2005 FEIS, Table 4-47).	To ensure SOLI are protected and survey are conducted when appropriate	Forest Service Manual 2670 and applicable federally listed recovery plans
I5	Picloram will not be used within 50 feet of the threatened plant species *Silene spaldingii.*	To ensure protection of emerging seedlings and potential non-target plant root uptake due to herbicide soil persistence.	US FWS Conservation Strategy (2004).
I6	Aerial herbicide applications will follow Recovery Plan recommendations for listed species (FWS). Presently, one federally listed species (Silene spauldingii) is documented on the forest with recovery plan recommendations suggesting no aerial herbicide within 1000 feet of occurrence. No aerial herbicide applications would occur within 300’ of a non-federally listed SOLI, and spray cards to monitor drift can be used in conjunction with	To ensure SOLI are protected and survey are conducted when appropriate	Forest Service Manual 2670 and applicable federally listed recovery plans. Aerial drift buffers were derived from various scientific publications (See aerial application methods)

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	monitoring and adaptive management to adjust buffers if needed.		
I7	[2]Compliance monitoring would occur before implementation to ensure that prescriptions, contracts and agreements integrate appropriate Project Design Features. This will be done via a pre-work review.		
I8	Implementation monitoring would occur during implementation to ensure Project Design Features are implemented as planned. An implementation monitoring form will be used to document daily field conditions, activities, accomplishments and/or difficulties. Contract administration mechanisms would be used to correct deficiencies. Herbicide use will be reported as required by the Forest Service Health Pesticide Use Handbook.		
I9	Effectiveness monitoring would occur before, during and after treatment to determine whether invasive plants are being		

[2] Forest level monitoring would occur according to the Umatilla National Forest Plan, as amended by the R6 2005 ROD. Project specific monitoring would occur in all action alternatives as explained in I6, I7, and I8.

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	effectively controlled and to ensure non-target vegetation, especially native vascular and non-vascular species of local interest, is adequately protected.		

PDF Reference	Design Features	Purpose of PDF	Source of PDF
I10	The impacts of herbicide use on plant SOLI are uncertain, especially regarding lichen and bryophytes. The potential for variances in aerial drift due to uncontrolled weather conditions during treatment may also be uncertain. To manage this uncertainty, representative samples of herbicide treatment sites adjacent to vascular and non-vascular plant SOLIs would be monitored. Non-target vegetation within 1000 feet of aerial treatment sites, 500 feet of herbicide broadcast treatment sites and 20 feet of herbicide spot and hand treatment sites would be evaluated before treatment, immediately after treatment, and two to three months later as appropriate. Treatment buffers would be expanded if damage is found as indicated by: •Decrease in the size of the SOLI plant population •Leaf discoloration or chlorophyll change •Mortality Monitoring would continue until three post-treatment visits (at one or more sites near each botanical SOLI) confirm a lack of adverse effects.		

PDF Reference	Design Features	Purpose of PDF	Source of PDF
I11	In the vicinity of *S. spaldingi* and all other SOLI, restoration and cultural treatments, including seeding and/or use of fertilizer, will be under the direct supervision of the forest botanist to ensure that plant communities are restored to their desired condition without negative impacts to existing SOLI populations or individuals. The vicinity areas will be evaluated on a case-by-case basis.	To ensure soil chemistry/biology is not negatively impacted, which can potentially alter the subsequent establishment of resident seedbank species	Professional judgement
J - Wildlife Species of Local Interest			
J1	**Bald Eagle**		
J1-a	Treatment of areas within 0.25 mile, or 0.50 mile line-of-sight, of bald eagle nests would be timed to occur outside the nesting/fledging season of January 1 to August 31, unless treatment activity is within ambient levels of noise and human presence (as determined by a local specialist). Occupancy of nest sites (i.e. whether it is active or not) would be determined each year prior to treatments.	To minimize disturbance to nesting bald eagles and protect eggs and nestlings	Bald Eagle Management Guidelines for OR-WA (Anonymous); U.S. Fish and Wildlife Service 2003, p. 9
J1-b	Noise-producing activity above ambient levels would not occur between October 31 and March 31 during early morning or late	To minimize disturbance and reduce energy demands during stressful winter season	Bald Eagle Management Guidelines for OR-WA (Anonymous); t Programmatic BO (U.S. Fish and Wildlife

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	afternoon near known winter roosts and concentrated foraging areas. Disturbance to daytime winter foraging areas would be avoided.		Service 2003, p. 9)
J2	**Gray Wolf**		
J2-a	Treatments within 1 mile of active wolf dens would be timed to occur outside the season of occupancy (April 1 through June 30)	To minimize disturbance and reduce energy demands on denning wolves.	Federal Register, Vol, 68, No, 62 4(d)
J2-b	Treatments within 0.50 mile or 0.50 mile line-of-sight of occupied rendezvous sites would be timed to occur outside the season of occupancy unless treatment activity is within acceptable ambient noise levels and human presence would not cause wolves to abandon the site (as determine by a local specialist)	To minimize disturbance/impacts to wolves at rendezvous sights.	Buffer is based on expected range of disturbance
J2-c	Consultation with FWS would be reinitiated (unless determined otherwise by FWS) if/when wolf dens or rendezvous sites are discovered in the vicinity of treatment sites.		
J3	**Peregrine Falcon**		
J3-a	Seasonal restrictions (J3-c to g) will be applied based on the spatial and temporal factors listed in J3-b. Restrictions would apply to all known	To reduce disturbance to nesting falcons and protect eggs and nestlings. Agitated parents can damage the eggs with thin shells resulting in failed reproduction for that nest.	Pagel, J. (2006) Peregrine falcon nest site data, 1983-2006.

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	peregrine falcon nest sites for 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		

PDF Reference	Design Features	Purpose of PDF	Source of PDF
J3-b	Seasonal restrictions would be waived if the site is unoccupied or if nesting efforts fail and monitoring indicates no further nesting behavior. 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. The nest zones associated with those nest sites are described below: (1) Primary: average of 0.5-mile radius from the nest site. Site-specific primary nest zones would be determined and mapped by a local Biologist for each known nest site. (2) Secondary: average of 1.5-mile radius from the nest site. Site-specific secondary nest zones would be determined and mapped for each known nest site. (3) Tertiary: a three-mile radius from the nest site including all zones. The tertiary nest zones are not mapped; they apply to a circular area based on the three-mile radius.	To reduce disturbance to nesting falcons and protect eggs and nestlings. Agitated parents can damage the eggs with thin shells resulting in failed reproduction for that nest.	Pagel, J. (2006) Peregrine falcon nest site data, 1983-2006.

PDF Reference	Design Features	Purpose of PDF	Source of PDF
J3-c	Protection of nest sites would be provided until at least two weeks after all young have fledged.	To reduce disturbance to nesting falcons and protect eggs and nestlings. Agitated parents can damage the eggs with thin shells resulting in failed reproduction for that nest.	Pagel, J. (2006) Peregrine falcon nest site data, 1983-2006.
J3-d	Invasive plant activities within the secondary nest zone requiring the use of machinery would be seasonally restricted. This may include activities such as mulching, chainsaws, vehicles (with or without boom spray equipment) or other mechanically based invasive plant treatment.	To reduce disturbance to nesting falcons and protect eggs and nestlings. Agitated parents can damage the eggs with thin shells resulting in failed reproduction for that nest.	Pagel, J. (2006) Peregrine falcon nest site data, 1983-2006.
J3-e	Non-mechanized or low disturbance invasive plant activities (such as spot spray, hand pull, etc.) within the secondary nest zone 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. Non-mechanized invasive plant activities such as back pack spray, burning, hand-pulling, lopping, and/or re-vegetation planting may be allowed within the secondary nest zone during the seasonal restriction period.	To reduce disturbance to nesting falcons and protect eggs and nestlings. Agitated parents can damage the eggs with thin shells resulting in failed reproduction for that nest.	Pagel, J. (2006) Peregrine falcon nest site data, 1983-2006.

PDF Reference	Design Features	Purpose of PDF	Source of PDF
J3-f	All foot and vehicle entries into Primary nest zones would be seasonally prohibited except for the following reasons: (1) Biologists performing monitoring in association with the eyrie and coordinated with the District Biologist. (2) Law enforcement specialists performing associated duties with notice to the District Ranger. (3) Access for fire, search/rescue, and medical emergencies under appropriate authority (Forest Service line officer or designee). (4) Trail access, when determined by a biologist to be non-disturbing. (5) Other exceptions on a case-by-case basis as determined by the Deciding Official.	To reduce disturbance to nesting falcons and protect eggs and nestlings. Agitated parents can damage the eggs with thin shells resulting in failed reproduction for that nest.	Pagel, J. (2006) Peregrine falcon nest site data, 1983-2006.
J3-g	Picloram and clopyralid would not be used within 1.5 miles of peregrine nest more than once per year.	To reduce exposure to hexachlorobenze, which has been found in peregrine falcon eggs.	Pagel, J. (2006) Peregrine falcon nest site data, 1983-2006.
J4	**Columbia Spotted Frog and Leopard Frog**		
J4-a	Avoid broadcast spraying of herbicides, and avoid spot spraying of glyphosate with POEA surfactant, sulfometuron methyl, and NPE-based surfactants, in occupied or	To minimize exposure of frogs to herbicides or surfactants that pose risk to frogs.	Appendix P of the R6 2005 FEIS; SERA 2003, 2004; Bakke 2003

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	suitable (within 100 feet) spotted or leopard frog habitat. Coordinate treatment methods, timing, and location with local Biologist.		
J5	**Painted Turtle**		
J5-a	The local Forest Service Biologist will review treatment locations, timing, and methods to minimize adverse impacts to painted turtles PDF H10 defines herbicide treatment limitations to protect amphibian habitat.	To minimize disturbance, trampling, and herbicide exposure to painted turtles.	David Anderson, WA Dept. of Fish and Wildlife, personal communication, 2005.
K	**Public Notification**		
K1	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 marked on the ground or otherwise posted. Postings would indicate the date of treatments, the herbicide used, and when the areas are expected to be clear of herbicide residue. See also F for aerial, L for special products, and M for cultural plants.	To ensure that no inadvertent public contact with herbicide occurs.	These are common measures to reduce conflicts.
K2	The public would be notified about upcoming herbicide treatments via the	To ensure that no inadvertent public contact with herbicide occurs.	R6 2005 ROD Standard 23 (see table 1).

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	local newspaper or individual notification, fliers, and posting signs. Forest Service and other websites may also be used for public notification.		
L	**Special Forest Products**		
L1	Triclopyr would not be applied to foliage in areas of known special forest products or other wild food collection areas.	To eliminate any scenario where people might be exposed to harmful doses of triclopyr.	Appendix Q of the R6 2005 FEIS
L2	Special forest product gathering areas may be closed for a period of time to ensure that no inadvertent public contact with herbicide occurs.	To eliminate any scenario where people might be exposed to herbicide.	R6 2005 ROD Standard 23
L3	Popular berry and mushroom picking areas would be posted, marked on the ground or otherwise posted.	To eliminate any scenario where people might be exposed to herbicide	R6 2005 ROD Standard 23
L4	Special forest product gatherers would be notified about herbicide treatment areas when applying for their permits. Flyers indicating treatment areas may be included with the permits, in multi-lingual formats if necessary. See section K.	To ensure that no inadvertent public contact with herbicide occurs.	R6 2005 ROD Standard 23
M	**American Indian Tribal and Treaty Rights**		
M1	American Indian tribes would be notified annually (see section K) as treatments are scheduled so that tribal members may provide input and/or be notified prior to gathering cultural plants.	To ensure that no inadvertent public contact with herbicide occurs and that cultural plants are fully protected.	Government to government agreements between American Indian tribes and the Umatilla National Forest.

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	Individual cultural plants identified by tribes would be buffered as above for botanical species of local interest; see section I2, I3, and I4).		
M2	The Forest Archaeologist will annually assess areas where mechanical treatment that could cause damage to cultural resources is proposed. Weed wrenching and grubbing techniques will not be used in known archaeological sites. Instead, treatment methods that would have no potential to affect cultural resources will be used.	To avoid conflicts impacts to cultural resources.	Common practice.
N	**Range Resources**		
N1	Use available administrative mechanisms to incorporate invasive plant prevention practices into rangeland management. Examples of admin. mech. include, but are not limited to, revising permits and grazing allotment plans, providing annualoperating instructions, and adaptive management. Plan and implmt practices in coop. with grazing permit holder.	To ensure proactive adaptive measures are taken to eliminate future spread of invasive plants.	Regional FEIS Standard #6
N2	Permittees will be notified of annual treatment actions	To ensure permittee has knowledge of activities occurring within the allotment	Common Practice

PDF Reference	Design Features	Purpose of PDF	Source of PDF
	at the annual permittee operating plan meeting, and/or notified within 2 weeks of planned treatments of infestations > 1 acre in size. See section K.		
N3	Follow most current EPA herbicide label for grazing restrictions.	To ensure grazing animals are not exposed to chemicals	EPA labeling requirements

Herbicide Use Buffers

Herbicide treatments would become more restrictive as they occur close to water. PDFs and herbicide use buffers within the aquatic influence zone were developed based on label advisories; SERA risk assessments, and various studies of drift and runoff to streams such as Berg 2004. Table 7,

Table 8 and Table 9 specify buffers according to treatment methods, herbicides used, risk, and type of aquatic zone.

Table 7 - Herbicide Use Buffers in feet – Perennial and Wet Intermittent Streams - Proposed Action

Herbicide	Perennial and Wet Intermittent Stream			
	Aerial	Broadcast	Spot	Hand/Select
Aquatic Labeled Herbicides				
Aquatic Glyphosate	300	100	Water's edge	Water's edge
Aquatic Triclopyr-TEA	None Allowed	None Allowed	15	Water's edge
Aquatic Imazapyr*	300	100	Water's edge	Water's edge
Low Risk to Aquatic Organisms				
Imazapic	300	100	15	Bankfull
Clopyralid	300	100	15	Bankfull
Metsulfuron Methyl	None Allowed	100	15	Bankfull
Moderate Risk to Aquatic Organisms				
Imazapyr	300	100	50	Bankfull
Sulfometuron Methyl	None Allowed	100	50	5
Chlorsulfuron	None Allowed	100	50	Bankfull
High Risk to Aquatic Organisms				
Triclopyr-BEE	None Allowed	None Allowed	150	150
Picloram	300	100	50	50
Sethoxydim	300	100	50	50
Glyphosate	300	100	50	50

Table 8 - Herbicide Use Buffers in feet – Dry Intermittent Streams - Proposed Action (Alternative B)

Herbicide	Dry Intermittent Stream			
	Aerial	Broadcast	Spot	Hand/ Select
Aquatic Labeled Herbicides				
Aquatic Glyphosate	100	50	0	0
Aquatic Triclopyr-TEA	None Allowed	None Allowed	0	0
Aquatic Imazapyr*	100	50	0	0
Low Risk to Aquatic Organisms				
Imazapic	100	50	0	0
Clopyralid	100	50	0	0
Metsulfuron Methyl	None Allowed	50	0	0
Moderate Risk to Aquatic Organisms				
Imazapyr	100	50	15	Bankfull
Sulfometuron Methyl	None Allowed	50	15	Bankfull
Chlorsulfuron	None Allowed	50	15	Bankfull
High Risk to Aquatic Organisms				
Triclopyr-BEE	None Allowed	None Allowed	150	150
Picloram	100	100	50	50
Sethoxydim	100	100	50	50
Glyphosate	100	100	50	50

Table 9 - Herbicide Use Buffers in Feet–Wetlands-Proposed Action (Alternative B)

Herbicide	Wetlands			
	Aerial	Broadcast	Spot	Hand/ Select
Aquatic Labeled Herbicides				
Aquatic Glyphosate	300	100**	Water's edge	Water's edge
Aquatic Triclopyr-TEA	None Allowed	None Allowed	15	Water's edge
Aquatic Imazapyr*	300	100**	Water's edge	Water's edge
Low Aquatic Hazard Rating				
Imazapic	300	100	15	high water mark
Clopyralid	300	100	15	high water mark
Metsulfuron Methyl	300	100	15	high water mark
Moderate Aquatic Hazard Rating				
Imazapyr	300	100	50	high water mark
Sulfometuron Methyl	None Allowed	100	50	5
Chlorsulfuron	None Allowed	100	50	high water mark
Greater Aquatic Hazard Rating				
Triclopyr-BEE	None Allowed	None Allowed	150	150
Picloram	300	100	50	50
Sethoxydim	300	100	50	50
Glyphosate	300	100	50	50

*Aquatic Imazapyr (Habitat) may not be used until the risk assessment (currently underway) is completed for inert ingredients and additives.

** If wetland, pond or lake is dry, there is no buffer.

Figure 9 illustrates how the Aquatic Influence Zone restricts application methods and herbicides to only those approved for use in aquatic areas. "Aquatic Influence Zone" is not equal to the "buffer widths" listed in the tables above. For purposes of analysis in this EIS, the Aquatic Influence Zone is defined by the innermost half of the RHCA. For instance, a 300 foot RHCA would have an Aquatic Influence Zone of 150 feet. Establishing buffer widths reduces the potential for herbicides to come in contact with water via drift, leaching, and runoff at or near concentrations of concern

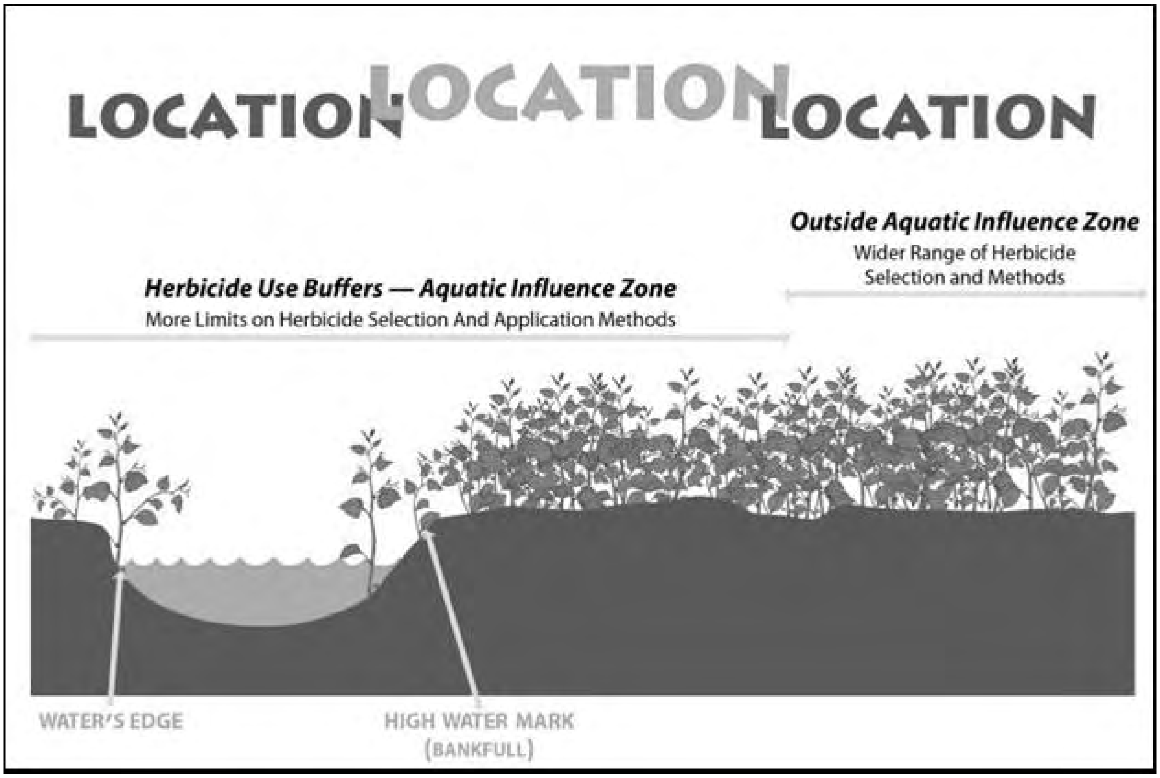


Figure 9 - Illustration of how herbicide selection and application methods in the established buffer widths are more limited in Aquatic Influence Zones

Restoration

Passive site restoration is a component common to all action alternatives. This method of restoration may include mulching, seeding, planting native species, or may simply allow desirable vegetation to naturally replace target invasive species that have been removed. When needed to facilitate recovery, native seed would be used to recover the site to increase competition and provide erosion protection.

Restoration would not include soil surface disturbing activities such as tilling, plowing or mechanical seed drilling. Projects utilizing such restoration methods would require individual site environmental analysis. Other restorative activities such as road or trail closures allow treated sites to recover without concern of the outside introduction of invasive species seed by vehicle, human or stock travel through the site. Such closures will not be considered under this project. They are managed under the Travel Management and Recreation Management programs, and have separate environmental analyses.

2.2.4 Alternative C - No Broadcast Spraying in Riparian Areas

There is concern that detrimental effects could occur from broadcast spraying herbicide chemical in riparian areas. This alternative would not allow broadcast applications of herbicides in riparian areas. However, spot spraying, or hand applications like wiping or wicking of herbicides would be allowed.

The ID Team reviewed comments and concerns received from the public during the scoping process. From those concerns, issues about the proposed project were identified. Among those, the following issues would be addressed by this alternative:

Human Health:

- There is concern by members of the public that exposure to herbicides may have serious human health consequences (reduced potential for effects to water supplies compared to Alternative B)

Treatment Effectiveness:

There is a concern that the spread of invasive species will increase if all available treatment methods are not utilized (broadcast spraying in riparian areas eliminated)

Non-target Species:

- There is a concern that herbicide exposure, particularly when applied using aerial or broadcast spraying, may harm terrestrial wildlife species (more targeted application and reduced potential of drift compared to Alternative B)
- There is a concern that herbicide exposure, particularly when applied using aerial or broadcast spraying, may harm non-target plants (more targeted application to riparian species than under Alternative B)

Soil, Water Quality, Aquatic Biota:

- There is a concern that there may be potential adverse effects of herbicide treatment on soils (reduced application of herbicides and less drift potential compared to Alternative B)
- There is a concern that there may be potential adverse effects of herbicide treatment on riparian areas adversely impacting water quality and aquatic ecosystems (reduced application of herbicides and less drift potential compared to Alternative B)

Treatment applications would be the same as for Alternative B except for the use of herbicides in riparian areas. Herbicide treatment applications would only include spot spraying, wicking, foliar applications, injections, etc. These application methods target specific invasive plants, apply the herbicide to the plant or small group of plants and have little possibility of contact with other plants, animals or non-organic matter. With this level of control specificity, potential contact with water or aquatic organisms from chemical drift is virtually eliminated.

Table 10 – Acres of Treatment Methods for Alternaive C

Treatment Methods	Alternative C – No Broadcast Application of Herbicide
Upland Areas	**Acres**
Manual, mechanical and/or ground based chemical	14,456
Treatment in Riparian Habitat Conservation Areas 1	
Manual, mechanical ground-based broadcast and/or ground based chemical spot treatment	0
Manual, mechanical, and/or chemical ground based spot treatment only (including wicking and wiping), no broadcast allowed	5,560
All areas	
Bio-Control only	3,917
Manual only	41
Aerial only	675
Total Acres Treated	**24,649**

Invasive plants have been inventoried on 5,560 acres within riparian/wetlands lands. Potentially, under Alternative B, all riparian areas could be treated by broadcast spraying, unless restricted by project design features. Broadcast spraying was proposed either because large, concentrations of invasives would make weed control difficult using other methods, or because it was the most cost effective method. Under Alternative C some acres, otherwise proposed for broadcast spraying may:

- Contain spread of the weeds with herbicides or manual/mechanical methods, but with no attempt to control the infestation site
- Control the infested area with spot treatment, other hand application of herbicides or manual/mechanical methods

For each treatment site, the decision to treat or not, and if so, how to treat would be determined on a site by site basis.

With the exception of the limitations imposed on broadcast spraying in riparian areas, the features of this alternative are the same as Alternative B.

2.2.5 Alternative D - No Aerial Application

There is concern that aerial application of herbicides could cause detrimental effects to areas targeted and to adjacent areas where chemical drift could impact non-target environments. Alternative D would eliminate this concern by eliminating the option to aerially apply herbicides.

The ID Team reviewed comments and concerns received from the public during the scoping process. From those concerns, issues about the proposed project were identified. Among those, the following issues would be addressed by this alternative:

Human Health:

- There is concern by members of the public that exposure to herbicides may have serious human health consequences (reduced potential for effects to water supplies compared to Alternative B)

Treatment Effectiveness:

- There is a concern that the spread of invasive species will increase if all available treatment methods are not utilized (aerial application method eliminated)

Non-Target Species:

- There is a concern that herbicide exposure, particularly when applied through aerial or broadcast spraying, may harm terrestrial wildlife species (aerial application eliminated)
- There is a concern that herbicide exposure, particularly when applied through aerial or broadcast spraying, may harm non-target plants (aerial application eliminated)

Soil, Water Quality, Aquatic Biota:

- There is a concern that there may be potential adverse effects of herbicide treatment on soils (less drift potential than under the Alternative B)
- There is a concern that there may be potential adverse effects of herbicide treatment on riparian areas adversely impacting water quality and aquatic ecosystems (less drift potential than under the Alternative B)

Alternative B proposes to treat approximately 675 acres using aerial application of herbicides. Aerial application is the most cost effective way to apply herbicides on large areas of continuous infestations, or on remote or inaccessible infestations. By eliminating the aerial application option, either:

- Some containment could occur using ground-based chemical, manual or mechanical methods or
- Control would be pursued with ground-based broadcast spraying methods

For each treatment site, the decision to treat or not, and if so, how to treat, would be determined on a site by site basis.

With the exception of the limitations imposed on broadcast spraying in riparian areas, the features of this alternative are the same as Alternative B.

Table 11 – Acres of Treatment Methods for Alternative D

Treatment Methods	Alternative D – No Aerial Application of Herbicide
Upland Areas	**Acres**
Manual, mechanical and/or ground based chemical	15,131
Treatment in Riparian Habitat Conservation Areas 1	
Manual, mechanical ground-based broadcast and/or ground based chemical spot treatment	3,022
Manual, mechanical, and/or chemical ground based spot treatment only (including wicking and wiping), no broadcast allowed	2,538
All areas	
Bio-Control only	3,917
Manual only	41
Aerial only	0
Total Acres Treated	24,649

2.3 Alternatives Not Considered in Detail

2.3.1 High Potential for Spread Areas of Priority 1 and 2 Species

There is a concern the herbicide treatments proposed are unnecessarily extensive. By potentially treating so many acres for so many years, the concern is that cumulatively there would be detrimental environmental effects. Some of those concerned reason that many invasive plant sites don't pose as serious threat to the human environment as the herbicides proposed to control them. To respond to this issue and reduce the amount of acres proposed for treatment an alternative was developed to limit herbicide use to high priority areas only. That is, areas with high potential for weeds to spread, and/or areas with priority 1 or 2 invasive weed species.

When it was determined that only approximately 300 acres would be dropped from herbicide treatment this alternative was dropped from detailed consideration because that few acres is insignificant compared to the approximately 20,691 acres proposed for herbicide treatment in the Proposed Action.

2.3.2 Invasive Plants Managed through Natural Processes

Some commenters believe that if National Forest use is restricted enough, natural processes will displace invasive plant infestations with native plant populations. Specifically, suggestion was made to remove livestock and ORVs from the National Forest. It was reasoned that removing resource uses or activities would allow native plant communities to recover where invasive weeds now dominate.

National Forests exist to provide a variety of goods and services to the American people. National Forests are managed through many programs to provide these benefits to national forest visitors and users. These uses are acknowledged by the Forest Plan and are permitted uses. The proposed invasive plant treatment program (Alternative B) would focus on directly reducing weed populations, not on limiting existing national forest programs or establishing prevention measures for other activities (see Purpose and Need in Chapter 1). While preventative measures would be incorporated in this project at specific locations needed for treatment or removal of invasive plants, weed prevention measures for other activities will be administered through other programs such as livestock grazing and transportation management when those activities occur to meet Forest plan Standards and Guidelines for invasive plants.

A project based on weed prevention alone would not satisfy the Purpose and Need of this project to contain, control or eradicate existing and future invasive plants populations. Invasive plants have been expanding for decades. The present weed treatment program has had some success, yet invasive plant populations continue to expand. It is doubtful that a passive, prevention program alone, would reverse this trend because the species are wide spread and occur in many high use areas. Furthermore, it is beyond the scope of this analysis to review actions approved by the Forest Plan and not limit other national forest programs benefiting forest visitors and users. For these reasons, this alternative was not considered in detail.

2.3.3 No Herbicides

Some commenters expressed the belief that herbicide use is unacceptably toxic to the human environment and to native ecosystems. They acknowledge that herbicides kill target weeds, but are concerned that containing, controlling or eradicating weeds using herbicides comes at an unacceptable cost to humans and the natural environment. Therefore, they propose an invasive plant treatment project that uses methods other than herbicides to address weed populations.

The 1995 Environmental Assessment for the Management of Noxious Weeds (USDA 1995) and the Regional Invasive Plant EIS (USDA 2005) considered alternatives to manage weeds without using herbicides. The 1995 EA considered such an alternative in detail. That alternative was rejected because the likelihood of controlling weeds without herbicides was low (USDA 1995, page 44). The selected alternative allows herbicide use, but only after other methodologies has proven ineffective. The current invasive treatment program has been based on this alternative. It also represents the no action, or ‘no change from the current program’ alternative (Alternative A) in this EIS. Because invasive plant populations continue to grow, this alternative has not contained, controlled or eradicated weeds as we now hope to do under the current Purpose and Need statement. Therefore another alternative proposal to treat weeds without herbicide applications will not be considered in detail because its ineffectiveness has been predicted by past analysis.

2.3.4 1995 Guidelines Applied Forest-wide

The current program established by an environmental assessment (EA) completed in 1995(as amended), allows herbicide treatment on 1,774 acres only if non-chemical treatment proved ineffective. Some believe that the safeguards of this program, limiting how and when herbicides can be used should be continued without restricting where herbicides can be used. In other words, the current program should be continued without limiting herbicide use to pre-designated sites. Instead, other features of that integrated weed management (IWM) program would limit herbicide treatment.

This alternative would not take advantage of the advances made both in herbicide effectiveness and safety, because it would only allow two of the nine chemicals approved by the Regional FEIS (USDA 2005). In fact, dicamba, approved for use in the 1995 EA has been removed from the list of US Forest Service Region 6 approved chemicals because of toxic concerns. Other limitations of this program would require that non-herbicide treatments be used on new sites first. Herbicide application would only occur if non-herbicide treatments proved ineffective.

The present inventory of invasive plants suggests that the weed problem is growing, not shrinking. The present program has successfully addressed some weed sites; however, overall, the program has not been as effective because it has severely restricted the circumstances of herbicide use. Because only two herbicides would be used and because the present program would not meet this project’s Purpose and Need, this alternative was not considered in detail.

2.3.5 Restricted Use – No Herbicides in Riparian or Special Areas

Some members of the public expressed concern that use of herbicides in riparian areas would have adverse effects to aquatic species and amphibians. Further, they believe it is inappropriate to use herbicide in special areas such as wildernesses, wild and scenic river corridors and municipal watershed. Therefore an alternative was considered that would not allow herbicide applications in any of these special areas or riparian areas.

Without herbicide treatments, riparian areas and special areas become an unacceptable 'safe harbor' for invasive plants. Riparian areas are a long narrow network of lands across the forest. Special areas such as wilderness and wild and scenic corridors have large land bases. Eliminating the herbicide treatment option would allow invasives to persist throughout the forest. This is contrary to the project Purpose and Need of containing, controlling or eradicating invasive plants across the Forest. Therefore this alternative was not considered in detail.

2.3.6 Deviations from Existing Approved Herbicide List

There is a concern that limiting herbicide use to the approved list in the Regional ROD (USDA 2005a) prevents use of effective herbicides coming on the market and future herbicides that may be developed during the life of this project. Therefore an alternative was considered that would add, new, EPA approved herbicides that were not available or not analyzed at the time of the Regional assessment.

While future improvements in herbicide products may be attractive, it is costly and time consuming to do a chemical assessment for each new product. This diverts funds and staff from the primary Purpose and Need of containing, controlling or eradicating invasive infestations. The current list of approved herbicides is considered safe and effective for most priority invasive plants in most circumstances. For these reasons this alternative was not considered in detail.

2.4 Alternatives Compared

During scoping members of the public identified several issues of concern regarding this proposed project. (A detailed discussion of public involvement and issues can be found in Chapter 1.7, 1.8, and 1.9 of this EIS). Significant issues were grouped into these four categories;

- Human health
- Treatment effectiveness
- Non-target species
- Soils, water quality and aquatic biota

The significant issues were the basis for developing alternatives to the Proposed Action (Alternative B). Table 12 summarizes some of the major activities of each alternative. Herbicide treatment acres in Table 10 are based on gross acreage infestations and represent worst case scenarios. Actual herbicide treatment acres would be evaluated at treatment time and would likely be much less than reported here. Table 13 compares the No-action (Alternative A) and Alternatives B, C, and D on each of the significant issues.

It is important to understand the significant issue statements as they appear in the table. They are representative statements of concern members of the public expressed during scoping. For instance, the statement, "the exposure to herbicides may have serious human health consequences" (first significant issue listed in Table 13 below) reflects a concern or belief stated by a member of the public. It does not necessarily agree with conclusions the interdisciplinary team has drawn after analyzing the effects of the proposed alternatives.

Table 12 – Comparitive Summary of Alternatives

Activity	Alt A	Alt B	Alt C	Alt D
Acres identified for treatment	**3154**	**24,649**	**24,649**	**24,649**
Acres identified for aerial spraying of herbicides	0	675	675	0
Estimated % of treatment sites proposed for treatment	40	100	100	100
Acres of proposed herbicide treatments	1774	20,691	20691	20691
Number of herbicides available for use	2	10	10	10
Estimated % of herbicide treatment using broadcast methods on known infestations in RHCA's (with adherence to all project PDFs)proposed for treatment	9%	100%	54%	100%
Estimated % of herbicide treatment using broadcast methods on known infestations proposed for treatment	2%	10%	23%	10%
Biocontrol releases	Yes	Yes	Yes	Yes
EDRR including chemical methods	No	Yes	Yes	Yes
% of Total Forest Landbase Treated with Herbicides	Apprx: 0.12%,	Apprx: 1.5%,	Apprx: 1.5%,	Apprx: 1.5%,
% of Total Forest landbase treated annually1	<0.008%	0.3%	0.3%	0.3%
Treatment effectiveness	Low	Highest	High	High
Total cost initial treatment, all acres	$641,695	$3,887,460	$3,963,010	$3,942, 840
Cost per effectively treated acre	$814	$197	$201	$200
Jobs potentially supported to contain or control acres proposed for treatment (total that would occur over life of project)	105	326	335	332
Income potentially supported, to contain or control acres proposed for treatment, $1,000s (total that would occur over life of project)	$2,673	$8,338	$8,550	$8,493
Projected time to achieve P & N	P & N would not be met	19 years	19 years	19 years
Estimated annual cost of target treatment program	$133,700	$539,030	$549,790	$546,95 0
Estimated undiscounted costs to achieve P & N at target annual treatment level ($1,000)	unlimited	$6,824	$6,960	$6,924

Table 13 – Alternative Comparison Relative to Significant Issues

Significant Issue	Unit of Measurement	(No Action) Alternative A	(Proposed Action) Alternative B	Alternative C	Alternative D
***1 – Human Health**					
	Worker and public exposure to herbicides	No significant impact (1995 FONSI).	Forest Plan standards and project design features eliminate plausible harmful exposure scenarios	Same as Alternative B	Same as Alternative B
	Contamination of drinking water	No significant impact (1995 FONSI).	Forest Plan standards and project design features eliminate plausible harmful exposure scenarios	Same as Alternative B	Same as Alternative B
2 – Treatment Effectiveness					
2a-the spread of invasive species will increase if all available treatment methods are not utilized	Estimated rate of invasive species spread	High because: Current treatments are estimated at 25%effective. Invasive species are predicted to spread 8-12% annually. Only two herbicides can be used as last resort. Only 13 % of presently identified acres can be treated	Lower than Alternative A because: Proposed trtmnts are estimated at 80% effective. Invasive species are predicted to spread 8-12% annually. EDRR and increased treatment effectiveness will reduce spread potential. Ten herbicides available for use. 100% of presently identified acres can be treated	Same as Alternative B	Same as Alternative B
	Acres treated by method	41 acres manually; 1339 acres biocontrol; 1,774 acres treated chemically only after other methods shown to be ineffective	41 acres of manual; 3917 acres of biocontrol; 20,691 acres of any method, but most would be herbicide treatment	Same as Alt B except no broadcast herbicide treatment in riparian areas, though spot or hand herbicide treatment allowed in riparian areas	Same as Alt B except no aerial application of herbicides but areas may still be treated with herbicides or up to 675 acres less than Alt B

Significant Issue	Unit of Measurement	(No Action) Alternative A	(Proposed Action) Alternative B	Alternative C	Alternative D
2b-herbicides should be used only as a last resort when other methods fail	Estimated rate of invasive species spread	Estimated 25% effective on treated acres & infestation continues to grow because emphasis on non-herbicide treatments; residual infestation spread rate 8-12%	Estimated 80% effective on treated acres & infestation; post-treatment rate of spread estimated at 4-6%. residual infestation spread rate 8-12% in untreated acres	Same as Alternative B	Same as Alternative B
	Acres of non-herbicide treatment	41 acres manual/mechanical; 1339 acres Biocontrol; Emphasis on 1774 acres for non-herbicide treatement	41 acres of manual/mechanical; 3917 acres of biocontrol; Emphasis on 20,693 for herbicide treatment	Same as Alt B however invasive plants more persistent in riparian areas	Same as Alt B however rate of decrease may be less because some areas proposed for aerial treatment may not be treated
2c-not using herbicides will result in the continued spread of invasive plants	Estimated rate of spread	Acreage increase continue as in the past	Acres of invasive species reduced by less than half during project life	Same as Alternative B	Same as Alternative B
	Acres of invasive species	Exponential acreage increase continue as in the past	Acres of invasive species reduced by half or less during project life	Same as Alternative B	Same as Alternative B
3 – Non-Target Species					
*3a-herbicide exposure, particularly when applied through aerial or broadcast spraying, may harm terrestrial wildlife and non-target plants	Acres of potential herbicide application using broadcast methods (ground and aerial spraying)	Ground based method: 1,252 acres no aerial	Ground based method 17,478 acres aerial 675 acres	Ground based method 14, 456 acres aerial 675 acres	Ground based method 18,153 acres no aerial 675 acres proposed for aerial would be treated with ground based methods
4 – Soil, Water Quality, Aquatic Biota					
4a-there may be potential adverse effects of herbicide treatment on soils	Acres of herbicide treatment by broadcast and	1,774	20,691	Same as Alternative B	Same as Alternative B

Significant Issue	Unit of Measurement	(No Action) Alternative A	(Proposed Action) Alternative B	Alternative C	Alternative D
	spot methods				
4b-there may be potential adverse effects of herbicide treatment on riparian areas adversely impacting water quality and aquatic ecosystems	Acres of herbicide treatment in riparian by broadcast & spot methods	broadcast = 0 acres spot only = 522	broadcast = 3022 spot only = 2,538	broadcast = 0 spot only = 5560	Same as Alternative B
	Character of herbicide use inside riparian areas	1995 FONSI	Buffers protect riparian from herbicides (see Tables 7,8 & 9); Herbicides used in riparian restricted (see PDFs H2, H3, Treatment method and extent restricted (see PDFs H 9, H10, H15)	Same as Alt B and no broadcast application method in riparian areas	Same as Alternative B

* Indicates issue will tier to the Regional EIS

2.5 Monitoring

Invasive plant treatment and restoration activities 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 possible that a site will be treated multiple times over the years. Tracking these efforts and subsequent progress will be crucial to determining success. The Umatilla National Forest Plan has a monitoring plan, and monitoring results are reported by the Forest annually. In addition, the R-6 2005 ROD established an invasive plant treatment framework for project and program monitoring (see Appendix 1-7 to 11 of the R-6 2005 ROD). The Forest staff will follow Forest Plan and R-6 monitoring requirements, and contribute data to the framework.

The monitoring framework begins with the Umatilla National Forest invasive plant inventory that followed the NRIS/Terra protocol. It suggests beginning a monitoring regime once treatment of a site has started, which includes 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. With the current inventory in place, two types of monitoring would be included in the framework for all action alternatives. They are:

Implementation/Compliance Monitoring – This type of monitoring basically answers the question, “Did we do what we said we would do?” For example, did we use only the chemicals analyzed and approved in the places and under the constraints we set forth? Did we adhere to the buffers established? Answers to these and other questions would ultimately answer the initial question.

Effectiveness Monitoring – This type of monitoring would answer the following questions:

- Have the number of new invasive plant infestations increased or decreased on the Forest?
- What changes in distribution, amount, and proportion of invasive plant infestations have resulted due to treatment activities on the Forest?
- Has the infestation size for a targeted invasive plant species been reduced regionally or at the project level?
- Which treatment methods, separated or in combination, are most successful for specific invasive species?
- Which treatment methods have not been successful for the specific invasive species?
- Do follow-up treatments demonstrate a reduction of herbicide use or the selected method on treated sites?

Effectiveness monitoring would be required; 1) where aerial herbicide applications occur and 2) where broadcast application of herbicide occurs in riparian areas, ditches or water corridors connected to habitat for listed fish; or proximity to federally listed plants.

Monitoring of a representative, statistically reliable, sample of invasive plant treatments would be required. This process will help lead the Region toward efficient and reliable data collection and allow statistical analysis of the data gathered (Regional Standards and Forest Plan).

Project Design Features serve to minimize or eliminate the risk of significant effects so that even though precise treatment locations may not be known, the effects of treatment are known. Uncertainty is addressed through effectiveness monitoring and adaptive management. That is, monitoring data would help managers evaluate when, where, how, etc. follow-up treatment would be appropriate.

For example, monitoring required in the PDFs would track direct effects and adjust buffers and treatment options to protect against any future effects. Such adjustments or treatment changes could be made as long as they were consistent with the findings of this EIS analysis. For instance, monitoring may have shown that spot spraying of a small roadside weed infestation proved ineffective. The treatment was changed to broadcast spraying to better control the weeds that were missed by spot spraying.

PDFs in Table 6 with a monitoring dimension include:

- PDF – F8 = Inventory and Monitor – Effectiveness Monitoring required for “a representative sample” in project involving aerial application of herbicide
- PDF – F8 = All aviation activities shall be in accordance with FSH 2109.14, 50 (Quality Control Monitoring and Post-Treatment Evaluation)
- PDF – I1 = A USDA Forest Service botanist would use monitoring results/adaptive management to refine buffers in order to adequately protect SOLI
- PDF – I8 = Implementation monitoring would occur during implementation to ensure Project Design Features are applied as planned. An implementation monitoring form will be used to document daily field conditions, activities, accomplishments and/or difficulties. Contract administration mechanisms would be used to correct deficiencies. Herbicide use will be reported as required by the Forest Service Health Pesticide Use Handbook
- PDF – I9 = Effectiveness monitoring would occur before, during and after treatment to determine whether invasive plants are being effectively controlled and to ensure non-target vegetation, especially native vascular and non-vascular species of local interest, is adequately protected
- PDF – I10 = Impacts of herbicide use on plant SOLI are uncertain, especially regarding lichen and bryophytes. Monitoring would continue until three post-treatment visits (at one or more sites near each botanical SOLI) confirm a lack of adverse effects

The implementation planning and monitoring would ensure that effective treatments are completed according to PDFs, and undesired effects are minimized. Further analysis would be required if the effective treatment for a new infestation was determined to be outside of existing PDFs (for instance, if the herbicides available for use near streams were not effective for a new infestation).

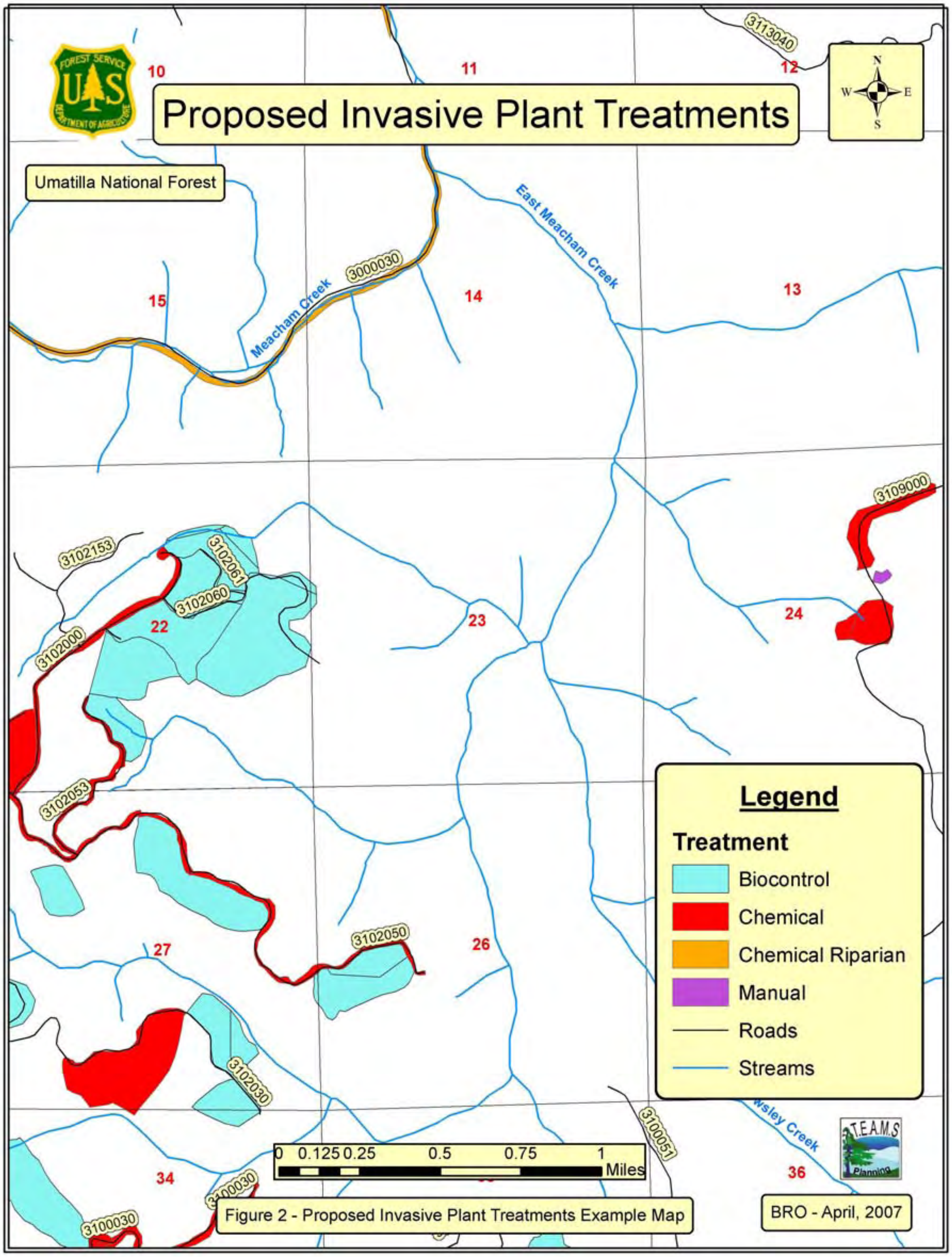


Figure 1 – Proposed Invasive Plant Treatments Example Map

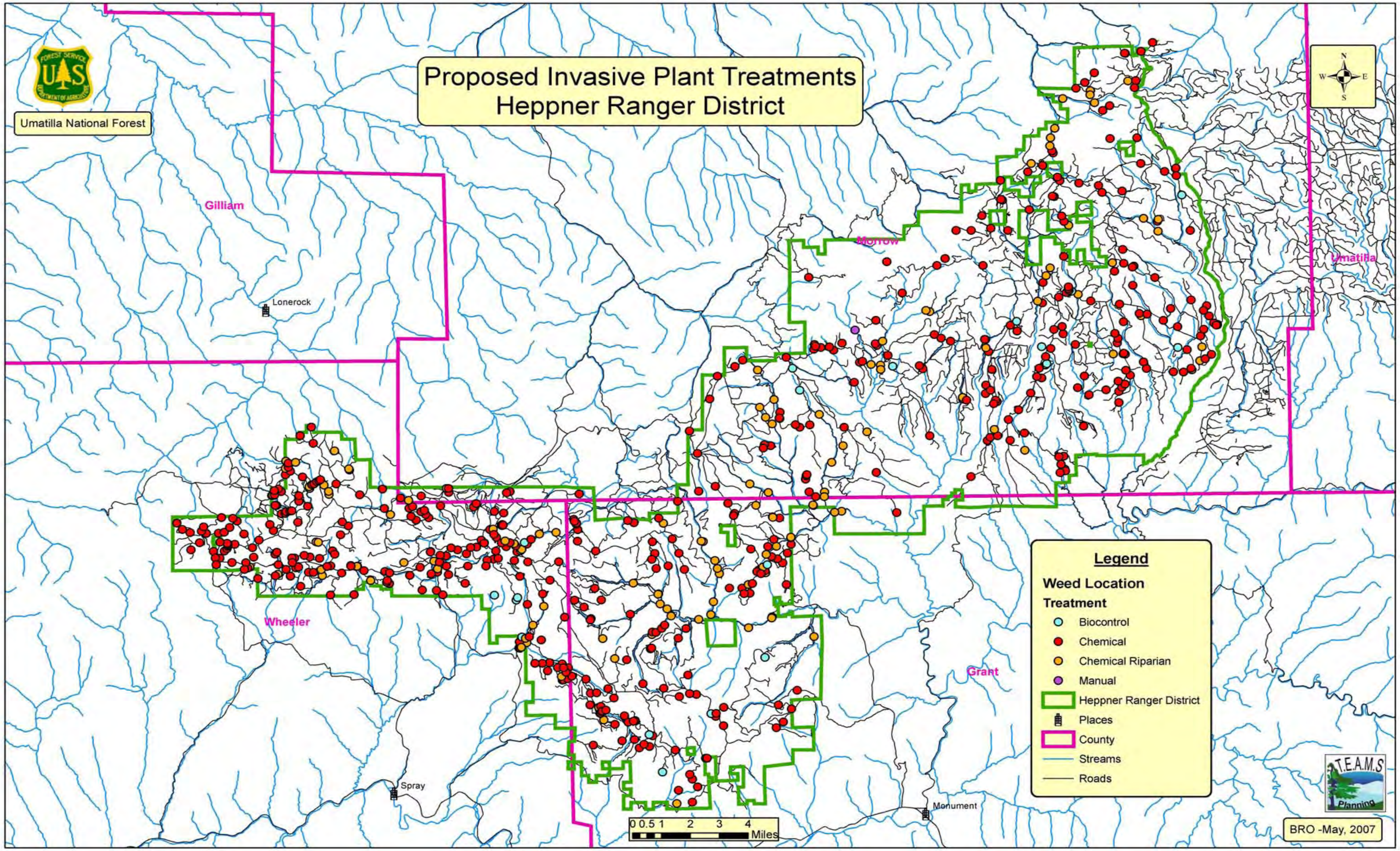


Figure 3 – Heppner Ranger District Proposed Invasive Plant Treatments

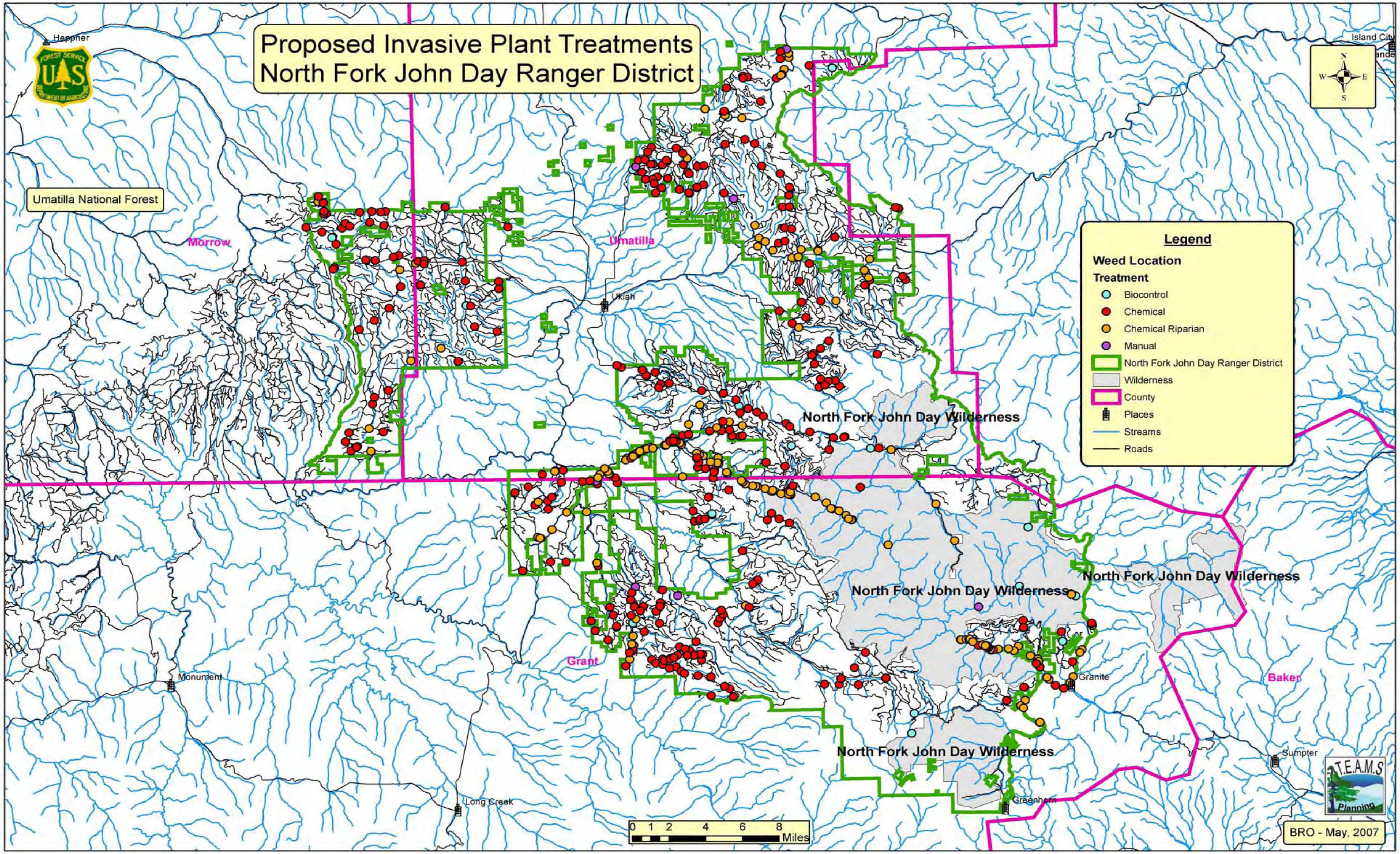


Figure 4 – North Fork John Day Ranger District Proposed Invasive Plant Treatments

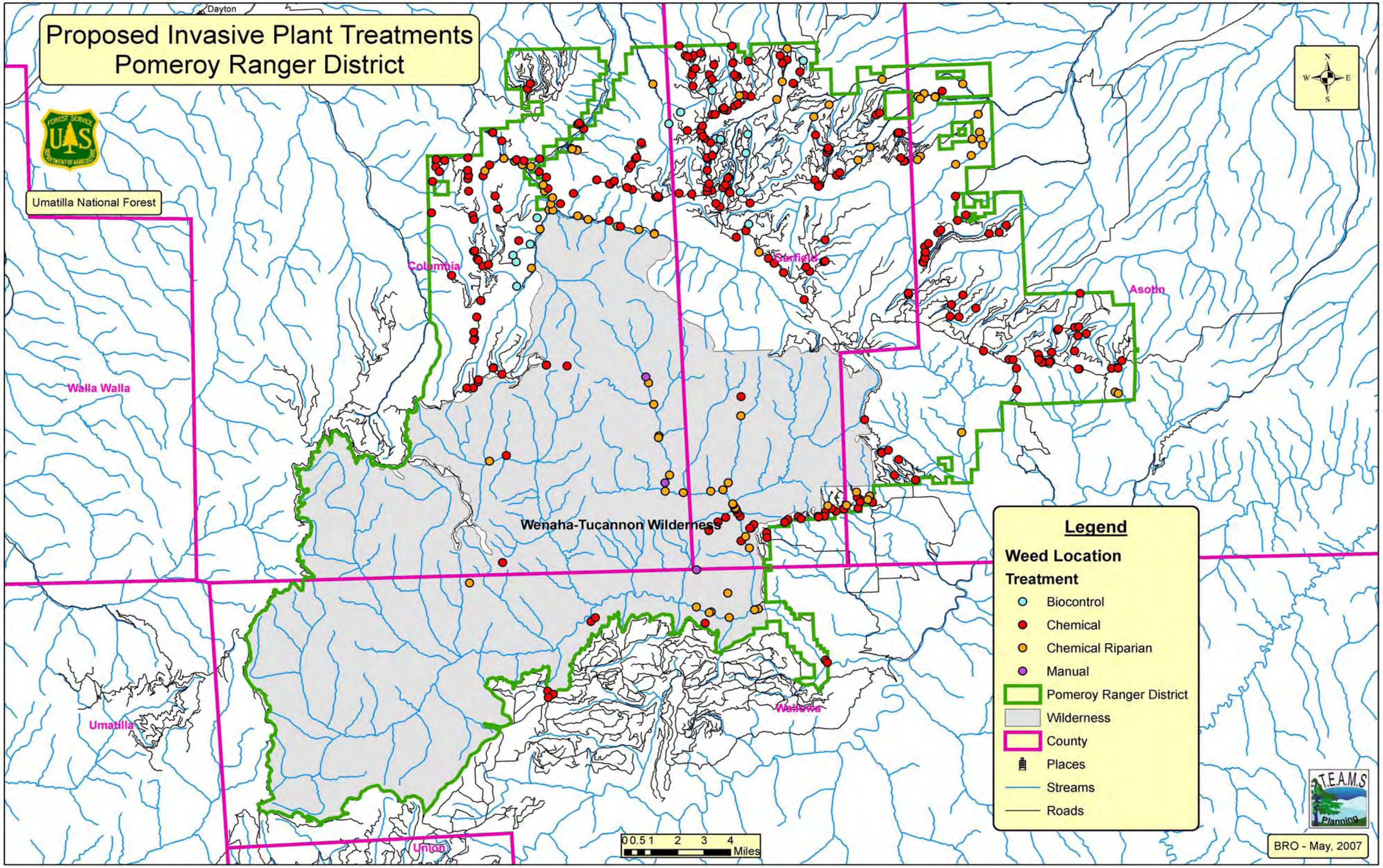


Figure 5 – Pomeroy Ranger District Proposed Invasive Plant Treatments

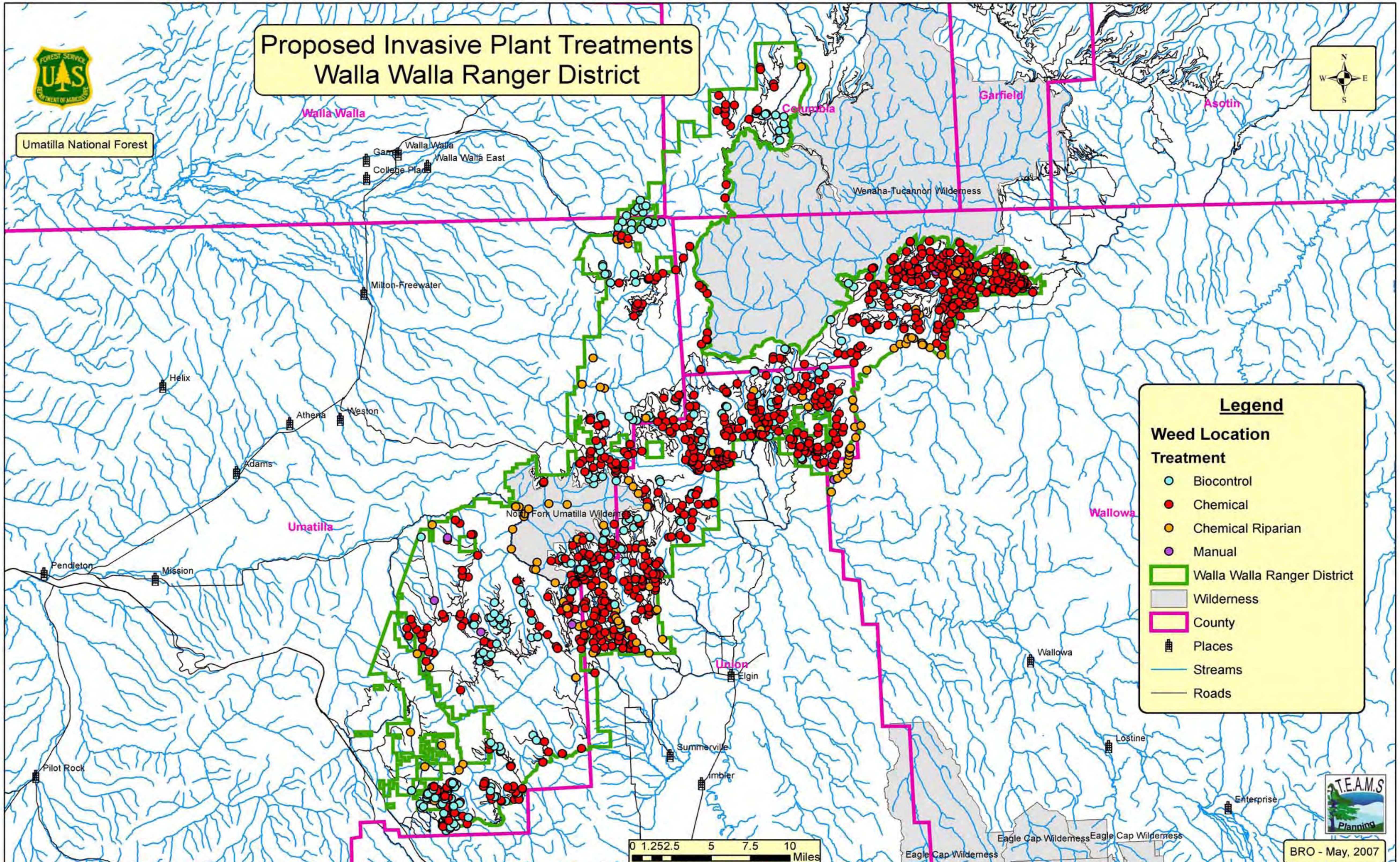


Figure 6 – Walla Walla Ranger District Proposed Invasive Plant Treatments

Chapter 3 Affected Environment and Environmental Consequences

3.1. Introduction

This chapter describes both the existing conditions of the Project Area, and the environmental effects of implementing the alternatives described in Chapter 2. Effects are defined as: •

- Adverse and/or beneficial direct effects occur at the same time and in the same general location as the activity causing the effects.
- Adverse and beneficial indirect effects are those that occur at a different time or location from the activity causing the effects. Both types of effects are described in terms of increase or decreases, intensity, duration, and timing.
- Cumulative Effects result from the incremental impacts of the Proposed Actions/alternatives when added to other past, present, and reasonably foreseeable actions, both on the Forest and Wild and Scenic River corridor as well as other adjacent federal, state, or private lands.

Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative (40 CFR 1508.7 and 1508.8).

3.1.1 Project Area

The Umatilla National Forest is located in the northern portion of the Blue Mountains in northeastern Oregon and southeastern Washington. There are over 1.5 million acres within the Forest boundary, of which 1.4 million are National Forest system lands. Interstate Highway 84 passes through the Forest dividing it into two halves. The north half extends into Washington and is bordered partially by the Umatilla Indian Reservation on the west and by the Wallowa-Whitman National Forest on the southeast flank. The southern half is bordered on the east by the Wallowa-Whitman National Forest and by the Malheur National Forest on the south (USDA 1990).

The Umatilla National Forest is the home of a collection of diverse landforms and ecotypes. The Forest lies within the headwaters of four large drainage basins: Umatilla, John Day, Walla Walla, and Grande Ronde river basins. The north and south forks of the Umatilla, north and south forks of the Walla Walla, Touchet, Grande Ronde, Wenaha, Tucannon, and North Fork John Day are the local rivers. The waters of the latter are recognized for their high quality anadromous fisheries. There are also a few small lakes and reservoirs greater than five acres in size. The Forest provides timber and other wood products, water, recreation, and supports one of the largest Rocky Mountain elk herds. Elk hunting is a particularly popular activity in the area. There are also three wildernesses covering 304,400 acres, and twenty-two roadless areas total 281,000 acres (USDA 1990).

The Forest most directly influences ten counties: Asotin, Columbia, Garfield, and Walla Walla in Washington; and Grant, Morrow, Umatilla, Union, Wallowa, and Wheeler in Oregon. The local economy and lifestyle tend to revolve around agriculture, ranching, government, and the timber industry. Portions of Umatilla and Morrow counties along the Columbia River in Oregon are more industrialized (USDA 1990).

3.1.2 Basis for Cumulative Effects Analysis

Cumulative effects result from the incremental impacts of the Proposed Actions/alternatives when added to other past, present, and reasonably foreseeable actions, both on National Forest System lands and other adjacent federal, state, or private lands (40 CFR 1508.7). Cumulative effects related to the spread of invasive plants, and cumulative effects related to the risks associated with herbicide or other invasive plant treatments are considered in this Environmental Impact Statement (EIS).

Activities of man and natural processes have led to the introduction, establishment and spread of invasive plants across the Umatilla National Forest. The Umatilla National Forest Plan was amended in October of 2005 to provide management direction aimed at preventing further spread of invasive plants. The cumulative effects analysis assumes that the prevention standards will reduce rates of invasive plant spread within the Project Area, and that treatments will reduce the density and extent of invasive plants further lowering the rates of spread.

Only the land and roads within the National Forest system would be treated in the action alternatives proposed by this EIS. The Forest, however, is intermingled with other federal, state, county, and private ownerships. Management activities and actions on neighboring lands may contribute to spread or containment of invasive plants on National Forest system lands, and vice versa. The effectiveness of the proposed invasive plants treatment project would be increased if coordination with adjacent landowners treats invasive infestation across land ownerships. Coordination would also tend to prevent unwanted effects such as duplication of treatment along a property boundary. The cumulative effects analysis assumes that this cooperative, coordinated effort continues for the life of this project. In addition, the cumulative effects analysis assumes that the release of biological control agents on National Forest system lands and adjacent lands by the Oregon and Washington Departments of Agriculture, as analyzed by Animal Plant Health Inspection Service (APHIS), will continue to reduce the invasive plant infestations in Oregon and also decrease the spread of invasive plants.

Herbicides are commonly applied on lands other than National Forest system lands for a variety of agricultural, landscaping and invasive plant management purposes. Herbicide use occurs on tribal lands, state and county lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. No requirement or central reporting system exists to compile invasive plant management information on or off National Forests in Oregon or Washington. So, accurate accounting of the total acreage of invasive plant treatment for all land ownerships is unavailable. Even the estimates provided are not to be precisely analyzed given the long time span and uncertain implementation schedule for this project.

Although it is difficult to estimate, the Region 6 Invasive Plant FEIS (2005) estimated that invasive plant control occurs on over 1.25 million acres in Oregon and Washington and above 90 percent of this control is through the use of herbicides. Even the highest estimates of herbicide use on National Forest system lands in the two states would amount to less than three percent of the estimated total acres treated with herbicides in Oregon and Washington (R6 FEIS 2005, page 4-1). Regardless, many people express personal concern about their exposure to agricultural and industrial chemicals, and the cumulative effects to human and environmental health from herbicide, pesticide, and other chemical use in our society.

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, aquatic species, and/or wildlife species.

For additive doses to occur, the two exposures would have to occur approximately at the same time, since the herbicides proposed for use are rapidly eliminated from humans and do not significantly bioaccumulate (R6 FEIS 2005). The application rates and extent considered in this EIS are unlikely to result in additive doses beyond those evaluated for chronic and acute exposures in the USDA Forest Service risk assessments, which formed the basis for the effects analysis in the Region 6 Invasive Plant FEIS (2005). The Region 6 Invasive Plant FEIS (2005), in return, served as the basis for the site-specific effects analysis discussed in this EIS.

The risk of adverse effects of invasive plant treatments in all action alternatives have been minimized by the project design features (PDFs). These limit, but not exclude, the possibility of cumulative adverse effects caused by treatment. The use of herbicides within the scope of this project is unlikely to contribute to cumulative effects beyond those described in the Invasive Plant FEIS (2005). Herbicide persistence is managed through PDFs to avoid chemical loading in the soil over time at any one site. Buffers minimize risk of herbicide concentrations of concern near water. Specific PDFs and buffers can be reviewed in Chapter 2.2.3.

Early detection-rapid response is part of all action alternatives, and is considered in the direct, indirect and cumulative effects analysis. Effects of treatments each year under early detection-rapid response, by definition, would not exceed those predicted for the most ambitious conceivable treatment scenario. This is because the Project Design Features do so much to control the potential for adverse effects and because if the most ambitious treatment scenario were implemented, the potential for spread into new areas would be greatly reduced.

Natural events such as drought, weather events, wildfires, and others affect the spread of invasive plants. These events would have implications on where and how treatments would occur; however, natural events do not act cumulatively with the treatment of weeds to multiply possible environmental effects. Potential effects of treatments to contain, controll or eradicate invasive plants are the focus of this analysis.

3.1.3 Life of the Project

This project would be implemented over several years as funding allows, until no more treatments were needed or until conditions otherwise 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, specific non-target plant or animal species of local interest could change, and/or new invasive plants could become established within the project area. The effects analysis considers a range of treatments applied to a range of site conditions to accommodate the uncertainty associated with the project implementation schedule.

Many variables affect invasive plant treatment prescriptions, including land management objectives and standards related to a particular site; treatment area priority and treatment strategy (see Chapter 2 for more discussion about treatment areas, priorities and strategy); and landscape scale goals. The relative proportion and timing of integrated treatments including herbicides and other methods; the effectiveness of invasive plant management on neighboring lands; and available funding also affect the treatment that would be implemented.

The treatment scenarios are not intended to be binding treatment prescriptions. Actual annual treatments will adapt to information gathered through inventory and monitoring and make the most of available funding. Newly discovered infestations could be prioritized over existing sites.

The assumption of full funding to treat approximately 4000 acres annually allows the greatest and most intense impacts possible to be evaluated; however, both the positive and negative impacts of the project are likely to be less than predicted for the most ambitious conceivable treatment.

The analysis assumes that the treatment methods would be applied according to Project Design Features for each alternative.

Thus, herbicides, specifically applied by broadcast methods, are assumed to be part of the prescription unless specifically excluded by each alternative's design. In many cases, the implementation planning protocol shown in Appendix B would lead to similar site treatments no matter which alternative was selected. Broadcast methods would not be used in any alternative where conditions do not warrant the risk associated with this application method, and herbicides would not be used if conditions do not warrant the risk associated with using them. However, assuming the most ambitious conceivable treatment scenario clearly highlights the differences between the costs, effectiveness, and adverse effects from different treatment approaches.

Early Detection-Rapid Response

All action alternatives include the ability for Forest Service land managers to approve treatments on currently unknown invasive plant sites assuming Project Design Features would be followed. The effectiveness of future treatments would reflect the ranking of each alternative, because the effectiveness is strongly influenced by the design features.

Assuming the full funding and treatment of approximately 4000 acres annually, early detection/rapid response would be expected to be a very small part of the program initially because the current inventory would be the treatment priority in the early years of the project. Over time, early detection-rapid response would tend to cover a larger part of the program. Even if the acreage treated in one year were to exceed 4000 acres, the effects analysis would still be valid, because the Project Design Features (Chapter 2) and the Implementation Planning Process (Appendix B) ensures that the plausible adverse effects of treating currently unknown infestations would be within the scope of those disclosed here.

3.1.4 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 relied on herbicide risk assessments 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 Umatilla National Forest. Risk assessments were done by Syracuse Environmental Research Associates, Inc using peer-reviewed articles from the open scientific literature and current EPA documents, including Confidential Business Information. Information from laboratory and field studies of herbicide toxicity, exposure, and environmental fate was used to estimate the risk of adverse effects to non-target organisms.

Table 14 displays the risk assessments available by chemical; these 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 14 - Risk Assessments for Herbicides 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 03-43-17-01b
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	May 2003	USDA Forest Service, R-5

In addition to the analysis of potential hazards to human health from every herbicide active ingredient, Forest Service/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).

In some cases, toxicity data on inerts and adjuvants is produced to comply with other federal laws that regulate non-herbicide uses of these chemicals, such as the Federal Food, Drug, and Cosmetic Act.

The risk assessments considered worst-case scenarios including accidental exposures and application at maximum label rates. The Project Design Features described in Chapter 2 were developed to abate hazards indicated by the assessments. Although the risk assessments have limitations (see R6 2005 FEIS pages 3-95 through 3-97), they represent the best science available. The risk assessment methodologies and detailed analysis is incorporated into references of conclusions about herbicide toxicology in this document.

Herbicide Toxicology Terminology

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

Hazard Quotient (HQ)

The definition of hazard quotient for this analysis is the ratio of the estimated level of exposure to a substance from a specific pesticide application, to the level of the 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.

Exposure Scenario

Exposure scenarios consider both the toxicity of a given chemical and the mechanism by which an organism may encounter it. The application rate and method influences whether a person, animal or non-target plant could be adversely affected by exposure to a particular herbicide.

Plausible Effects

The analysis in Chapter 3 focuses on whether effects that are possible based on risk assessments are plausible, given site conditions, life history of organisms in an area, herbicide application methods and other Project Design Features. Project Design Features are often used to minimize or eliminate the plausibility of effects indicated as possible in the risk assessments.

3.2. Botany and Treatment Effectiveness

3.2.1. Introduction

This section focuses on the relative likelihood that the proposed treatment of invasive plants would be effective in reducing threats to desirable, non-target vegetation (addresses issues listed in section 1.9.4) This section discloses the potential risks to non-target vegetation, including SOLI (threatened and endangered species, regional forester sensitive species and other species of local interest to the forest).

3.2.2. Affected Environment

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 13122). 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.

Invasive plants pose threats to biological diversity of native plant communities by altering ecosystem processes and can completely displace native plant species and cause a decline in overall species richness. Invasive plants are highly adept at capturing available moisture and nutrients, and often spread quickly.

Invasive plants have been detected on approximately 24,649 acres (1.7 percent) of the 1.4 million-acre Umatilla National Forest located in northeast Oregon and southeast Washington. Presently, 24 different invasive plant species are known to occur within the boundaries of the Forest. In the past 13 years, nearly 2,069 invasive plant sites have been mapped covering approximately 24,649 gross acres, and in many cases, a single mapped site may contain one or more species. 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 and Canada thistle (Salsola kali and Cirsium arvense, respectively), occur in such abundance that many sites have either not been mapped or have been dropped from existing databases and vary from district to district. These species are sometimes considered as low priority for treatment due to task force and/or monetary constraints, or species naturalization. Table 15 summarizes the 24 species that are presently documented from inventory efforts and proposed for treatment.

Infestation sites range in size from one plant to numerous plants scattered over large acreages (see Table 16). The majority of inventoried sites (77 percent) are less than 10 acres in size. Infestations located in high-spread areas such as, roadsides, trails, quarries, range structural improvements, developed recreations sites, parking areas represent 50 percent of the total acres infested (12,339 acres). The remaining acres are found throughout forest lands. Table 17 provides a forest wide invasive plant summary by species, priority and acres. It lists the primary target species which has the greatest abundance or highest priority at each particular treatment site and multiple species can and do occur within a primary target species site. Each Ranger District determines invasive species priority ranking based on local circumstances. Priority ranking differences among species can vary based on whether a species is established on a district, rapidly expanding and invading into native plant and wildlife habitats, or whether a species is a new invader that needs to be controlled before it becomes established. Although Table 17 lists current species priority, this ranking can change in the future to adjust to changing environmental conditions or management activities.

Table 15 - Invasive plant species documented from inventory efforts and the number of sites within each district

Scientific Name	Common Name	Districts No. of sites			
		Heppner	Pomeroy	North Fork John Day	Walla Walla
Articum minus	Lesser burdock	7	1	3	6
Cardaria draba	Whitetop		2	6	1
Carduus nutans	Musk thistle			2	3
Centaurea biebersteinii	Spotted knapweed	1	54	63	98
Centaurea diffusa	Diffuse knapweed	442	151	131	463
Centaurea repens	Russian knapweed				1
Centaurea solstitialis	Yellow starthistle		22	2	18
Chondrilla juncea	Rush skeletonweed				3
Cirsium arvense	Canada thistle	15	48	26	240
Cynoglossum officinale	Houndstongue	10	26	110	154
Cytisus scoparius	Scotch broom	3			2
Daucus carota	Wild carrot				1
Euphorbia esula	Leafy spurge			2	53
(Hieracium pratense 0	Yellow hawkweed				4
Hieracium aurantiacum	Tall hawkweed			1	
Hypericum perforatum	St John's wort	242	36	36	247
Lathyrus latifoliis	Everlasting peavine			1	
Linaria dalmatica	Dalmation toadflax	82	29	7	6
Linaria vulgaris	Butter and eggs	4	1	8	1
Onopordum acanthium	Scotch thistle	6	19	8	6
Phalaris arundinacea	Reed canary grass				1
Potentilla recta	Sulphur cinquefoil		2	88	62
Senecio jacobaea	Tansy ragwort	3	7	11	70
Taeniatherum caput-medusae	Medusahead			4	15
Total (individual species occurrences)		**815**	**398**	**509**	**1455**

Table 16 - Range of invasive plant site sizes

Size of Infestation	# of Invasive Plant Sites	% of Known Sites
Less than 1 acre	531	26
1 to <5 acres	814	39
5 to < 10 acres	247	12
10 to < 50 acres	370	18
50 to < 100 acres	64	3
More than 100 acres	43	2
Total	**2,069**	**100%**

Table 17 – Primary target invasive plant species on the Umatilla National Forest by species priority and acres

Primary Target species	Priority[1]	Number of sites[2]	Acres	Estimate of Total Infested Acres[3]	Other Documented Invasive Plant Species within a priority site (one or all)
Common burdock	3,4	24	184	46	
Whitetop	1,3	15	104	57	diffuse knapweed, hounds tongue, scotch thistle, sulphur cinquefoil
Musk thistle	1	6	42	10	spotted knapweed, diffuse knapweed, tansy ragwort
Spotted knapweed	1,2	327	2,413	603	hounds tongue, yellow hawkweed, dalmation toadflax, yellow toadflax, scotch thistle, sulphur cinquefoil, diffuse knapweed, tansy ragwort
Diffuse knapweed	1,2	1,413	9,968	2,492	tansy ragwort, sulphur cinquefoil, scotch thistle, yellow toadflax, dalmation toadflax, yellow hawkweed, hounds tongue, rush skeletonweed, yellow starthistle
Russian knapweed	2	1	3	1	tansy ragwort
Yellow starthistle	1	36	1,257	314	diffuse knapweed, spotted knapweed, sulphur cinquefoil, tansy ragwort, scotch thistle
Rush skeleton weed	1	2	1	1	
Canadian thistle	4	255	4,482	1,120	diffuse knapweed, spotted knapweed, sulphur cinquefoil, scotch thistle, tansy ragwort
Houndstongue	2	191	2,606	651	sulphur cinquefoil, tall hawkweed, scotch thistle
Scotch broom	1,3	3	6	1	sulphur cinquefoil
Leafy spurge	1	64	35	9	diffuse knapweed
Yellow hawkweed	1	1	1	<1	
St John's wort	4	191	2,783	695	sulphur cinquefoil, tansy ragwort
Dalmation toadflax	1	51	93	23	yellow toadflax
Yellow toadflax	1	4	19	5	
Scotch thistle	1	11	231	58	sulphur cinquefoil, tansy ragwort
Reed canary grass	4	1	1	<1	
Sulphur cinquefoil	2	92	260	64	diffuse knapweed, tansy ragwort
Tansy ragwort	1	38	100	25	
Medusahead	3,4	8	56	14	
Total		**2,724**	**24,645**	**6,188**	

1 Priority 1 = Generally State Class A or T listed species. Goal is to eradicate new populations and/or control existing populations of these aggressive and harmful species
Priority 2 = Goal is to contain existing populations of aggressive species. Priority 3 = Goal is to eradicate new populations and/or control existing populations of these less aggressive invasive species
Priority 4 = Goal is to contain existing populations of less aggressive invasive species. Species with different priorities vary from district.
2 Individual species can occur on multiple sites, therefore total site numbers are inflated
3. This column is net infested acres, acres that would have 100% ground canopy coverage by invasive species. Ground canopy coverage is estimated to be 55 % for whitetop, and hawkweed and 25 % for all other speces. Net acres are calculated by multiplying gross acres (column 4) by .55 and .25 respectively (L. Dawson 2006).

Native Vegetation

The Umatilla National Forest contains a wide diversity of plant species and communities due to varying elevation and precipitation zones that occur within eastern Oregon. Invasive plants pose threats to biological diversity of native plant communities by altering ecosystem processes and can completely displace native plant species and cause a decline in overall species richness. Invasive plants are highly adept at capturing available moisture and nutrients, and often spread quickly.

The complex geologic history of the area which included floods, volcanic eruptions, landslides and erosion have shaped the landscape of the Umatilla National Forest into a unique combination of landforms and vegetation patterns. The unique combination of geology and topography has produced a distinctive, mosaic pattern of dense, heavily timbered slopes interspersed between open, rugged grasslands. The Forest lies at the extreme eastern edge of the Cascade Range's rain shadow. This high-desert climate is characterized by hot, dry summers (less than 10 inches of precipitation per year) in the lower valleys and moist maritime conditions influenced by the Columbia River at the higher elevations (over 80 inches of precipitation per year). This variety of landform, elevation and climate results in a diversity of plants.

Ecological habitats ranging from low to high elevation include: juniper, sage, grasslands, ponderosa pine, mixed conifer, sub-alpine fir, Engelmann spruce, and alpine plants. Biophysical settings are aggregations of plant associations and represent a combination of temperature and moisture regimes for the Umatilla National Forest (See Table 18). Given this combination of physiography and climate, habitats are highly variable and retain a legacy of botanical diversity.

Plant communities can be classified by a variety of factors such as vegetation structure, site moisture, overstory, and understory. The 2005 R6 FEIS used broad potential vegetation groups (PVGs) to rate the susceptibility of vegetation.

Table 18 provides a summary of the PVGs found in the Project Area, their susceptibility to damage from invasive plants, the local plant community types that correspond to these broad PVG types, and mapped acres of invasive plants within the plant community types.

Table 18 - Potential Vegetation Groups on the Umatilla National Forest's 1.4 million acres and their susceptibility to invasive plants

Potential Vegetation Group	Susceptibility to Invasion[1]	% of Forest	Infested acres (all species)[2]
Cold Forest	Moderate	12	1725
Cold Grassland	Moderate	<1	182
Cold Shrubland	Moderate	<1	46
Dry Upland Forest	Moderate-high	33	7254
Dry Grassland	High	11	3622
Dry Riparian Forest	High	<1	3
Dry Riparian Shrubland	High	<1	1
Dry Shrubland	High	<1	104
Dry Woodland	High-moderate	<1	---
Impounded Water	-----	<1	4
Moist Upland Forest	Moderate-high	29	6897
Moist Grassland	Moderate-high	3	780
Moist Upland Shrubland	Moderate-high	3	332
Moist Upland Woodland	Moderate-high	2	205
Wet Riparian Forest	Moderate	<1	60
Wet Riparian Shrubland	Moderate	<1	7
Riparian Herbland	Moderate	<1	48
Unvegetated Rock	Moderate	<1	45
Unknown	-----	3	3506

1 Susceptibility ratings (derived from R6 FEIS, V. Erickson, and J. Wood): High = high susceptibility to invasion. Invasive plant species invades the cover type successfully and becomes dominant or co-dominant even in the absence of intense or frequent disturbance; Moderate = moderate susceptibility to invasion. Invasive plant species is a "colonizer" that invades the cover type successfully following high intensity or frequent disturbance that impacts the soil surface or removes the normal canopy; Low = low susceptibility to invasion. Invasive weed species does not establish because the cover type does not provide suitable habitat.

2 Some mapping error due to overlap in species occurrences in duplicate potential vegetation groups in GIS database

Since the time of the pioneers, movement of people into the area and the associated establishment of invasive weed spread vectors (highways, railroads, canoes, rafts, and other transportation methods) have continued to alter habitats and vegetation types across the landscape. For example, many areas within the forest have become permanently altered by cheat grass, which has become naturalized. It is highly probable that in the past, this permanent alteration of habitat has affected native vegetation and species of local interest (SOLIs).

Eastside forests are more susceptible to invasive plants than other forests in the region (USDA, 2005b). In general, their grasslands, riparian areas, and relatively dry, open forests are more susceptible to invasion than are dense moist forests and high montane areas (USDA 2005b). The grasslands, riparian areas, and relatively dry, open forests have frequent gaps in the plant cover, which favor invasive plant establishment. The moist forests and high montane areas 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 and around developments such as roads, highways, utility (power line) corridors, recreational residences, trails, campgrounds and quarries. These are all places where native vegetation has been removed and disturbance has been created areas for invasive plants to establish.

Botanical Species of Local Interest

SOLI are vascular and nonvascular botanical plant species that are:

- Threatened and/or endangered species (federally listed or proposed for listing under the Endangered Species Act
- Regional Forester Sensitive or Proposed Sensitive Species (Forest Service Manual 2670)
- Plant species endemic to the forest, Oregon and Washington State, and/or Oregon and Washington Natural Heritage Program endangered, threatened, or sensitive species; and
- Species of Local Interest to the Forest

Departmental Regulation 9500-4 – This regulation directs the Forest Service to manage habitats for all existing native and nonnative plants, and fish, and wildlife species on National Forest system lands in order to maintain at least viable populations of such species. 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, the management objective for sensitive species is, in part, to develop and implement management actions to ensure that species do not become threatened or endangered because of Forest Service actions and to maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats throughout their geographic range on National Forest System lands. A viable population is a population that has the estimated numbers and distribution of reproductive individuals to ensure the continued existence of the species throughout its existing range (or range required to meet recovery for listed species) within the planning area.

Prefield 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 prefield review:

- Regional Forester's Sensitive Species List (July 2004) modified by J. Wood (July, 2006)
- Oregon Natural Heritage Information Center's (formerly the Oregon Natural Heritage Program) Rare, Threatened and Endangered Species List (May 2004)
- U.S. Forest Service sensitive plant survey GIS layer and associated databases
- USFS personnel (Forest Botanists and Ecologists)
- Literature (see References)

One federally listed species, *Silene spauldingii* (Spaulding's catchfly) is documented on the forest. There are presently 44 SOLI documented or suspected to occur on the Umatilla National Forest (see Table 19). Four bryophytes and six lichen species (non-vasculars) recently suspected of occurring on the forest and considered of local interest are listed in Table 20.

Baseline surveys of prime habitat for the bryophtes and lichen species are nearly complete and no species occurrences are documented.

Table 19 - Sensitive plant species documented (D) or suspected (S) to occur on the Umatilla National Forest

Scientific Name	Common Name	Documented or Suspected	Documented habitat
Allium campanulatum	Sierran onion	D	Dry open areas surrounded by ponderosa pine and juniper wetlands. Usually found growing in clay soils with considerable gravel. Elevation range is 3,000 to 7,400 feet.
Allium diction	Blue mountain onion	D	Openings in subalpine fir stands, Southeast aspects; cobbly shallow soils. Elevation range is 5,200 to 5,500 feet.
Astragalus arthurii	Arthur's milkvetch	D	Moist grasslands, Northerly aspects; shallow, stony soils. Moderate elevations (4,000 feet).
Astragalus cusickii var. cusickii	Cusick's milkvetch	D	Canyon grasslands (Snake and Grande Ronde rivers; loose, fine-textured basalt soils on cliffs, road-cuts and areas of vegetation cover < 50%.
Bolandra oregano	Oregon bolandra	D	Moist rocky seeps, springs, waterfalls, wet road banks. Low to moderate elevations 2,000 to 5,000 feet.
Botrychium crenulatum	Crenulate moonwort	D	Partially shaded or open settings, primarily in sedge/forb communities associated with seeps, small streams, drainages and edges of wet meadows. Englemann spruce and stands of grand fir, Douglas fir and lodgepole pine.
Botrychium hesperium	Windowleaf moonwort	D	Same as above
Botrychium lanceolatum	Lance-leaf grapefern	D	Same as above
Botrychium lunaria	Moonwort grapefern	D	Same as above
Botrychium minganense	Mingan moonwort	D	Same as above
Botrychium montanum	Peculiar moonwort	D	Same as above
Botrychium paradoxum	Northern moonwort	D	Same as above
Botrychium pedunculosum	Stalked moonwort	D	Same as above
Botrychium pinnatum	Northern moonwort	D	Same as above

Scientific Name	Common Name	Documented or Suspected	Documented habitat
Calochortus longebarbatus var. longebarbatus	Long-bearded mariposa lily	D	Seasonally wet meadow and stream margins. Ponderosa, lodgepole pine and juniper forest openings and forest edges of vernally moist grassy meadows, occasionally along seasonal streams.
Calochortus macrocarpus var. maculosus	Nez Perce mariposa lily	D	Pristine grassland on steep slopes, rock outcrops and cliffbands with basaltic soils over a wide elevation range
Calochortus nitidus	Broadfruit mariposa	S	Palouse grasslands, deep soils.
Camissonia pygmaea	Dwarf suncap	S	Sagebrush steppe at 1800' – 2000' elevation
Carex cordillerana	Back's sedge	D	Wet meadows, streams, springs, seeps, moist conifer forest.
Carex hystericina	Porcupine sedge	D	Wet to moist conditions in riparian zones; in or along ditches/canals in prairies and wetlands.
Carex stenophylla (C. eleocharis)		S	Open, dry to moderately moist places, often with grasses, over a wide elevation range.
Cypripedium fasciculatum	Clustered lady slipper	D	Wet forests dominated by grand fir overstory to, more commonly, drier forest types such as ponderosa pine and/or Douglas fir overstory with pinegrass (Calamagrostis rubescens) understory. Found near springs and creeks in moist plant associations, as well as in drier environments in duff and moss under Douglas fir and oceanspray (Holodiscus discolor), and Douglas fir and ninebark (Physocarpus malvaceus). Elevations of 1,600 to 8,000 feet.
Erigeron disparipilus	Snake river daisy	D (only sensitive in OR)	Ridgetops and forest openings at moderate elevations in the Blue Mountains and Snake River regions.
Eleocharis bolanderi1	Bolander's spikerush	D	Intermittent stream channels, edges of wet meadows, and roadside ditches; in dry bunchgrass and scab communities on basaltic substrates
Haplopappus liatriformis		S	Native, undisturbed, prairie grasslands, including shrubland and open forest verges. Elevation ranges generally below 3,000 feet.

Scientific Name	Common Name	Documented or Suspected	Documented habitat
Leptodactylon pungens ssp. hazeliae	Prickly phlox	D	Sheer rock outcrops and talus-covered slopes. Low elevations (below 2,000 feet).
Lomatium cusickii		S	Open slopes with rocky soils in bunchgrass communities, mid to high elevations
Lomatium rollinsii	Rollins' biscuitroot	D	Open slopes in bunchgrass communities of the canyonlands of the Blue Mountain and Snake River ecoregions.
Lomatium salmoniflorum	Salmon-flowered lomatium	S	Open, rock slopes at lower elevations.
Lupinus sabinianus	Sabin's lupine	S	Open grassy slopes in mixed coniferous forest; road-cuts and disturbed soils. Low to moderate elevations (3,300 to 5,500 feet).
Lycopodium complanatum	Ground cedar	S	Coniferous forest with thick duff. Often on rotting wood or in acidic soils. Also in meadows and on open ridgetops. Moderate elevation (4,300 feet).
Mimulus clivicola	Bank monkey-flower	S	Open rocky slopes. Southerly aspects with steep slopes. Shallow soils at low to moderate elevations (2,500 to 5,500 feet)
Montia diffusa	Branching montia	S(sensitive only in WA)	Moist forest with Douglas fir, on disturbed soils over a wide elevation range.
Pellaea bridgesii		D	This small, evergreen fern favors south and east aspects of rocky outcrops and talus slopes of metamorphic and igneous origin. Elevation ranges between 4000 to 9500 feet.
Phacelia minutissima		S	Streambanks in sagebrush communities and in aspen stands. In the Blue Mountains it occurs in association with false hellebore (Veratrum californicum) and white mules ears (Wyethia helianthoides) in vernally moist meadows and small scablands at elevations 5000 to 7000 feet.
Phlox multiflora	Many-flowered phlox	S	Dry, rock areasl; cliffs to ridgetops and open slopes. Wooded, rock areas as well as open sites. Loose substrate at elevations around 3,500 feet.
Ranunculus populago	Mountain buttercup	D	Wet meadows, streamside, and in bogs,and seedps at mid-montane elevations.
Salix farriae	Farr's willow	D	Wet meadows, lakeshores, and streambanks. Elevation range is 7,000 to 8,000 feet.

Scientific Name	Common Name	Documented or Suspected	Documented habitat
Silene spaldingii	Spalding's silene	D	Native, undisturbed, prairie grasslands. Elevation ranges between 1,200 to 4,500 feet.
Spiranthes porrifolia		S	Wet meadows, bogs, streambanks and seepage areas from 60 to 6800 feet in elevation.
Suksdorfia violacea		S	Rock crevices, mossy banks, cliffs, and shaded sandy areas, usually at least vernally wet.
Thelypodium eucosmum	Arrow-leaved thelypody	D	Moist, seepy areas on ashy-clay soils in Grant and Wheeler Counties. Sites include steep drainages along the John Day River.
Trifolium douglasii	Douglas clover	D	Moist to wet meadows and forested wetlands and streambanks, with ponderosa pine, Douglas fir, and lodgepole pine.
Trifolium plumosum var. plumosum	Pussy clover	S	Dry hillsides and forest edges with ponderosa pine, Douglas fir and lodgepole pine.

Table 20 - Non-vascular species of local interest suspected to occur

Bryophytes	Lichens
Rhizomnium nudum (Oregon only)	*Dermatocarpon luridum*
Schistostega pennata	*Leptogium burnetiae* var. *hirsutum*
Scouleria marginata	*Leptogium cyanescens*
Tetraphis geniculata	*Nephroma bellum* (Washington only)
	Peltigera neckeri
	Peltigera pacifica

Field Surveys

Extensive botanical surveys have been conducted on the Umatilla National Forest (J. Wood 2006). Survey routes and documented occurrences and habitats for SOLI are on file at the Umatilla National Forest supervisor's office. Due to the extensive surveys conducted on the forest no additional surveys are proposed for this project. Databases and records from the Umatilla National Forest were used to identify SOLIs within 100 feet of identified treatment areas. Presently, there are 13 plant SOLIs on 44 sites within 100 feet of identified invasive plants proposed for treatment (see Table 21 and Appendix B for a complete listing of sites).

Of the 44 sites documented to be within 100 feet of an invasive species documented occurrence:

- 40 percent of the sites are located adjacent to or within 0-10 acres of an invasive species site
- 71 percent of the sites are located adjacent to or within 11-50 acres of an invasive species site
- 21 percent of the sites are located adjacent to or within 51-100 acres of an invasive species site
- 21 percent of the sites are located adjacent to or within 101 or more acres of an invasive species site

In some cases more than one invasive species was documented within 100 feet of a SOLI, the largest reported acreage of infestation was reported in the above stated ranges.

Table 21 - SOLI occurrences within 100 feet of an identified invasive species site

District	Scientific Name	Common Name	Number of occurrences within 100 feet of invasive species	Invasive Species	Previously Treated under "95 EA"
Pomeroy	*Astragalus arthurii*	Arthur's milkvetch	2	Diffuse knapweed, yellow starthistle, scotch thistle	NO
Walla Walla	*Botrychium lanceolatum*	Lance-leaf grapefern	6	Spotted and diffuse knapweed, Canada thistle, tansy ragwort, houndstongue	Yes, hand pulling, chemical on 2 sites for knapweeds
Walla Walla	*Botrychium minganense*	Mingan's moonwort	5	Diffuse knapweed, Canada thistle, tansy ragwort	Yes, 4 sites. 1 site hand pulling for diffuse knapweed and tansy ragwort, 3sites chemical for knapweed
Walla Walla	*Botrychium Montanum*	Mountain Grapefern	1	Diffuse knapweed,	NO
Walla Walla	*Botrychium Pedunculosum*	Stalked moonwort	1	Diffuse knapweed	NO
Walla Walla	*Botrychium pinnatum*	Northern moonwort	6	Diffuse and spotted knapweed, tansy ragwort, Canada thistle	Yes, 4 location, hand pull and chemical for tansy ragwort and knapweeds
Walla Walla	*Carex cordillerana*	Back's sedge	5	Common burdock, diffuse knapweed, sulphur cinquefoil, tansy ragwort	Yes, 2 locations. Hand pulling and chemical for common burdock, knapweed, tansy ragwort
Pomeroy	*Carex hystericina*	Porcupine sedge	1	Scotch thistle	NO

District	Scientific Name	Common Name	Number of occurrences within 100 feet of invasive species	Invasive Species	Previously Treated under "95 EA"
Pomeroy	*Calochortus macrocarpus var. maculosus*	Nez Perce mariposa lily	7	Yellow starthistle, scotch thistle, diffuse knapweed, tansy ragwort	NO
Walla Walla	*Eleocharis bolanderi*	Bolander's spikerush	4		Yes, 1 location, chemical
Pomeroy	*Leptodactylon pungens ssp. hazeliae*	Prickly phlox	1	Diffuse knapweed	NO
Pomeroy and John Day	*Trifolium douglasii*	Douglas clover	4	Diffuse knapweed, houndstongue, St john's wort	NO
District	**Federally Listed Species**	**Common Name**	**Number of occurrences within 1000 feet of invasive species**	**Invasive Species**	**Previously Treated under "95 EA"**
Pomeroy	*Silene spaldingii – Federally listed*	Spaulding's catchfly	1	Yellow starthistle, diffuse knapweed	NO
Total		**13 Species**	**44 Occurrences**	**NA**	**5 species 13 occurrences**

3.2.3 Environmental Consequences

The public has expressed concerns that there is and will continue to be a loss of vegetation diversity within native plant communities from invasive plants. The public has also expressed concern that the application of herbicides has the potential to adversely affect non-target plant species. Determination of effects assumes implementation of all PDFs as listed in Chapter 2.2.3 Table 6, and follows all standards outlined in the Regional FEIS.

Continued loss of vegetation diversity is addressed through the analysis of treatment effectiveness towards the reduction of invasive plants. Treatment effectiveness is measured by the decrease or elimination of the invasive species, and the concomitant recovery of the area with native vegetation. Effectiveness for non-herbicide methods was derived from a thorough review of literature, including technical handbooks such as The Nature Conservancy Weed Control Handbook (Tu et al. 2001), county and state extension service or weed control board publications, and peer reviewed journal articles. A compilation of this review, Common Control Measures for Invasive Plants of the Pacific Northwest Regions (Mazzu 2005) can be found in the project record of this EIS

Concerns related to impacts from treatments to non-target plant species including SOLI were addressed through herbicide risk assessments (FEIS 2005) and a thorough review of the literature including non-herbicidal effects to plants (USDA 2005, Appendix J), risk to pollinators of native plant communities (USDA 2005), and peer reviewed scientific papers.

Risks to non-target species including SOLI were based on the combination of treatment effectiveness between alternatives and direct and indirect effects from invasive plant treatments.

Treatment effects to native plant communities and pollinators associated with these communities is evaluated at a forest wide scale. Effects to individual SOLI are based on individual site occurrences, proposed treatment to nearby invasive species, and overall risk of treatment effectiveness by alternative

3.2.4 Treatment Effectiveness and General Impacts to Native Vegetation Common to All Alternatives

This section describes treatment effectiveness related to each treatment type proposed in this EIS (as tiered to the Regional FEIS). Forestwide, treatment effectiveness typically increases with the number of treatment options available and the percentage of infested lands that may be treated. Early detection, rapid response to newly discovered infestations also increases treatment effectiveness and reduces potential effects of herbicide treatment on non-target vegetation. The effectiveness of an alternative to treat the diverse group of invasive plants depends on the variety of tools available. Thus, alternatives that limit the variety of tools also limit the effectiveness of treatments. Strategies such as integrated weed management, cooperation with private and public landholders, prevention, EDRR and site restoration and revegetation practices apply to all alternatives proposed in this EIS and are described in this section.

Integrated Weed Management

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.

Cooperation with Private and Public Landholders as well as Other Agencies

Cooperative treatment of weeds by various land ownerships and neighboring parcels also contributes to optimizing effectiveness of all 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 city and county weed boards, Wallowa Resources, Rocky Mountain Elk Foundation, Bureau of Land Management, Oregon Department of Transportation, and North Fork John Day Watershed Council. Efforts such as these are imperative for the promotion of healthy ecosystems by reducing invasive plants and the economic and community benefits that healthy ecosystems provide

Prevention

Prevention practices as outlined by the Regional FEIS and adopted into the Umatilla National Forest Plan suggest that incorporation of these activities will reduce the annual area spread of invasive species to approximately 5 percent compared to the estimated current spread of 8-12 percent (R6 FEIS, 4-22).

Early Detection Rapid Response (EDRR)

Sometimes considered the “second line of defense “after prevention, EDRR is a critical component of any effective invasive species management program. When new invasive species infestations are detected, a prompt treatment to these small occurrences can reduce environmental and economic impacts compared to allowing the infestation to spread and establish, thus warranting a long-term control program.

This action results in lower cost and less resource damage than implementing a long-term control program after the species is established. The no action alternative presently uses manual and mechanical methods to treat new infestations, whereas, the proposed alternatives B, C, and D could treat new or previously undiscovered infestations using the range of methods described in this EIS as directed in the decision tree implementation process and in full accordance with PDFs listed in Chapter 2 of this EIS. EDRR is considered to be one of the four primary elements in the Forest Service National Strategy and implementation for invasive species (USDA 2004) and implementation on any scale would reduce negative impacts to native plant biodiversity. However, treatment effectiveness for control and eradication increases with the more treatment options available.

Site Restoration/Revegetation

Restoration or reclamation of sites infested with invasive species follow treatment restoration standard 13 (USDA-PNW-ROD, 2005a) and incorporate guidelines for revegetation of invasive weed sites and other disturbed areas on National Forests and Grasslands in the Pacific Northwest (Erickson et al. 2003, also Appendix G this document) On degraded 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 (Sheley et al. 1996 in Erickson et al. 2003).

Restoration and revegetation projects that would include ground disturbing activities such as disking or plowing would require additional NEPA analysis on a site specific level.

In all alternatives, the threat to native plant habitats from invasive plants is considered greater than any effects that would occur from treatments. Specifically, 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 treatment methods.

The following treatment types provide specific information related to the effectiveness and impacts to native vegetation common to all alternatives.

Biological Control

Biological control is used 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 reduces or eliminates the need to use herbicides. For example, bio-control releases on yellow starthistle and diffuse knapweed have shown positive control results on Walla Walla District in the past (J. Mitchell, 2006). Bio-control agents previously released and established in an area will continue to spread to other nearby invasive sites providing a potential long-term control treatment to invasive species with associated bio-control agents.

Even though control agents are reviewed and approved by APHIS prior to release in this country, there is a slight risk that an approved agent the Forest Service releases may unintentionally affect native plants or animals. There also remains the possibility that regardless of what the Forest Service does, unapproved agents or agents known to affect non-targets will spread from neighboring lands to National Forest system lands. There are a few examples of indirect effects on non-target organisms resulting from biological control introductions. Callaway et al. (1999) found the reproductive output of native *Festuca idahoensis* planted with spotted knapweed was lower when the introduced root moth (*Agapeta zoegana)*, had attacked neighboring knapweed. A study of native deer mouse (*Peromyscus maniculatus*) diets found introduced knapweed gall flies were the primary food item for most of the year and over 80 percent of the winter diet (Pearson et al. 2000). These studies illustrate ways that biocontrol agents can indirectly affect their new communities or ways their communities can change agent effectiveness.

Region 6 policy allows redistribution of approved biocontrols without further NEPA decisions. The redistribution of biocontrols may be considered similar to invasive plant prevention practices in NEPA documents.

In compliance with the R6 2005 FEIS, Standard #14 which stipulates to use only APHIS and State-approved biological control agents and agents demonstrated to have direct negative impacts on non-target organisms would not be released, the regional office will annually provide a list of agents that may not be released because they do not meet the standard (Pacific Northwest Region Six White Paper, 2006 (See Appendix B this EIS). This annual list will also add new and approved biological control agents for invasive plants. Additionally, weed practitioners are encouraged to coordinate with the state experts regarding the selection of agents.

Cultural Treatments

No cultural treatment sites are presently identified within the Project Area. Ground disturbing restorative activities such as disking or use of heavy equipment for revegetation will require separate NEPA analysis.

Manual Treatments

Manual treatments proposed by local district personnel in this EIS are mostly on small (less than 2 acres), easily accessible populations of houndstongue, scotch thistle, medusahead and reed canarygrass.

The removal of invasive plants using manual techniques (i.e. hand pulling, digging with hand tools, clipping flower heads with hand tools) could directly affect listed plants in situations where the invasives are co-located with these species. Direct negative effects would be unintentional removal of flowers, fruits, or root systems of these species. Vigor could be reduced in individuals through reduction in photosynthesis or reproduction potential. Solarization coverings may have negative effects on soil microorganisms and non-target species' seed viability and would not selectively allow other plants to grow, as would a selective hand application of an herbicide. Hot water and foaming treatments, shown to be effective on small areas on annual weeds and seedlings, is less effective on underground roots or rhizomes, is restricted to proximity to steam generating equipment (i.e. roadsides), has high risks of applicator burns, and unknown impacts to soil microorganisms and co-located non-target species.

These short-term impacts, if kept to a minimum in relation to population size, would be more than compensated by the long-term positive benefits of removal of aggressive, competitive invasive plants. Manual control crews could also directly impact listed plants through trampling of individuals or creation of erosive conditions within or upslope of populations. These impacts may have a more long term negative impact, but again if minimized, the benefit to the species would be more positive than negative.

Indirect negative impacts from manual control could be attributed to soil disturbance and opening of the canopy (understory, shrub layer or overstory depending on the species).

This could cause shifts in microsite condition such as reduction in soil moisture, disruption of mychorrhizal associations and cause an increase in surface temperatures. All of these indirect effects could lead to a shift in species composition away from the native community upon which listed plants depend. It is possible that one invasive species could be replaced by another invasive through various means of introduction (e.g. windblown seeds, human transport, breaking dormancy of other species seeds). This would likely be at a small scale (scattered 1 acre patches or less). Monitoring treated sites, doing follow-up treatments and taking restorative actions such as seeding desirable species would likely prevent undesirable new invasions.

Positive benefits from the removal of invasive species overshadow indirect negative impacts. Listed plant populations would be affected in a positive way by providing the space for increased growth in population size. One possible scenario is that removal of invasives will encourage native seed dormant in the soil to germinate due to less competitive conditions. Dremann and Shaw (2002) documented the success of converting live oak woodland from 99 percent exotic species cover to 85 percent native plant cover through a strategy of timed manual/mechanical removal that released the native seed bank. No reseeding was necessary.

Mechanical Treatments

Mechanical treatments are not singularly proposed in this EIS, however, could be used in combination with other treatment methods to increase overall treatment effectiveness. Objectives are to reduce biomass which reduces herbicide use, to stimulate new growth making some herbicides more effective, to prepare a site for revegetation, and/or remove and dispose of propagule source (seeds or other vegetative material capable of re-introduction). The majority of mechanical treatments involve using a weed-whackers and mowers.

Herbicide Treatments

The objectives of herbicide treatments are often two fold: 1) to more efficiently reduce the size of moderate to large infestations of invasive plants to a point at which they can be hand-pulled, and, 2) more efficiently treat large expansive areas where invasive plants are continually showing up due to the nature of the site. Different herbicides vary in effectiveness and length of control on different invasive plants, and herbicide techniques can vary in effectiveness, environmental effects, and costs.

Herbicide risks provided the basis for the analysis of effects on non-target plants including SOLIs. Herbicide selectivity, potency, and persistence and ability to move off site were all factors that contribute to risks associated with non-target impacts from herbicides. In general, 1) the more selective an herbicide is, the less impacting it would be on non-target plants, 2) more potent herbicides, which take a very small amount of active ingredient to cause damage, are considered to have higher risk to affect non-target plants if drift occurred, and 3) a persistent herbicide would have the ability to affect non-target plants more than a non-persistent herbicide either directly through off site movement or indirectly through impeding native or desirable seed germination. Summaries of effects to plants by active ingredient are available in Appendix B.

Surfactants

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. 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 compared to active ingredients (See Appendix E of this EIS, and the BE for this EIS (available upon request from the Project Record at the Umatilla National Forest in Pendleton, OR) for a detailed discussion of surfactants). Impurities are inadvertent contaminants in the herbicide, usually present as a result of the manufacturing process.

Herbicide Application Methods

Effects to non-target vegetation also vary with the herbicide application method; spot and hand application methods substantially reduce the potential for impacts to non-target vegetation because there is reduced chance for drift. Drift is associated primarily with broadcast treatments and can be mitigated to some extent by the applicator. Drift can also be minimized by equipment (correct nozzle designed for herbicide application), application methods (use of low nozzle pressure), and applying during certain weather conditions (e.g. apply when wind velocity is between two and eight miles per hour and do not spray if precipitation is predicted to occur within 24 hours.). Table 22 summarizes the influences of various factors on spray drift.

Spray nozzle diameter, pressure, the amount of water 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.

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 ground based broadcast treatment methods.

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. 5-10m” (~16-33 feet).

The maximum safe distance at which no impacts are found, obviously is greater with aerial applications due to the distance above the ground at which the herbicide is sprayed, in addition to other factors previously described. All aerial applications of herbicides will comply with EPA label restrictions, in addition to buffer distances described in Project Design Features for the protection of SOLI and stream and riparian areas to meet the direction given in Standards 19 and 20.

Impacts to non-target plants resulting from aerial drift are often studied in conjunction with drift associated with the protection of water quality. To ensure protection to non-target plants (and pollinators), buffer widths are determined by taking into consideration factors such as height of application, weather conditions, nozzle type and orientation and drop size. As with ground broadcast applications, the same factors listed in Table 22 affect aerial drift.

For a complete summary of spray guidelines and current models used to determine buffer distances see Appendix F of this document.

Terrain on the Umatilla National Forest is geared towards using helicopters for access and treatment to proposed and potentially new aerial sites (Pope 2006). Helicopters would be able to apply herbicides at heights of 10 to 20 feet above the ground in most cases. In steep terrain, the pilot would attempt to fly up and down the slope in order to maintain an equal distance of the boom to the ground. Surfactants added to tank mixtures to reduce drift may be added to the herbicide spray to provide additional precaution for off target drift. Surfactants proposed for use in this project and effects analyses have been disclosed in the R6 2005 FEIS (Chapters 4.4, 4.5, 4.7 along with Appendices P and Q).

New applicator technology also exists for more precise application with minimal drift of herbicide to very small areas from helicopters (spray balls). These small applicator tools are lowered via a boom from the helicopter and the pilot applies herbicide (by a trigger mechanism and pump) to approximately a 4 foot radius area two to four feet above the ground (Pope 2006).

Sensitive areas were shown to be fully protected using a 300 foot buffer (no aerial deposition) in a study using three commonly used helicopters, with various nozzle types applying picloram at a rate of 2 gallons/acre (USDA 2006c).

Additionally, helicopter application of clopyralid and picloram to control yellow starthistle in Hells Canyon, Idaho reported application method had greater than 90% percent control and no apparent damage to the native grasslands following treatment (TNC 2006). This application method was reported to be very accurate and negligible drift was observed. Some temporary set-back of some arrowleaf balsamroot (*Balsamorhiza sagittata*) was observed, however most plants recovered.

Table 22 - Summary of the Influence of Various Factors on Spray Drift

Factor	More drift	Less drift
Spray particle size	Smaller	Larger
Release height	Higher	Lower
Wind speed	Higher	Lower
Spray pressure	Higher	Lower
Nozzle size	Smaller	larger
Nozzle orientation (aircraft)	Forward	Backward
Nozzle location (aircraft)	Beyond 2/3 wing span	2/3 or less wing span
Air temperature	Higher	Lower
Relative humidity	Lower	Higher
Nozzle type	Produce small droplets	Produce larger droplets
Air stability	Vertially stable air	Vertical movement of air
Herbicide volatility	volatile	Non-volatile

Glyphosate was ranked as third or fourth choice for most herbicides (i.e., not the preferred option) because it is non-selective (i.e. it will kill any plant that comes into contact with it), and has the potential to leave bare ground potentially ripe for new invasives to establish. Selective herbicides are more desirable for maintaining as much native vegetation on site as possible.

Herbicide Effects on Pollinators

Limited research is available that addresses impacts from invasive plants on mutual relationships between plant pollinators and native plant communities. One study has indicated that exotic plants may compete better for native plant pollinators by producing more desirable nectar and therefore increasing fitness and reproductive ability of the non-native plant (Levine et al. 2003). Presently, little is known about native plant and native plant pollinators in general and efforts in understanding these interactions are just beginning to study basic aspects of plant-pollinator interactions for optimal management decisions to be made for conservation of these interactions in natural systems (Kearns et al. 1998). It is estimated that there may be between 130,000 and 200,000 invertebrate and vertebrate species that regularly visit the flowers of higher plants, which depend on these animals to assure cross-pollination. The majority of flowering plants in the world (88 percent) are pollinated by beetles, followed by wasps (18 percent) and bees (16.6 percent of flowering plants) (Buchman and Nabhan, 1996).

Treatments that reduce invasive plants, positively impact the native plant community when the native plants are restored. Very little information is available on the effect of herbicides on native pollinators. Most information is related to impacts on the non-native honey bee. It is known that pollinators can be directly affected by spray or indirectly when plants needed as food for adults or larvae are eliminated by herbicides (Shepaherd et al., 2003). The only known quantified effects are from direct spray. The herbicides approved for use in the regional FEIS are not expected to have toxic effects when directly sprayed on honeybees at the typical Forest Service application rates.

However, glyphosate and triclopyr, may have some toxic effects if applied at the maximum application rate proposed by the Forest Service (SERA, 2003-glyphosate; SERA, 2003-Triclopyr). Table 23 lists the potential herbicide doses for bees in a direct spray scenario.

Table 23 - Toxicity levels for bees from exposure totypical herbicide application rates

Herbicide	Typical Application Rate	Potential Dose for Bee	Toxic Level for Bee
Chlorsulfuron	0.056 lb/ac	8.98 mg/kg	>25 mg/kg (LD50)
Clopyralid	0.350 lb/ac	56.10 mg/kg	909 mg/kg (no mortality)
Glyphosate	2.000 lb/ac	321.00 mg/kg	540 mg/kg (NOAEC)
Imazapic	0.130 lb/ac	16.00 mg/kg	387 mg/kg (no mortality)
Imazapyr	0.450 lb/ac	72.10 mg/kg	1000 mg/kg (no mortality)
Metsulfuron Methyl	0.030 lb/ac	4.81 mg/kg	270 mg/kg (NOEC)
Picloram	0.350 lb/ac	56.10 mg/kg	1000 mg/kg (no mortality)
Sethoxydim	0.300 lb/ac	60.10 mg/kg	107 mg/kg (NOAEL)
Sulfometuron Methyl	0.045 lb/ac	7.21 mg/kg	1,075 mg/kg (NOEC)
Triclopyr BEE	1.000 lb/ac	160.00 mg/kg	>1,075 mg/kg (LD50)
Triclopyr TEA	1.000 lb/ac	160.00 mg/kg	>1,075 mg/kg (LD50)
NP9E (main generic ingredient in most surfactants)	1.67 lbs/ac	268.00 mg/kg	unknown

Uncertainty exists regarding the effects of herbicides on non-target plant species and pollinators because native species are not the usual test species for EPA toxicity studies. The EPA performs studies predominantly on crop species. Boutin et al. (2004) concluded that it was likely that the current suite of tested species were not representative of the habitats found adjacent to agricultural treatment areas,

and suggested the current suite of tested species might cause an unacceptable bias and underestimated risk. Because of the lack of studies available to fully assess the impacts to native pollinators, it is possible that some short term impacts to pollinators in localized areas could occur from herbicide treatments. Long-term impacts would not be expected because annual herbicide treatments are presently proposed on less than .3 percent of the forest landbase leaving over 99 percent of the forest lands serving as future native pollinator sources after invasive areas are restored or recovered to native vegetative states.

Herbicide Effects on Plant Diversity

Just as changes in plant diversity or species composition can occur due to invasive plants, changes can also occur due to treatments. Short-term changes in species dominance can lead to long-term shifts in plant community composition and structure. Repeated treatments over time could favor tolerant species, which in turn could shift pollinators available to a community.

Some studies cited in this EIS found that species diversity was not affected by herbicide treatment. Species diversity was determined using the number, or richness, of species found on a site. Diversity was then evaluated by comparing the distribution of the number of species by total cover of the plant community using diversity indices. More species distributed across an area equates with higher species diversity.

The number of species on a site may not significantly change, but the composition of these species could change. For example, replacing perennial natives with the same number of non-native annuals may not change species richness, but could change composition enough to affect other components of the ecosystem. Naeem et al. (1999) summarized studies related to biodiversity and ecosystem functioning. Recent theoretical models predict that decreasing plant diversity leads to lower plant productivity. These models also show diversity and composition are equally important determinants of ecosystem functioning.

A completely integrated invasive plant strategy should include multiple herbicides because as DiTomaso (2001) points out, continuous broadcast use of one or a combination of herbicides will often select for tolerant plant species. When broadleaf selective herbicides are used, noxious annual grasses such as medusahead, cheatgrass or barbed goatgrass may become dominant. Population shifts through repeated use of a single herbicide may also reduce plant diversity and cause nutrient changes. For example, legume species are important components of rangelands, pastures, and wildlands, and are nearly as sensitive to clopyralid as yellow starthistle. Therefore, repeated clopyralid use over multiple years may have a long-term detrimental effect on legume populations.

3.2.5 Treatment Effectiveness by Alternative

Effective treatments are defined as those that reduce the extent of invasive plants so that the area can reach its desired condition. Invasive plants are considered to be effectively controlled when acres of plant spread is less than or equal to the annual acres successfully treated (USDA, 2005b). 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. Treatment effectiveness is often enhanced by using a combination of treatment methods and prevention activities applied according to IWM 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 persistent species like spotted knapweed. Herbicide treatment alone was found to be most cost effective in the short-term but the combination of treatments maintained better control in the long-term. For example, biological control combined with herbicides could prove more cost effective if insects could establish and maintain long-term control. The regional FEIS (USDA 2005) suggests that with prevention standards implemented in combination with use of chemical treatments are approximately 94-96 percent effective in reducing the rate of invasive species spread (USDA 2005, and Bulkin 2006).

The Umatilla National Forest presently treats invasive weeds according to the *Umatilla National Forest Environmental Assessment for Managing Noxious Weeds* (USDA, 1995). This document incorporated the integrated weed management (IWM) practices emphasizing prevention and non-chemical control strategies prior to the use of herbicides. Under this 1995 EA, 157 sites (1,339 acres) became eligible for biological treatment, 29 sites (41 acres) remained eligible for manual treatment and 587 sites (1,391 acres) were eligible for herbicide treatment using three herbicides, glyphosate, dicamba, and picloram. One additional project (1998 Eden Timber Sale) added 59 additional invasive species sites (383 acres) approved for herbicide treatments.

Presently, with adoption of the 23 regional standards into the forest plan, treatment includes use of two herbicides (dicamba is not approved under the amended forest plan); biocontrol agents on previously specified sites and manual and mechanical treatments are allowed on new infestations.

Alternative A – No Action

Under the No Action Alternative, invasive plant treatments would be limited to areas authorized under the existing “95” EA decision documents. The “95 EA” approved use of herbicides on 587 sites (1,391 acres) on the Umatilla National Forest (USDA 1995). Amendments to this decision added an additional 59 sites (383 acres) approved for chemical treatments (USDA 1998). The total number of sites approved for chemical treatments represents 36 percent of the total number of sites presently mapped. New infestations have been and would continue to be treated with manual and mechanical methods. Methods of treatment for each alternative are summarized in Table 24. Invasive plant sites have continued to increase over the years and, if left untreated, will continue to expand based on projections of spread (Figure 9 below). These expanding, spreading populations would become increasingly more difficult and costly to control in the future and further degrade native plant habitats. Invasive plants would continue to displace native plant species, thereby decreasing vegetative diversity, not to mention serve as additional seed sources for new infestations both on and off federal lands.

Table 24 - Treatment Methods Proposed for Each Alternative

Treatment Methods	Alternative A No Action1	Alternative B Proposed Action	Alternative C No Broadcast in Riparian	Alternative D No Aerial herbicide
Upland Areas	**Acres**			
Manual, mechanical, biological and/or chemical	1,252	14,456	14,456	15,131
Chemical Treatment in Riparian Habitat Conservation Areas [2,3]				
Broadcast	0	3,022	0	3,022
Spot only (including wicking and wiping)	522[1]	2,538	5,560	2,538
All areas				
Bio-Control only	1339	3,917	3,917	3,917
Manual only	41	41	41	41
Aerial only	0	675	675	0
Total Acres Treated	**3,154**	**24,649**	**24,649**	**24,649**

[1]No action alternative includes ’95 EA and all amendments to the document. Restrictions on herbicide us under this alternative allows no chemical application within 100’ of streams or standing body of water.
[2]Riparian Habitat Conservation Areas (RHCA) as designated under PACFISH, INFISH
[3]Riparian acres are included within the total acres treated.

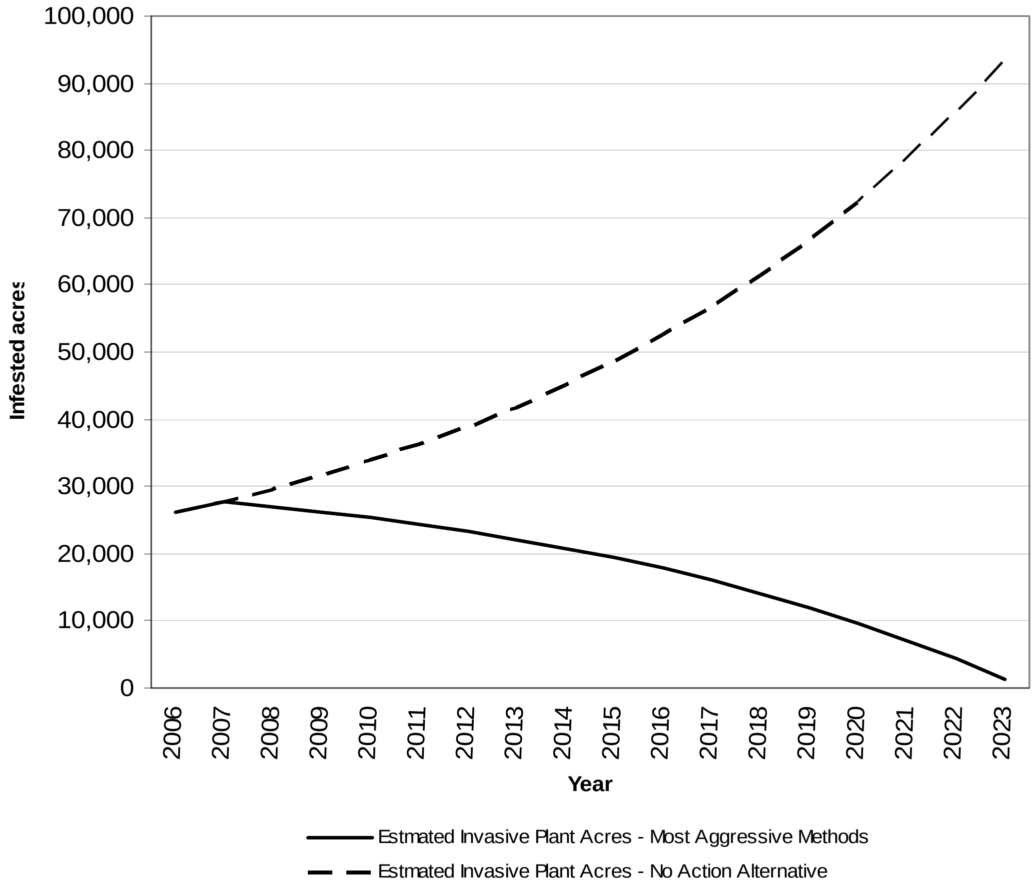


Figure 9 – Estimated invasive species spread for the No Action Alternative and the Proposed Action Alternatives.

Assumptions for invasive species growth include: 8-12 percent spread annually, implementation date of 2008, 4,000 acres treated annually, 25 percent and 80 percent effectiveness with No Action Alternative and Proposed Action Alternative, respectively.

Herbicide use is limited to two herbicides approved for this alternative (glyphosate and picloram). Table 25 describes the number of herbicides available for use and treatment effectiveness by alternative.

Table 25 - Herbicide formulations, invasive plant sites, total acres treated and treatment effectiveness for all proposed alternatives

Measuring Factor	Alternative A – No Action	Alternative B – Proposed Action	Alternative C – Restricted Riparian	Alternative D – No Aerial Application of Herbicide
# of herbicide formulations available for use	2[1]	10	10	10
# of invasive plant sites that could be treated	832	2,069	2,069	2,069
# of invasive plant sites that could be treated with herbicides either alone or in combination with other techniques	646	1,812	1,812	1,812
Total acres treated using all methods	3,154[2]	24,646	24,646	24,646
EDRR (including herbicide use)	No	Yes	Yes	Yes
Treatment Effectiveness	Low	Highest	High	High
% of Total Forest Landbase Treated with Chemicals (all identified acres/annually)[3]	Apprx: 0.12%, <0.008% annually	Apprx: 1.5%, 0.3% annually	Apprx: 1.5%, 0.3% annually	Apprx: 1.5%, 0.3% annually

[1]Previous herbicide applications prior to the incorporation of the regional guidelines into the forest plan, glyphosate, dicamba and picloram were approved for use. Dicamba will not be used in sites approved for herbicide under the no action alternative in the future

[2]This acreage represents acres approved under existing NEPA documents; additional new acres are treated using manual and/or mechanical methods. Average annual treatment forest wide is approximately 3,500 acres.

[3] These values based on currently identified infested acres, 3,500 – 4,000 acres treated annually, EDRR estimates not included.

Summary of Treatment Effectiveness for Alternative A – No Action Alternative

Only 8-9 percent of infested acres would be approved for herbicide treatments - With only 8-9 percent of the acres available for herbicide treatment and approximately only 5 percent treated with bio-control methods. All remaining acres (21,536) would need to be treated manually and would likely need multiple years of repeated treatment to control and in some cases may not ever control. This less effective method of control would likely lead to the continued displacement of native plant species and increased spread of invasive species.

Fewer treatment and herbicide options would be available - Only two herbicides are available for use on a limited number of acres. Available herbicides are not as effective on target invasive species as currently approved and proposed herbicides in other alternatives. For instance, the preferred herbicides for some of the most abundant invasive plant species would not be available for use e.g. clopyralid on knapweeds, metsulfuron methyl on houngdtongue and sulfometuron methyl for medusahead. Limited use of herbicides, combined with less effective herbicides for target species would result in additional loss of native plants and habitats. Treatment methods do not include use of aerial herbicide methods which can be an effective and rapid means of controlling or eradicating large infestations of invasive weeds, particularly in areas that have steep slopes, rocky soils, and are difficult or lack access to effectively treat from the ground.

Continued spread of invasive species forest wide - Estimates of present effectiveness of this alternative and projected annual rate of spread would not effectively address public concerns related to continued spread of invasive species (Figure 9 this section).

Alternative B –Proposed Action

Under the Proposed Action alternative all currently mapped invasive species would be treated with the most effective methods to control, contain or eradicate invasive plants, including the 10 newly approved herbicides and surfactants approved in the Regional FEIS. Estimates of annual treatment acres is expected to be approximately 4,000 acres, yet could vary based on funding. EDRR to newly identified infested areas would follow the decision tree matrix for treating invasive weeds and would comply with all PDFs as outlined in Chapter 2.2.3 of this document. As directed by PDFs, the use of all treatment methods combined with prevention and restoration methods amended to the forest plan from the Regional FEIS is expected to decrease existing invasive species populations over time. In addition to the increased effectiveness of treatment options, EDRR will also decrease the potential for continued spread and new establishment of invasive plants on the forest.

Summary of Treatment Effectiveness for Alternative B – Proposed Action Alternative

More sites, acres and more effective methods would be approved for treatment under this alternative compared to the No Action Alternative. Because this alternative also allows the use of all 10 herbicides approved in the Regional FEIS, more effective control of species is expected. Using the decision tree matrix and PDFs also allows the same treatment methods on unknown future sites while still protecting forest resources. Where feasible, this alternative also allows more broadcast spraying of herbicides than Alternative C. This alternative allows aerial application of herbicides on specific identified sites which is not allowed under Alternative A or D.

More acres could be treated more efficiently, therefore increasing overall treatment effectiveness where necessitated by size and density of the invasive plant population. This alternative would allow aerial broadcast spraying of herbicides on sites presently proposed and on potential future sites that fit PDF criteria and application guidelines. Aerial spraying would, more efficiently address large infestations, particularly on steep rocky slopes and soils that otherwise are difficult to access safely.

Expected effectiveness of this alternative combined with projected annual rate of spread would address the public concerns of continued spread of invasive species across the forest (Figure 9 this section).

Alternative C –No Broadcast Herbicide Treatment in Riparian Areas

Under alternative C all currently mapped invasive species would be treated the same as under the Proposed Action. However, no broadcast treatment methods would be allowed in riparian areas. All acres proposed within the riparian areas would be treated using spot herbicide treatments in addition to manual and mechanical methods. Estimates of annual treatment acres would be similar to those reported in the Proposed Action. EDRR to newly identified infested areas would follow the Treatment Decision Tree (Figure 8, Chapter 2) for treating invasive weeds and would comply with all PDFs as outlined in this document. The elimination of broadcast as a method of treatment in riparian areas may reduce the treatment effectiveness because spot treatments often miss small, emerging plants that would likely have been killed by broadcast spraying. With this alternative there is an increased potential for spread in riparian areas that could serve as a source to infest upland sites. This would likely result in more herbicide treatment over time and add cost to the project; however, the effectiveness of this alternative is significantly greater in comparison to the No Action alternative because it authorizes treatment of many more known infestations and allows for herbicide us of EDRR sites prohibited under the no action alternative.

Summary of Treatment Effectiveness for Alternative C – No Broadcast Herbicide Treatment in Riparian Areas

Similar to Alternative B - All herbicide restrictions and buffers as described in the PDFs remain the same as in Alternative B, except no broadcast herbicide treatment would be allowed in riparian areas (3,022 acres). Herbicide methods of treatment that reduce the potential for off site drift such as spot, wiping, or wicking herbicide applications as well non-herbicide methods are possible. The elimination of broadcast treatment as an option in this area would reduce the effectiveness of the treatment especially for species that are widespread and the seedbank or underground vegetative parts capable of re-establishment in future years is large. Effectively controlling species that exhibit this type of growth morphology would require multiple repeated treatments over a period of years.

Expected effectiveness of this alternative in combination with projected annual rate of spread is expected to be much higher than the No Action Alternative and more similar to effectiveness of alternative B because of more sites are approved for a variety of different treatment options in combination with EDRR strategy. Although there is a potential for less effective treatments to be used in the areas where broadcast methods are not possible, these estimates are worst case scenarios and it is likely that not all of these acres could be or would be broadcast treated. This alternative is also expected to effectively address public concerns that the increase of invasive species across the forest would not continue

Alternative D –No Aerial Herbicide Treatment

Under alternative D all currently mapped invasive species would be treated the same as the Proposed Action however, no aerial treatment methods would be allowed on any proposed (675 acres) or future infested acres. All PDFs would be implemented as outlined for riparian areas and PDFs for aerial application would be eliminated. Estimates of annual treatment acres would be similar to those reported in the Proposed Action. EDRR to newly identified infested areas would follow the decision tree matrix for treating invasive weeds and would comply with all PDFs as outlined in this document. The elimination of the aerial treatment method in currently mapped and future sites could reduce the effectiveness of treatment in these areas because some sites may not ever be treated due to safety issues or costs associated with alternative methods of treatment (i.e. hiking in with backpack sprayers). These sites may also be dropped to a lower priority for treatment due to cost factors.

Summary of Treatment Effectiveness for Alternative D – No Aerial Herbicide Treatments

Similar to Alternative B - All herbicide restrictions and buffers as described in the PDFs remain the same as in Alternative B, except no aerial herbicide treatment would be allowed on 675 acres. Herbicide treatment on these acres is still possible using all other methods. However, due to the steepness and remoteness of these proposed aerial sites the use of mechanical equipment such as ATVs for broadcast treatment or mowers is not possible. Therefore, any treatment of these areas would require work crews to hike in and treat the areas and if the terrain is too steep and poses a safety hazard the area will not be treated. The elimination of aerial treatment reduces treatment effectiveness in these areas now or in the future due to the potential inability to treat either from a safety or monetary standpoint. Sites that are presently proposed for aerial herbicide application consist of high priority aggressive invasive species (spotted and diffuse knapweeds and yellow starthistle), if left untreated expected increase in these infested acres is anticipated.

Estimates of effectiveness associated with this alternative in combination with projected annual rate of spread is expected to be much higher than the no action alternative and more similar to effectiveness of Alternative B because of more sites are approved for a variety of different treatment options in combination with EDRR strategy. Although there is a potential for less effective treatments to be used in the areas because the proposed aerial sites would be treated with the most efficient methods, the presently proposed areas would still receive treatment (via backpack sprayers or other methods). Additionally there is a potential for unknown future sites to establish where access issues may be a problem however, EDRR strategies are expected to address these issues in most cases and quickly eradicate areas before they are spread. This alternative is also expected to effectively address public concerns that the increase of invasive species across the forest would continued.

3.2.6 Impacts of Treatments to Native Vegetation including SOLI by Alternative

Alternative A – No Action

Direct and Indirect Effects

Native Vegetation

Current numbers of acres approved for herbicide use would remain the same placing heavy reliance on manual and mechanical treatments for all presently identified sites and all future sites. The removal of invasive plants using manual or mechanical techniques could directly affect native plants and plant communities. Direct negative effects would be unintentional removal, mowing or trampling of flowers, fruits, or root systems of native plants, but should be minimal with properly trained crews. Vigor could be reduced in individuals due to repeated treatments, however; impacts would be short lived, not likely to last a complete growing season. The removal of individuals could also directly affect remaining native plant community components negatively by reducing native seed production (if methods such as mowing are used), creating soil disturbance, and opening the canopy (understory, shrub layer or overstory depending on the species). For instance, hand-pulling trials conducted on spotted knapweed in western Montana and on diffuse knapweed in west-central Montana resulted in an increase in bare ground from 2.7 percent to 13.7 percent during the first year after treatment (Brown et al. 2001). Although these hand-pulling trials were shown to reduce the potential for knapweed seed production by exhibiting 100 percent flower control and 56 percent plant control (Brown et al. 2001) follow-up investigations on resultant vegetation from resident seed banks after treatment were not reported.

Indirect effects from these changes include microsite shifts such as reduction in productivity, reduction in soil moisture, disruption of mychorrhizal connections and increase in surface temperatures. These indirect effects could allow invasive species to reinfest the bare ground because many invasive species are aggressive, opportunistic plants that can thrive in the harsher microsites described above. Invasive plant seed introduction could occur through various means of introduction (windblown seeds, human transport etc.).

Alternatively, native plant communities could be affected positively by providing the space for increased growth in community size. One possible scenario is that removal of invasives will encourage native seed dormant in the soil to germinate due to less competitive conditions.

Dremann and Shaw (2002) documented the success of converting live oak woodland from 99 percent exotic species cover to 85 percent native plant cover through a strategy of timed manual/mechanical removal that released the native seed bank. No reseeding was necessary. Overall effects can vary by species and level of past and present infestation.

No impacts are anticipated from the use of biocontrol agents (see impacts to native vegetation common to all alternatives)

Herbicide use under this alternative would likely cause mortality to some, non-target native plants. Only two herbicides are available under the No Action Alternative for use on seven percent of the currently mapped invasive species sites (less than 0.001% of the forest). These two herbicides do not provide the best options for the variety of invasive plant species and situations that are present within the Forest. For example, the two chemicals available for use (picloram and glyphosate) are not considered to be highly effective on houndstongue, and are considered by weed experts to be herbicides of last choice. For some areas this may require more initial herbicide volume or more repeated applications compared to the same sites treated under Alternative B, C, or D that could use more specific herbicides to target invasive species. Additionally, under Alternative A, approved herbicide treatments rely heavily on picloram to treat a large proportion of sites. Picloram is considered a higher risk herbicide to the environment compared to the other herbicides because it is very mobile and persistent, and because of the levels of hexachlorobenzene (Bautista 2005). This persistent herbicide can readily move to non-target native plants through root translocation or runoff.

The threat of off-site damage to native plants and plant communities around sites presently approved for herbicide use is expected to be higher under under the No Action Alternative compared to alternatives that use more selective herbicides. Overall effects to non-target vegetation from herbicide use would be substantially less compared to Alternatives B, C or D, because less than 10 percent of the acreage approved for treatment under the Proposed Action alternatives is approved under the No Action Alternative. However, on sites approved for treatment under the No Action Alternative, greater negative effects would likely result with this alternative compared to herbicide treatment on the same sites under Alternatives B, C or D. The two approved herbicides available under the No Action alternative are general herbicides that would damage or kill more non-target plants sprayed compared to the more target-specific herbicides approved under the three action alternatives.

SOLI at highest risk (within 100 feet of invasive species)

In the No-Action Alternative, five SOLI with a total of eight occurrences have been treated under the existing EA. Seven of the eight SOLI occurrences (*Botrychium lanceolatum*- three sites, *Botrychium pinnatum*- one site, *Carex cordillerana*- two sites, and *Eleocharis bolanderi*- one site) were previously approved for herbicide treatments. The remaining occurrence was approved for treatment using non-herbicide methods. The invasive species presently being treated chemically near these approved SOLI sites are diffuse knapweed, tansy ragwort and sulphur cinquefoil with either picloram or Glyphosate and possibly dicamba in the past. The remaining seven species and 31 occurrences would only be protected from invasive species using manual or mechanical methods in the future. Table 21 lists the sensitive species, the number of occurrences on the Forest at risk, the invasive species documented nearby and if these specific sites have received invasive plant treatments under the existing EA.

SOLI species near invasive species being treated by manual or mechanical methods could be unintentionally damaged by removal or trampling of flowers, fruit, or root systems. Damage would likely be repeated because these treatments require repetition over many years. Impacts are likely to individual plants but minimal impacts to SOLI populations are expected because crews would be trained to identify and avoid SOLI species. Hand pulling would avoid impacts to individuals. Grubbing invasive plants could cause damage to nearby individual SOLIs by severing roots or corms but they would likely respout if corms are not severely damaged.

Risk to SOLI from herbicide use has previously been evaluated in existing analysis (USDA 1995) and no impacts were anticipated from treatments with existing PDFs. Even with herbicide treatments, monitoring indicates that the five sites treated with herbicide still have invasive species present. This could be attributed to the lower effectiveness of the herbicides used. Even though the herbicide did not impact the SOLI populations and their habitats are expected to continue to be at risk of invasive plant infestation under this alternative.

Lichens, bryophytes, and fungi

Impacts of invasive species to lichens, bryophytes, and fungi is not widely documented in the literature, likely due to taxonomic problems, lack of experts, the small size and intermixing of taxa in the field and the life history and variation of species. It is, however, widely recognized that alteration or loss of habitat resulting from invasive species infestations likely would affect these species. Unknown effects from herbicide treatments are possible. Most of the nonvascular SOLI exist in habitats that don't occur in the disturbed areas often associated with invasive species. Sites presently approved for herbicide use have been evaluated by the forest botanist or proposed to be surveyed prior to treatment if potential habitat of these species occurs. It is likely that if invasive species continue to spread across the forest as predicted with this alternative, habitats for these species would likely be more negatively impacted compared to the treatments proposed in Alternatives B, C and D.

All other SOLI –

The risks to all other SOLI within the forest are similar to risks to native vegetation and habitats in which they thrive. The reduced effectiveness of current treatment options, combined with inability to effectively treat any newly established invasive species near SOLI could threaten these species and their occurrence in the future. Most SOLI are not commonly located in frequently disturbed areas which is commonly where invasive species establish. However, since Alternative A would be less effective at controlling invasives plants, potential spread of invasives into SOLI habitats and associated threats to SOLI population viability would be considerably higher with this alternative compared to the other three alternatives.

Impacts to pollinators

Some impacts to pollinators could occur with the use of highest level of Glyphosate potentially used on sites approved for herbicide use with this alternative (SERA, 2003-glyphosate). There is, however, minimal impact expected to native plant pollinators because only 0.001 percent of the Forest is anticipated to be treated with herbicides, and likely only a portion of that percent would be treated with Glyphosate. If the highest allowable glyphosate application level was used some impacts to pollinators could occur with this alternative (SERA, 2003-glyphosate).

A greater percentage of invasive treatments would be manual or mechanical. Little to no effects to pollinators are expected from manual or mechanical treatments in the long term. Some short-term could occur due to the reduction of flower heads used as food sources for pollinators. Overall, fewer effects would be expected to pollinators under this alternative compared to Alternatives B, C, and D because fewer acres would be treated.

Summary of Effects to Plants for Alternative A-No Action Alternative

Alternative A is the least effective in treating invasive plants and therefore, poses the highest risk to native vegetation including SOLI.

Native vegetation will continue to be impacted by invasive plants - Native plants, and potentially SOLI, would continue to be displaced because this alternative allows less acres of treatment of invasive species and the treatment methods are less effective. A loss of native plant biodiversity, higher risks to SOLI and their habitats would likely result.

Less risk of 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. Picloram or glyphosate could be used to treat diffuse knapweed, common burdock, tansy ragwort and sulphur cinquefoil on only eight sites.

Alternative B – Proposed Action

This alternative proposes to treat inventoried invasive plant populations to achieve long-term site objectives using a multitude of treatment methods and herbicides for a more effective method for control, eradication, or containment of invasive weeds. The alternative also includes an EDRR strategy (Figure 8, Treatment Decision Tree, Chapter 2 this EIS) that allows treatment of newly identified or expanding invasive plant infestations with various treatment methods not available in the no action alternative.

The 10 herbicides analyzed and approved for use in the Regional FEIS would be available to more effectively control invasive plant infestations. This suite of herbicides would enhance the ability to choose herbicides that pose a lower risk to non-target plants (in some cases) yet remain effective at controlling target invasive species. Use of these methods and herbicides would follow all PDFs as outlined in Chapter 2 and tiers to the Regional ROD.

Direct and Indirect Effects

Native Vegetation

Impacts from manual and mechanical treatments would be similar to those as described in alternative A. The removal of invasive plants using manual or mechanical techniques could directly affect native plants and plant communities. Direct negative effects would be unintentional removal, mowing or trampling of flowers, fruits, or root systems of native plants, but should be minimal with properly trained crews. These effects could reduce native seed production, create soil disturbance, and open the canopy (understory, shrub layer or overstory depending on the species). However, under this alternative, manual and mechanical methods would typically follow herbicide treatments and seldom used as the primary control method.

Future sites using the Early Detection Rapid Response process may be appropriate for foaming or solarization/mulching techniques for invasive plant control. Such sites would have to be very small patches because both of these methods of treatments are very expensive (TNC 2006). Impacts to non-target vegetation would be limited to small areas. Both of these treatments use heat (plastic mulch in solarization, and steam combined with biodegradable sugar producing foam) to kill target invasives and therefore kill all plants in the treated area. Such treatments would likely be used where there are special resource concerns or where other methods are ineffective.

These sites would likely have higher levels of prioritization and monitoring and likely receive immediate revegetation and restoration methologies. Only short term effects in very limited areas are expected with these treatments.

EDRR sites may also be appropriate for the use of fertilizer/soil amendments and competitive planting as a method of controlling invasive weeds. Some short term, minor effects to community diversity may occur from the establishment of native species that thrive in the modified condition as established by the addition of soil amendments or seeding. No long-term impacts are expected because passive restoration techniques are designed to promote the establishment of desirable plant communities (USDA 2005).

Approximately 1.5 percent of the 1.4 million acres of the Umatilla National Forest are presently proposed for treatment using of herbicides. Proposed annual herbicide treatments would be 0.3 percent of the Forest area or 4,000 acres. Over time herbicide use would be expected to decline as known sites are effectively controlled and EDRR methodologies eradicate new sites.

This alternative has the greatest potential to negatively affect non-target plants. Because it would treat many more acres using herbicides than Alternative A it would cause mortality to more non-target plants. Because Alternative B proposes use of broadcast herbicide spraying in riparian areas it would likely have more negative effects to non-target riparian vegetation than Alternative C. Because Alternative B proposes aerial application of herbicides, it would likely have more negative effects on non-target plants due to chemical drift than Alternative D. However, these effects are considered short term and minor because the Regional prevention and restoration standards adopted by the Forest Plan (USDA 2005), the common control measures and the project design features (PDFs) are considered adequate to protect native plant populations.

The Action Alternatives (B, C, and D) allow the use of several new herbicides, some of which are associated with hazards to non-target vegetation (regional FEIS 4-27- 4-33) and as previously described above. Alternatively, some of these herbicides are more specific to certain plant families which would reduce impacts to native vegetation compared to the two chemicals available in the No Action Alternative. In turn, the reduced impacts to non-target species would aid the recovery of affected native plant communities. For instance alternative A only allows use of picloram and glyphosate. However, Metsulfuron methyl and chlosulfuron are recommend for treating houndstongue compared to other herbicides, clopyralid and chlorsulfuron controls tansy ragwort more effectively than picloram and glyphosate, and imazapic and sulfometuron methyl/chlorsulfuron, sulfumetruon methyl and sethoxydim controls medusa head more effectively than glyphosate. Infestations of houndstongue, tansy ragwort and medusa head are 6,071; 945, and 1,498 acres respectively. Being more effective means reducing the number of applications and volume of herbicide required compared to Alternative A. Risks to non-target vegetation are further reduced by careful implementation of PDFs and common control measure notes and supplemental information provided by local experts. Although some short-term negative effects to native vegetation likely will occur, this alternative would be more effective at accomplishing the projects purpose and need of containing, controlling and eradicating invasive plant infestations. Long term, Alternative B would likely be more effective at allowing native vegetation and plant communities to recover compared to Alternative A.

In summary, there would likely be more risk from herbicide impacts to non-target native vegetation because more acres and sites would be treated compared to Alternative A. The annual forest-wide risk to non-target effects from herbicide use between the no-action and the Proposed Action is less than 0.008 percent and 0.3 percent acres respectively.

Although more acres may be impacted by Alternative B, in the long-term native plant community health will improve because existing and potential future invasive plant sites will be more effectively treated.

SOLI at highest risk (within 100 feet of an invasive species)

Table 26 lists all SOLI site locations within 100 feet of an identified invasive species and the proposed (1st and 2nd choice) treatments for each individual site. For the federally listed species *S. spaldingii* invasive species sites within 1000 feet are listed. Risks to SOLI from each individual herbicide proposed for use are listed in Appendix B. For completed analysis of impacts to federally listed specie *S. spaldingii* see the Botany Report and Biological Assessment for Invasive Plants.

Effects from manual and mechanical methods as primary methods of treatment or as a follow-up treatment after herbicide treatment are expected to be the same as SOLI listed to in the No Action Alternative. Since no cultural methods are proposed close to any SOLI, no impacts are anticipated and, if used in the future, treatments would be directed by the forest botanist.

Risks to SOLI presently determined to be at highest risk from herbicide treatments would be minimized through the application of site specific PDFs. Therefore, no impacts are expected from Alternative B, except for the *Botrychium* species. Though *Botrychium* species depends on symbiotic relationships with soil fungi; the symbiotic and/or other unidentified interrelated multiple relationships are unclear. Triclopyr inhibits growth of some species of mycorrhizal fungi (Cox, 2000). Although triclopyr is not the preferred herbicide for treatment of invasive species identified near the *Botrychium* species, very little is known about impacts of other herbicides to soil fungi and microorganisms (USDA 2005). Therefore approved herbicides could potentially alter the relationship between these two species and associated soil fungi. Five sites proposed for chemical treatment are within 100 feet of a documented *Botrychium* species. Monitoring, required in the PDFs, would track direct impacts and, adjust buffers and treatment options to protect from potential future impacts. Therefore only short-term impacts would be expected from unknown herbicide impacts to inter-related symbiotic or mutualistic relationships. Information derived from monitoring results could be used to further protect any future *Botrychium* sites that could become at risk from invasive weeds.

Table 26 - Determination statements for each sensitive species occurrence within 100 feet of documented invasive species and impacts from alternative B, C, and D

Site no.	SOLI1	Invasive species nearby	Alt A	Alt. B	Alt. C	Alt. D	Proposed Treatment for Alternatives B, C, and D 1st choice, other methods also available
0614000011	*Astragalus arthurii*	diffuse knapweed scotch thistle	MIIH	NI	NI	NI	chem.
6140000073	*Astragalus arthurii*	yellow starthistle diffuse knapweed	MIIH	Ni	NI	NI	biocontrol
0614000200	*Botrychium species B. lanceolatum, B. minganense, B. montanum, B.pedunculosum, B. pinnatum*	spotted knapweed	MIIH	MIIH	MIIH	MIIH	chem.-riparian
0614000210	*Botrychium species B. lanceolatum, B. minganense, B. pinnatum*	diffuse knapweed	MIIH	MIIH	MIIH	MIIH	chem.
0614000212	*Botrychium lanceolatum*	canada thistle	MIIH	NI	NI	NI	biocontrol
0614000242	*Botrychium species B. lanceolatum B. minganense,*	diffuse knapweed tansy ragwort	MIIH	NI	NI	NI	biocontrol
0614000780	*Botrychium species B. lanceolatum, B. minganense, B. pinnatum*	spotted knapweed	MIIH	NI	NI	NI	biocontrol
0614000884	*B. lanceolatum*	diffuse knapweed	MIIH	MIIH	MIIH	MIIH	chem

Site no.	SOLI1	Invasive species nearby	Alt A	Alt. B	Alt. C	Alt. D	Proposed Treatment for Alternatives B, C, and D 1st choice, other methods also available
0614000235	*Botrychium minganense*	diffuse knapweed tansy ragwort	MIIH	NI	NI	NI	biocontrol
0614000198	*Botrychium pinnatum*	diffuse knapweed	MIIH	MIIH	MIIH	MIIH	chem.
0614000199	*Botrychium pinnatum*	tansy ragwort	MIIH	NI	NI	NI	biocontrol
0614000837	*Botrychium pinnatum*	canada thistle	MIIH	MIIH	MIIH	MIIH	chem.
0614000228	*Carex cordillerana*	common burdock	MIIH	NI	MIIH	NI	chem.-riparian
0614000759	*Carex cordillerana*	yellow starthistle	MIIH	NI	NI	NI	biocontrol
0614000841	*Carex cordillerana*	diffuse knapweed sulphur cinquefoil	MIIH	NI	MIIH	NI	chem.-riparian
0614000856	*Carex cordillerana*	diffuse knapweed sulphur cinquefoil	MIIH	NI	MIIH	NI	chem.-riparian
0614000876	*Carex cordillerana*	common burdock	MIIH	NI	MIIH	NI	chem.-riparian
0614000071	*Carex hystericina*	scotch thistle	MIIH	NI	MIIH	NI	chem.-riparian
0614000022	*Calochortus macrocarpus var. maculosus*	yellow starthistle scotch thistle	MIIH	NI	MIIH	NI	chem.-riparian
0614000058	*Calochortus macrocarpus var. maculosus*	yellow starthistle scotchthistle	MIIH	NI	MIIH	NI	chem.-riparian
0614000074	*Calochortus macrocarpus var. maculosus*	yellow starthistle scotch thistle	MIIH	NI	MIIH	NI	chem.-riaprian
0614000075	*Calochortus macrocarpus var. maculosus*	yellow starthistle diffuse knapweed	MIIH	NI	NI	NI	biocontrol
0614000183	*Calochortus macrocarpus var. maculosus*	diffuse knapweed	MIIH	NI	MIIH	NI	chem.-riparian

Site no.	SOLI1	Invasive species nearby	Alt A	Alt. B	Alt. C	Alt. D	Proposed Treatment for Alternatives B, C, and D 1st choice, other methods also available
0614000186	*Calochortus macrocarpus var. maculosus*	diffuse knapweed	MIIH	NI	MIIH	NI	chem.-riparian
0614000187	*Calochortus macrocarpus var. maculosus*	tansy ragwort	MIIH	NI	NI	NI	biocontrol
0614000878	*Eleocharis bolanderi*	houndstongue	MIIH	NI	NI	NI	chem.
0614000881	*Eleocharis bolanderi*	spotted knapweed diffuse knapweed	MIIH	NI	NI	NI	chem.
0614000882	*Eleocharis bolanderi*	spotted knapweed	MIIH	NI	NI	NI	chem.
0614000883	*Eleocharis bolanderi*	houndstongue	MIIH	NI	NI	NI	chem.
0614000757	*Leptodactylon pungens ssp. hazeliae*	diffuse knapweed	MIIH	NI	NI	NI	chem.
061400076	*Silene spaldingii1*	Yellow starthistle, scotch thistle	LAA	NLAA	NLAA	NLAA	chem.
0614000105	*Trifolium douglasii*	diffuse knapweed	MIIH	NI	NI	NI	chem.
0614000314	*Trifolium douglasii*	diffuse knapweed houndstongue	MIIH	NI	NI	NI	chem.
0614000330	*Trifolium douglasii*	St. john's wort	MIIH	NI	MIIH	NI	chem.-riparian
0614000761	*Trifolium douglasii*	diffuse knapweed	MIIH	NI	NI	NI	chem.
Totals for Weed Sites, Species and Occurrences							
35 Weed sites	***13 species 44 occurrences***						

NI = No impact, MIIH= May Impact Individuals or Habitat, But Will Not Likely Contribute to a Trend Towards Federal Listing or Loss of Viability for the Population or Species
Determinations were derived from the combination of treatment effectiveness, risks from herbicides, and species habitat requirements. All PDFs would be implemented.

Lichens, bryophytes, and fungi

Impacts of invasive species to lichens, bryophytes, and fungi is not widely documented in the literature, likely due to taxonomic identification problems, lack of experts, the small size, the life history and variation observed within individual species. Additionally, impacts from herbicides on these taxa have not been widely studied. Because bryophytes and lichens receive their mineral nutrition and water from precipitation, splash water, or directly from the atmosphere, the species listed in Table 26 could be impacted from potential herbicide drift.

As previously stated, triclorpyr inhibits the growth of mycorrhizal fungi, beneficial fungi that increases the ability of plants to uptake nutrients (Cox, 2000). Glyphosate and triclopyr applications in the field and laboratory have also reported reduced diversity and negative impacts to bryophytes and lichens (Newmaster et al. 1999); in some studies, herbicide applications have shown little effect on other species of bryophytes and lichens in field and laboratory conditions (Atkinson et al. 1980; Balcerkiewicz and Rusińska 1987, Bond 1976, Mabb 1989, Pihakaski and Pihahaski 1980, Ronoprawiro 1975, Rudolph and Samland 1985, Stjernquist 1981). Supportive field trials are few. Physiological research is also needed to explain whether herbicides directly alter the physiology of bryophytes and lichens or simply affect their water relations due to loss of associated microhabitats. Bryophytes listed in Table 20 may be impacted by herbicide treatments, but impacts are uncertain and hard to predict. It is expected that the implementation of PDFs that outline effectiveness monitoring will provide much needed information and adjust buffers to protect these species if negative impacts are observed. Short term impacts could be expected. Long-term positive effects to habitats are expected because effective treatment of existing and future invasive plants would restore, protect and maintain habitats these species require.

Impacts to pollinators

Some additional impacts to pollinators from herbicide treatments could occur over and above those listed for alternative A with the addition of triclopyr as a new herbicide. Risk assessments indicate that triclopyr and Glyphosate may have some toxic effects if applied at the maximum application rate proposed by the Forest Service (SERA, 2003-glyphosate; SERA, 2003-Triclopyr). Some shifts in native pollinators due to herbicide treatments may occur at some invasive plant sites that are more than five acres (35 % of sites), highly infested and proposed for broadcast treatment. The level of infestation on these larger sites is unknown. Sites could have a few invasive plants scattered across an area or be heavily infested. In the worst case scenario if all 35 percent of the sites were heavily infested and broadcast sprayed, only 0.003 percent of the forest area where native plant pollinators occur would be impacted. Treatments proposed and standards approved as outlined in the Regional FEIS broadly estimate that the methods would be 80 percent effective thereby it is expected that any impacts to specific sites would be short term and the ability of native pollinators to migrate into potentially impacted area from other nearby areas is highly probable.

Little to no effect to pollinators is expected from manual or mechanical treatments in the long term. Some short-term (year of treatment) effects could occur due to the reduction of flower heads used as food sources for pollinators.

All other SOLI

The risks to all other SOLI within the forest are similar to risks to native vegetation. Most SOLI are commonly located in undisturbed areas and not in disturbed areas where invasive species are commonly established. Many other SOLI exist on the Forest, and are not presently considered to be at highest risk from invasive species infestation. Invasive sites with high potential for spread that are near, but more than 100 feet from identified SOLI, would likely receive high priority for treatment to fully protect SOLI and their habitats. PDFs requiring surveys of potential habitats, adherence to the project decision tree, and incorporation of all PDFs should protect SOLI discovered in the future. Increased levels of treatment effectiveness combined with EDRR strategies will further protect future SOLI sites and habitats that might otherwise be impacted from invasive species establishment.

Summary of Effects to Plants for Alternative B—Proposed Action Alternative

Currently inventoried invasive sites will be treated as prioritized by each district and as funding allows. Over time currently impacted native plant communities and habitats will likely recover with implementation of PDFs, prevention and restoration standards and EDRR strategies.

Risks to SOLI within 100 feet of an invasive site would be minimized through the application of site specific PDF - No impacts to SOLI (at highest risk) or their associated habitats is expected except for Botrychium species and Cypripedium fasciculatum where project activities may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability for the population or species. This conclusion of risk was based on specific herbicide characteristics and best available information related to individual SOLI habitat requirements.

Risks to all other SOLI forest wide would be reduced - More effective invasive plant treatment and herbicide options would be available (compard to Alternative A) thereby reducing the present risk of invasive spread into other SOLI areas. Additionally, EDRR strategies in conjunction with PDFs provide for adequate protection of SOLI sites if invasive plant species pose a risk in the future.

Impacts to bryophytes and lichens and fungi are not presently known - Project Design Features would require surveys for these species as well as post treatment monitoring and adaptive management that could adjust buffers, if needed, to further protect these species from unknown effects.

Risks to pollinators may increase - The addition of triclopyr to the list of available herbicides could increase the risk to pollinators (compared to Alternative A). Glyphosate and triclopyr, may have some toxic effects if applied at the maximum application rate proposed by the Forest Service (SERA, 2003-glyphosate; SERA, 2003-Triclopyr).

Alternative C – Restricted Riparian

This alternative is very similar to alternative B except broadcast methods (hand broadcast and boom mounted sprayers on vehicles) would not be allowed in riparian areas. This alternative addresses concerns about risk of herbicide delivery to water and potential impacts to fish. Based on GIS mapping and stream buffers an estimated 3,022 acres would not be broadcast treated.

Direct and Indirect Effects

Native Vegetation and SOLI at highest risk (within 100 feet of an invasive species)

This alternative reduces the potential for non-target plant impacts by reducing the risks of drift from broadcast applications. However, spot treating individual invasive plants would likely be less effective and more costly than broadcast treatments, and repeated treatments within the same site may be required for species with a long-lived seed bank.

Broadcast treatments spray herbicides over a wide swath of vegetation and bare soil if present, and can be effective at killing emerging invasive seedlings due to the persistent nature in the soil of some herbicides.

Lichens, bryophytes, and fungi

As stated previously, impacts from invasive species and from herbicides to lichens, bryophytes, and fungi are not widely documented. This alternative would reduce the impacts associated with drift and broadcast application in riparian areas. It is possible that this could be of importance since many of these species thrive in these wetter environments; however, at this point in time it is difficult to predict. Future surveys, monitoring and adaptive management techniques outlined in PDFs will provide additional information.

All other SOLI

Impacts to all other SOLI are similar to those discussed in the Proposed Action. There could be a slight increase in risk to SOLI in the future because broadcast methods could not be used nearby (within 300 feet) to more effectively treat a newly established invasive species. It is expected that EDRR strategies would reduce and eliminate the potential of this risk. Little to no measureable impacts to habitat would be expected should chemical use be needed.

Impacts to pollinators

Impacts to pollinators are expected to be similar to those described in the Proposed Action; however, the potential for direct spray to pollinators (from drift) in the riparian areas where broadcast treatments are limited would be greatly reduced.

In summary the effects from the implementation of Alternative C are similar to those described in the Proposed Action. There would be a reduction of impacts to non-target plants, pollinators, and SOLI (including lichens, bryophytes and fungi) from drift associated with broadcast treatments in riparian areas (potentially 3,022 acres). Without broadcast methods treatment effectiveness could be less, potential for invasive species spread could increase, and potential degradation of habitat could last longer. This could result in a longer, more expensive control period using spot, manual and mechanical methods.

Alternative D – No Aerial Herbicide Application

This alternative is similar to Alternative B except it does not allow aerial herbicide application on currently proposed (675 acres) sites. This alternative addresses concerns about risk of herbicide drift, impacts to non-target plants, herbicide delivery to water and potential impacts to fish.

Table 27 - Proposed aerial sites on the Umatilla National Forest. All sites are located on the Pomeroy Ranger District

Site no.	Invasive species	Proposed treatment	Acres
06140400051	yellow starthistle	chem-riparian	3
06140400059	diffuse knapweed	chem	211
06140400061	diffuse knapweed	chem	3
06140400063	yellow starthistle	chem	8
06140400067	diffuse knapweed	chem-riparian	2
06140400082	diffuse knapweed	chem	1
06140400086	diffuse knapweed	chem	7
06140400188	diffuse knapweed	chem-riparian	3
06140400191	yellow starthistle	chem	134
06140400287	yellow starthistle	chem	286
06140400292	diffuse knapweed	chem	4
06140400495	spotted and diffuse knapweed	chem-riparian	5
06140400498	yellow starthistle and diffuse knapweed	chem	3
06140400499	yellow starthistle	chem	6
Total			**675**

Direct and Indirect Effects

Native Vegetation

This alternative reduces the potential for impacts to non-target plants because it reduces the risks of drift associated with aerial broadcast applications. Currently, 675 acres are proposed for aerial treatment application in Alternative B. Sites proposed for aerial herbicide application often have very limited access; costs for ground based methods of treatment in these areas are high, and worker safety is a concern due to steep slopes. Where worker safety is not a concern, the potential for treatment using backpack sprayers is still a viable alternative, but may have a lower priority because of time and cost constraints. Since such sites may not be as effectively treated as they could be using aerial application methods, the potential for weeds spreading in remote areas is greater, and greater long term impacts to native vegetation are probable.

SOLI at highest risk (within 100 feet of an invasive species)

Presently there are no SOLI located near proposed aerial sites, therefore no impacts are expected. Follow PDF’s for newly identified invasive species.

Lichens, bryophytes, and fungi

As stated previously, impacts from invasive species and from herbicides to lichens, bryophytes, and fungi are not widely documented. This alternative would reduce the impacts associated with drift and aerial broadcast application. At this point in time, due to lack of scientific studies effects are difficult to predict.

Impacts to pollinators:

Impacts to pollinators are expected to be similar to those described in the Proposed Action; however, the potential for herbicide contact to pollinators from drift during aerial broadcast treatments would be eliminated.

In conclusion, numerous factors need to be considered in the assessment of direct and indirect effects of this project. Treatment effectiveness is important when measuring effects. That is, if the invasive species still persist, then effect on non-target species will also persist. However, other effects and impacts may be equally important but not always as easily determined, mostly due to the lack of scientific knowledge to conclusively support determinations. Table 28 lists risk factors related to botanical resources for this project. Each factor is classified into low, medium and high risk. Risk factors are not considered to be equal in weight to other risk factors**.**

Table 28 - Risk factor comparison summary table for all alternatives

Risk Factor	Alt A – No Action	Alt B Proposed Action	Alt C. Restricted Riparian	Alt D. No Aerial Broadcast Treatment
Loss of native plant communities and plant bio-diversity from invasive species infestation	high	low	medium	medium
Risks to non-target plants from herbicide use	lowest	high	medium	medium
Impact to SOLI at highest risk from invasive plants	high	low	medium	medium
Impacts to other forest SOLI from invasive plant establishment and infestation	high	low	medium	medium
Impacts to forest bryophytes, lichens and fungi	unknown	unknown	unknown	unknown
Impacts to plant pollinators (honey bees and native pollinators)	low	high	medium	medium

1 Insufficient data on impacts from invasive species invasion and physiological herbicide to species - Prevention and restoration standards from Regional FEIS expected to further protect for Alternative A, PDF's and prevention and restoration standards from Regional FEIS expected to further protect apply to Alternatives B, C, and D.
2 Comparison evaluation included treatment effectiveness in combination with direct and indirect effects and included future potential EDRR sites

Cumulative Effects

Past, present and foreseeable future actions include natural events, forest uses and management activities on the Forest in combination with the conservative approach to controlling invasive weeds has resulted in the current increase in infested acres existent on the Forest today. Events, uses and activities on the Forest and adjacent ownerships include:

- Recreational use
- Other ground disturbing activities such as construction or maintenance of recreation sites
- Road use
- Fire and its associated management activities
- Logging
- Agricultural crop production
- Grazing
- Wind and other weather conditions
- Climatic events such as drought are all documented to contribute to the spread of invasive species

Present and reasonably foreseeable future actions will continue to provide opportunities for invasive species to establish. Roads will continue to be a major conduit for invasive plants. Forest Service projections suggest that recreation uses of National Forests will continue to increase. Other land management and use activities such as grazing, vegetation management, fuels management (Healthy Forest Initiative), wildfire, and fire suppression will continue to cause ground disturbances that can contribute to the introduction, spread and establishment of invasive plants on National Forest system lands (USDA, 2005).

Many of these same natural events, uses and activities have, and will continue to also happen on lands adjacent to or in the vicinity of Umatilla National Forest lands.

Alternative A - Cumulative Effects

The 1995 EA/DN found that the currently approved treatments (The No Action Alternative) would have no significant impact on non-target vegetation, including SOLI. However, based on the past effectiveness of treatments combined with past natural events, forest uses and management activities, negative cumulative impacts are evident because invasive species continue to spread. No change in this trend would be expected in the foreseeable future. Therefore, continued negative impacts to native vegetation including SOLI and their habitat are expected under this alternative. Future spread of invasive species on National Forest system lands increases the likelihood of weeds spreading to private, tribal, state and other ownerships, and may increase the challenge of controlling weeds on those land ownerships, thereby increasing the use of herbicides.

Herbicide treatment of invasive species is common on lands near or adjacent to the Umatilla National Forest for agricultural crop production, range improvement, landscape improvement and other reasons. If other land owners and managers do not control weeds on their lands, the challenge of controlling weeds increases for Umatilla National Forest managers.

Potential effects of herbicide treatment to non-target vegetation, including SOLI, on National Forest system land is relatively small as reported in the direct/indirect effects section above. The cumumlative effects of herbicide treatments on all land ownerships in and near the Umatilla National Forest are somewhat unknown. Uncertainty exists because a comprehensive reporting system of treatment activities across all land ownerships does not exist. County weed boards report treatment accomplishments from cooperators that participate with their program; however, other treatments of unknown extent using unknown chemicals most likely exist. For known treatments, herbicide treatment likely impacts individual non-target plants sprayed. While PDFs add a measure of protection for SOLI on National Forest system lands, SOLI may be more vulnerable on other ownerships where protective measures are unknown. Overall, potential impacts are considered minor and short term for two reasons: 1.) The great majority of area proposed for treatment on National Forest system land is known, and chemicals used, application rates and methods will follow labeled requirements. 2.) The overall positive effect of killing target invasive infestations is a far greater long term benefit to non-target plant communities, including SOLI, than the temporary damage that may occur to individual non-target plants.

There is likely some damage to individual non-target plants from manual and mechanical treatments. The temporary and incidental effects are also considered minor because affected plants would likely resprout. The benefit of invasive plant removal or reduced seed production due to treatment is considered a greater benefit to non-target plants than the minor damage that could occur to non-target individuals.

While crews treating weeds on National Forest system lands would be trained to identify and avoid damage to SOLI, the effect on SOLI of manual/mechanical treatements could vary on other ownerships.

The cumulative effects analysis assumes that the release of biological control agents on National Forest system lands and adjacent lands by the Oregon and Washington Departments of Agriculture, as analyzed by Animal Plant Health Inspection Service (APHIS), will continue to reduce the invasive plant infestations and decrease the spread of invasive plants. It is recognized that biocontrol agents will likely cross land ownership boundaries. Though biocontrol agents could occasionally affect non-target plants, that would be considered rare and minor compared to the benefits of reducing the area and spread of weeds.

No comprehensive scientific evidence exists to the cumulative impacts to pollinators. However, based on professional opinion native pollinators are expected to be impacted in some heavily infested areas due to loss of native forbs and other plants pollinators use.

In summary, while some herbicide treatments in the vicinity of the National Forest are unknown, most treatments are known. Overall the known potential negative effects of past, present and foreseeable future treatments are considered minor and short term, especially compared to the benefits of reducing the negative influence invasive plants have on non-target plant communities.

The cumulative effects of Alternative A combined with the past, present and foreseeable future actions listed above will likely continue the present trends on native plant communities. Namely:

- Some reduction of invasive plant infestations where authorized treatments on the Umatilla National Forest and other lands have occurred and would probably occur in the future;
- Some minor, short-term loss of native plants due to treatment of invasive plants now and throughout the life of this project;
- Continued growth in the number of invasive plant species and the acres infested on the Umatilla National Forest and adjacent lands due to the natural and man-caused activities (listed above) that can favor invasive plants,
- The effect of weather and climate can have a profound impact positively or negatively on invasive plants even though local conditions happen to all plant communities equally. For example, a drought, though causing stress to many plant species, tends to favor the spread of weeds because, in general, they tend to tolerate drought better than native species. Also natural events such as wildfires effect invasive plant infestations and native plant communities. While weather, climate and natural events will predictably occur; where, when and the impact they will have is prophetically unpredictable.

Alternative B - Cumulative Effects

The effectiveness of the proposed invasive plants treatment project would be increased if coordination with adjacent landowners treats invasive plants infestations across land ownerships. The cumulative effects analysis assumes that this cooperative, coordinated effort continues for the life of this project. Alternative B would more effectively control invasive infestations on the Forest. The likely result of this would be improved weed control effectiveness on adjacent land ownerships. That is, because aggressive treatment expects to reduce invasive infestations on the National Forest, there would be less weed seed and invasive plants to spread onto neighboring lands. Herbicide treatment of invasive species on lands near or adjacent to the Forest would likely continue.

However, as the future spread of invasive species on National Forest system lands decreased, the likelihood of weeds spreading onto private, tribal, state and other ownerships would also decrease. Over time, this could reduce herbicide use on National Forest and adjacent land ownerships.

The land uses and management activities listed at the beginning of this cumulative effects section would continue on National Forest and other lands. The uses and activities would partially compromise treatment effectiveness by spreading weeds. Because many of these activities spread weed seed, an effective treatment program requires vigilance to successfully treat weeds over the long term. The EDRR component of this alternative allows for treatment of newly discovered, future infestations on Forest lands. Other landowners may or may not have the flexibility, funds or manpower to address new infestations whenever and wherever they are found. Because the extent of future treatment programs on other lands is unknown, the effect this will have on weeds migrating onto national forest lands is also unknown. The effects of natural events, weather and climate would be similar to that listed in Alternative A.

The cumulative effects of Alternative B combined with past, present, and foreseeable future actions listed above are expected to have a mixed combination of effects on the native plant communities of the Umatilla National Forest. These effects include temporary loss of non-target native and desirable non-native plants from damage and mortality caused by proposed invasive plant treatments. The damage on each treatment site would be similar to those described for Alternative A; however, Alternative B proposes to treat many more acres, therefore more non-target plant damage and mortality is expected, especially from chemical spraying. Still, because treatments would be a very small percentage of the Forest's total area, and because the losses are likely to be temporary, they are considered acceptably minor. In the long-term, vegetation management will favor re-establishment of native plant communities across ownership boundaries, especially where coordinated treatments have occurred.

There are 42 invasive weed sites (approximately 3,600 acres) adjacent to other land ownerships proposed for treatment on the forest. Identified invasive sites likely infest these other land ownerships. Drift associated with herbicide treatments from or onto adjacent lands is possible which could have effects on non-target plants. Potential effects of drift from forest lands would likely be minor and temporary due to PDF's developed to significanlty reduce impacts of all herbicides proposed. Potential effects from herbicide drift from adjacent landowner application to non-target plants on forest lands may have slighly higher impacts to non-target plants because adjacent land owners are not restricted to regional standards, herbicides approved for use and forest PDF's. Overall, coordinated treatment of invasive plants with adjacent landowners to restore native vegetation (see PDF B.1 in section 2.2.3) is essential to effectively control weeds on both sides of the boundary.

Manual, mechanical and biological control cumulative effects would be similar to those described for Alternative A.

Alternative C and D – Cumulative Effects

Alternatives C and D would predictably have very similar cumulative effects as Alternative B. It is acknowledged that invasive treatments are somewhat different among these three alternatives. However those differences become miniscule when considered in the context of all cumulative effect factors that have, can and will influence invasive plant infestations and native plant communities.

It is acknowledged that the combination of past, present and foreseeable future actions have a combination of effects both positively and negatively influencing the purpose and need of containing, controlling and eradicating invasive species. It is also understood that some of the Umatilla National Forest programs that deliver goods and services to the American people can have both positive and negative influences on the establishment and spread of invasive species. This invasive plants treatment project is conscientiously specific to containing, controlling and eradicating invasive plants. This project in no way attempts to diminish or modify other Umatilla National Forest programs. Each Forest program is responsible to manage activities in ways that will minimize the potential for invasives plants to become established and spread.

With this understanding it is our firm belief that the result of this project acting in the context of past, present and foreseeable future actions will reduce the influence of invasive species and thereby improve native plant communities and their ecologic functions.

3.3 Terrestrial Wildlife

3.3.1 Introduction

Invasive plant species have become established and continue to spread, causing a loss of wildlife habitat and posing a risk of injury to wildlife, so the Umatilla National Forest has proposed to conduct invasive plant treatment projects within its administrative boundaries. Methods used to treat invasive plants also have the potential to adversely affect individual animals as well as wildlife habitat. This section will summarize the effects on wildlife from invasive plants and the methods used to control invasive plants.

3.3.2 Affected Environment

Invasive Plants and Wildlife Resources

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.

Although it is rare, some wildlife species can 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). These are not preferred plants for any of these species. The few uses that an invasive plant may provide do not outweigh the adverse impacts to an entire ecosystem (Zavaleta 2000).

Displacement of native plant communities by non-native plants results in alterations to the structure and function of ecosystems and constitutes a principle 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 1996); 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 photos 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).

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 1982; Thompson, Stuckey, and Thompson 1987; Weihe and Neely 1997; Weiher et al. 1996).

Of the federally listed species that occur on Umatilla National Forest system land, none are known to be adversely affected by invasive plants within the Project Area.

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
- Change to effective population 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, perhaps due to altered nutrient cycling
- Source-sink population demography, with more demographic sinks than sources

- Lack of proper forage quantity or nutritional value at critical life periods

Threatened, Endangered, Sensitive (TES) Species

Federally Listed Species

Two species listed as "threatened" and one species listed as "endangered" under the Endangered Species Act (ESA) of 1973, as amended, have habitat in the project area. The bald eagle *(Haliaeetus leucocehpalus*), which is currently listed as threatened, is the only listed species confirmed to currently occupy habitat on the Forest.

Canada lynx (*Lynx canadensis*), which is listed as threatened, has limited potential habitat on the Forest. Although unconfirmed sightings are occasionally reported, only limited historical evidence suggests lynx once occupied this area. The Forest is considered to contain "unoccupied habitat" by the U.S. Fish and Wildlife Service (FWS). Gray wolf (*Canis lupus*), is currently listed as endangered by FWS. The Forest contains habitat for the gray wolf, however no confirmed sightings have occurred for over five years. Government officials continue to investigate reported sightings. No den or rendezvous sites have been found so no resident populations are known to occur on the Umatilla National Forest or in the Blue Mountains. Listed species and one candidate species found, or with potential habitat in the Project Area are included in Table 29. A brief overview of the bald eagle, Canada lynx, and gray wolf regarding their presence in the Project Area is discussed below. The Columbia spotted frog (*Rana luteiventris*) is a FWS candidate species and on the Regional Forester's Sensitive Species List. It is discussed in the "Forest Service Sensitive Species" section. All species life history, threats, and generally recognized species protection measures are discussed in the sections of the Terrestrial Wildlife Specialist Report/Biological Assessment prepared for this document in Appendix C. The complete report is available upon request from the Project Record at the Umatilla National Forest Supervisor's Office in Pendleton, Oregon. Additional detailed accounts can be found in the Biological Assessment prepared for the Regional Invasive Plant Program (USDA Forest Service 2005). This Biological Assessment is incorporated by reference.

The FWS maintains a list of "candidate" species. Candidate species are those taxa which the FWS has 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 1996).

Table 29 - Federally listed or candidate species known to occur on the Umatilla NF

Species	Scientific Name	Status	Critical Habitat	Presence
Bald eagle	*Haliaeetus leucocephalus*	Threatened	None	Yes
Canada lynx	*Lynx canadensis*	Threatened	None	No
Gray wolf	*Canis lupus*	Endangered	None	No
Columbia spotted frog	*Rana luteiventris*	Candidate	None	Yes

Bald Eagle

The bald eagle ranges throughout much of North America, nesting on both coasts and north into Alaska, and wintering as far south as Baja California. The largest breeding populations in the contiguous United States occur in the Pacific Northwest states, the Great Lakes states, Chesapeake Bay, and Florida. Oregon and Washington are important for wintering bald eagles, however the Umatilla National Forest provides only limited wintering habitat for migratory eagles as well as residents.

Bald eagle populations have made substantial recoveries in recent years. Formerly listed as endangered in 1978, the bald eagle was down-listed to threatened status in the lower-48 states in 1995. In March 1999, FWS proposed to delist the bald eagle throughout its entire range (Federal Register 1999). A final rule on the delisting proposal has not yet been issued, and the species remains protected under the ESA.

Bald eagle numbers vary by season and include breeding, migration and wintering populations. The breeding season begins in late February or March, with juveniles fledging between mid-July and early September. They generally leave the nest area between late August and late September. Migration generally peaks during March-April in the spring, and October-November in the fall.

Bald eagles first breed at five to six years of age. Egg-laying can start as early as February and continue until April, and both sexes incubate one to three eggs for 31 to 35 days. Eggs hatch from March to May, and the nestling period lasts 11 to 14 weeks. Some breeding birds remain near nesting territories throughout the winter months (USDI 1986).

Nesting territories are normally associated with lakes, reservoirs, rivers, or large streams (U.S. Fish and Wildlife Service, 1986). In the Pacific Northwest recovery area (for more information see the Bald Eagle Recovery Plan, U.S. Fish and Wildlife Service, 1986) , preferred nesting habitat for bald eagles is predominately uneven-aged, mature coniferous (ponderosa pine, Douglas-fir) stands or large black cottonwood trees along a riparian corridor (NatureServe 2006 and USDI 1986). Eagles usually nest in mature conifers with gnarled limbs that provide ideal platforms for nests. Trees selected for nesting are characteristically one of the largest in the stand or at least codominant with the overstory. Nest trees usually provide an unobstructed view of the associated water body and are often prominently located on the topography. They also tend to be found in relatively remote areas that are free of disturbance. Snags, trees with exposed lateral limbs, or trees with dead tops are often present in nesting territories and are used for perching or as points of access to and from the nest. The size and shape of a defended breeding territory varies widely (1.6 to 13 square miles) depending upon the terrain, vegetation, food availability, and population density of an area (USDI 1986). 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).

The most common food sources for bald eagle in this region are fish, waterfowl, rabbits, and various types of carrion (NatureServe Explorer 2006 and USDI 1986). The main food source for bald eagles during the breeding season is fish; therefore, habitat of most importance during this period consists of areas near large bodies of water and major river systems (U.S. Fish and Wildlife Service, 1995).

During the critical incubation (March) and brooding (late April/early May) phases, human disturbance can result in nest failure with the risk reduced as the nesting cycle progresses towards fledgling at the end of July. Some habituation of eagles to human activity has been observed, varying according to type and proximity to the bald eagle. Individual birds vary widely in their response to human disturbance (USDI 1986).

The Umatilla National Forest has one known bald eagle nest site, which was discovered in 1994. The Dry Creek bald eagle nest is located on the Heppner Ranger District, west of Dry Creek and is approximately three air miles north of the North Fork of the John Day River. The nest has had variable success over the years in fledging young, but the majority of the time has successfully fledged 1 to 2 young each year. The nest site is surveyed each spring to determine nest success. A site-specific management plan was developed and reviewed by the FWS and Frank Isaacs (bald eagle specialist form Oregon State University) for the Dry Creek bald eagle nest site in 1999. The plan developed both a Bald Eagle Consideration Area (BECA) boundary and a Bald Eagle Management Area (BEMA boundary. The BECA includes both private and Bureau of Land Management (BLM) land, while the BEMA is entirely within National Forest system lands. It is presumed that the eagles occupying this nest stay in the area year-round.

The nest is on a north-facing slope in a canyon that contains mixed conifer with dry/juniper/pine on the south-facing slope. Several age classes of trees exist within the area, including several older, large diameter trees. An unimproved dirt road runs up the canyon bottom near the nest. The area is grazed by livestock early in the season (early spring and summer). Motorized travel is limited and is mostly used for livestock operations. The BEMA is within critical elk winter range. The road in close proximity to the nest is within a seasonal road closure for elk, which happens to coincide with when the birds nest. The eagles have become accustomed to some degree to human disturbance. There are no identified invasive plants sites within the BEMA, however there are several small sites on National Forest system lands within the BECA. They are well over a mile from the nest and are currently not large enough to impact eagle prey foraging habitat.

At this time the Forest has no established winter roost sights; however bald eagles do roost on the Forest during winter months. Winter bird count surveys occur along the North Fork of the John Day River and the Umatilla River each year. Bald eagle numbers appear to be fairly small and both the roost and perch sites seem to vary somewhat from year to year. The majority of the bald eagle migration and winter sightings are in areas along the Mecham and Umatilla creeks as well as the Grande Ronde and Tucannon Rivers. Currently, there are no invasive plants adversely affecting bald eagles on the Forest.

Canada Lynx

Lynx occur in mesic coniferous forest that have cold, snowy winters and provide a prey base of snowshoe hare (Lepus americanus) (Ruediger et al. 2000). Both snow conditions and vegetation types are important factors in defining lynx habitat. Crusting or compaction of snow may reduce the competitive advantage that lynx have in deep, soft snow. Primary vegetation that contributes to lynx habitat is subalpine fir types where lodgepole pine is a major seral species, generally between 4,100-6,600 feet (Ruediger et al. 2000, Ruggiero et al. 1999, and Verts and Carraway 1998). Moist grand fir and Douglas-fir types intermixed with subalpine types constitute secondary vegetation that may also serve as foraging habitat when characterized by a dense, multi-layered understory that maximizes hare browse at ground level and at varying snow depths (Ruediger et al. 2000 and Ruggiero et al.1999). Hares comprise 33-100 percent of the lynx' diet and a hare density of greater than or equal to 0.5 hares/hectare is likely required for lynx persistence (Ruggiero et al. 2000). Riparian areas, aspen stands, and high-elevation willow communities are also important lynx prey habitats.

Large, course woody debris is a common element of natal den sites. Hollow logs and root wads provide protection and thermal cover for kittens.

Denning habitat must be in or adjacent to foraging habitat to be functional (Ruediger et al. 2000). Lynx seem to prefer to move through continuous forest, and frequently use ridges, saddles, and riparian areas. Home range sizes for lynx can be variable, but it appears that at least 6,400 acres of primary vegetation should be present to support survival and reproduction.

Canada lynx are thought to occur in Oregon as dispersers that have never maintained resident populations. They are considered an infrequent and casual visitor by the state of Oregon (Ruediger et al. 2000, pp. 4-7). The Umatilla NF has not had a verified lynx observation, therefore the Forest is considered “unoccupied” habitat. To be considered “occupied” habitat, the Forest would have to have at least two verified lynx observations or records within the past five years, or evidence of lynx reproduction.

Winter track surveys for lynx and wolverine were conducted by the Forest from 1991-1994 and no confirmed lynx tracks were found. Hair snares were used to survey for lynx, according to the National Lynx Survey, during the summers of 1999-2001. There were no lynx detections confirmed from the survey effort. It is unknown whether lynx are currently present on the Forest, but there are no verified records of lynx, and there is no evidence of occupation or reproduction that would indicate colonization or sustained use by lynx.

Lynx habitat on the Umatilla National Forest was mapped using the vegetation and environmental conditions for the Northern Rocky Mountains Geographic area, and more specifically, the Blue Mountain Section, including northeast Oregon and southeast Washington. Primary vegetation was based on the direction provided in the Canada Lynx Conservation Assessment and Strategy (LCAS) (Ruediger et al. 2000), and follow-up guidance from the Forest Service Regional Office and the Lynx Biology Team. Sixth code Hydrologic Unit Codes (HUC), were used as the basis for delineating Lynx Habitat across the Forest. Potential lynx habitat generally occurs in an elongated cluster in the northern portion of the Umatilla National Forest with another habitat cluster in the Blue Mountains on the southern end. However, the Lynx Conservation Agreement (May 2006), states that the LCAS does not apply to forests that are considered as having unoccupied habitat. Table 30 describes the size and type of potential lynx habitat as defined in the LCAS and acres of known invasive plant sites that exists within the Forest.

Table 30 – Descriptions of Potential Lynx Habitat

Potential Lynx Denning	Potential Lynx Forage	Currently Unsuitable	Total Potential Lynx Habitat	Acres of Invasive Plants Within Potential Habitat
81,485	**154,761**	**121,716**	**357,962**	**3,486 (<1%)**

Gray Wolf

Habitat preference for the gray wolf appears to be more prey dependent than cover dependent. The wolf is more of a habitat generalist inhabiting a variety of plant communities, typically containing a mix of forested and open areas with a variety of topographic features including grasslands, sagebrush steppe, and coniferous, mixed, and alpine forests (NatureServe 2006, Verts and Carraway 1998, and Witmer et al. 1998).

Wolves prefer fairly large tracts of roadless country; generally avoiding areas with an open road density greater than one mile per square mile (Witmer et al. 1998). The basic social unit in wolf populations is the pack. A pack can consist of 2 to 20 wolves (average of 10).

Wolves prey primarily on large ungulates such as elk and deer (NatureServe Explorer 2006, Verts and Carraway 1998, and Witmer et al. 1998). Their alternate prey base typically consists of smaller mammals and birds, such as, beaver, ground squirrels, rabbits, and grouse (NatureServe Explorer 2006 and Witmer et al. 1998). It is not uncommon to observe wolves "mousing" in grassy meadows much like coyotes and red fox. Individuals may take livestock as secondary prey when ungulates are less vulnerable or available (Witmer et al. 1998).

Gray wolves have extensive home ranges but specific habitat requirements for denning, rearing young, and foraging. Dens are usually located on moderately steep slopes with southerly aspects within close proximity to surface water. Rendezvous sites, used for resting and gathering, are complexes of meadows that have adjacent hillside timber with nearby surface water (Kaminski and Hansen 1984). Both denning and rendezvous sites are often characterized by having nearby forested cover, remote from human disturbance (NatureServe Explorer 2006). Wolves are strongly territorial; defending an area of 75-150 square miles, and are threatened by negative interactions with humans. There are currently no known denning or rendezvous sites on or near the Forest, but potential habitat for denning or rendezvous does exists. Several inventoried roadless areas and wilderness areas offer secluded places that would be logical for wolves to inhabit.

While occasional wolf sightings are reported in the Blue Mountains, there are no known established wolf packs or territories (e.g. observations of reproduction, den sites, or rendezvous sites) on the Forest. Wolf sighting information seems to indicate transient or lone individuals that are not part of a resident pack. Government officials have not yet confirmed a wolf pair near a tributary of the Minam River, just south of the Umatilla National Forest (on the north-end of the Wallowa-Whitman National Forest); however, there have been numerous reported sightings and some evidence to indicate their existence in this area. During the summer of 2006 government officials surveyed the area but were not able to confirm the pair. Investigations of wolf sightings are on-going. One investigation took place in late January 2007, in response to reported sightings in the vicinity of Saddle and Tryon Creeks near the Minam, however no wolves were located. There are also camera bait stations located on National Forest system lands and state lands. At the time of this writing none of the stations have produced confirmed evidence. No den or rendezvous sites have been found so no resident populations are known to occur in the Blue Mountains.

Forest Service Sensitive Species

This section of Chapter 3 discusses the Affected Environment of Sensitive Species documented (shown by a D in the Occurrence column of Table 31) as a component of the Umatilla National Forest. Sensitive Species suspected (shown by an S in the Occurrence column of Table 31) to be, but not currently found on the Forest, are discussed in Appendix C.

The Regional Forester's Sensitive Species List, is a proactive approach for meeting the Agency's 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 31 - Suspected (S) or Documented (D) Wildlife of the Umatilla NF on the Regional Forester's Sensitive Species List (July 2004)

Common Name	Scientific Name	Occurrence
Mammals		
California wolverine	*Gulo gulo*	D
Rocky Mountain Bighorn Sheep	*Ovis canadensis canadensis*	D
Birds		
American peregrine falcon	*Falco peregrinus anatum*	S
Green-tailed Towhee (WA only)	*Pipilo chlorurus*	D
Upland sandpiper	*Bartramia longicauda*	S
Gray flycatcher	*Empidonax wrightii*	S
Amphibians		
Northern Leopard frog	*Rana pipiens*	S
Columbia spotted frog	*Rana luteiventris*	D
Reptiles		
Painted Turtle	*Chrysemys picta*	S
Striped Whipsnake (WA only)	*Masticophis taeniatus*	S
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.		

California Wolverine

Wolverine range in the contiguous United States is thought to include Idaho, Montana, Oregon, Washington, Wyoming and possibly California. 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 (Copeland, 1996). In California and southern Oregon and throughout the Cascades, the wolverine inhabits alpine, boreal forest and mixed vegetation (Grinnell et al. 1937; Schempf and White 1977). 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.

Natal denning habitat includes open rocky slopes (talus or boulders) surrounded or adjacent to high elevation forested habitat that maintains a snow depth greater than 3 feet into March and April (Forest Service 1994). 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.

The wolverine is an opportunistic scavenger, with large mammal carrion the primary food source year-round. Prey items also include small and medium-sized mammals, birds and their eggs, insects, fish, roots, berries, and carrion. While foraging, they generally avoid large open areas and tend to stay within forested habitat at the mid and high elevations (greater than 4,000') and typically travel 18-24 miles to forage/hunt (Forest Service 1994).

Prior to 1973, wolverines were classified as furbearers in Oregon. They are considered rare throughout all of Oregon, Washington, Idaho, and California, but recent sightings, tracks, and a road kill document their continued presence at low densities (Csuti et al. 2001). Records for eastern Oregon include a partial skeleton and tufts of fur found near Canyon Mountain, Grant County (1992), tracks and a possible den site discovered in the Strawberry Mountain Wilderness (1997), and tracks that were noted in the Monument Rock Wilderness (1997).

There are historical sighting records of wolverines on the Umatilla National Forest but there has been no physical evidence of their occurrence found on the Forest. Formal winter track surveys for wolverine were conducted during the winters of 1991 through 1994. Those surveys found no verified tracks. There are no known den sites on the Forest. The Umatilla lacks much acreage above 7,000 feet, which is generally where wolverine prefer to den.

The most likely places wolverines would be found are the wilderness areas since wolverines prefer remote and high elevation areas for denning. The Umatilla NF has three wilderness areas totaling approximately 304,925 acres, and there are approximately 251 acres within those three wildernesses known to have invasive plants. Therefore, far less than one percent of these three wilderness areas have invasive plants. In addition, no acres above 7,040 feet have invasive plants. What this means is that potential wolverine den sites would not be disturbed by invasive plant treatments because there are no invasive plants known to exist above 7,040 feet in elevation. In addition, since less than one percent of the wilderness areas contain invasive plants the likelihood of disturbance or impacts to wolverine or their habitat is highly unlikely. Although wilderness areas appear to be the most likely places to find wolverine den sites, they could in fact be foraging just about anywhere on the Forest since they have such large home ranges and are capable of traveling long distances in a day.

Rocky Mountain Bighorn Sheep

Bighorn sheep generally inhabit open areas of rocky slopes, ridges, rim rocks, cliffs, and canyon walls with adjacent grasslands or meadows, and few trees (Verts and Carraway 1998). Dense forest communities are avoided. Their primary diet consists of bunchgrass, but also includes significant amounts of forbs and shrubs during the growing seasons. In the spring they will also utilize cheatgrass, which is an invasive annual plant. The distribution of escape terrain regulates the extent to which other habitat components are used. Most bighorn sheep use forage areas within 0.5 mile of escape terrain and generally not seen farther than 1.0 mile.

Summer range varies from subalpine meadows above 7,500 feet to canyon grasslands at 1,000 feet. Winter range is usually below 6,000 feet. Some herds are yearlong residents on a given area, with little or no spatial separation of summer and winter ranges (Drewek 1970). Other herds migrate several miles between summer and winter range and occupy areas that include a variety of elevations and environmental conditions (Geist 1971). Both summer and winter range must provide freedom from disturbance and a proper juxtaposition of forage, escape terrain, and water.

Terrain for lambing is rugged, precipitous and remote (Van Dyke et al. 1983). Such terrain provides pregnant ewes security and isolation during the lambing season. Ewes select rugged cliffs of at least five acres for lambing. Ewe-lamb groups prefer more rugged topography than ram groups (Valdez and Krausman 1999) and are more restricted in use of their range. Ram groups will range farther from escape terrain than ewe groups.

The Forest has both Rocky Mountain and California bighorn sheep. Rocky Mountain bighorn sheep are listed as sensitive on the Regional Forester's Sensitive Species List and includes all the herds except the Potamus herd, which is the only herd that are California bighorn sheep.

Bighorn sheep can be found in the vicinity of the Grande Ronde, Wenaha (north end) and North Fork of the John Day (south end) rivers and the Tucannon Wilderness. They were recently introduced (2002) into the Heppner/Ukiah area, and although the populations are small, they appear to be stable. Bighorn sheep habitat on the Forest is not typical in that the Forest does not have a lot of high elevation habitat so these animals utilize lower elevation habitat year-around. Table 32 in this section contains the five areas bighorn sheep are found on the Forest and the number of acres within which invasive plants are found. Invasive plants do not appear to be currently impacting bighorn sheep habitat to any measurable degree since such a small portion of the bighorn sheep habitat includes invasive plants.

Table 32 - Bighorn sheep locations and the approximate number of acres of invasive plants

Bighorn Sheep Location	Approximate Acres Within The Area	Acres with Invasive Plants	Percent of Bighorn Sheep Area with Invasive Plants
Asotin	21,745	613	2.8%
Cottonwood Creek/Lost Prairie/Mountain View	19,384	191	< 1%
Potamus	17,922	197	1.0%
Tucannon River/Wooten	7,434	146	1.9%
Wenaha	67,709	203	< 1%
Wenaha/Haas/Cottonwood	20,054	490	2.4%

Green-tailed Towhee

The green-tailed towhee is a bird of the western portion of the lower 48 states. Its northern limit is in the Blue Mountains of Washington, just over the Oregon state line. From there it breeds south to southern California and east to Wyoming and eastern New Mexico. It is migratory, spending winters in the southwestern U.S. and Mexico (Csuti et al. 2001).

The green-tailed towhee prefers vigorous shrub stands with high shrub species diversity. It occupies the undergrowth of sagebrush, bitterbrush, manzanita, mountain mahogany, and buckbrush in open ponderosa pine woodlands. During the breeding season, this species is generally found in brushy areas on the mountain slopes, where scattered trees such as juniper or aspen intermingled with significant stands of shrubs, particularly mountain mahogany or snowbrush (Marshall et al. 2003), sometimes as high as 6,000-7,000 feet. It breeds in higher-elevation coniferous woodlands in some parts of Oregon. While in the more arid portions of eastern Oregon, it occurs only in riparian woodlands and sagebrush thickets on mountain slopes (Csuti et al. 2001).

Little is known about the food habits of green-tailed towhees. Like other towhees, it scratches litter on the ground, presumably looking for seeds and insects.

It probably takes a variety of forb and shrub seeds, with more insects added to the diet in the breeding season. It will take some berries from shrubs when they are available (Csuti et al. 2001).

Forest records show a very limited number of sightings of green-tailed towhee on the Pomeroy and Walla Walla Ranger District. These sightings were on south, southwest, or west facing slopes with greater than 30 percent dry bunch grass interspersed with woody shrubs. NatureServe Explorer (2006) shows the green-tailed towhee as ‘apparently secure’ in Oregon and ‘imperiled’ in Washington, but this may be simply because southeast Washington is at the furthest northern part of their range and not much is known about them in this area. Mapping potential breeding and foraging green-tailed towhee habitat included: all dry shrubland habitat, ponderosa pine forest and juniper woodlands with less than 30 percent canopy closure, and south, southwest and west slopes. Using this broad scale analysis, there is approximately 71,394 acres of potential green-tailed towhee habitat on the Forest. Approximately 1,424 acres or two percent of those acres have known invasive plants. Approximately 43 percent of those acres are adjacent to roads (549 acres) or trails (63 acres).

Columbia Spotted Frog

Columbia spotted frogs range from southeastern Alaska to central Nevada, east to Saskatchewan, Montana, western Wyoming, and north central Utah. 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. The Columbia spotted frog is considered a Forest Service sensitive species and has been documented on the Malheur, Ochoco, Umatilla, and Wallowa-Whitman National Forests. This species was once considered to be included in *Rana pretiosa,* with the Oregon spotted frog

The spotted frog frequents waters and associated vegetated (grassy) shorelines of ponds, springs, marshes, and slow-flowing streams and appears to prefer waters with a bottom layer of dead and decaying vegetation (NatureServe Explore 2006, Hayes et al. 1997, Csuti et al. 2001). They occur along the grass and sedge margins of streams, lakes, ponds, springs, and marshes. They typically occur between 150 and 8,000 feet in elevation (Corkran and Thoms 2006). The Columbia spotted frog exhibits strong fidelity to breeding sites and often deposits eggs in the same locations in successive years. They deposit egg masses in still, shallow waters atop submergent herbaceous vegetation or among clumps of herbaceous wetland plants. Breeding habitats include a variety of relatively exposed, shallow-water (less than 60 centimeters), 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. Tadpoles live in the warmest parts of ponds (Corkran and Thoms 2006). Froglets and adults live in well-vegetated ponds, marshes or slow, weedy streams that meander through meadows (Corkran and Thoms 2006). Springs may be used as over-wintering sites for local populations of spotted frogs (Hayes et al. 1997).

Larvae have a diet of algae, plant material, and other organic debris. Adults eat insects (ants, beetles, mosquito larvae, and grasshoppers), spiders, mollusks, tadpoles, crayfish, and slugs (NatureServe Explore 2006, Hayes et al. 1997, Csuti et al. 2001). Columbia spotted frogs eat arthropods, earthworms and other invertebrate prey.

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 pesticides, herbicides, fertilizers, and heavy metals may slow reactions or cause behavioral changes that make spotted frog tadpoles more vulnerable to predation (Lefcort et al. 1998, Rosenshield et al. 1999, Marco et al. 1999, Bridges 1999, Bridges and Semlitsch 2000). Threats to the species include mining, livestock grazing, road construction, agriculture, and direct predation by bullfrogs and non-native fishes (USDI 1998).

Columbia spotted frogs occur in a number of locations (at least 15 sites) on the Umatilla National Forest. This species is often found in natural ponds, rock pits, old mining ponds, livestock ponds, and slow moving streams that retain water year-round. More have been found on the south end of the Forest than the north. Most spotted frog sites found on the Forest are in created habitat such as mining ponds and rock pits. Several of the known or potential spotted frog sites have invasive plants.

The Umatilla National Forest does not have GIS converage for manmade and natural ponds, lakes, reservoirs, wet meadows, springs and stockponds; however, it does have GIS coverages for lakeshores and springs. Although lakeshores and springs contain only a portion of the potential Columbia spotted frog habitat available in the Project Area, it does show some of the potential habitat available and a portion of the potential habitat which contains invasive plants. This gives a sense of what proportion of the other waterbodies mentioned above may contain invasive plants.

There are eight waterbodies and 397 springs defined in the Umatilla GIS converages. The potential habitat model for spotted frog used springs buffered by 300 feet and lakeshores 300 feet to the outside and 25 feet to the inside. Using these parameters there are approximately 2,775 acres of spotted frog habitat on the Forest, of which 133 acres contain invasive plant species.

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 33 includes those wildlife species that were identified as MIS for the Umatilla National Forest (USDA 1990).

Table 33 - Management Indicator Species and Their Associated Habitat for the Umatilla NF

Species	Habitat Types
Rocky Mountain elk	General forest habitat and winter ranges
Pileated Woodpecker	Dead/down tree habitat (mixed conifer) in mature and old growth stands
Northern three-toed woodpecker	Dead/down tree habitat (lodgepole) in mature and old growth stands
Pine Marten	Mature and old growth stands at high elevations
Primary cavity excavators	Dead/down tree (snag) habitat

Rocky Mountain elk

Rocky Mountain elk was selected as an indicator species in the Forest Plan to represent general forest habitat and winter ranges. Concern over this species arises from its status as an important game species. Habitat quality for elk is evaluated in terms of forage, cover (satisfactory and marginal), elk screening, and open road density. The quality of elk habitat is influenced by the presence of humans, which causes animal stress and hunting vulnerability. This is primarily associated with motorized use of open roads and the availability of vegetation (live and dead) to screen elk. Elk have been found to select habitats preferentially based on increasing distance from open roads (Rowland et al. 2000). Vulnerability and hunting mortality have been found to be higher in forested stands with greater road densities and less vegetation to provide screening (Weber et al. 2000).

Elk habitat on the Forest was mapped as part of a cooperative effort sponsored by the Rocky Mountain Elk foundation using a 1:250,000 scale map. This mid-scale mapping is used for a "big picture" perspective of habitat use. When this map is overlain with the Forest mapped invasive species layer, it shows approximately 364,188 acres of elk winter range on the Forest. Approximately 8,967 acres (two percent) of the elk winter range is currently known to contain invasive plant species.

Of the elk winter range that contains invasive plants, approximately 39 percent is adjacent to roads and trails (approximately 37 percent is along roads only).

Elk summer range (approximately 1,252,527 acres) includes most of the Forest except for small portions of the Walla Walla and Pomeroy Districts. Approximately 22,736 acres (1.8 percent) of elk summer range is infested with invasive plants. Approximately 48 percent of the summer range infested with invasive plants is adjacent to roads and trails (45 percent along roads only). About three percent of the total mapped elk calving areas are impacted by invasive plants. Of that three percent, 64 percent is adjacent to roads and trails. Invasive plants within 100 feet of a road or trail are considered to be adjacent. What this analysis shows is that a fairly high proportion of the invasive plants within elk habitat are adjacent to roads and trails.

Pileated woodpecker

Pileated woodpecker was selected as an indicator species in the Forest Plan to represent dead and down tree habitat in mature and old growth mixed conifer stands. The pileated woodpecker is the largest woodpecker species in the western United States and nests in cavities of large trees or snags. It is an occupant of mature forests, relying on dead and decaying trees for foraging and nesting. 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). The pileated woodpecker is fairly common throughout the Umatilla National Forest in mature and late-successional mixed conifer forest. Pileated woodpeckers rely on large areas of unburned, mature and old-growth forests for their foraging resources, because they forage primarily on ants (Hymenoptera and Formicidae) within softened wood (Bull and Holthausen 1992).

Parameters used for mapping potential habitat for pileated woodpecker included late forest structure in mixed conifer stands consisting of ponderosa pine, western larch, grand fir and Douglas-fir, which had greater than or equal to 50 percent canopy closure and trees and snags that were at least 15 inches diameter breast height. Using this analysis there are approximately 191,171 acres of potential pileated woodpecker habitat within the project area. There are approximately 3,719 acres (2 percent) of known invasive plant species infestations within this potential pileated woodpecker habitat.

Since pileated woodpeckers utilize down logs and snags and forage on beetles and ants buried inside decaying wood, their habitat is not impacted by invasive plant infestations but infestations may occur in proximity to pileated woodpecker habitat. Fifty-two percent (1,949 acres) of those acres are adjacent to roads and trails.

Northern Three-toed Woodpecker

The northern three-toed woodpecker was selected as an indicator species in the Forest Plan to represent dead and down tree habitat in mature and old growth lodgepole pine stands. The northern three-toed woodpecker preferred habitat (foraging and nesting) includes late successional, cold/moist forest types (lodgepole/mixed conifer) with high standing-wood density, generally in higher-elevations above 4,500 feet (Marshall et al. 2003, Csuti et al. 2001).

This woodpecker feeds mostly on wood-boring larvae of moths and beetles, which it captures by probing dead or decaying wood. It also gleans some insects (ants, caterpillars), and eats fruits, mast, and cambium (Csuti et al. 2001). The loss of mature lodgepole pine forest habitat, essential to this naturally rare species, could lead to its decline.

Pine marten

The pine marten (aka American marten) was selected as an indicator species in the Forest Plan to represent complex mature and old growth stands. Preferred habitat for the marten consists of higher elevation (greater than 4000 feet) stands of dense conifer and large down-wood, often associated with streams. Pine martens occur in dense 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 windfalls (Maser 1998). Martens spend a great deal of time in trees and can even leap from branch to branch between trees. They tend to avoid areas that lack overhead protection and the young are born in nests within hollow trees, stumps, or logs. They eat a variety of small mammals, particularly squirrels, as well as voles, mice, pika, and rabbits. Martens do not tolerate concentrated human use or habitat modification (Maser et al. 1981). The historical and current density and distribution of marten in the Forest is unknown, but they are thought to occur in low numbers.

Multi-storied, mature and old forest stands with trees and snags 15 inches in diameter at breast height or larger, and at 4,000 feet in elevation or above were used to determine broad-scale potential marten habitat. No acres of juniper woodland, hot-dry ponderosa pine or whitebark pine habitat was calculated into the marten habitat. This analysis does not include the marten preference for close proximity to riparian habitat so it is more inclusive. Using these factors to determine potential marten habitat; the Project Area contains approximately 78,595 acres of habitat. Approximately 1,662 acres (2 percent) contain known invasive plant sites. Approximately 2 percent of those sites are adjacent to roads (729 acres) and trails (67 acres). It is not entirely clear why two percent of potential marten habitat shows up with invasive plants, since they tend to use areas with dense canopy cover, which is not where invasive plants are generally found. It could be that much of the area is adjacent to roads where invasive plants are often found, the stands are adjacent to cut-over areas that contain invasive plant infestations, or there was a slight mapping error.

Cavity excavators

A large number of species rely on cavities in trees for shelter and nesting. Primary cavity excavators include 16 species of birds with the potential for habitat to occur in the Umatilla National Forest.

These species include Lewis' woodpecker, Williamson's sapsucker, red-naped sapsucker, downy woodpecker, hairy woodpecker, white-headed woodpecker, three-toed woodpecker, black-backed woodpecker, northern flicker, pleated woodpecker, black-capped chickadee, mountain chickadee, chestnut-backed chickadee, red-breasted nuthatch, white-breasted nuthatch, and pygmy nuthatch (Johnson and O'Neil 2001, and Thomas 1979). Primary cavity excavators create holes for nesting or roosting in live, dead or decaying trees.

Secondary cavity users such as owls, bluebirds, and flying squirrels may use cavities created by primary cavity users for denning, roosting, and/or nesting. By addressing available habitat for primary cavity excavators, it is expected that habitat for secondary cavity users will be provided (USDA 1990). Habitat for primary cavity excavators includes dead trees in various size and decay classes with coniferous and hardwood vegetation and a variety of structural stages (Wahl et al. 2005, Johnson and O'Neil 2001, and Thomas 1979). This group of primary cavity excavators is considered one management indicator in the Forest Plan and represents a vast array of vertebrate species that depend upon dead trees and down logs for reproduction and/or foraging (USDA 1990).

Species of Interest

Landbirds (migratory birds)

Landbirds which include neotropical migratory birds that have been defined as those species that regularly breed in continental North America and winter south of the Tropic of Cancer, typically in Central and South America and the Caribbean. Landbirds are defined as all birds except loons, grebes, seabirds, waterfowl, long-legged waders, shorebirds, gulls, terns, alcids, cranes, and rails. One hundred sixty two species of landbirds breed in Oregon and Washington including common passerine songbirds, hawks, and owls (Andelman & Stock 1994).

Landbirds occur in a wide variety of habitat types including early and late-seral forests (Finch & Stangel 1993). In the relatively arid western United States, however, densities of neotropical migrants are highest in riparian areas, with coniferous forests being the second-most used habitat by this assemblage of species (Saab and Rich 1997).

Species Discussion

Focal Species Analyzed

The Conservation Strategy for Landbirds in the Northern Rocky Mountains of Eastern Oregon and Washington (Altman 2000) set up biological objectives and management actions. The Plan says, "Simply stated, biological objectives are "what we think the birds need. They are not regulatory nor do they represent the policies of any agency or organization." The list of management level focal species was used to select species to analyze which represent key species of birds that could indicate any adverse affects to landbirds from the proposed invasive plant treatments.

Large-scale declines in open park-like dry forests with large trees and snags have led to population declines of the white-headed woodpecker, flammulated owl, white-breasted nuthatch, pygmy nuthatch, Williamson's sapsucker, and Lewis' woodpecker.

These bird species have likely suffered some of the greatest population declines and range retractions (Altman 2000).

Local overstory nesting species and foliage or crown feeders may include the pine siskin, golden-crowned kinglet, mountain chickadee, hermit thrush, ruby-crowned kinglet, yellow-rumped warbler, and western tanager.

The Conservation Strategy for Landbirds (Altman 2000) identifies three priority habitat types: Dry Forest, Mesic Mixed Conifer, and Riparian Woodland and Shrub. Several "unique" habitats are also important. The Project Area contains all three forest types over large areas.

Dry Forest habitat type is characterized as coniferous forest composed exclusively of ponderosa pine, or dry stands co-dominated by ponderosa pine and Douglas-fir or grand fir. It is generally at lower elevations and mostly on xeric, upland sites with shallow soils.

Focal species include: white-headed woodpecker (large patches of old forest with large trees and snags), flammulated owl (old forest with interspersion of grassy openings and dense thickets), chipping sparrow (open understory with regenerating pines, and Lewis' woodpecker (patches of burned old forest). Dry forest type comprises about 51 percent of the forested area within the Umatilla Forest.

Mesic Mixed Conifer habitats are primarily Douglas-fir and grand fir sites that are generally higher elevation, wetter, on northerly aspects, and in draws where soils are mesic.

Focal species include Vaux's swift (large snags), Townsend's warbler (overstory canopy closure), varied thrush (structurally diverse, multi-layers), MacGillivray's warbler (dense shrub layer in forest openings or understory), and olive-sided flycatcher (edges and openings created by wildfire). Mesic mixed conifer (moist upland forest) occurs on about 33 percent of the forested habitat within the Umatilla Forest.

Riparian woodland and shrub habitats are typified by the presence of hardwood tree and shrub species, along with associated wetland herbaceous species. Water is an important component of these habitats, whether it is in the form of standing wetlands, springs, seeps, or flowing water (streams). Riparian vegetation is particularly important to Neotropical migratory songbirds (Sallabanks et al. 2001). Although these habitats generally comprise only a small portion of the landscape, they usually have a disproportionately high level of avian diversity and density when compared to surrounding upland habitats.

In addition, the Conservation Strategy identifies aspen as a unique habitat important to landbirds. In the Blue Mountains, aspen trees are nearly always associated with riparian areas or ephemeral draws, so they are included in this section.

Focal species include: Lewis' woodpecker (large snags), red-eyed vireo (canopy foliage and structure), veery (understory foliage and structure), and willow flycatcher (willow/alder shrub patches) and red-naped sapsucker (aspen). Riparian woodland and shrub habitat occurs on less than one percent of the Forest.

Focal species for Unique Habitats include: hermit thrush (subalpine forest), upland sandpiper (montane meadows), vesper sparrow (steppe shrubland), gray-crowned rosy finch (alpine), and red napped sapsucker (aspen). The Forest has only a small amount of any of these habitat types.

Table 34 - Unique Habitat/Focal Species on the Forest

Unique Habitat	Habitat Attribute	Focal Species	Approximate Percent of Forest Acres
Subalpine Forest	Patches	Hermit thrush	Less than 1
Montane Meadows	Mesic and dry conditions	Upland sandpiper	1.4
Steppe Shrublands	Patches	Vesper sparrow	3
Aspen	Large trees/snags with regeneration	Red-naped sapsucker	Less than 1
Alpine	Patches	Gray-crowned rosy finch	Less than 1

3.3.3 Alternatives Analyzed

Effects Analysis & Methodology for Analysis

Excerpts from the Invasive Plants FEIS (USDA Forest Service, 2005a) are used throughout this discussion. The effects analysis of individual herbicides and surfactants are used here. Facts, figures, herbicides, and species analysis are modified to reflect the site-specific analysis effort on the Forest.

The following terminology and introduction from the Invasive Plants FEIS (USDA Forest Service, 2005a) are repeated here for easy reference, and are pertinent to discussion of effects on wildlife on the Forest (R6 FEIS Pages 4-42 to 4-44).

- **NOAEL (No observed adverse effect level):** An exposure level at which there is no statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control. Some effects may be produced at this level, but they are not considered as adverse, or as precursors to adverse effects. In an experiment with several NOAELs, the regulatory focus is primarily on the highest one, leading to the common usage of the term NOAEL as the highest exposure without adverse effects.
- **LOAEL (Lowest Observed Adverse Effect Level):** The lowest dose associated with an adverse effect.
- **Toxicity index:** The benchmark dose used in analysis to determine a potential adverse effect when it is exceeded. Usually a NOAEL, but when data are lacking other values may be used.

When considering the effects of herbicides on wildlife species, it is important to remember these herbicides are designed to affect plants at relatively low rates, while much higher rates would be required to kill animals. Plants have metabolic systems that do not exist in animals. It is these metabolic systems at which the herbicides are targeted. Michael (2002) explained it well when he said, “All chemicals, natural or man-made, are toxic at some level of exposure. The difference between acute and chronic toxicity versus the no observed effect level (NOEL) is primarily a function of the amount of exposure in a unit of time and the mode of action of the chemical.

For example, vitamin D is essential to good health and mammals consume it on a daily basis. However, it could be very toxic, in fact more toxic than most of the herbicides used in forest management" (Michael 2002).

Results of numerous field studies indicate the likelihood for direct adverse effects to wildlife from herbicide use is low (e.g., Marshall & Vandruff, 2002; Dabbert et. al., 1997; Fagerstone et. al., 1977; Rice et. al., 1997; Sullivan et. al., 1998a, Cole et. al., 1997; Cole et. al., 1998; Johnson and Hansen, 1969; Nolte and Fulbright, 1997, McMurray et. al., 1993a; McMurray et. al., 1993b). The use of herbicides to treat invasive plants, however, does have the potential to harm free-ranging wildlife. Certain herbicides have the potential, for example, to affect the vital organs of some wildlife species, change body weight, reduce the number of healthy offspring, increase susceptibility to predation, or cause direct mortality. Individual birds and mammals may ingest vegetation or insects that have been sprayed with some herbicides and potentially experience these types of effects.

Herbicides may also cause some malformations or mortality to amphibians that have been exposed to herbicides or surfactants in water (Relyea 2005). In addition, herbicides contain impurities and additives, and produce metabolites that could be toxic to wildlife.

A metabolite of triclopyr, 3, 56-trichloro-2-pyridinol (TCP), is toxic to aquatic animals. The impurity hexachlorobenzene, found in picloram and clopyralid, is carcinogenic. Surfactants added to herbicides could substantially increase toxicity to aquatic species, like amphibians. These substances were evaluated in the relevant risk assessments and, with the exception of surfactants, were found not to contribute substantially to toxic exposures or increase cancer risk (SERA, 2003a, 2003b, 2003c, 2004b).

The results of the herbicide analysis indicate that birds or mammals that eat grass or insects are most susceptible to harm from herbicides. Birds or mammals that eat vegetation (primarily grass) that has been sprayed with herbicide have relatively greater risk for adverse effects because herbicide residue is higher on grass than it is on other herbaceous vegetation or seeds (Kenaga 1973; Fletcher et. al. 1994; Pfleeger et. al. 1996). Because of their small size and relatively larger surface area, herbicide residues on insects may also be higher (Kenaga 1973). Some birds and mammals that eat grass include elk, rabbits and hares, chukar, California quail, and geese. Some bird species (like quail) are primarily herbivorous as adults but require insects as a primary food source as chicks. Insect-eating mammals include bats and shrews. Insect-eating birds include a huge number of species, such as bluebirds, flycatchers, swallows, wrens, and others.

NPE surfactants added to herbicides also have the potential to result in harmful doses to birds and mammals that eat vegetation or insects that have been sprayed. For the purpose of analysis, it is assumed that the number of plausible exposure scenarios that exceed the toxicity indices is the same for surfactant as it is for the herbicides. No estimate of acres treated using NPE surfactants is made because surfactants may not be used, or other additives may be used instead, so there is no direct correlation between acres treated with herbicide and acres treated with NPE.

Analytical Methods

The analytical methods used in determining toxicity of herbicides and surfactants on wildlife species including PETS, management indicator species and landbirds can be found in Appendix C of this document.

The number of acres of wildlife habitat benefited by removal of invasive species to restore native vegetation and rate of treatment is determined by the acres treated and the rate of treatment determined by the effectiveness of the treatment method.

The number of special status species potentially exposed to herbicides following implementation of the PDF is determined by Geographic Information System (GIS) analysis of the number of acres of herbicide treatment that dissect or traverse habitat that is potentially suitable. These acres are discussed in the wildlife effects section.

The number of special status species potentially impacted by manual, or mechanical, treatments following implementation of the PDF is determined by Geographic Information System (GIS) analysis of the number of acres of non-herbicide treatment that dissect or traverse habitat that is potentially suitable. These acres are discussed in the wildlife effects section.

3.3.4 Environmental Consequences

General Effects of Invasive Plant Treatments

Effects of invasive plant treatment methods to wildlife were evaluated and discussed in detail in the Region Six Invasive Plant Program FEIS (USDA Forest Service 2005a), the corresponding Biological Assessment (USDA Forest Service 2005b), project files, and FS/SERA risk assessments (SERA 2001, 2003a-d, 2004a-e). These documents indicate that the most plausible adverse effect to wildlife from invasive plant treatments is from disturbance caused by manual and mechanical treatments.

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 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 methods. 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 probability 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 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 (see Duncan and Clark 2005).

There are two primary effects likely for most species from invasive plant treatments; disturbance and trampling from machinery or people treating invasive plants, and risk from herbicide contact for species in which data is not sufficient to allow quantitative estimates of risk. There is no risk to species' habitat 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 in the Project Area may have suitable habitat along roads, although in small amounts relative to the amount of suitable habitat that is not within a road corridor.

Invasive Plants Treatment Methods Effects to Wildlife

Manual

Manual treatments can result in trampling of non-target plants (habitat) and animals and create bare ground. 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 chemical methods, the duration of disturbance, caused by the presence of people, may be longer in the treatment area. The slower pace of work allows animals in the area to leave and reduces the risk of direct harm from trampling. Bare ground is likely to be patchy in distribution with this method and less likely to interfere with animal movement or dispersal.

Mechanical

Some mechanical treatments may crush small mammals, reptiles, amphibians, or eggs of ground-nesting birds. Small species that lack rapid mobility (e.g. turtles and toads) are vulnerable to crushing or injury from people or equipment.

Hand-held mechanical equipment, like chainsaws and string trimmers, can be used very selectively on target plants and may be less likely than larger equipment to directly harm wildlife. Use of vehicle-mounted mechanical equipment (mowers, or hammer flails, etc.) is much less selective and more likely to directly harm small wildlife species. Vehicle-mounted equipment is most often applied to monocultures of invasive plants on gentle slopes or road verges, and even though those areas do not provide preferred or suitable habitat for most native wildlife, adverse effects from disturbance or crushing are still possible. Mechanical treatments may produce more bare ground, reducing cover, exposing more soil to erosion, potentially disrupting dispersal or foraging patterns of small animals, and possibly exposing some to increased predation as a result of decreased cover. Mechanical methods generate more noise than other treatments, except for aerial applications, and have a higher likelihood of disturbing species that are secretive or sensitive to noise.

For several species 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. Based on interviews with State and County weed control operators, the vehicles used to spray roadside vegetation with herbicides do not make noise as loud as logging trucks or large delivery trucks and are therefore within the background noise level for open roads. Other mechanical devises 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 certain wildlife species. Bald eagles could be disturbed by these same tools, as well as human presence, however eagles are quite variable in their responses to activity and noise in the vicinity of their nests or roosts.

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 affect native plant species could adversely affect wildlife; however these biological control agents would not be used as per standard 18.

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.

Herbicide

The herbicides proposed for use in this document were determined to have minimal impacts to wildlife species in the analysis conducted for the *Region Six Invasive Plant Program FEIS* (USDA Forest Service 2005a). Risk from herbicide exposure was determined using data and methods outlined in the SERA risk assessments (2001, 2003, 204). Tables 5 and 6 in Appendix P of the 2005 FEIS, and the Wildlife Biological Assessment (USDA 2005c pp. 24 – 27) 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. If a dose exceeded a toxicity index, then it was determined to have a potential for adverse effect.

Under “worst case” scenarios, mammals and birds that eat insects or grass that have been contaminated by herbicides are at most risk of adverse effects for some herbicides and NPE surfactants. Amphibians also appear to be at higher risk of adverse effects due to their permeable skin and aquatic or semi-aquatic life history. In most cases, there is insufficient data available on toxicity thresholds to allow a quantitative estimate of risk to an amphibian using a “worst case” scenario.

For this EIS, no aerial, broadcast or spot application will exceed the typical application rate, so highest application rate scenarios are not discussed here. For typical application rates and exposures to birds and mammals, only triclopyr and NPE surfactants produced doses that exceeded toxicity indices. Results of triclopyr exposures do not take into account the strict limitations on use required by a Forest Plan Standard, which makes the exposure scenarios implausible. NPE surfactant exceeded the toxicity index for direct spray of a small mammal, large mammal and large bird that consumed contaminated vegetation (acute), and a small mammal and small bird that consume contaminated insects. There is insufficient data to assess risk of chronic exposures for a large grass-eating bird or insect-eating birds and mammals.

Data is very limited or lacking on potential adverse effects of herbicides to reptiles 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 a posing potential risks to fish in the aquatic species BA (USDA Forest Service 2005c). 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.

The 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, or implementation ofProject Design Features and therefore exaggerate risk when compared to actual applications proposed in this EIS.

Early Detection Rapid Response (EDRR)

EDRR is designed to be aggressive in the control of invasive plants. This is necessary to ensure success in managing and controlling the spread of these highly competitive and easily established plants.

Allowing the treatment of newly found sites adds additional risk factors to wildlife just by adding additional exposure areas. The decision tree would be used with each new infestation site.The risk factors do not change and the PDFs (Chapter 2) would still reduce the effects to little or no impacts to wildlife species.

The management direction included in all alternatives as well as the environmental conditions and animal behavior would tend to minimize actual impacts for EDRR. At the project scale, choices would be made to avoid situations that could cause harm to wildlife. For example, certain herbicides would be avoided in specific areas or times of the year where/when grass-eaters or amphibians may be at risk, or more specific application methods could be used. In addition the PDFs would be used under each action alternative. Alternative A (No Action) does not incorporate EDRR. Actual adverse effects are therefore not likely to occur. Any short-term adverse effects would be largely offset by the long-term benefits of protecting wildlife habitat from loss due to invasive plants.

Incomplete and Unavailable Information

The data available for mammals are derived from numerous studies conducted to meet registration requirements, and primarily on laboratory animals that serve as surrogates. Data for mammals are available for more types of toxicity tests and often on a wider variety of species than are available for birds.

Availability of information on the direct toxicological effects of the 10 herbicides approved for use in Region 6 on wild mammals varies by herbicide. Glyphosate has been widely studied, including field applications. Little or no data on wildlife may exist for other herbicides because they have been tested on only a limited number of species under conditions that may not well represent populations of free-ranging animals (SERA 2001b, 2003a, 2003b, 2003c, 2004a, 2004b, 2004c, 2004d, 2004e, 2004f).

Toxicity data available for birds are derived from studies conducted to meet registration requirements, and primarily on domestic birds that serve as surrogates. There are typically fewer types of toxicity studies conducted on birds using a more restricted variety of species than are conducted for mammals.

Almost all laboratory data is collected on mallards and northern bobwhite. How the sensitivities of different bird species to herbicides may vary from that reported for mallard and bobwhite is not known.

Effects Common to All Alternatives

The treatment of invasive plants has short-term impacts by reducing cover, but restoring native vegetation would have long-term benefits by providing food and cover (See Chapter 3.2.3 – Treatment Effectiveness in the EIS). Birds or mammals that eat vegetation (primarily grass) that has been sprayed with herbicide have relatively greater risk for adverse effects because herbicide residue is higher on grass than it is on other herbaceous vegetation or seeds (Kenaga, 1973; Fletcher et. al., 1994; Pfleeger et. al. 1996). Broadcast treatments would impact larger areas than spot treatments, however; disturbance would occur once a year and normally would last for less than a few hours. Species such as turkeys, grouse, quail, and waterfowl all consume grass as part of their diet. Other birds would eat grass seeds especially. The end result of all of the alternatives is some degree of improvement in the quality of habitat, while having a short-term negative effect on individual birds. One example from this project would be the treatment of knapweed. Knapweed seed is not consumed by birds and provides very poor nest cover. By reducing the presence of knapweed and allowing native grasses and forbs that do provide food and cover there is a positive effect from the treatment.

The effects of herbicides, from all methods of intake and to all species on the landscape, are limited. The studies that were analyzed for the Regional EIS indicated that there was a low toxicity of herbicides to birds, but because of the large gaps in data it must be stated that some effects to birds from herbicides are unknown. The data that is available would indicate that the risk is low.

Bald eagles are sensitive to disturbance from noise during the breeding season. The mandatory PDFs for disturbance to bald eagles will effectively minimize the potential for disturbance to this species, so there is no meaningful measure that can be used to compare alternatives. At this time, no bald eagle nests occur within 0.50 miles of any treatment areas, so they are not likely to be disturbed.

For some species with limited toxicity data (amphibians, snakes), their habitat, life history, or required PDFs would make herbicide exposure a negligible risk. In addition, their locations are not mapped sufficiently to enumerate overlap with treatment areas, and their movements would make mapped occurrences less meaningful. For other species (amphibians and painted turtle), there remains some risk from herbicide exposure even when PDFs are followed. For the painted turtle, there is no toxicity data upon which to base an assessment of risk, however; at this time no painted turtles are known to exist on the Forest. For amphibians, there is some toxicity data, and some information indicating that toxicity data on fish may provide a reasonable surrogate (see USDA 2005, Appendix P, p. 28). Amphibians have permeable skin and complex metamorphoses, so they could be sensitive to herbicide exposures. The aquatic PDFs required in all alternatives would reduce, but not eliminate, risk to aquatic amphibians and the painted turtle from herbicide entering the water. The majority of the known locations for spotted frogs (leopard frogs and painted turtles are only suspected, see Appendix C) are not within any proposed treatment areas.

Mechanical and manual invasive plants treatment techniques pose a risk of trampling, introduction of sediment to aquatic habitat, or disturbance from noise.

For sedentary or slow moving species like turtles and terrestrial amphibians, trampling would cause direct and immediate mortality. Aquatic amphibians are very sensitive to the introduction of sediment into their habitat.

The overall likelihood of adverse effects from invasive plant treatments is low. Sensitive species like terrestrial amphibians are often underground or other insulating structures during the dry summer months when most invasive plant treatments would occur. They would therefore not be susceptible to trampling or herbicide exposure. PDFs reduce, but do not eliminate, risk to terrestrial amphibians. This low level potential effect makes it difficult to compare effects between alternatives in meaningful ways.

The distinction between alternatives could be compared to the difference between low potential for adverse effect and very low potential for adverse effect.

Also, because reducing herbicide use often means increasing manual or mechanical methods, the risk from herbicide exposure is traded for the risk from trampling or disturbance.

General Overview of Herbicide Analysis by Species

The analysis is based on exposure scenario results from the SERA risk assessments for mammals, birds, and honeybees using the typical application rate. The effects analyses are those effects that could be expected to exceed toxicity index based on the information outlined in Appendix P of the Invasive Plant FEIS (USDA Forest Service, 2005a).

The anticipated effects are extrapolated results based on the scenarios used for particular taxonomic groups and may be different from actual toxicity of a particular species. Worst-case for both acute and chronic exposures are combined if it is anticipated that both scenarios would apply to the species analyzed. For species that are mobile and have large home ranges only the acute scenarios are applied, because these species would not be in an area long enough to receive chronic exposure to the herbicides. Effects determinations for the purpose of NEPA analysis are made on the effects to individuals and populations for Threatened and Endangered species, but only on the population basis for migratory birds, sensitive, and MIS.

Basic assumptions for wildlife species analysis:

- Aquatic organisms such as frogs would have the same sensitivity to herbicides as fish (2005 Regional Invasive Plants FEIS).
- Small insectivorous birds that defend territories may feed in the same area and could be subject to chronic exposures from some methods of applications. Exposures to herbicides is possible by the five Partners in Flight watch listed insectivorous migratory birds; however, exposure would likely be low since these species forage higher in the canopy and forage mostly on insects above the spray zone. These species may occasionally eat species from the ground or that fly into the canopy but this incidence of exposure would be low. Other land birds may forage lower and could be subjected to higher levels of exposure.
- Mustelids (wolverine) travel widely and would not be in the same area long enough to be subjected to chronic exposures.
- Peregrine falcons forage over a large territory and would not be subjected to chronic exposures.
- Aquatic birds that forage on fish or macro invertebrates would not find a concentration of herbicides in the water high enough to be exposed at levels that could get toxic (2005 Regional Invasive Plants FEIS).

- Woodpeckers would rarely be exposed to herbicides because of their feeding methods. Their food sources are protected since the beetles and ants that the woodpeckers feed on are generally buried inside of decaying wood. The food source of these of these birds is not likely to be contaminated by spraying herbicides.
- Elk (and deer) would occasionally feed in the same area for multiple days which could lead to chronic exposures.

3.3.5 Effects to Threatened, Endangered, and Sensitive (TES) Species

Effects to Bald Eagle

Effects Common to All Alternatives

At this time invasive plant infestations are not known to exist within one half mile of the one known bald eagle nest on the Umatilla National Forest. However, new bald eagle nests and roost sites could be discovered during the life of this document so Project Design Features have been incorporated to limit impacts to bald eagles should nest or roost sites be found in close proximity to invasive plants.

No effect to the bald eagles would occur from ingesting or contacting herbicides. The effects analysis showed no anticipated toxic effects. 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. The concentrations of herbicides from invasive plant treatment would not be elevated to a point where there would be any observable effect to eagles. For bald eagles, which feed upon fish, adverse effects from herbicide or NPE surfactant exposure are not plausible because the estimated dose for herbicide or NPE does not exceed a threshold of concern for potential effects (i.e. the toxicity index).

The Project Design Features (J1a and J1b) listed for bald eagles apply to all action alternatives. 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 from disturbance, which supports direction from Standards 19 and 20.

Therefore, no invasive plant treatments in any alternative would result in adverse effects to bald eagles.

Manual and Mechanical 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 treatments 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 have detrimental effects to eggs or young (USDI, 1986). Effects from mechanical methods (e.g. tractors, chainsaws, string trimmers, etc.) may be more likely to occur, and occur at greater distances from the project site, because machinery creates louder noise. The PDF in place for Bald Eagle should eliminate the disturbance from mechanical treatment methods.

The critical period in Oregon and Washington when human activities could disturb occupied nests extends from January 1 to August 31 (Anthony and Isaacs, 1989). 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.

Most invasive plant treatments could avoid conducting the project in proximity to an occupied nest during these time-frames, but some projects may occur during the nesting season that may adversely affect bald eagles. If a bald eagle nest was located near invasive plants, it still may be prudent to treat the invasive plants, due to the detrimental affects to habitat if these plants were to be left untreated.

Projects conducted at anytime that are more than a quarter mile from a nest, or a half mile line of sight distance from a nest, and do not result in the modification of use areas or the eagles' food resource, and noise is below ambient levels, should have no effect on bald eagles (FWS 2003). Activities that occur within a quarter mile or half 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 a Limited Operating Period (LOP) (October 31 to March 31 for winter roosting and foraging; and January 1 to August 15 for nesting and rearing), are not likely to adversely affect bald eagle. The duration of the disturbance would likely be less than a day in any given year.

Invasive plant treatments will not result in the removal of bald eagle nests or roost trees, or suitable habitat, because invasive plants do not provide habitat. Invasive plants could occur within suitable habitat, however.

Treatment and Restoration

Methods used to treat invasive plants or restore habitat may affect the bald eagle. The general effects of each method (alternate from herbicide methods) to wildlife are discussed previously in this chapter and PDFs were developed specifically to limit disturbance/effects to bald eagles. The potential effects from herbicides are summarized previously in this chapter, and discussed in detail in Appendix C. All treatment methods that result in improved habitat for potential bald eagle prey species will provide a long-term benefit.

Biological Control

There is no indication that any biological controls would adversely affect the cover or forage of prey for the bald eagles. Biological controls cannot affect bald eagles directly, because they only act on invasive plants.

Herbicides

Exposure scenarios used to analyze potential effects from herbicides are discussed in USDA Forest Service 2005b, Appendix P, p. 24-27). None of the herbicides proposed for use in this EIS or 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 on the ranger district where the known nest site is located. No ground applications of herbicide would reach the upper canopies of mature trees where bald eagles nest. In addition, the bald eagle PDFs (J1a & 1b) place seasonal treatment restrictions around occupied nests if new nest locations are discovered to minimize disturbance.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 equilibrium with water, contaminant level in whole fish is used, and upper estimate assumes 15 percent of body weight eaten/day. For chronic exposures thescenario used was 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 proposed for use 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 NOAEL (See Appendix C).

The weight of evidence suggests that adverse effects to bald eagles from NPE or the herbicides included in the action alternatives are not plausible. Each of the action alternatives would treat the same number of acres within the BECA. No aerial applications are currently proposed in the vicinity of the bald eagle nest.

Early Detection Rapid Response

If new invasive plant treatment sites are discovered in close proximity to a bald eagle nest, the PDF is in place to limit impacts to the bald eagle and its habitat for all action alternatives. Alternative A (No Action) does not include EDRR using integrated weed management, although manual methods without herbicide may be used.

Summary of Effects to Bald Eagle

Disturbance by humans and vehicles during project implementation is the primary adverse effect that is plausible for bald eagles. There are no bald eagle nest locations within more than a mile of proposed treatment areas. The Project Design Features (J1a and J1b) 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 (per Standards 19 and 20) from disturbance to any future nests that may occur, and also applies to EDRR should new infestations of invasive plants occur near existing nests.

Conducting invasive plant treatments **may affect, but is not likely to adversely affect** the bald eagle. This conclusion is based on:

- The Project Design Feature required for application in areas within one-quarter mile of a bald eagle nest, or within one-half-line-of-sight of a bald eagle nest will minimize adverse effects from disturbance.

Adverse effects to bald eagles from herbicide exposure are not plausible because:

- Studies have shown that even if a bald eagle 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.

Cumulative Effects to Bald Eagle

Since there would be negligible direct or indirect effects to bald eagles, if any, there are no effects to accumulate. In the site-specific management plan for the Dry Creek eagle nest site, recommendations limit on-going and foreseeable future activities that would have the potential to affect the bald eagles.

Activities of man and natural processes have led to the introduction, establishment and spread of invasive plants across the Umatilla National Forest. Only the land and roads within the National Forest System would be treated in the action alternatives proposed by this EIS. The Forest, however, is intermingled with other federal, state, county, and private ownerships. Management activities and actions on neighboring lands may contribute to spread or containment of invasive plants on National Forest System lands, and vice versa. The effectiveness of the proposed invasive plant treatments project would be increased if coordination with adjacent landowners treats invasive infestation across land ownerships. The cumulative effects analysis assumes that this cooperative, coordinated effort continues for the life of this project.

Herbicides are commonly applied on lands other than National Forest system lands for a variety of agricultural, landscaping and invasive plant management purposes. Herbicide use occurs on tribal lands, state and county lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. No requirement or central reporting system exists to compile invasive plant management information on or off National Forests in Oregon or Washington. So, accurate accounting of the total acreage of invasive plant treatment for all land ownerships is unavailable.

The proposed use of herbicides on and off National Forest system lands could result in additive doses of herbicides to wildlife species. For additive doses to occur, the two exposures would have to occur closely together in time, since the herbicides proposed for use are rapidly eliminated from wildlife and do not significantly bioaccumulate (USDA 2005). The application rates and extent considered in this EIS are unlikely to result in additive doses beyond those evaluated for chronic and acute exposures in the USDA Forest Service risk assessments, which formed the basis for the effects analysis in the Invasive Plant FEIS (2005). The Invasive Plant FEIS (2005), in return, served as the basis for the site-specific effects analysis discussed in this EIS.

The risk of adverse effects of invasive plant treatments in all action alternatives have been minimized by the Project Design Features (PDFs). These limit, but do not exclude, the possibility of cumulative adverse effects caused by treatment. The use of herbicides within the scope of this project is unlikely to contribute to cumulative effects beyond those described in the Invasive Plant FEIS (2005). Herbicide persistence is managed through PDFs to avoid chemical loading in the soil over time at any one site. Buffers minimize risk of herbicide concentrations of concern near water. Specific PDFs can be reviewed in section 2.2.3.

Early Detection Rapid Response is part of all action alternatives, and is considered in the direct, indirect and cumulative effects analysis. Effects of treatments each year under early detection-rapid response, by definition, would not exceed those predicted for the most ambitious conceivable treatment scenario. This is because the Project Design Features do so much to control the potential for adverse effects and because if the most ambitious treatment scenario were implemented, the potential for spread into new areas would be greatly reduced.

Effects to Canada Lynx

As stated earlier, the Umatilla National Forest is categorized as “peripheral area” based on the Draft Lynx Recovery Outline (2005) for lynx habitat. Although historically lynx occupied Oregon, self maintaining populations of lynx in Oregon are not known to have existed historically. There is no documentation of lynx reproducing in the state of Oregon. The Forest has not had a verified lynx observation since 1999, therefore the Forest is considered “unoccupied” habitat by the USDI Fish and Wildlife Service (FWS) (letter August 2006). Since lynx are not considered present in the area and it is highly unlikely that lynx will ever occupy the Forest there will be **no effects to lynx** from any of the alternatives considered in this document. As shown in the existing condition portion of this document, one LAU has invasive plants within approximately 3 percent of the LAU, two with 2 percent and six with less than 1 percent. Invasive plants do not constitute lynx habitat so treatment of invasive plants would not affect habitat. Short-term disturbance could affect prey habitat but the long-term benefits to prey habitat from invasive plant treatments outweigh the short-term impacts.

Effects to Gray Wolf

Effects Common to All Alternatives

As discussed earlier, there are no known denning or rendezvous sites on or near the Forest. There are currently no confirmed wolves on the Forest. However, investigations of wolf sightings are ongoing, and the discovery of a wolf pack is a possibility. There is potential for wolves to become established on the Forest in the future. The actions discussed below would have the same common impacts on wolves and/or their habitat for each of the alternatives considered.

Treatment and Restoration

Methods used to treat invasive plants or restore habitat though not likely, may affect the gray wolf. The general effects of each non-herbicidal method to wildlife are discussed previously in this chapter. The potential effects from herbicides are also summarized previously in this chapter, and discussed in detail in Appendix C and in the R6 Invasive Plants Program FEIS (USDA Forest Service 2005b, Appendix P). All treatment methods that result in improved habitat for elk, deer or other prey species will provide a long-term benefit to wolves.

Manual and Mechanical Methods

Direct effects from invasive plant treatment include disturbance caused by noise, aircraft, people and vehicles, which are activities common to manual and mechanical methods. These activities could potentially disturb gray wolves. However, invasive plant projects involve very short-term disturbance with few people and might only be repeated once in the same growing season. Currently, wolves may be transient within the Project Area and are unlikely to encounter any individual project.

Although wolves will travel over large distances, they are most likely to occur in wilderness and roadless areas, away from human disturbance. These areas have minimal invasive plant infestations so the likelihood of disturbance would likely be nominal. The life history traits of the species, current literature, existing guidelines, and expert opinion of biologists familiar with the species (Gaines, pers. comm.; Naney, pers. comm.) indicate that the level of disturbance expected from any invasive plant project is not likely to adversely disturb the gray wolf. In addition the PDF that addresses activities in close proximity to known denning or rendezvous sites, should wolves become established on the Forest, will limit disturbance.

Biological Control

Biological control methods have been utilized on the Umatilla National Forest, and on other National Forests where wolves currently exist. There is no indication that any biological controls adversely affect the forage of elk or other prey items for the gray wolf. Biological controls cannot affect gray wolves directly, because they only act on invasive plants.

Herbicides

Exposure scenarios used to analyze potential effects from herbicides are discussed in "Summary of Herbicide Effects to Wildlife" Appendix C and in the R6 Invasive Plants Program FEIS (USDA Forest Service 2005b, Appendix P). The potential effects are not likely to occur under actual field conditions because the worst-case scenarios do not account for plausibility of exposure, differences in application methods and timing, seasonal presence, species behavior, current protection measures in place, the current distribution of the species, or the standards adopted with the existing 2005 Pacific Northwest Region Invasive Plant Program decision. In addition, although wolves will travel over large distances, they are most likely to occur in wilderness and roadless areas, away from human disturbance. These areas have minimal invasive plant infestations so the likelihood of herbicide use where they exist would likely be nominal.

Gray wolves prey upon large mammals and will also eat carrion. It is extremely unlikely that a gray wolf would enter into an invasive plant treatment area, because they tend to be transient and generally avoid areas where there has been recent human activity. Wolves are even more unlikely to be exposed to herbicide because any appreciable exposure would require wolves to feed upon the exact individual of prey that had been feeding exclusively within the treatment area, or had been directly sprayed. Even if an elk or deer had foraged in the treatment area, or been directly sprayed, a single wolf would have to consume the entire deer or elk before the herbicide was eliminated from the herbivore's body. Again, an extremely unlikely scenario, since most of any herbicide dose for the herbicides contained in the Proposed Action is eliminated within 24-48 hours.

Small mammals are not the typical prey item for wolves. Nonetheless, the scenario in which a medium-sized canid eats small mammals that have been directly sprayed was used to evaluate a general risk to carnivores from herbicide use. This scenario, while not very plausible, would constitute the worst-case scenario of herbicide exposure for a gray wolf.

The following interpretations of the exposure scenario results are made with the reservation that toxicity data was generated from laboratory animals that may not accurately represent potential effects to free-ranging wildlife.

At typical and highest application rates, the estimated doses from the exposure scenario are all less than the reported NOAELs for all herbicides except chronic doses of triclopyr.

There is no data available to estimate an actual chronic dose in this scenario, so the chronic estimate is obtained by comparing the acute dose to the chronic toxicity index. This comparison will over-estimate the dose and risk to the carnivore. At the typical application rate, the estimated acute dose to a carnivore consuming contaminated small mammals is 2.1 mg/kg (project file worksheets USDA Forest Service 2005b). The chronic NOAEL for effects to kidneys in dogs is 0.5 mg/kg/day.

For triclopyr, the worst-case analysis uses a very conservative toxicity value. Toxicity of triclopyr acid and triclopyr BEE does not differ for mammals. The EPA has used two different values for a reference dose on the effects of triclopyr to mammals. The FS/SERA risk assessment (2003 Triclopyr) relies on a chronic toxicity index (NOEL of 5 mg/kg/day) from a rat reproduction study. In this analysis, a lower value from a 1-year feeding study of dogs is used (chronic NOEL of 0.5 mg/kg/day; Quast et al., 1976, cited in SERA, 2003 Triclopyr). Dogs were not considered by EPA to be a good model for human health effects, because they do not excrete weak acids as well as other animals (see Timchalk and Nolan 1997; Timchalk et al. 1997). Canids are, however, relevant for concerns about effects to wildlife in general and gray wolves specifically. It may be argued that the use of the 0.5 mg/kg/day value for the toxicity index in this analysis is overly cautious, because it represents competition for excretion rather than a toxic effect (Timchalk et al., 1997). However, it meets the criteria for providing a worst-case analysis based on available toxicity data for potential effects to wildlife, and is therefore consistent with the criteria for choice of other indices used in this analysis.

The use of triclopyr for invasive plant treatment is restricted in the Proposed Action by Standard #16, which states, "The use of triclopyr is limited to selective application techniques only (e.g. spot spraying, wiping, basal bark, cut stump injection)." The above exposure scenarios calculate doses based on a broadcast spray-method application that would directly spray an entire day's diet of small mammals. The direct spray of many small mammals could not occur with triclopyr applied to non-desirable vegetation in a selective manner. Therefore, with Standard 16 in place, adverse effects to gray wolves from the use of triclopyr will not occur.

It is unlikely a wolf would be in areas with extensive acres of invasive plants, since invasive plants are not generally utilized by their prey species and are usually in more open or populated areas. It is unlikely a wolf would be directly sprayed through aerial application since the wolf would run from a low flying plane or helicopter or at least hide under some type of cover. The smallest area proposed for aerial spraying is less than one acre in size and the largest is approximaltey 286 acres. At this time, no wolves are known to occupy the Forest. If in the future they are detected, they will most likely remain in the less human populated areas, where generally there are no invasive plants. Wolf sightings are being investigated regularly so if wolves are located, their presence will be taken into account prior to aerial spraying. If it is determined that aerial spraying a particular area could negatively impact an individual or pack the spraying would be postponed until they were outside the Project Area. As the PDF requires, treatments within 0.50 mile or .50 mile line of sight occupied rendezvous sites would be timed to occur outside the season of occupancy unless treatment activity is within acceptable ambient noise levels and human presence in the area would not cause wolves to abandon the site (as determined by a local specialist). The restriction in the vicinity of active rendezvous sites is not backed up by scientific data but is intended to reduce impacts to wolves. Occupancy of both denning and rendezvous sites (i.e. whether it is active or not) will be determined each year prior to treatments. Consultation with FWS would be reinitiated (unless determined otherwise by FWS) if/when wolves are discovered in the vicinity of treatment sites.

Early Detection and Rapid Response

If new invasive plant treatment sites are discovered in close proximity to a wolf den or rendezvous site the PDF is in place to limit impacts to the wolf and its habitat for all the action alternatives. The short-term impacts of the treatments would be largely offset by the long-term benefit of protecting habitat for wolf prey species from loss due to invasive plants.

Summary of Herbicide Effects to Gray Wolf

Indirect effects to gray wolf would consist of changes to the habitat of their prey. Invasive plant treatments will not remove or degrade prey habitat since invasive plants do not provide adequate forage for elk and other prey, although certain invasive species may be utilized during some parts of the year. Successful control of invasive plant infestations provides long-term benefits to gray wolf by restoring native habitat and forage for their prey and preventing future degradation of habitat. Indirect effects of herbicide are not likely because the herbicides in the alternatives considered do not bioaccumulate and any exposure for gray wolf is highly unlikely. In addition, PDFs (J2a and J2b) would be in place to limit disturbance to denning and rendezvous sites (See Chapter 2 of the EIS).

Determination of Effects to Gray Wolf

At this time gray wolves are not known to exist on the Forest so invasive plant treatments will have **no effect** on the gray wolf. However, in the future if wolves are confirmed on the Forest invasive plant treatment projects conducted according to the standards in the Proposed Action, **"may affect, but is not likely to adversely affect"** the gray wolf. This determination is based on:

- The Region 6 Invasive Plants FEIS prevention standards will help to protect the foraging habitat of their prey from invasive plants
- Distribution of gray wolves within the infested areas would likely be very limited, and sporadic, so the opportunity for wolves to be in or near treatment areas is also very limited
- Disturbance from projects could occur, but is unlikely. In addition, the PDF for wolves would further limit possible disturbance
- Disturbance from invasive plant treatment projects is low level, short duration, and infrequent
- Doses of any herbicides in the Proposed Action that would cause potential adverse effects are not plausible

Cumulative Effects

Cumulative effects for the purposes of consultation under ESA are defined as, "the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area…" (50 CFR, Part 402).

As wolves move into Oregon and Washington, they will be subject to the same pressures and conflicts with humans that occur in Idaho, Wyoming and Montana. The projected increases in population for Oregon and Washington will likely increase recreation on the National Forests where wolves may occur. This could increase human disturbance and potential sources of mortality, to wolves in the area.

The cumulative effects described within the bald eagle portion of this document would also apply to the gray wolf.

3.3.6 Effects to Sensitive Species

Effects to California Wolverine

Effects Common to All Alternatives

Wolverines probably occur in remote wilderness areas of the Umatilla National Forest. Currently approximately 251 acres of the 304,925 acres of wilderness contain known invasive plants. The short duration, low intensity invasive plant treatments are not likely to disturb wolverines since such a small percentage of treatment areas are located in potential wolverine habitat. There is a minor potential for short-term disturbance, which is an indirect effect, from implementing any of the action alternatives. The herbicide effects analysis above shows no toxic effects (direct effect) determined from herbicide use on wolverines. There are no anticipated direct and only short duration, low intensity indirect effects from manual or mechanical treatments because their location is not in the proximity of possible denning areas or likely foraging habitat. In addition wolverine travel widely and would not be in the same area long enough to be subjected to chronic exposures.

Treatment and Restoration

Potential effects of invasive plants treatment methods on wolverine are associated with disturbance that may occur during the denning season. Direct effects from invasive plants treatment methods include disturbance caused by noise, people and vehicles. However, since wolverine den in the high country and no invasive plants have been located in potential den site habitat, it is unlikely they would be disturbed. If a wolverine were to be foraging in the immediate vicinity of a treatment, they would likely be temporarily displaced. They tend to travel widely and be opportunistic hunters so being temporarily displaced would have a minimal impact. Wolverines appear to be most vulnerable to disturbance during the winter months. Invasive plant treatments would not occur during winter.

Manual and Mechanical Methods

Methods used to treat invasive plants or restore prey habitat may have a limited affect on wolverine. The general effects of each non-herbicidal method (disturbance) to wildlife are discussed previously in this chapter and PDFs were developed specifically to limit disturbance in wilderness areas, which due to their remoteness are places wolverine likely use. Motorized treatments and aerial spraying are not permitted in the wilderness. Wilderness areas also tend not to have many invasive plants since they lack roads or much active resource management. All treatment methods that result in improved habitat for potential wolverine prey species will provide a long-term benefit.

Biological Control

There is no indication that any biological controls would adversely affect the cover or forage of prey for the wolverine. Biological controls cannot affect wolverine directly, because they only act on invasive plants.

Herbicides

The potential effects from herbicides are summarized previously in this chapter, and discussed in detail in Appendix C. As stated previously, the most likely places wolverines would be found on the Forest are the wilderness areas since wolverine prefer remote and high elevation areas for denning.

Of the 304,925 acres of wilderness approximately 251 acres have known infestations of invasive plants. In addition, no areas above 7,000 feet in elevation have invasive plants. The higher elevation areas are where wolverine would most likely den. Although wilderness areas appear to be the most likely places to find wolverine, they could be found just about anywhere on the Forest since they have such large home ranges and are capable of traveling long distances in a day. Wolverines eat a wide variety of foods; however they are opportunistic scavengers with large mammal carrion tending to be their primary food source year-round. While foraging, they generally avoid large open areas and tend to stay within forested habitat at the mid and high elevations. Unless directly along roads; the forested areas of the Forest tend not to have many invasive plants. If wolverines consume prey that has ingested herbicide, the herbicides approved for use, except for picloron, are not retained in the body.

There will be no aerial spraying in the wilderness areas and since aerial spraying will not occur in areas with canopy closure over 30 percent, it is highly unlikely aerial or broadcast spraying will impact wolverine habitat.

Infrequent and short-term disturbance from treatment projects could affect wolverines during breeding season or if they happen to be in the area at the time of treatment. However, this type of disturbance is unlikely. Worst-case exposure exceeds the toxicity index from ingesting prey that has been sprayed with triclopyr. However, the worst-case herbicide exposure is highly unlikely for the reason mentioned above in herbicide portion of the Invasive Plant Treatment Method Effects to Wildlife section (pages 45-46). Broadcast spraying in wilderness would only be applied using tanks mounted on horses. No aerial spraying would occur in the wilderness or in areas that have over 30 percent canopy closure, which are the type of areas one would expect to find wolverine. For more detail on effects to medium sized carnivores see Herbicide Effects to Wildlife (Appendix C). Invasive plants may degrade habitat for some prey species of wolverine, such as elk and deer. The possible short-term disturbance to an individual wolverine caused by invasive plant treatments are worth the long-term benefits to wolverine and their prey by protecting their habitat from loss due to invasive plants.

Early Detection Rapid Response

Since wolverine prefer remote areas that are far from human activity, it is unlikely that they would spend time in the vicinity of invasive plants. Their prey would generally not be in areas with concentrations of invasive plants. It is unlikely invasive plant sites will be discovered in close proximity to a wolverine den since no invasive plants have been located above 7,040 feet in elevation. The No Action Alternative (Alternative A), does not include EDRR and has no sites located in potential denning habitat. The short-term impacts of the treatments would not outweigh the long-term benefit of retaining habitat for wolverine prey species. Effects, if any, are expected to be negligible.

Differences between Alternatives

The effects of each of the alternatives would be similar. Alternative A has no treatments proposed in the wilderness; Alternative B would treat the same number of acres as Alternative C and D. Aerial spraying would not occur within the wilderness in any alternative and since that is where wolverine would most likely be found the impacts between the action alternatives would be similar. Alternative C would have no broadcast spraying within riparian areas, but infestations would still be treated. The No Action Alternative would be the least affective of the alternatives considered in protecting wolverine prey foraging habitat because it would treat the least number of acres and does not incorporate EDRR to help reduce the spread of invasive plants in the future.

Each alternative has the potential for short-term disturbance to wolverine due to treatments but the long-term benefit of treatments proposed in the action alternatives outweighs the possible short-term impacts.

Summary of Effects to Wolverine

There has been no recent sign of wolverine existence on the Forest. If wolverine were to be present, they would likely occur in remote areas of the Umatilla National Forest. Currently approximately 251 acres of the 304,925 acres of wilderness contain known invasive plants. The short duration, low intensity invasive plant treatments are unlikely to disturb wolverines since such a small percentage of treatment areas are located in likely wolverine habitat. If wolverines consume prey that has ingested herbicide approved for use, except for picloram, it is not retained in the body. Herbicide persistence is managed through PDFs to avoid chemical loading in the soil over time at any one site.

Therefore invasive plant treatments **"may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species"** of California wolverine as a result of any of the alternatives considered in this EIS.

Cumulative Effects

Though it is unlikely, there are foreseeable future actions within the Forest that could impact wolverines and their habitat. Winter recreation and hiking as well as proposed improvements for these activities increase human activity in potential wolverine habitat, and could add to the effect of disturbance. Any increase in human activity in areas where wolverines exist is a cumulative effect on this species. However, at this time wolverines have not been detected on the Forest.

Although extremely unlikely, the proposed use of herbicides on and off National Forest system lands could result in additive doses of herbicides to wildlife species. For additive doses to occur, the two exposures would have to occur approximately at the same time, since the herbicides proposed for use are rapidly eliminated do not significantly bioaccumulate (R6 FEIS 2005). The application rates and extent considered in this EIS are unlikely to result in additive doses beyond those evaluated for chronic and acute exposures in the USDA Forest Service risk assessments, which formed the basis for the effects analysis in the Region 6 Invasive Plant FEIS (2005). The Region 6 Invasive Plant FEIS (2005), in return, served as the basis for the site-specific effects analysis discussed in this EIS.

The risk of adverse effects of invasive plant treatments in all action alternatives have been minimized by the PDFs. These limit, but not exclude, the possibility of cumulative adverse effects caused by treatment. The use of herbicides within the scope of this project is unlikely to contribute to cumulative effects beyond those described in the Invasive Plant FEIS (USDA, 2005). Herbicide persistence is managed through PDF to avoid chemical loading in the soil over time at any one site.

Effects to Bighorn Sheep

Effects Common to All Alternatives

Currently approximately 1,636 acres of the 136,401 acres of the bighorn sheep areas contain known invasive plants. Approximately 44 percent of the bighorn sheep habitat with invasive plants is adjacent to roads. The short duration, low intensity invasive plant treatments are unlikely to disturb bighorn sheep since such a small percentage of treatment areas are located in bighorn sheep habitat.

There is a minor potential for short-term disturbance, which is an indirect effect, from treatments proposed by the action alternatives considered. Triclopyr and NPE surfactant are the chemicals where exposure scenario results in a dose that exceeds the toxicity index using the highest application rate and upper residue rates. However, a PDF states that the lowest effective label rates would be used. No broadcast applications of herbicide or surfactant will exceed typical label rates and NPE surfactant would not be broadcast at a rate greater than 0.5 pounds of active ingredient per acre. Triclopyr would only be spot sprayed within riparian areas, which contains over one half of the bighorn sheep habitat with invasive plants, and although it may be used, it will not be used at the highest application rate on any sites within bighorn sheep habitat. Triclopyr is not approved for the No Action Alternative. The short-term disturbance due to the treatments is worth the long term benefit to bighorn sheep foraging habitat.

Treatment and Restoration

Methods used to treat invasive plants or restore habitat may affect the bighorn sheep. The general effects of each non-herbicidal method to wildlife are discussed previously in this chapter. The potential effects from herbicides are also summarized previously in this chapter, and discussed in detail in Appendix C. All treatment methods that result in improved foraging habitat for bighorn sheep will provide a long-term benefit.

Manual and Mechanical Methods

Potential effects of invasive plant treatment methods on bighorn sheep are associated with disturbance. Direct effects from invasive plant treatment include disturbance caused by noise, people and vehicles. Effects from mechanical methods (e.g. tractors, chainsaws, or string trimmers) are not likely to occur in primary habitat since bighorn tend to utilize steep slopes and only about 1.2 percent of bighorn sheep areas currently contain invasive plants. Even if there are short-term impacts, all treatment methods that result in improved habitat for bighorn sheep and their potential forage will provide a long-term benefit.

Biological Control

There is no indication that any biological controls would adversely affect the cover or forage for bighorn sheep. Biological controls cannot affect bighorn sheep directly, because they only act on invasive plants.

Herbicides

Approximately 1.2 percent of the bighorn sheep habitat currently contains known sites with invasive plant species. Much of the bighorn sheep summer range is in the higher elevation habitat which currently has less invasive plant sites. Winter range is usually below 6,000 feet in elevation and is currently where the known infestations are located, so invasive plant treatments in the winter range is not likely to impact the bighorn sheep since treatments are done mainly during the summer months. Cheatgrass which is considered an invasive plant and is utilized by bighorn sheep is not targeted for treatment.

Triclopyr and NPE surfactant are the chemicals where exposure scenario results in a dose that exceeds the toxicity index using the highest application rate and upper residue rates. However, high rates will not be used as per the PDFs. Triclopyr would be spot sprayed within riparian areas, which contains over one half of the bighorn sheep habitat with invasive plants. Standard 16 restricts broadcast use of triclopyr, which eliminates plausible exposure scenarios.

In addition, although it may be used, triclopyr would not be used at the highest application rate on any sites within bighorn sheep habitat. Triclopyr is not approved for use in the No Action Alternative.

Currently less than 20 acres of the Asotin bighorn sheep unit is the only area within bighorn sheep habitat that is proposed for aerial spraying. This is the only aerial spray unit within bighorn sheep habitat. It is improbable that the sheep would be in the area at the time since it is winter range, and the noise from the helicopter would cause them to move if they happened to be there. Aerial spraying should have similar impacts on bighorn sheep as broadcast spraying. PDFs would be in place to reduce impacts from aerial spraying. If bighorn are in the area, disturbance from the noise and people would be short-term. It is likely that the sheep would leave areas of noise and human disturbance. If a bighorn sheep were to ingest the treated vegetation, which is highly unlikely since the area would contain unpalatable forage, it is highly unlikely an individual would choose to consume 100 percent contaminated grass for one day since the aerial spray would be only 20 acres of the approximately 21,745 acres the herd occupies. Bighorn sheep tend to graze over large areas in a day.

Early Detection Rapid Response

EDRR is designed to be aggressive in the control of invasive plants. This is necessary to ensure success in managing and controlling the spread of these competitive and easily established plants. Allowing the treatment of newly found sites adds additional risk factors to bighorn sheep just by adding additional exposure areas. The risk factors do not change because the PDFs would apply to reduce the effects to little or no impacts to wildlife species.

The management direction included in all action alternatives, as well as the environmental conditions and bighorn sheep behavior, would tend to minimize actual impacts from EDRR. Specific herbicides will be avoided in specific areas or times of the year where/when bighorn sheep may be at risk. In addition the PDFs would be applied in each action alternative. Aerial spraying is not included in EDRR. Alternative A (No Action) does not incorporate EDRR. Any short-term adverse effects would be largely offset by the long-term benefits to bighorn sheep from protecting their habitat from loss due to invasive plants. Negative effects, if any, are expected to be negligible.

Differences between Alternatives

The No Action Alternative would be the least effective of the alternatives considered in protecting bighorn sheep foraging habitat because it would treat the least number of acres and does not incorporate EDRR to help reduce the spread of invasive plants in the future.

The three action alternatives tend to have about the same impacts on bighorn sheep because they treat the same number of acres of habitat. A wider variety of chemicals may be usedin the action alternatives than in Alternative A. Alternative C would not allow broadcast herbicide treatment in the riparian areas but the areas would still be treated possibly using spot spraying or stem injection for example. It is possible under Alternative C, that bighorns would be disturbed or temporarily displaced for a longer period of time, because these methods of treatments are selective and take longer to complete.

The scenario would be the same for Alternative D; the areas would be treated though the process would be more time consuming, slower to get implemented and expensive. Currently less than 20 acres are proposed for aerial spraying in the Asotin bighorn sheep area for Alternatives B and C; and under EDRR aerial spray would not be used.

PDFs and standards would be in place to minimize the impacts of aerial spraying. Noise and disturbance could impact the bighorn sheep, depending on the location of the animals at the time of treatment. The disturbance would take place whether the site is spot, broadcast or aerially treated. However, with any of the treatments, disturbance would be limited to the time it takes to apply the herbicides and leave the area.

It is unlikely bighorn sheep would be directly sprayed during aerial spraying since they would tend to run from the noise of the helicopter. Twenty acres of the 21,745 acres of bighorn sheep habitat are proposed for aerial treatment.

Alternative B would be most efficient because it allows all available treatment methods to be considered for use, which when applied should cause less disturbance to bighorn sheep than Alternative C or D.

Summary of Effects to Bighorn Sheep and Determination of Effects

It is unlikely bighorn sheep will be in the vicinity of treatment areas at the time of treatment since they tend to go to higher elevations during the period of time most treatments will take place. In addition since less than 2 percent of their herd location areas contain invasive plants and they are not known to consume invasive plants. Disturbance from noise, people and mechanical equipment is the most probable impact to bighorn sheep and that would be minimal and short in duration.

Triclopyr and NPE surfactant result in a dose that exceeds the toxicity index using the highest application rate and upper residue rates. The PDFs prevent Triclopyr from being sprayed at the highest application rate. The lowest effective label rates would be used. No broadcast applications of herbicide or surfactant will exceed typical label rates and NPE surfactant would not be broadcast at a rate greater than 0.5 pounds of active ingredient per acre. Triclopyr will not be broadcast sprayed within riparian areas, which contains over one half of the bighorn sheep habitat with invasive plants. Standard 16 restricts broadcast use of triclopyr, which eliminates plausible exposure scenarios. The limited spatial extent of infestation, which is limited primarily to disturbed roadsides, and the limits placed on herbicide applications will reduce exposure of bighorn sheep to herbicides.

Therefore invasive plant treatments **“may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species”** of bighorn sheep as a result of any of the alternatives considered in this EIS.

Cumulative Effects

The cumulative effects described within the bald eagle portion of this document would also apply for bighorn sheep.

Effects to Green-tailed Towhee

Effects Common to All Alternatives

Due to the low likelihood of green-tailed towhees being present in the treatment sites, actual risk to the birds is very low. Potential effects of invasive plant treatment methods on green-tailed towhee are limited and mainly associated with disturbance that may occur during the nesting season. Direct effects from invasive plant treatment include disturbance caused by noise, people and vehicles. Green-tailed towhees are known to build their nests on the ground or low in a bush so there is the possibility of the nest being trampled or crushed, birds being flushed from the nest or being directly sprayed. However, of the potential 71,394 acres of habitat for the towhee, only about 2 percent has invasive plants. If a green-tailed towhee were to be in the immediate vicinity of a treatment, they could be temporarily displaced.

Treatment and Restoration

Potential effects of invasive plant treatment methods on green-tailed towhee are mainly associated with disturbance that may occur during the nesting season. Direct effects from invasive plant treatment include disturbance caused by noise, people and vehicles. Green-tailed towhees are known to build their nests on the ground or low in a bush so there is the possibility of the nest being trampled or crushed, birds being flushed from the nest or being directly sprayed. However, of the potential 71,394 acres of habitat for the towhee, only about 2 percent has invasive plants, and of that 43 percent is adjacent to roads. If a green-tailed towhee were to be in the immediate vicinity of a treatment, they would likely be temporarily displaced. Restoration work could cause similar temporary disturbance as well.

Manual and Mechanical Methods

Methods used to treat invasive plants or restore forage and prey habitat may affect green-tailed towhee. The most obvious impacts from manual and mechanical treatment would be the potential to crush or trample nests, disturbance from machinery noise and people. The general effects of each non-herbicidal method to wildlife are discussed previously in this chapter and PDFs were developed specifically to limit disturbance (E2, F1, F2, F4, F5, F6). The potential effects from herbicides are summarized previously in this chapter, and discussed in detail in Appendix C.

All treatment methods that result in improved habitat for green-tailed towhee and their potential forage and prey species will provide a long-term benefit.

Biological Control

There is no indication that any biological controls would adversely affect the cover or forage for the green-tailed towhee. Biological controls cannot affect green-tailed towhee directly, because they only act on invasive plants.

Herbicides

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. Also, triclopyr is used on invasive woody vegetation, like blackberries and Scotch broom, neither of which are present in this species habitat and if they were, green-tailed towhee would be unlikely to forage for insects exclusively on or near these plants. Exposures of concern for triclopyr are not expected.

At typical application rates, no herbicide exceeded a dose of concern for insectivorous birds. In this document no herbicide is approved for use at their highest application rate so it will not be discussed. However, NPE-based surfactants exceeded the dose of concern for insectivorous birds at typical application rates.

Contamination from NPE-based surfactants of an entire day's diet of invertebrates seems unlikely for the following reasons: 1) green-tailed towhees are not known to forage within areas dominated by invasive plants, and, 2) the presence and movement of applicators is likely to scare off some invertebrates.

The food habits of green-tailed towhees are poorly studied, although it eats insects it also scratches litter on the ground, presumably looking for seeds and insects. It probably takes a variety of forb and shrub seeds. It will also take some berries from shrubs when they are available so a worst-case scenario was used that estimated herbicide exposure for a bird eating contaminated vegetation. 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 LC50 for quail was greater than 5,000 ppm, which is at the higher range or well above the reported range of LC50 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.

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. Green-tailed towhees do not feed extensively on invasive plant species or contaminated insects, if at all, and they are highly unlikely to feed exclusively within treated patches for an extended amount of time.

No herbicides in the exposure scenario analysis produced exposures that exceeded the toxicity thresholds for birds when sprayed at typical application rates. Triclopyr cannot be broadcast sprayed due to a standard in the Forest LRMP, so exposures of concern are not likely.

About 43 percent (of the 2 percent of potential habitat with invasive plants) of treatments within or adjacent to potential suitable habitat for green-tailed towhee occurs along road shoulders and trails. It is highly unlikely this is preferred habitat for the green-tailed towhee. Proposed roadside treatments involve spraying the patch of invasive plants with truck-mounted nozzles or with hand-held sprayers.

Currently, there are approximately 55 acres within potential green-tailed towhee habitat that is proposed for aerial spraying. The likelihood of the birds actually being in that area at the time of aerial spraying is very low due to the extremely limited number of green-tailed towhees documented for the Pomeroy Ranger District and the sightings were not in close proximity to where the aerial spraying is proposed. Green-tailed towhees nest under brushes so it is unlikely they would be directed sprayed. If by chance they were foraging, the sound of the helicopter would likely cause them to take cover so they would not be directly sprayed. The aerial units in potential green-tailed towhee habitat are small acreages. The 55 potential habitat acres proposed for aerial spraying are not all in one unit of potential habitat. It is unlikely an individual bird would eat only contaminated seed or insects in a treated area since much of the seed or insects would not have been contaminated by the treatment. However, if birds were in the area during aerial spraying the same possible impacts as described above in the exposure discussion would be applicable.

Early Detection Rapid Response

The effects discussed above will be the same with EDRR. The No Action Alternative (Alternative A), does not include EDRR. The short-term impacts of the treatments would be largely offset by the long-term benefit of retaining habitat for green-tailed towhee prey species. Effects, if any, are expected to be negligible since very few green-tailed towhees have been detected on the Forest.

Differences between Alternatives

There is very little difference between alternatives for the green-tailed towhee. Alternative A would treat less acres and does not include EDRR so would be the least effective of any of the alternatives considered. Alternative B, the preferred alternative is the least restrictive alternative although it has standards and PDFs in place that minimize impacts to wildlife. It treats the same number of acres as Alternatives C and D, however does it more efficiently. Approximately 55 acres of potential green-tailed towhee habitat would likely be aerial sprayed under Alternative B and C. The impacts of aerial spraying would be similar to those described above for herbicide effects. Alternative C currently has close to 400 acres in riparian habitat that would not be broadcast sprayed, however it would be treated so the impacts would still be the same as discussed above. Disturbance within the riparian treatment areas with Alternative C would likely be of longer duration than under Alternatives B and D. The short-term impacts of treatment are outweighed by the long term beneficial impacts to habitat for the green-tailed towhee.

Summary of Effects and Determination of Effects to Green-tailed towhee

The plant material cup nests of the green-tailed towhee are susceptible to crushing or trampling by people or vehicles. If they were nesting in areas where invasive plant treatments occurred, eggs or nestlings could be trampled, regardless of the treatment technique used, except for aerial spraying. Data is not sufficient to distinguish in a meaningful way the magnitude or duration of disturbance or trampling between alternatives. Due to the low likelihood of green-tailed towhees being present in the treatment sites, actual risk to the birds is very low.

Using broad-scale analysis approximately 2 percent (1,424 acres) of potentially 71,394 acres contain invasive plants. Green-tailed towhees eat insects so the risk from herbicide and NPE-based surfactants is as discussed above under effects from herbicides. At typical application rates, no herbicide exceeded a dose of concern for insectivorous birds. 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. Adverse effects cannot be ruled out for glyphosate at high application rates or NPE at typical and high rates. However, high application rates would not be used due to the PDF in place.

Data is insufficient to distinguish between alternatives the likelihood or magnitude of this potential effect. Due to the low likelihood of green-tailed towhee being present in the treatment sites, actual risk to the birds is low.

This analysis shows that under any of the alternatives, though the chances are small, invasive plant treatment methods **"may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species"** to green-tailed towhee.

Cumulative Effects

Since the herbicides selected do not pose a risk from bioaccumulation or a long residual effect there are not anticipated cumulative effects from either projects on or off of the Forest. The cumulative effects described within the bald eagle portion of this document would also apply for the green-tailed towhee.

Effects to Columbia Spotted Frog

Effects Common to All Alternatives

Columbia spotted frog are known to have a fairly large distribution within the Project Area. Since Alternative A did not identify sites near known frog habitat, and the spotted and leopard frog PDF will be in place under all of the action alternatives, the chance of negative impacts to amphibians is considerably lessened. The PDF would avoid broadcast spraying of herbicides, and avoid spot spraying of glyphosate with POEA surfactant, sulfometuron methyl, and NPE-based surfactants, within 100 feet of occupied or suitable spotted or leopard frog habitat. The PDF also requires the coordination of the treatment methods, timing, and location with the local Biologist. Sites may require surveys prior to application.

Treatment and Restoration

Potential effects of invasive plant treatment and restoration methods on spotted frogs are mainly associated with disturbance, effects to their skin and absorption through the skin, and the potential affects of specific herbicides on their prey. Direct effects from invasive plant treatment include disturbance caused by noise, people and vehicles. Since no emergent vegetation is proposed for treatment under this plan, it is unlikely this species will be in the immediate vicinity of treatment; however they could be temporarily displaced by workers in the area.

Manual and Mechanical Methods

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 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 and they tend to jump back into the water whenever they detect disturbance close by. Disturbance in close proximity to amphibians would likely be for a longer duration with Alternative C since the plants would be treated individually rather than by broadcast treatment in the riparian areas. However, potential short-term disturbance would occur with all alternatives. All treatment methods that result in improved habitat for amphibians and their prey will provide a long-term benefit.

Biological Control

There is no indication that any biological controls would adversely affect the cover or forage for frogs. Biological controls cannot affect amphibians directly, because they only act on invasive plants.

Herbicides

Data on herbicide effects to amphibians is limited. Appendix P of the R6 2005 FEIS summarized available data on the effects of herbicides to amphibians and this discussion is incorporated by reference. Several studies have found that amphibians are less sensitive, or about as sensitive, as fish to some herbicides (Berrill et al. 1994; Berrill et al. 1997; Johnson

1976; Mayer and Ellersieck 1986; Perkins et al. 2000). As stated previously, 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®.

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” 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 LC50 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).

At 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 lethal doses.

Sufficient data are available for toxicity of sulfometuron methyl to allow quantitative estimates of exposure and risk. Data is limited to that generated by studies on *Xenopus*, 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.

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 the restriction is a standard in the LRMP. 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 higher application rates, tadpole responsiveness could be reduced. These concentrations 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.

In summary, adverse effects to amphibians are only likely from glyphosate with POEA and triclopyr applied at high rates, both of which are actions prevented by the PDFs in place for this project.

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). This is well below the levels reported to cause concerns dicussed above. 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 (Bakke 2003). However, overspray or accidental spills could produce concentrations of NP9E that could adversely affect amphibians, particularly in small stagnant ponds.

Early Detection Rapid Response

The impacts of EDRR for these frogs would be the same as those discussed above. The No Action alternative (Alternative A), does not include EDRR. The short-term impacts of the treatments would be outweighed by the long-term benefit of retaining habitat for Columbia spotted frogs.

Differences between Alternatives

Alternative A (No Action): Invasive plants sites are not delineated in spotted frog habitat under this alternative. The existing infestations in spotted frog habitat are not part of the current projects included in the No Action alternative. Existing spotted frog populations would not be affected by manual, mechanical, or herbicide treatments. Alternative A is the least effective for improving habitat for frog species since it does not allow for treatment in frog areas, and does not incorporate EDRR.

Alternative B (Proposed Action): No emergent vegetation would be treated under any of the action alternatives considered in this EIS, which reduces the amount of herbicide that could come in contact with water. Glyphosate isopropylamine (IPA), RoundUp and POEA surfactant used in RoundUp have been specifically tested for ability to cause malformations in the frog embryo teratogenesis assay using *Xenopus* (Perkins et al. 2000). *Xenopus* is a highly sensitive assay species for determining the teratogenicity of chemicals (Mann and Bidwell 2000, Perkins et al. 2000).

No increases in malformations were noted at levels that were not also lethal to the embryos. The 96-hour LC50 for glyphosate IPA was 7297 mg a.e./L. Formulations containing surfactant are known to have much higher toxicity to amphibians than glyphosate. RoundUp formulation containing POEA surfactant was 700 times mores toxic than glyphosate IPA (See Appendix C – Herbicide Effects to Wildlife, for glyphosate). The Forest Service does not use the formulation used in the Smith study; however, potential effects to spotted frogs from glyphosate cannot be ruled out. To further minimize frog exposure a PDF was developed that prohibits broadcast spraying of herbicides, as well as spot spraying of glyphosate with POEA surfactant, sulfometuron methyl, and NPE-based surfactants within 100 feet of occupied or suitable spotted or leopard frog habitat.

In addition, treatment methods, timing, and location would be coordinated with local Biologists. With all of this protection in place, it is very unlikely that glyphosate will enter the water adjacent to treatment areas.

Adults could also be dermally exposed to glyphosate if they were to move through treated vegetation; however invasive plants have not been identified at any of the known spotted frog sites. It is, therefore, unlikely that frogs would be exposed to herbicides in this way.

Broadcast application of triclopyr, including aquatic triclopyr TEA, is prohibited. Some exposure could occur with spot applications which triclopyr TEA up to 15 feet of perennial streams, lakes and ponds. Spot or hand applications of Triclopyr BEE are prohibited within 150 feet of streams, lakes and ponds. Exposure from spot or hand applications would be much less than that modeled in the "worst case scenario." There would be no aerial spraying within amphibian habitat.

Alternative C: The use of triclopyr is the same as Alternative B. No adverse effects to spotted frogs would occur from triclopyr or TCP exposure. No herbicide at all is permitted within intermittent stream channels or within 10 feet of perennial streams, lakes, or ponds. This would reduce, but may not eliminate, exposure to glyphosate or other herbicides. Because glyphosate is strongly adsorbed to soil, runoff or percolation of glyphosate through the buffer and into water is unlikely. Eggs and tadpoles are unlikely to be exposed to glyphosate. Spotted or leopard frogs may be exposed to other herbicides, but available data suggests that adverse effects are unlikely. Adults could still be dermally exposed to glyphosate as they move outside the buffers through treated vegetation. There is insufficient data to quantify dose received from dermal exposure to contaminated vegetation. It is assumed there is the potential that this type of exposure could result in adverse effects.

Alternative D: There would be no aerial spraying within close proximity to amphibian habitat under any of the alternatives since PDFs would be adhered to under all alternatives so Alternative D would have the same effects as Alternative B for spotted frogs.

Summary of Effects to the Columbia Spotted Frog and the Determination of Effects

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 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 more likely in Alternative C due to increased use of manual and mechanical techniques. All treatment methods that result in improved habitat for frogs and their prey will provide a long-term benefit.

No emergent vegetation would be treated under any of the action alternatives considered in this EIS, which reduces the amount of herbicide that could come in contact with water. Glyphosate isopropylamine (IPA), RoundUp and POEA surfactant used in RoundUp have been specifically tested for ability to cause malformations in the frog embryo teratogenesis assay using *Xenopus* (Perkins et al. 2000). *Xenopus* is a highly sensitive assay species for determining the teratogenicity of chemicals (Mann and Bidwell 2000, Perkins et al. 2000). No increases in malformations were noted at levels that were not also lethal to the embryos. The 96-hour LC50 for glyphosate IPA was 7297 mg a.e./L.

Formulations containing surfactant are known to have much higher toxicity to amphibians than glyphosate. RoundUp formulation containing POEA surfactant was 700 times mores toxic than glyphosate IPA (See Appendix C – Herbicide Effects to Wildlife, for glyphosate). The Forest Service does not use the formulation used in the Smith study; however, potential effects to spotted frogs from glyphosate cannot be ruled out. To further minimize frog exposure a PDF was developed that prohibits broadcast spraying of herbicides, as well as spot spraying of glyphosate with POEA surfactant, sulfometuron methyl, and NPE-based surfactants within 100 feet of occupied or suitable spotted or leopard frog habitat. In addition, treatment methods, timing, and location would be coordinated with local Biologists. With all of this protection in place, it is very unlikely that glyphosate will enter the water adjacent to treatment areas.

Adults could also be dermally exposed to glyphosate if they were to move through treated vegetation; however invasive plants have not been identified at any of the known spotted frog sites. It is, therefore, unlikely that frogs would be exposed to herbicides in this way.

Buffers established for use of triclopyr (see Aquatic Species section) would be effective at avoiding adverse effects from exposure to triclopyr BEE and others. The restriction on broadcast spray of any triclopyr would also greatly reduce potential adverse effects from triclopyr TEA and TCP. Some exposure could occur with spot and selective applications; these exposures would likely be much less than that modeled in the “worst case scenario.”

No herbicide is permitted within intermittent stream channels or within 10 feet of perennial streams, lakes, or ponds. This would reduce, but may not eliminate, exposure to glyphosate or other herbicides. Because glyphosate is strongly adsorbed to soil, runoff or percolation of glyphosate through the buffer and into water is unlikely. Eggs and tadpoles are unlikely to be exposed to glyphosate. Spotted frogs may be exposed to other herbicides, but available data suggests that adverse effects are unlikely.

The analysis shows that under any of the alternatives, though the probability is low, treatments could impact spotted frogs.

Therefore, the invasive plant treatments **“may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species”** for spotted frogs.

Cumulative Effects

Since the herbicides selected do not pose a risk from bioaccumulation or a long residual effect there are not anticipated cumulative effects from either projects on or off of the Forest. The cumulative effects described within the bald eagle portion of this document would also apply to the Columbia spotted frog.

3.3.7 Effects to Management Indicator Species

The purpose of this section is to evaluate and disclose the impacts of the Umatilla National Forest Invasive Plants Treatment Project on the Umatilla Management Indicator Species (MIS) identified in the Forest Land and Resource Management Plan (USDA 1990). This documents the effects of project alternatives on the habitat of selected MIS.

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:

- Large mammal consuming contaminated vegetation: elk
- Carnivore consuming contaminated small mammal: American (pine) marten
- Effects to pileated woodpeckers, three-toed woodpecker, and primary cavity excavator are included below

Effects to Rocky Mountain Elk

Concern over elk (and deer) arises from its status as an important game species. 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. Elk (or deer) would have to consume an entire day’s diet of contaminated grass in order to receive this dose. Broadcast spraying is proposed over areas in which deer or elk could forage. Spot spraying, roadside boom and aerial 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 elk (or deer) would forage exclusively on the scattered treated patches.

Treatment of invasive plants in meadows and along roadsides in meadow habitat could beneficially affect elk (and deer) 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 elk (and deer) (Rice et al. 1997). The effects to elk and deer are almost identical, since their habitat requirements and forage are so similar. Even if a few individuals were adversely impacted by herbicides or disturbance caused by people, vehicles and mechanical treatments, there would be no substantial change in the population levels for elk (or deer) due to invasive plant treatments. Elk and deer populations on the Forest are in not in danger.

Elk (and deer) have been analyzed for direct effects of the herbicides and it was determined that based on the method of application that there would be little to no effect on the species.

The fact that game animals do forage in the areas that would be sprayed, there is a potential that a hunter could harvest an animal that has been foraging on herbicide treated areas. Since these herbicides do not bio-accumulate in the fat of animals, there would be no increase in the toxic effect to someone eating the animal. The amount of herbicides that might be ingested by the animal is anticipated to be low, and depending on the size of the animal, the amount ingested by a person would be even lower. Although there is no a research data that was reviewed to confirm the effect of eating meat from an animal that has been foraging on herbicide sprayed vegetation, it is expected that there would be no observable or detectable effects on people who eat meat from an animal harvested that has ingested herbicides sprayed at the recommended rates and by the methods prescribed by this document. Since, many of these same herbicides have been sprayed in much larger quantities on private lands, especially on commercial agriculture lands, and there have not been recorded cases of humans developing problems following the consumption of game animals foraging on these lands, it is assumed that there would be no health issues on this project. See Section 3.7 – Effects of Herbicide Use on Workers and the Public- for more information. Rice (2000) demonstrated that the appropriate use of herbicides can provide clear benefits in the restoration of native plant communities and the enhancement of wildlife values in areas that had been degraded by spotted knapweed.

Effects Common to All Alternatives

Invasive plants probably affect elk (and deer) more than any other species analyzed in the MIS section. Invasive plants out compete and replace native forage plants for these ungulates. Eradicating, controlling and/or containing invasive plants would improve elk (and deer) habitat. This factor outweighs any detrimental effects of herbicide ingestion and disturbance.

Of the herbicides analyzed, triclopyr has a toxic effect on ungulates when ingested over a number of days (chronic exposure). At times, elk (and deer) could continue to return to a patch of vegetation that they prefer over other plants and continue to forage in that area. Due to this site selection behavior they are prone to chronic exposures. As a result, the *2005 Pacific Northwest Region Invasive Plant Program Record of Decision* (2005b) contains a standard that restricts the use of triclopyr and does not allow broadcast boom or aerial spraying of this herbicide. However, if there are a substantial amount of invasive species in an area (which are not preferred forage) elk (and deer) are not likely to continue to forage in such an area.

Mammals that eat vegetation (primarily grass) that has been sprayed with herbicide have relatively greater risk for adverse effects because herbicide residue is higher on grass than it is on other herbaceous vegetation or seeds (Kenaga, 1973; Fletcher et. al., 1994; Pfleeger et. al., 1996). Elk (and deer) eat grasses so they are more susceptible to toxic effects than carnivores.

Alternative A – No Action

Under the existing 1995 Umatilla National Forest 1995 EA for invasive plant treatment, the use of triclopyr is not available. This is the only herbicide that the effects analysis (Appendix C) shows as a potentially toxic herbicide for elk. The only herbicides available in the No Action Alternative are glyphosate and picloram. As discussed before, this alternative is the least effective at containing, preserving or restoring invasive plant sites since it has only a limited number of sites identified for treatment and does not incorporate EDRR.

Alternative B, C and D

There is at least some elk (and deer) forage on every acre of the proposed treatment areas. Potentially elk (and/or deer) could be affected by the treatment of invasive plants. As a result, potentially 25,000 acres of habitat could be improved by the removal of invasive plants, but also could expose elk (and deer) to herbicides. Acres treated with triclopyr could potentially have toxic effects for individual elk. This effect is offset by the fact that the chemical would only be used as a spot spray. The amount of forage plants that would be sprayed would be reduced substantially. This should eliminate the potential for toxic effects from acute and chronic exposure since elk (or deer) rarely forage on the invasive plants targeted for treatment.

All the acres aerial sprayed under Alternative B have the potential to expose elk (and deer) to herbicides by being sprayed directly and exposure through walking in areas that have been sprayed. Currently 675 acres are proposed for aerial treatments; and there would be no additional aerial treatments under EDRR. The 675 acres is not in one large unit. There are 14 aerial treatment sites proposed that range in size from approximately .90 acres to 286 acres. Elk would likely run from the low flying helicopter or plane and so would not expected to be directly sprayed by herbicide.

The assumptions for toxicity are similar for each alternative. This would not affect the population of elk (or deer). There have been no reports of deer or elk suffering from exposure to any herbicides used on farms or commercial tree plantations where herbicide use is more prevalent.

Alternative C could cause more disturbances to elk than Alternative B because it doesn’t allow broadcast spraying in riparian areas so application of herbicides may take longer on certain sites. Alternative D would be very similar in effects to elk (and deer) as both Alternative B and C, except there would be no aerial spraying of herbicides. The 675 acres proposed for aerial treatment in alternative B and C would be treated if safety concerns and/or cost did not eliminate sites from treatment.

Cumulative Effects

It is not known how many acres of invasive plant herbicide treatment would occur near the borders of the Forest where this project could affect elk (and deer) that move across the boundary to forage. In these isolated situations, however, there could be cumulative effect of the herbicides on individual deer or elk that forage on both private and National Forest system lands that have been treated with herbicides. In rare situations, there could be an individual animal that receives a toxic dose from this scenario. At this time there are no reports of animals in agricultural or commercial tree operations that have suffered toxic effects from use of herbicides where chemicals are used more widely for vegetation control.

Effects to Pileated Woodpecker, Three-toed Woodpecker and Cavity Excavators

These species were grouped together because for the most part they share similar habitats and the effects from treatments would be similar. The pileated woodpecker is a Forest Management Indicator Species. Concern over pileated woodpeckers arises from their association with mature forest habitat, a habitat type that has been affected by logging throughout the woodpeckers range. Breeding bird survey data collected between 1966 and 1991 shows no significant change in the population in the western United States (Bull, 2003).

Species that forage and nest in trees are not likely to be exposed because aerial applications are limited to sites with less than 30 percent canopy cover.

The aerially sprayed trees would intercept the herbicide, which would protect the cavity excavators from being directly contaminated. 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 can't 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.

Invasive plant treatments are not expected to affect the pileated woodpecker, the three-toed or cavity excavators. These birds nest in cavities in trees, usually dead trunks or dead limbs, and forage largely on trees and perhaps some shrubs, making it unlikely for them to be exposed to herbicides or affected by manual or mechanical treatments. Invasive plant treatments will not reduce the availability of dead trees, down logs or appropriate cavity sites. Since these woodpeckers utilize down logs and snags and forage on beetles and ants buried inside decaying wood, their habitat is not impacted by invasive plant infestations but infestations may occur in proximity to their habitat. The differences between alternatives do not result in any differences in effects to the pileated woodpecker, three-toed woodpecker or cavity excavators. There is no impact to these species for all action alternatives.

Alternative A – No Action

None of the treatments that occur under the existing 1995 Management of Noxious Weeds decision impact pileated habitat, three-toed woodpecker or primary cavity excavator's forage, or nesting. There are no effects to these birds from this alternative.

Alternatives B, C, & D – Action Alternatives

None of the proposed treatments would affect pileated woodpecker habitat, three-toed woodpecker or primary cavity excavator's forage or nesting habitat. The insects that pileated woodpeckers forage on live inside dead wood and snags: these insects have almost no chance of contacting herbicides at the treatment sites. The herbicide effects analysis showed no toxic effects to these species (Appendix C). Very few acres would be treated in pileated woodpecker habitat, three-toed woodpecker or primary cavity excavator's forage or nesting habitat. Any treatment sites would not be in areas slated for aerial treatment since the forest canopy would be too dense for aerial spray. Treatments in riparian areas would generally be on more open sites and therefore not in typical habitat for these species. No habitat would be affected by manual or mechanical treatments. The EDRR would not increase or decrease this risk.

Cumulative Effects

There are no anticipated effects to pileated woodpecker habitat, three-toed woodpecker or primary cavity excavator's forage or nesting habitat, and there are no expected cumulative effects.

Effects to American Marten

The American marten is a Forest Management Indicator Species. Concern for this species arises out of their association with mature and old-growth forest. Since this species is not restricted to riparian areas there is no appreciable difference between alternatives. There will be no aerial spraying within areas of dense tree cover so there will not be any difference between Alternatives B and D.

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.

Even if pine martens consumed for an entire day nothing but prey that had been directly sprayed, they would not receive a dose that exceeded the toxicity indices for any herbicides or NPE (USDA 2005, Appendix B). Because there is a lack of plausible effects from any treatments, there is no difference in effects regardless of alternative chosen.

Alternative A– No Action

Martens could to occur in some of the areas treated under the 1995 decision that implements the Umatilla National Forest EA for the Management of Noxious Weeds.. These animals would potentially travel through areas treated, but avoid openings.

They do, however, travel across roads and small forest openings at times, so they could go through a treatment area. Exposure would be short and acute. Their home range makes chronic exposure unlikely. The effects analysis for herbicides showed no risk of exposure. No habitat would be altered by this alternative. None of the treatment methods would have any effect on martens. The effect determination for this alternative is No Effect to martens or their habitat.

Alternatives B, C and D

Martens do occur throughout the proposed treatment areas at the higher elevations. The analysis for these alternatives is the same as Alternative A. Martens would travel through the treatment areas but there is no risk from any of the treatments methods. There are no toxic effects from herbicides as indicated in Appendix C, and there is no habitat altered. **The effect determination for martens and their habitat is No Effect. This includes the EDRR as well as all treatment methods.**

3.3.8 Effects to Other Species of Interest

Landbirds

Effects Common to All Alternatives

The treatment of invasive plants has short-term impacts by reducing cover, but restoring native vegetation would have long-term benefits by providing food and cover (See Section 3.2– Botany and Treatment Effectiveness). Birds or mammals that eat vegetation (primarily grass) that has been sprayed with herbicide have relatively greater risk for adverse effects because herbicide residue is higher on grass than it is on other herbaceous vegetation or seeds (Kenaga, 1973; Fletcher et. al., 1994; Pfleeger et. al., 1996). Turkeys, grouse, quail, and waterfowl would all consume grass as part of their diet. Other birds would eat grass seeds especially. The end result of all of the alternatives is some degree of improvement in the quality of habitat, while having a potential short-term negative effect on individual birds. One example from this project would be the treatment of knapweed. Knapweed seed is not consumed by birds and provides very poor nest cover. By reducing the presence of knapweed and allowing native grasses and forbs that do provide food and cover there is a positive effect to the treatment.

The effects of herbicides, from all methods of intake and to all species on the landscape, are limited. The studies that were analyzed for the adopted 2005 Pacific Northwest Region Invasive Plant Program decision indicted that there was a low toxicity of herbicides to birds.

But because of the large gaps is data it must be stated that some effects to birds from herbicides are unknown. The data that are available would indicate however that the risk is low.

Alternative A – No Action

The herbicide effects analysis from Appendix C shows no effect to the species analyzed from herbicides except triclopyr and NPE surfactant for blue grouse. These two herbicides are not allowed under the 1995 decision that implements the Umatilla National Forest EA for the Management of Noxious Weeds, so there could be no effect to these two species. The treatment areas are limited and should not result in a large exposure to blue grouse or other landbirds that are not analyzed.

Alternatives B, C and D

All of the treatment methods used to treat invasive plants have some short-term negative effect on early successional bird species use. All methods if implemented in the spring and early summer could impact nesting success of birds, especially ground nesting birds. All of these methods (herbicide, manual, and mechanical) could possibly flush birds from their nest. When flushed from a nest many birds return with no harm to the young or eggs, but some species are highly sensitive to disturbance and would abandon the nest.

These alternatives include the use of triclopyr. Since this herbicide is only approved for spot spraying, the risk of exposure is reduced substantially. It is not likely that blue grouse or other ground feeding birds would receive chronic dosages that would become toxic.

EDRR would expose landbirds to a possible additional disturbance and possible exposure to herbicides. In the short-term, this may cause some reduced reproduction from a reduction in ground cover for nesting but in the long-term their habitat would be restored or maintained and this is a greater benefit than the possible negative side affects.

Alternatives C and D could both result in more disturbance to landbirds than Alternative B since both would require more ground work involving people and machines which can crush eggs, flush birds etc. However, the short-term negative impacts are outweighed by the long-term benefits to habitat.

Cumulative Effects

Birds are mobile animals that could potentially receive a dose of herbicides on private, state, or National Forest System lands, and fly to another area where herbicides are being used. In very rare cases, there is a potential for receiving a toxic dose. It is not possible to predict the amount of times this would actually happen but it is anticipated that this would only happen in extremely rare cases. It is also impossible to predict the effect of two different chemicals interacting synergistically that could cause a toxic effect. For example if a bird were to fly here from an agricultural field where there was use of a pesticide and then the bird arrived on the National Forest and ingested a herbicide there could be a combined effect that could harm the bird. For such an individual the effects would be cumulative, there are no major cumulative effects.

Focal Species

The following species are listed in the Conservation Strategy for Landbirds and were used for analysis purposes and represent a variety of habitats and feeding strategies; hermit thrush (subalpine forest), upland sandpiper (montane meadows), vesper sparrow (steppe shrubland), gray-crowned rosy finch (alpine), and red napped sapsucker (aspen).

The herbicide effects analysis showed no toxic effects from the proposed treatment methods to these birds. Appendix P of the Invasive Plants EIS (2005a) found that small insectivorous birds could be affected by herbicides if exposed to chronic levels of certain herbicides, such as sethoxydim, which could reach "three times greater than the chronic LOAEL for birds so suppressed reproduction of insectivorous birds are expected from chronic dietary exposures." When the focal species were analyzed, it did not appear likely that most of them would be exposed chronically due to feeding strategies of these birds. Except for the vesper sparrow the rest of the focal bird species do not occupy habitat where invasive plants are likely to be found. The potential effects to vesper sparrows would be similar to those described for the green-tailed towhee above. The invasive plant treatments are not expected to have an impact on any of the focal bird species.

3.4 Soil and Water

3.4.1 Introduction

The effect of invasive plant treatments on soil and water is a primary public issue. Specifically, there is a concern that there may be potential adverse effects of herbicide treatment on soils, riparian areas, water quality and aquatic ecosystems.

While other types of treatments are analyzed, the primary focus of this section is the effect of herbicide treatments on soil and water resources. Project Design Features (PDFs) were developed to minimize the effects of invasive plant treatments on these resources.

Project Area

The Project Area for direct and indirect effects is the Umatilla National Forest and lands administered by the Forest, approximately 1.4 million acres in Oregon and Washington. Cumulative effects analysis is on the basis of 5th field watersheds. Approximately 30 percent of the land within these watersheds is on National Forest system lands administrated by the Forest.

Methodology for Analysis

This analysis is tiered to the R6 Invasive Plant FEIS 2005. A primary focus of the site-specific analysis was developing Project Design Features to insure compliance with standards introduced by R6 as well as Umatilla National Forest Plan standards and guidelines. Information used to develop criteria to minimize effects from treatment included properties of herbicides from SERA risk assessments, properties of soils in relation to herbicide properties, proximity of treatment sites to streams, stream/road connectivity and acres of proposed treatment for each 5th field watershed. To compare alternatives, the acres treated by non-herbicide and herbicide methods were compared within each alternative. For each 5th field watershed, the number of acres of aerial treatment, broadcast treatment (both boom and hand broadcast) versus hand and spot treatment within aquatic influence zone was compared by alternative.

The Forest Service has a contract 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 report, and in the EIS, relies on these risk assessments. Herbicide effects to stream aquatic resources was analyzed in risk assessments for each of the 10 herbicides included in the Proposed Action The risk assessments considered worst-case scenarios including accidental exposures and application at maximum reported rates.

The R6 2005 FEIS added a margin of safety to the SERA Risk Assessments by lowering acceptable thresholds of herbicide exposure to account for increased protection needed for federally listed species (EPA 2004). Although the risk assessments have limitations (see R6 2005 FEIS pages 3-95 through 3-97), they represent the best science available.

The GLEAMS model is a computer model used to simulate water quality events after herbicide application on an agricultural field. This model is well validated for agricultural use. As the GLEAMS model was originally an agriculture model, all parameters used are not compatible with site specific parameters for treatment areas on the Forest. Despite these limitations the model is the best available at this time. The SERA Risk Assessment analysis takes the herbicide concentration provided by GLEAMS and uses them in a dilution model for a stream or pond to get the water contamination rates for specific scenarios.

The risk assessment model assumes broadcast treatment along a small perennial stream. The treatment area modeled is 50 feet wide and 1.6 miles long (10 acres). This would over estimate herbicide in streams on the Forest as no broadcast is proposed within 100 feet of a perennial or flowing intermittent stream or 50 feet of a dry intermittent stream (Table 7, Table 8). However, many treatment areas are larger than 10 acres. In steeper areas, the model may underestimate the herbicide delivery as it assumes a 10 percent slope, although much of the Forest has a steeper slope. The model also assumes even rainfall every ten days.

The spreadsheets developed for the SERA Risk Assessments were modified for type of herbicide, herbicide application rates, soil texture and rainfall conditions found at treatment sites on Forest. These were run for the specific herbicides to be used at these sites to estimate the potential herbicide concentrations in streams and lakes after treatment. When specific treatment areas parameters were rerun in the worksheets for this project the upper limit of rain was set as high as 75 inches a year to model a 2 inches of precipitation in 24 hour event. While no treatment area was over a threshold of concern for sensitive fish or human consumption, there were model parameters that do not accurately reflect parameters at treatment sites, adding uncertainty to modeled results.

For aerial application the model AGDISP was used to model drift from aerial application of herbicide for the worst case scenario allowed under the PDFs of this project.

Past monitoring studies of herbicide use in forested areas were used to create PDFs, particularly stream buffers, near water resources to protect streams from adverse effects from treatments.

3.4.2 Affected Environment

Invasive Plants and Soil and Water Resources

Climate

The northern half of the Forest, generally consisting of the Pomeroy and Walla Walla Ranger Districts has a marine-influenced climate with average annual precipitation ranging from 30-65 inches. Winter conditions often include rain mixed with snow in mid elevations (2000-4500 feet) as a result of moist marine air intrusions. In contrast, the southern half of the Forest, the Heppner and North Fork John Day (NFJD) Ranger Districts has a more continental climate, with annual precipitation ranging from 20-55 inches, and colder winters dominated by snow. For all the Forest, the highest precipitation intensities occur during summer, localized, convective storms, and winter, regional, frontal storms, with varying precipitation accumulations.

Geology

For the northern half of the Forest basic geology is dominated by Columbia River basalt flows, which have been uplifted and dissected, forming gentle upland plateaus, narrow ridges, steep slopes and confined, narrow valleys. There are lake deposits interlaid between some of the basalt flows. Watersheds of the Lower Snake are deeply incised, and moderately dissected. There are both volcanic ash and loess deposits (airborn silts), and most have been reworked. The thickest deposits are found lower in the drainages.

The southern Forest geology is more complex and includes Columbia River basalts overlying older John Day volcanics and intrusive granitics. The southeast part of the Forest has the highest elevations (up to 8000'), with glaciated landforms, and areas of landslide deposits. Landforms are more complex with rolling mountain ridges, separated by steep canyons. Watersheds on the south half of the Forest are moderately incised, and moderately dissected. Volcanic ash deposits are common.

While mass wasting is rare on the Forest (USDA Forest Service 2004), there are 3,747 acres of land within the Forest listed as unstable in Forest GIS coverage, Slumps. The largest single block is about 340 acres. Of these areas, 54 acres are along gravel roads within areas proposed for treatment.

Soils

The surface texture of the soils in the northern half of the Forest are primarily silt loam and gravelly silt loam with volcanic ash dominating on the deep, footslope positions and more stable uplands. The shallower soils found on steeper shoulder and upper sideslope areas developed in the basalt and andesite rock, usually mixed with volcanic ash. They have gravelly loam and silt loam textures with some areas of silty clay loam in the more developed residuals soils. Loess subsoils also occur in similar locations as the volcanic ash, usually at depth below the volcanic ash or mixed into surface horizons of residual soils formed in basalt and andesite. These wind-blown deposits have favorable water-holding capacity, though not quite as good as ash soils, and favorable nutrient content when weathered. These soil properties, along with the marine-influenced climate, provide for the good growing conditions in the deep to moderately deep soils found on the plateaus and lower sideslopes and drainage ways.

The soil texture on the southern half of the Forest is similar to the northern Forest where the parent material is basalt or the soil contains ash. Soils that have developed on the older volcanics of the John Day formation tend to be finer textured and have higher clay content. These soils range from silty clay loam to clay loam with high gravel content (USDA Forest Service, Rimrock FEIS, 2004).

In general, the ash-derived soils are less erodable and more productive than non-ash soils, since the ash soil layer is very porous with a high water infiltration rate, and can retain more water. Thus, there is less overland water flow to cause soil erosion. With a higher water holding capacity, the vegetation on ash soils re-establishes more quickly, thus minimizing the erosion potential. However, with ground disturbing activities, these ash cap soils may easily erode. Soil particles easily detach in these ashcap surface soils once groundcover is removed. Also, with no ground cover, these soils are more susceptible to soil displacement and mixing from management activities, especially when the surface soils are dry.

The greatest surface erosion problems occur in highly erodible terrain. This would include areas with soils derived from granitics and wind-deposited soil types (volcanic ash and loess) on steep slopes. Older volcanic material on the south end of the North Fork John Day district also tend to be more prone to road-related erosion problems (USDA Forest Service, Roads Analysis, 2004).

Soil Conditions within Treatment Areas

The majority of infested sites identified for treatment under this analysis are along roads, quarries, trails and recreation sites. These areas have highly disturbed soil conditions. This generally includes 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. As many invasive plants prefer disturbed sites, this creates conditions in which invasive species can out-compete native species.

Infested sites not along roads can include areas burned by fires and areas where streams have acted as a corridor for movement of plants downstream. Burned areas temporarily lack plant cover, generally include disturbances from heavy equipment creating fire breaks, and can have changed soil properties from soil heating. Where streams have acted as a corridor for movement of invasive plants downstream, soils are fairly undisturbed.

Effects of Invasive Plants on Soils

Invasive plants can affect soils in many ways. They can cause changes in soil properties such as pH, nutrient cycling and changes in composition or activity of soil microbes. A reduction in soil nutrient levels makes it difficult for native plants to compete with the invasive plants, and probably also affects the soil biotic community. The long-term effects of these changes are not known.

Soil and Water Interactions - The rate and volume of water infiltration can be reduced on weed infested 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 weed infested 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 weeds is dense and associated transpiration rates are high (Olson 1999a).

Soil Erosion - Weed infested soil has been shown to be more susceptible to erosion than soil supporting native grass species (Lacey et al. 1989). Soil erosion in a simulated rainfall test more than doubled in spotted knapweed-dominated rangeland areas when compared to natural bunchgrass/forb grasslands. This is primarily due to significantly lower infiltration rates and higher levels of bare ground on the knapweed dominated site compared to the uninfested areas (Lacey and Marlow, 1989). Weeds 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 species on site (Torri and Borselli 2000; Fryrear 2000).

Soil Biota- Plants and mycorrhizal fungi are strongly dependent on each other, and species of fungi are associated with specific plants. Presence of non-native plants also leads to changes in the mycorrhizal fungus community (ibid). These changes could increase the difficulty of reestablishing native vegetation after the invasive plants are removed.

Soil Nutrient Availability - Noxious weeds directly limit nutrient availability by out-competing native species for limited soil resources. Weeds 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 1999a). Spotted knapweed has been implicated in reducing available potassium and nitrogen (Harvey and Nowierski 1989).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 1999a).

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. Weed infested areas 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). An example of an invasive plant found on the Forest that out-competes other plants by changing soil nutrients is Leafy spurge. It displaces native vegetation in prairie habitats through shading and usurping available water and nutrients. Leafy spurge also secretes toxins that prevent the growth of other plants underneath it. Once present, this aggressive invader can completely overtake large areas of open land (http://www.nps.gov/plants/alien/).

Existing Condition for Water Resources

Where fractured basalts are exposed they can have high permeability, which may serve to transfer contaminants from the surface to groundwater.

Water quality and riparian condition are the two elements potentially affected by invasive plant treatments. The 24,649 acres of invasive plants identified for treatment are scattered across the Forest 34 of 39 5th field watersheds. Of these acres, 5560 (23%) are within PACFISH defined Riparian Habitat Conservation Areas (RHCAs) in 31 5th field watersheds.

Water Quality

Section 303d of the Clean Water Act requires that states develop a list of waterbodies that do not meet standards and submit the list for approval to the US Environmental Protection Agency (EPA). The most recent listings in Oregon were approved in 2002 and Washington developed their list in 2004. These water quality limited streams and the parameters they are listed for are shown in Table 35. Temperature is the most widespread water quality impairment followed by sediment. High temperatures coinciding with low rainfall and low stream flow during the summer months cause stream water temperatures to increase. South-facing aspects and lower elevations tend to create drier and hotter conditions, which serve to further elevate temperatures under these conditions.

Table 35 - Water quality impaired streams within the Umatilla National Forest on Oregon's or Washington's 303d list.

Waterbody	State	Parameter 1	Parameter 2	Invasive Plant Acres within 100 feet of 303d streams*
Big Wall Creek	Oregon	Temperature	Sedimentation	11
Camas Creek	Oregon	Temperature		18
Ditch Creek	Oregon	Temperature		11
Granite Creek	Oregon	Temperature		37
Henry Creek	Oregon	Temperature		10
North Fork John Day River	Oregon	Temperature		60
Swale Creek	Oregon	Temperature	Sedimentation	13
Willow Creek	Oregon	Temperature		15
Wilson Creek	Oregon	Temperature	Sedimentation	7
Asotin Creek	Washington	Temperature		24
Lick Creek	Washington	Temperature		12

*Acres of invasive plants proposed for treatment to contain, control or eradicate the target species.

By direction of the Clean Water Act, where water quality is limited, state agencies develop Total Maximum Daily Load (TMDL) plans to improve water quality to support the beneficial uses of water. For water quality limited streams on National Forest system lands, the USDA Forest Service provides information, analysis, and site-specific planning efforts to support state processes to protect and restore water quality. Two TMDLs have been completed for streams partially located on the Forest. The TMDLs were developed on a Sub-Basin level, not for individual streams. They are for the Umatilla Sub-Basin and the Upper Grande Ronde River and the Oregon portion of the Walla Walla Sub-Basin.

Goals for temperature and sediment reductions were developed in the Umatilla Subbasin Total Maximum Daily Load and Water Quality Management Plans (Oregon Department of Environmental Quality, approved 2001). The temperature analysis was based on a heat source model, and targets were developed for site potential vegetation and channel morphology. Forest Plan standards and guidelines including PACFISH were incorporated into an approved water quality management plan. Turbidity targets were based on studies of impacts to fish. Sediment loads were modeled using relationships between turbidity and total suspended sediment. Overall, Umatilla Forest watersheds have a negligible contribution to downstream sediment, and no load reductions were assigned to the Forest (Umatilla Monitoring Report, 2001). However, management plans specify the importance of control of sediment during Forest management operations.

The State of Oregon completed the Upper Grande Ronde River Sub-Basin Total Maximum Daily Load TMDL and Water Quality Management Plan (WQMP) in December 1999. The document established water quality goals for the streams of the Upper Grande Ronde. The TMDL analysis assigned pollutant loads for water temperature and the WQMP established water quality goals to meet the TMDL, and remove streams from impairment listing (303d). No TMDL for sediment was developed in the Upper Grande Ronde Sub-basin. The state determined that, "the load allocations provided to address temperature, pH, and dissolved oxygen standard violations, coupled with ongoing efforts by the U.S. Forest Service (USFS) to reduce loads from roads and other sources, will be adequate to address sedimentation and turbidity concerns in the Upper

Grande Ronde Sub-Basin." To insure that sediment standards are met, long-term monitoring has been implemented.

Geology and stream type play an important role in determining sediment sources, and the fate of sediment entering streams. On the Umatilla Forest, the highest potential sediment source areas are the granitic rock types and landslide-prone terrain in the Upper North Fork John Day Subbasin. The majority of perennial and intermittent streams across the Forest, have moderate to high gradients, therefore they tend to transport rather than store sediment. In general, these stream types are not susceptible to fine sediment accumulations. Lower gradient (less than 2 %) response reaches occur in the main valleys of larger streams: Asotin Creek, Tucannon River, Touchet River, Walla Walla River, Umatilla River, Meacham Creek, and the upper North Fork John Day River and its major tributaries (Desolation, Granite, Camas, and Wall Creeks). Low gradient meadow systems in the higher elevations are also areas of sediment accumulation. Examples include: Brock-Jarboe Meadow, Granite Meadows, Desolation Meadows, and Kelly Prairie. Streamside developments (including roads, trails, dikes, and campgrounds) in larger stream systems restrict floodplain areas and promote channel incision (deepening). Accelerated streambank erosion resulting from down-cut channels is also a source of sediment to streams.

Bacteria may be a concern in localized areas with heavy recreation use and grazing. Heavy metals are a concern in areas with mining such as Clear Creek and Granite Watersheds. The ability of water to hold oxygen decreases with increased water temperature, altitude, or dissolved solids (TDS). Dissolved oxygen (DO), can be lowered by high stream temperatures, bacteria blooms and decaying vegetation in water, although no streams located on the Forest are listed for low dissolved oxygen.

Flows

There are approximately 7683 miles of stream on the Umatilla. Of these, 2963 miles (39%) are perennial and 4720 miles (61%) are intermittent.

In general, high flows in Blue Mountains watersheds result from two principle hydrologic processes; rarely, a winter rain on snow event, which produces the largest flows, and spring snowmelt, which is an important annual occurrence. Lowest flows are in the summer when precipitation is low and water withdrawals are at their highest level.

Channel Morphology and Riparian Condition

Riparian shrubs are lacking on many Forest streams. There is over utilization of riparian vegetation in some areas by domestic livestock and wildlife. Large wood is lacking in many streams on the Umatilla, particularly where roads parallel streams. However, in recent years degraded riparian areas have been improved to provide for riparian-dependent resources. These improvements have resulted from better control and administration of livestock use in riparian areas, reduced timber harvest in forested riparian areas, and more roads being closed or obliterated (USDA Forest Service 2004b).

Native riparian vegetation plays a key role in forming aquatic habitat for fish and other aquatic species. Roots help stabilize stream banks, preventing accelerated bank erosion and providing for the formation of undercut banks, important cover for juvenile and adult fish. Riparian areas with native vegetation supply downed trees (large wood) to streams.

Riparian vegetation stabilizes stream banks, and serves as a filter to prevent the run-off of soil into streams. Riparian vegetation also provides large and small wood to streams, adding to habitat complexity and providing cover and food sourced for aquatic organisms. Aquatic ecosystems have evolved with certain vegetation types; invasive plants do not necessarily provide similar habitat.

Lakes, Wetlands and Floodplains

There are six reservoirs or lakes on the Forest. Wetlands occupy less than five percent of the Umatilla National Forest area and are generally associated with rivers and streams (USDA Forest Service 1990). Isolated wetlands occur on hillslopes in association with groundwater sources and atypical soil types (glaciated or landslide landforms).

Lakes, wetlands and floodplain areas are often popular for recreation, and so are at risk from invasive plants brought in by visitors. They are also at risk from invasive plants such as knotweed, which colonizes areas downstream of the original infestation along streams. Wetlands can be inundated with water year-round, and others are wet only seasonally. The areas that are wet only seasonally can be infested with upland invasive species, as well as invasive plants specifically adapted to wetlands.

Municipal Watersheds and Domestic Water Supplies

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 municipal water supply in the Project Area is Mill Creek Watershed, which serves Walla Walla Washington. Biological controls are being used to treat the 153 acres of yellow starthistle mapped within the watershed at this time. No chemical treatments are proposed within the Mill Creek Watershed.

The city of Pendleton uses water from the North Fork of the John Day River and the Dale administrative site has a domestic water right on Desolation Creek There are also wells and springs used for domestic water at campgrounds and private water rights on isolated springs on the Forest.

Roads

The R6 2005 FEIS describes roadside ditches as herbicide delivery mechanisms, potentially posing a high risk of herbicides reaching concentrations of concern for listed aquatic species (USDA Forest Service, 2004). Ditches may function as extensions of the stream network. Roadside ditches can act as delivery routes or ephemeral streams during high rainfalls, or as settling ponds following rainfall events.

According to the 2004 Umatilla Forest-Scale Roads Analysis Report, the entire road system is fundamentally hydrologically connected to the stream system because roads are part of watersheds; however, most of the Umatilla National Forest system roads comply with regional road standards in that drainage structures, which divert runoff away from streams, are in place. The Forest roads that remain hydrologically connected capture and release snow and rain, alter patterns and direction of runoff, erosion rates and processes, and can expand the channel network affecting routing of stream discharge. The most hydrologically connected roads cross streams or are located in floodplains and wetlands. For this project, roads within RHCAs are considered hydrologically connected to streams.and at risk for delivery of herbicides to streams. Of the 836.2 miles of road within invasive plant sites, 183 miles (21%) are within RHCAs.

Invasive Plants within RHCAs

Most of the invasive plants are not unique to riparian areas. Table 36 shows acres of invasive plants within RHCAs of both perennial and intermittent streams. Of the 5560 acres infested with invasive plants within PACFISH Riparian Habitat Conservation Areas (RHCAs) only reed canarygrass is specifically a riparian species. All the invasive plant species found within the RHCAs originate from disturbed sites. For example diffuse knapweed, which most often establishes on disturbed sites, is the most common species within the RHCAs of both perennial and intermittent streams.

There are 9,968 acres of diffuse knapweed on the Forest with about 25 percent found within RHCAs. This species is commonly found in open disturbed areas along roads or in areas frequented by cattle. Hounds tongue and spotted knapweed are also found on these sites.

Table 36 - Documented Invasive plants acres within RHCAs.

Primary invasive Plant	Acres within Perennial Stream RHCA	Acres within intermittent Stream RHCA	Total Acres	Percent Perennial	Percent Intermittent
Canary reedgrass	0.1	0.0	0.1	100.0	0.0
russian knapweed	0.0	0.2	0.2	2.3	97.7
rush skeleton weed	0.3	0.0	0.3	88.9	11.1
musk thistle	0.9	1.1	2.0	45.1	54.9
scotch broom	0.0	2.2	2.3	1.3	98.7
medusahead	0.6	2.4	2.9	19.1	80.9
yellow toadflax	6.9	12.0	18.9	36.3	63.7
tansy ragwort	3.4	17.0	20.4	16.6	83.4
leafy spurge	12.5	13.8	26.4	47.5	52.5
dalmation toadflax	7.2	21.2	28.4	25.4	74.6
whitetop	53.3	35.6	89.0	59.9	40.1
common burdock	69.8	56.3	126.1	55.3	44.7
yellow starthistle	39.7	133.2	172.9	23.0	77.0
sulfur cinquefoil	47.2	145.6	192.8	24.5	75.5
scotch thistle	93.8	110.4	204.2	45.9	54.1
canadian thistle	72.5	393.0	465.5	15.6	84.4
st. johns wort	124.4	453.6	577.9	21.5	78.5
spotted knapweed	283.1	397.6	680.7	41.6	58.4
hounds tongue	122.9	563.9	686.9	17.9	82.1
diffuse knapweed	760.9	1501.8	2262.7	33.6	66.4
	1699.4	3861.1	5560.5	30.6	69.4

There are 24,649 acres within identified invasive plant sites on the Forest. Most watersheds have less than 1 percent of their area with infested acres. Meacham Creek is the only watershed with more than 2 percent infested.

Temperature- Stable banks tend to provide more shade which helps reduce water temperature. While invasive plants may provide some shade they are replacing native forbs and grasses that are better bank stabilizers and promote narrower-deeper channels. Such channels have healthier temperature gradients than wide, shallow streams.

Sediment- Reed canary grass is the only invasive riparian species presently identified on the Forest. At one time Reed canarygrass was seeded at culverts for bank stability of streams and as cattle forage. At this time it is found along many Forest streams. However, only one 0.1 acre of Reed canarygrass is proposed for treatment. This treatment area is near Sheep Creek just upstream from the confluence of Sheep Creek and Grande Ronde.

While the other invasive plant species found on the Forest are primarily upland species, they can colonize a range of sites and are present within many PACFISH defined RHCAs.

One of the more prevalent species on the Forest and within RHCAs is knapweed. Diffuse and spotted knapweed is found along many streams in the Forest. Lacey et al. (1989) reported higher runoff and sediment yield on sites dominated by knapweed versus sites dominated by native grasses.

Channel Morphology and Riparian Condition - In the Forest there are approximately 5,560 acres of invasive plants within in RHCAs (See Table 31 in Section 3.5.2). The largest amount of acres of invasive plants within RHCAs in a single 5th field watershed is 606 acres in Wall Creek. The smallest amount is one acre in the Lower North Fork John Day River.

Native riparian vegetation plays a key role in forming aquatic habitat for fish and other aquatic species. Tree roots help stabilize stream banks, preventing accelerated bank erosion and providing for the formation of undercut banks, important cover for juvenile and adult fish. Riparian areas with native vegetation supply downed trees (large wood) to streams. In turn, downed trees in streams influence channel morphology characteristics such as longitudinal profile; pool size, depth, and frequency; channel pattern; and channel geometry. Turbulence created by large wood increases dissolved oxygen in the water needed by fish, invertebrates and other biota. Invasive plants could slow down or prevent the establishment of native trees, decreasing or delaying the future supply of large wood in stream channels (USDA Forest Service, 2005 Regional FEIS).

While invasive grasses and forbs would not directly replace riparian shrubs, in degraded areas where shrubs are no longer present, invasive plants can occupy sites and out-compete native vegetation, limiting opportunities for native shrubs to reoccupy the site.

Floodplains and Wetlands- The Forest SRI (Soil Resource Inventory) shows approximately 2,820 acres of invasive plants proposed for treatment on soils associated with riparian areas. Most are associated with stream channels or floodplains. About 780 acres of invasive plants have been identified for treatment within wet grass lands. No treatment would occur in water; but may take place if these areas become dry during the summer

3.4.3 Environmental Consequences

With the exception of aerial spraying herbicides, all alternatives, including the No Action Alternative, allow similar methods of treating invasive plants. Alternative B has the most aggressive management using herbicides. Alternative C omits broadcast spraying in the Riparian Habitat Conservation Areas (RHCAs). Alternative D omits aerial herbicide application. In addition, all the action alternatives include an early detection rapid response (EDRR) process to address new or unknown infestations over the next 10 to 15 years. Project Design Features such as riparian buffers, frequency of application limitations, and herbicide limitations specific to soil type, lower the risk of chemical contamination to RHCAs. These protective measures would work equally well for EDRR site that would be identified in the future. It is important to acknowledge that aerial and ground broadcast methods have higher risk for unknown variables such as wind drift and rainfall intensity. No herbicide application would occur within municipal watersheds or on domestic water supplies under any alternative. Water contamination risk from herbicide drift, runoff or leaching is low based on evaluation using GLEAMS modeling and added herbicide restrictions. No long term impacts to soils are expected at the Forest scale, although some adverse effects from these actions are unavoidable. Adverse impacts include local effects on some groups of micro-organisms that may be temporarily sensitive to picloram (Tordon), sulfometuron methyl (Oust), and triclopyr (Gralon, Access).

The following sections discuss the general effects of manual, mechanical and herbicide treatments on soil and water resources. Specific differences in alternatives are detailed after the general discussion.

Soils

General Effects of Manual and Mechanical Treatment

Manual and mechanical treatments are proposed under all alternatives. The overall impacts of these activities are low. Manual methods would decrease ground cover**,** temporarily leading to incremental effects from erosion or slight decreases in soil moisture from groundcover reductions. Mechanical methods would not lead to adverse effects on soils since soil organic matter would be supplemented from cut vegetative material.

Public scoping issues about these treatments were not raised. Manual treatments, such as lopping or shearing, cause an input of organic material (dead roots) into the soil. As the roots are broken down in the soil food web, nutrients would be released. Rainfall may cause these nutrients to be lost to surface runoff or to groundwater. Bare soils combined with high nutrient levels may provide ideal conditions for the establishment of many invasive species. However, in lower intensity infestations, non-target vegetation could provide erosion control as well as a seed source for establishing native vegetation. In areas with larger amounts of bare soil, PDFs require restoration activities to reestablish native vegetation. The intent is to re-establish competitive local, native vegetation post-treatment in areas of bare ground, to control soil erosion and provide native competition to invasive plant seeds.

Removal of plant roots will break mycorrhizal hyphae in the soil and probably cause a transient reduction of mycorrhizal function. Studies on crop plants have shown that leaving an undisturbed mycorrhizal network in the soil after harvest (e.g. zero-till agriculture) increases the nutrient uptake of the subsequent crop (Evans and Miller, 1990). Establishment of native plants may be more successful on undisturbed soil. Indirect negative impacts from manual control could be attributed to soil disturbance and opening of the canopy (understory or depending on the species). This could cause minor and transient shifts in microsite condition such as reduction in soil moisture, disruption of mychorrhizal associations and cause an increase in surface temperatures. As the treatment areas associated with this project are generally in previously disturbed sites, treatment would improve the condition of the site by allowing reestablishment of native vegetation.

Manual and mechanical treatments may slightly increase the potential for delivery of fine sediment to streams the year after treatment**.** Removal of surface cover could cause minor localized erosion trapped by surrounding vegetation for approximately one season until vegetation becomes reestablished.

Using mowing equipment on existing roads would not further impact soils. Mowing or use of foaming or steaming machines off roads has the potential to compact soil. Soil compaction eliminates soil pores and so reduces water infiltration, aeration, and the ability of plants to root effectively. To avoid this effect, all vehicles except ATVs would be required to remain on roads or trails. ATVs could be used in meadows or other open areas to carry herbicide to chemically treat invasive plants. As ATVs are light weight machines and would be used when soils were dry, their use is unlikely to compact soils.

While the relative amounts of manual and mechanical treatments vary between the alternatives, the differences in terms of intensity or duration of effects from such treatments have no substantive differences. Other mechanical treatments, such as the use of motorized hand tools are expected to have effects similar to manual treatments.

General Effect of Biological Control

Biological control can be defined as the use of natural enemies to reduce the damage caused by invasive plant populations. Biocontrol is often viewed as a progressive and an environmentally friendly way to control pest organisms because it leaves behind no chemical residues that might have harmful impacts on humans or other organisms. When successful, it can provide essentially permanent, widespread control with a very favorable cost-benefit ratio. For example, bio-control releases on yellow starthistle and diffuse knapweed have shown positive control results on Walla Walla District in the past (J. Mitchell, 2006). Bio-control agents previously released and established on the Forest will continue to spread to other nearby invasive sites providing a potential long-term control treatment.

The primary effect from biological controls is standing dead plants. There would be intangible changes to soil or water resources from any biological control considered on the Forest.

General Effects of Cultural Treatments

No cultural treatment sites are presently identified within the treatment areas. Cultural treatments of newly found invasive species sites could include the addition of fertilizer/soil amendments, and/or competitive planting.

General Effects of Herbicides on Soils

The effect of chemical treatments may affect soils by having short term adverse impacts on certain soil microbes and indirectly from losses in vegetative cover. Most of the proposed chemicals are decayed primarily by soil microbes. Only Chlorsulfuron is mainly degraded through hydrolysis. In the short term, chemicals can adversely affect microbial growth for 1 day to 1 week depending on the chemical used. Results from field and laboratory testing are mixed since soil conditions are highly variable. In general, herbicides are decayed and therefore effects are reduced when microbial metabolic rates highest. These conditions are when adequate warmth, moisture and microbial substrate are abundant such as during spring.

The effect of a chemical treatment on the soil depends on the particular characteristics of the chemical used, how it is applied, and the physical, chemical and biological condition of the soil medium. These characteristics were used to form Project Design Features to minimize adverse effects from the use of herbicides to soil. Picloram, clorpyralid, and sulfometuron methyl are excluded from use on coarse grained soils due to the risk for groundwater and nearby waterway contamination. Chlorsulfuron was excluded from treatment on high clay soils since sheet wash particular to this soil type spreads the herbicide to nontarget soils and vegetation in addition to nearby waterways.

In general, primary herbicide routes in soil are leaching, hydrolysis, adsorption/desorption onto soil particles, and biological degradation. Soil characteristics affect the herbicide residency time through drainage and adsorptive capacities. Highly drained soils have greater propensity to transfer herbicides to groundwater stores.

Organic rich soils and finer texture soils have higher adsorption potential for holding herbicides. Herbicides will vary in the degradation potential based on their chemical structure and the biologic potential of the soil.

Overall, the proposed herbicide types and application rates are low enough to facilitate decay by soil microbes. The proposed herbicide usage would have a low risk for soils since the bulk of treatments focus on roads and rock quarries where soils are unproductive and soil communities are uniform. Adverse effects may occur where diverse native grasslands are treated with unselective herbicides and broadcast methods. These impacts are related to the short term loss of non-target broadleaf forbs that support diverse soil communities.Soil attributes at greatest risk from chemicals include damage to soil organisms and erosion from removal of ground cover. A more extensive discussion of the individual herbicide properties can be found in Appendix B. Also, see the native plant community discussion in the botany report.

Herbicide Effects to Soil Organisms

The low application rates and type of herbicides proposed in general have a low impact on soil organisms. However, Picloram (Tordon) is known to affect soil organisms at the approved application rates (SERA 2004). At high rates, sulfometuron methyl (Oust) and Tryclopr (Gralon, Access) can affect soil microbes. Sulfometuron methyl can inhibit soil microbial growth. Tryclopr may adversely affect some fungi and algae. Effects are short term and transitory since effects decrease with time. Functional groups of microbes that have similar metabolic pathways as the target weeds would be most sensitive to the herbicides. However, collective adverse effects of the proposed herbicides on soil microbes are hard to predict, given the diversity of the soil community and varying resistance to the particular herbicides. For example, some laboratory studies found glyphosate adversely impacted several types of microbes, although populations rebounded quickly (Tu et al 2003). Similarly, Busse et al (2001) found no long term impact on microbial communities when using glyphosate on ponderosa pine plantations.

Ultimately, soil microbes facilitate the degradation of the herbicides by using the herbicides as growth substrate, cometabolizing, polymerizating, accumulating or altering the chemical structure by influencing the pH of the soil environment (Bollag andd Liu 1998). The residency times are a gross collective function of average soil types, application timing and frequency, and finally the unique chemical structure. Of the herbicides, Imazapr has the longest half-life at 1 year, while Sethoxydim has a comparitively rapid half-life from 5 to 25 days. As stated above, favorable microbial growth conditions will speed herbicide degradation.

Soil Cover

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 heavily infested with invasive plants moving toward monocultures, including those with medusahead or houndstongue. Chemically 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**.** If native populations were low native species would be seeded after treatment under all action alternatives.

Physical Properties of Herbicides

Factors that determine the fate of herbicides in soil include mobility and degradation. Herbicide degradation over time is a result of physical and chemical processes in soil and water. Herbicide fate in soil is determined by herbicide characteristics such as adsorption, solubility, degradation, and volatility. Soil characteristics such as organic matter, pH, temperature, moisture content, clay content, and microbial degradation are can modify certain properties of herbicides such as mobility in soils and half-life(time it takes for half the amount of chemical present to breakdown). General characteristics for the proposed herbicides are displayed in Table 37. Many of the proposed herbicides are highly soluble in water (Table 37). In general, this is often taken as an indicator of the mobility of the chemical in soils. There are exceptions, however. Glyphosate, while having a high solubility, also binds tightly with soil particles, and because of this it has low mobility. Herbicides with high mobility potential and long half-lives have a greater potential for leaching into near surface ground water.

Table 37 - Herbicide Properties

Herbicide	Toxicity to Soil Microbes	Potential Mobility1	Water Solubility1	Degradation path and half life2	Activation Mechanism2
Chlorsulfuron	Low	High Very high in clay soils	Very High	Hydrolysis 40 days	Acetolactate synthesis inhibitor (Selective: controls broadleaves and some grasses)
Clopyralid	Low	Very high especially in sandy soils	High	Soil microbes 14 to 29 days	Plant growth regulator (Very selective to broadleaves; post emergent)
Glyphosate	Low	Low	Very High	Soil microbes 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	Medium (Lower with increased organic Matter)	Very High	Soil microbes 113 days	acetolactate synthesis inhibitor (Uptake by roots & leaves; active in soil as pre-emergent)

Herbicide	Toxicity to Soil Microbes	Potential Mobility1	Water Solubility1	Degradation path and half life2	Activation Mechanism2
Imazapyr	Slight at high application rates.	Medium (low Organic Matter and high pH raise mobility)	Very High	Soil microbes 25 to 180 days	acetolactate synthesis inhibitor (Uptake by roots & leaves; active in soil as pre-emergent)
Metsulfuron methyl	At high application rates short-term decrease for a few days but reversed quickly.	Very High	High	Slow microbial degradation at high pH, fast at low pH Up to 120 days	acetolactate synthesis inhibitor (Potent herbicide; uptake by roots & leaves)
Picloram	Toxic to some soil organisms, even at low levels.	Very High	Very High	Slow microbial 90 days	Plant growth regulator (Selective: rate and season dependant; pre-emergent and soil active)
Sethoxydim	Low	Medium (Organic Matter decreases)	Very High	Rapid microbial Up to 60 days	Inhibits acetyl co-enzyme (ACE) (Systemic that is absorbed rapidly by foliage and roots.
Sulfometuron methyl	Toxic to soil organisms. Soil residues may alter composition of soil microorganisms	High	Medium	Soil microbes 10 to 100 days	Acetolactate synthesis inhibitor (Non-selective pre and post emergent - uptake by roots & leaves. Potent herbicide;)
Triclopyr	Inhibits algae at low rates Toxic to fungi at high rates.	Very High	Medium	Soil microbes 46 days	Plant growth regulator (Absorbed thru roots, foliage and green bark)

1 Mobility and water solubility categories from Bautista and are general breakdowns not a definitive classification
2 Deschutes Ochoco Invasive Plant EIS Soils Report, 2006

Summary of Soil Concerns with Specific Herbicides and Project Design Features

Clopyralid has high potential mobility in sandy soils. It is degraded by soil microbes not hydrolysis and therefore can be persistent in groundwater. PDF H5 - To minimize movement of clopyralid through soils into groundwater, clopyralid would not be used on high-porosity soils (more than 20 percent coarse fragments or coarser texture than loamy sand).

Chlorsulfuron does not adhere to clay particles. PDF H6 - chlorsulfuron would be avoided on soils with high clay content (finer than loam) to avoid herbicide movement.

Picloram and sulfometuron methyl persist longest in the soil and may also have adverse effects on soil organisms. Therefore, the PDFs H7 and H8 limit the frequency of use of these herbicides under all action alternatives, and prohibit their use on shallow or coarse soils to lower the risk of contact with groundwater. The Proposed Action avoids use of picloram sethoxydim, nonaquatic glyphosate and triclopyr bee on roads having high potential for herbicide delivery.

Water

Streams are complex and dynamic systems that reflect the balance between stream flow, sediment input and substrate/bank composition. Riparian condition and water quality are the two elements potentially affected by invasive plant treatments.

General Effects of Manual and Mechanical Treatment

Mechanical treatments except for mowing would take place away from water. Mowing would occur only along established roads. Manual effects are generally cutting, digging or pulling weeds. If seeds are present the weeds are bagged and taken off site. Removal of soil cover would be very small under these circumstances. However there could be small localized areas of erosion and subsequent sediment input to the stream. These effects would be transitory and too small to measure.

Pulling weeds along stream banks could also destabilize the banks in highly localized areas. As only 4.4 acres of hand treatments over 10 sites are planned within the aquatic influence zone only localized effects would be expected, lasting only about one season until vegetation reestablished. Manual and mechanical treatments within riparian areas could accelerate sediment delivery to streams through ground disturbance. However, most of the treatments areas are previously disturbed roadways and trails so additional ground disturbance would not be a significant change from the existing condition. Modification of surface ground cover can also change the timing of run-off. For all alternatives, treatment areas comprise a small portion of any watershed so no effects to stream flows are plausible.

General Effects of Herbicide Treatments

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 colonized along stream channels and out-competed native species. All invasive plant treatments carry some risk that removing invasive plants could exacerbate stream instability; however the restoration plan accounts for these areas and prescribes mulching, seeding and planting as needed to revegetated riparian and other treated areas.

A primary issue is the potential for herbicides to enter streams and impact domestic water sources and/or aquatic organisms. This section describes how Project Design Features minimize the possibility that herbicides would enter water and impact water quality.

Based on the R6 2005 FEIS, herbicides were grouped by their level of concern to aquatic resources. The herbicides of lower concern for aquatic resources are: clopyralid, imazapic, and metsulfuron methyl. The herbicides of moderate concern are chlorsulfuron, imazapyr, sulfometuron methyl. The herbicides of greatest concern are non-aqueous glyphosate, triclopyr, picloram, and sethoxydim. The aquatic formulations of glyphosate, triclopyr, and imazapyr may have more adverse effect effects to aquatic resources than the low concern herbicides but are licensed for use near or in water. Streamside buffers vary depending on the level of concern and label requirements.

Drift, Run-off and Leaching

The routes for herbicide 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. This section addresses each of these delivery routes.

No direct application of herbicide to water is intended under any alternative. No emergent plants would be treated under any alternative.

Effects from drift, runoff and leaching were considered in the herbicide risk assessments, prepared for the R6 2005 FEIS, and assume broadcast treatments occurr 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. The GLEAMS model likely overestimates the herbicide concentrations that would plausibly enter streams from this project. This is because broadcast treatments are prohibited within 100 feet of all perennial streams and within 50 feet of intermittent streams under all action alternatives. To minimize adverse effects to streams, Project Design Featues (primarily stream buffers) were developed depending on the herbicide and the method of application.

Spot treatments using herbicides of higher concern to aquatic organisms along streams would 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 an adjacent plant, but the concentrations of herbicide that may be delivered to streams from this mechanism is much less than GLEAMS predictions.

Berg (2004) compilation of monitoring studies on herbicide treatments with various buffer widths showed that any buffer helps lower the concentration of herbicide in streams adjacent to treatment areas. In California buffers between 25 and 200 feet generally had no detectable concentrations of herbicide in monitored streams with detection limits of 1-3 mg/m3.

In South Carolina, ground applications of the herbicides imazapyr, picloram and triclopyr had no detectable concentrations of herbicide in monitored streams with buffers of 30 meters (about 100 feet) (USDA HFQLG EIS, Appendix B, 2003). No detection limits were given.

The USGS in partnership with the Oregon Department of Transportation studied runoff of herbicides along roads (Wood, 2001). The study was conducted on runoff associated with several herbicides (including sulfometuron methyl and glyphosate) along a road in western Oregon simulating rainfall at 1/3 inches an hour at 1, 7 and 14 days after treatment. Samples were collected at the shoulder of the road and found concentrations of several hundred ppb of sulfometuron-methyl and nearly 1,000 ppb of glyphosate that could potentially leave the road shoulder.

In the fall the road was again sprayed and the ditch line of the road was checked during natural rainstorms for three months. Sulfometuron-methyl was found in concentrations of 0.1 to 1 parts per billion (ppb) along the shoulder and from 0.3 to 0.1 in the ditch line but was below detectable limits in the 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 duration (three months) of the study.

Berg 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 as would occur under the action alternatives (ibid.). If a large rainstorm occurs after herbicide application, sediment contaminated by herbicide could be carried into streams. As most herbicide application occurs in the late spring through the early fall, which is the driest time of the year, the probability of a large rainstorm soon after application of herbicides is low at any particular site.

Aerial Application

Wind drift is the mechanism most likely to carry herbicide to nontarget areas such as stream channels. This is primarily dependent upon the elevation of the spray nozzle, droplet size and air movement. The smaller the droplet, the longer it stays suspended and the farther it can travel.

Spray drift can be reduced by increasing droplet size (Table 38). Droplet size can be increased by: 1) reducing spray pressure; 2) increasing nozzle orifice size; 3) using special drift reduction nozzles; 4) additives that increase spray viscosity and; 5) using rearward nozzle orientation in aircraft.

Commercial drift reduction agents are available that are designed to reduce drift beyond the capabilities of the determinants described above. These products create larger and more cohesive droplets that are less apt to break into small particles as they fall through the air. Project Design Feature F6 requires a coarse spray with a median diameter of 500-800 microns.

Table 38 - Drift Distance versus Drop Diameter

Droplet Diameter (microns)	Type of Droplet	Time	Lateral Distance Traveled in 10 foot height & 3 mph wind speed
5	Fog	66 minutes	3 miles
20	Very Fine Spray	4.2 minutes	1,100 feet
100	Fine Spray	10 seconds	44 feet
240	Medium Spray	6 seconds	28 feet
400	Coarse Spray	2 seconds	8.5 feet
1,000	Fine Rain	1 second	4.7 feet

Source http://www.ag.ndsu.edu/pubs/plantsci/weeds/a657w.htm#factors

Copy of source available in project record

Washington State Department of Ecology and Oregon Department of Forestry have monitored aerial application of herbicides in forest settings. The purpose of both studies was to look at the effectiveness of buffers protecting water quality in streams within herbicide treatment areas. The Washington study looked at many factors in addition to stream buffers that affected the concentration of herbicides in streams within treatment areas.

The Washington study collected herbicide samples at seven sites on small streams (Rashan and Graber, 1993). Buffers were 50 feet on flowing streams and no buffers on small stream channels assumed to be dry. Peak herbicide concentrations ranged between 0.2 and 7.55 microgram per liter (ug/l). Maximum 24 hour averages were between 0.13 and 3.25 ug/l. Runoff samples collected at 4 sites 2 to 24 days after application had concentrations between 0.17 and 2.49 ug/l.

Oregon requires buffers of 60 feet on fish bearing streams or streams used for domestic water supplies. Two non-fish bearing streams also received 60 foot buffers (actual buffer ranged from 60 to 100 feet). For the Oregon study most of the samples (21 sites, and 105 post spray samples) had a detection limit of 1 ug/l. None of these samples had concentrations at detectable limits. Five sites (25 samples) had detection limits of 0.04 to 0.5 ug/l. Most samples were still below detectable limits, but 7 of the 25 samples tested between 0.9 and 0.56 ug/l (Dent and Robben, 2000).

The Washington study attributed the majority of herbicide introduction in buffered streams to swath displacement, drift and secondary contribution from overspray of small stream channels mistakenly assumed to be dry. This study recommended buffers of between 15 to 25 meters for downwind applications and 75 to 90 meters for streams upwind applications.

All aerial applications of herbicides would comply with Environmental Protection Agency (EPA) label restrictions and state regulations. Using the recommendations above, PDFs were developed to minimize potential impacts to water (See Chapter 2.2.3, Table 6, PDFs E and F)

Accidental Spill

Concentrations of herbicides in the water as a result of an accidental spill depend on the rate of application and the stream 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).

Potential for accidental spills is negligible and therefore not considered within the scope of the project. The Project Design Features to reduce the potential for spills are practices that have been developed over time and proven effective. If an accident were to occur, these PDFs would minimize the magnitude and intensity of effects. An herbicide transportation and handling plan is a project requirement. This EIS addresses spill prevention and containment (See Chapter 2.2.3, Table 6).

Lakes, Wetlands and Floodplains

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 or preferential adsorption of the herbicide into the lake sediments rather than from dilution. As no emergent treatments are proposed the primary pathways for herbicide to enter lakes would be from drift or runoff.

Some invasive plants may grow in wetlands or near lakes and reservoirs. To protect water quality, PDFs require that only spot or hand treatments occur within 100 feet of lakes or wetlands. A large rain event after treatment could carry herbicide into water resulting in minor amounts of herbicide contacting surface water. This amount would insignificant compared to concentrations modeled with GLEAMS and well under any threshold of concern.

To minimize risk to wetlands no more than 10 acres or half of a wetland would be treated in any 30-day period. The PDFs for wetlands limit the area treated at one time for two reasons:

1. They lower the amount of herbicide near the water body at one time and allow time for the herbicide to degrade. Many of the herbicides degrade quickly in soils high in organics or in water.

2. If only half an area is treated at a time it lowers the acreage affected by vegetation decay and leaves refugia for aquatic organisms in other areas around the lake, pond or wetland. No treatments are proposed to take place directly in water. Wetlands would only be treated if and when they dry out.

Small, unmapped ponds found during implementation planning would have the same PDFs on herbicide use within 100 feet of the pond.

Emergent Vegetation

There is no treatment of emergent vegetation proposed under any alternative.

Municipal Watersheds and Domestic Water Supplies

No herbicide application would occur within the municipal watershed under any alternative. The yellow star thistle would be treated with biocontrol under all action alternatives.

Other water supplies such as wells or springs at campgrounds would be buffered from herbicide application to protect water quality. *H13- Herbicide use would not occur within 100 feet of wells or 200 feet of spring developments as required by Washington states WAC 246-290-135. Oregon has no specific requirements.)*

Comparison of Alternatives

Chapter 2 of this document offers a more detailed alternative comparison.

Table 39 - Comparison of Acres Treated by Alternative

Treatment Methods	Alternative A No Action[1]	Alternative B Prop Action	Alternative C No Broadcast in RHCA	Alternative D No Aerial herbicide treatment
	Acres			
Upland Areas				
Manual and/or mechanical and/or ground based Chemical (broadcast and/or spot)	1,252	14,456	14,456	15,131
Treatments in Riparian Habitat Conservation Areas[2,3]				
Manual, mechanical, ground based chemical broadcast and/or ground based chemical spot treatment	0	2743	0	2743
Manual, mechanical and/or ground based chemical spot treatment only (including wicking and wiping) no broadcast allowed	522[1]	2817	5,560	2817
All Areas				
Bio-Control only	1339	3917	3917	3917
Manual only	41	41	41	41
Aerial only	0	675	675	0
Total Acres Treated	**3,154**	**24,649**	**24,649**	**24,649**

1No action alternative includes '95 EA and all amendments to the document. Restrictions on herbicide us under this alternative allows no chemical application within 100' of streams or standing body of water.
2Riparian Habitat Conservation Areas (RHCA) as designated under PACFISH, INFISH
3Riparian acres are included within the total acres treated.

Alternative A – No Action

Direct and Indirect Effects to Soils

Manual, Mechanical, Cultural and Biological treatments would continue under the existing NEPA decision from the 1995 *Umatilla National Forest Environmental Assessment for Managing Noxious Weeds.* Under this alternative less than seven percent of known sites would be treated with herbicide, leaving a heavy reliance on manual treatments. Alternative A would continue the use of glyphosate and picloram on up to 1,390 acres a year. There could be a short-term (1 to 2 years) reduction in soil cover for the areas treated. This localized reduction in cover would increase treated areas vulnerability to soil erosion. The effects would be minimal given the poor quality of groundcover provided by the invasive species proposed for treatment, the scattered nature of the treatments and the small amount of land treated, especially within Aquatic Influence Zones. These effects would last approximately one season until vegetation became re-established.

The No Action Alternative allows herbicide treatment only of invasive plant sites identified at the time of the project. Because newly discovered sites can only be treated manually or mechanically, it is expected that invasive plants would continue to spread. This would increase the number of acres negatively affected by invasive plants. These effects are described above in the Affected Environment section of this EIS.

Adverse impacts to soils may occur where some noxious weeds are left to populate. Alternative A has a much less agressive strategy for addressing this weed spread. Specific changes to soil nutrient regimes are associated with large spotted knapweed infestations (Lejeune and Seastedt 2001), and allelopathic influences (Bais et al 2003); in addition to changes in surface hydrology where the plant communities are moved from bunchgrass dominated to taproot forb dominated (Lacey 1989). Similarly, the influx of cheatgrass (Bromus tectorum) can alter soil dynamics with changes in structure, nutrient pulses and soil moisture status (Norton et al 2003). These changes may be coincident with the long term shifts from perennial grasslands to annual grasslands as documented in California (D'Antonio and Vitousek 1992). Other noxious weed species may have similar impacts as demonstrated by Vinton and Burke (1994) where fertilization caused long time shifts to favor weedy forb species.

Adverse tradeoffs with Alternative A, in this case the risk of nontreatment, would be highest for Centaurea spp and others that can spread into relatively undisturbed grasslands (see Tyser and Key 1988). These tradeoffs are weighed by addressing spread rate versus the impact from treatment (D'Antonio et al 2004); especially in regards to affecting nontarget plant species (see Ortega 2005b).

The botany report discusses dry grasslands and shrublands that have the greatest risk for invasion of these species. Highly disturbed sites are not as critical since prior disturbance has offset soil community structure to favor fast growing species as demonstrated with old field succession studies. Forest standards 12 and 13 (USFS 2005b) would be used to establish long term strategies for controlling invasives where treatments are applied.

Cumulative Effects

This alternative is covered under previous NEPA projects. Treatments would occur on an extremely small percentage of any watersheds in the Project Area. Direct and indirect effects are so insignificant and temporary that treatment under No Action could not plausibly contribute to significant cumulative effects.

Alternative B – Proposed Action

Direct and Indirect Effects to Soils

Herbicide treatments are proposed for 20,691 of the total 24,649 acres inhabited by invasive plants. Approximately 4000 acres of treatment are expected to occur annually (budget allowing). Aerial and broadcast application methods have more potential than other application methods to contact soil, and affect soil organisms and/or productivity. Therefore, Alternative B has the highest tradeoff between having the most effective elimination of noxious weeds while having the highest risk for affecting non-target vegetation and soils.

Herbicide application is favored in high traffic areas such as road corridors or where high disturbance occurs such as trailheads, stock yards or old agricultural areas. Approximately, 11,753 acres is planned for herbicide treatment along travelways. Herbicide application is intended at regular intervals due to the sustained risk. In these highly disturbed areas, soil communities are largely uniform and function well under disturbed conditions; therefore, impacts are not anticipated.

Where native communities are largely intact the tradeoff is less apparent. Habitats that may be affected are the highly invasible dry grassland. Approximately, 2,505 acres are slated for broadcast spraying within the 3,068 acres of dry grassland on the forest. The mixed conifer and shrubland plant communities are more resistant to effects of herbicides because they have fewer, sensitive herbaceous species. Sylivia and Jarstfer (1997) found that after three years, pine trees in plots with grassy weeds had 75 percent fewer mycorrhizal root tips than plots that had been treated three times per year with a mixture of glyphosate and metsulfuron methyl to remove the weeds.

For dry grassland communities, broadcast herbicide application has higher risks associated with the elimination of non-target species. This risk may lead to short term reductions in plant diversity with concomitant impacts to soil microbial communities, especially given that much of the diversity may be represented by forb richness (Pokorny et al 2004). Ortega et al (2005a) showed sustained losses of arrowleaf, balsaroot and other native forbs over three years of monitoring in fescue grassland in Montana. Further, the risk for spraying one target species must be balanced with the risk for invasion by another species. Ortega has preliminary findings with winter range restoration that suggest cheatgrass is increasing in response to spraying for spotted knapweed (Ortega 2005b). To address this risk, the Umatilla NF is directed to the long term strategy of weed managment of Forest Standards 12 and 13 of the Forest Plan (USFS 2005b).

For the dry grasslands, the knapweeds and star thistle have very high invasive potential. Broadcast methods as proposed in this alternative would have the greatest effectiveness in lowering the potential for these noxious weeds to expand in dry grassland habitat, particularly in the southern portion of the forest. Morghan et al (2003) suggested clopyralid would only have short term decreases on nontarget species as long as the spray intervals were greater than one year.

The 675 acres of aerial application sites proposed are primarily for treatment of yellow starthistle and diffuse knapweed. The geology underlying this site is primarily basalt and the associated soil is generally a loam. Clopyralid and picloram are the selective herbicides most effective for these species. Clopyralid would be sprayed because the area contains some conifers and clopyralid does not affect these species. The largest area is approximately 630 acres with slopes ranging from 6 to 56 percent (GIS). This site is next to private land (138 acres) that would be sprayed at the same time. This large site has a higher risk for wind movement of herbicide affected soil due to the nonselective nature of the herbicides, and the aerial application method. However, most of the treatment areas are in open forest of mixed ponderosa pine or grasses. Clopyralid would not affect these species; so much of the treatment areas would retain some vegetative covering to protect the soil.

Of the ten herbicides approved for use in Region 6, picloram and sulfometuron methyl pose risks to soil microorganisms and are most persistent in the soil. To protect soil organisms and therefore protect soil productivity, PDFs require sulfometuron methyl would only be used once a year and picloram once every two years. This will prevent accumulation of herbicides in the soils. The intent is to lower the noxious weed population where manual, mechanical or more selective herbicide methods could be used thereafter.

The other herbicides have small to no effect on soil microorganisms at normal application rates and could potentially be used three times on the same area in one year. More than likely, if an area was broadcast sprayed once, subsequent treatments would consist of spot spraying to treat missed areas, to treat areas where seeds have germinated since the last spraying, or to treat the small areas where invasives were damaged but are resprouting.

The Project Design Features limit herbicide uses based on soil textures. For example, chlorsulfuron is not to be used on heavy clay soils (see PDFs in Table 6). If herbicide treatment is necessary near streams or lakes when soils are wet, aquatic-labeled herbicides or those that pose low risk to aquatic organisms would be applied according to label directions and applicable PDFs.

Early Detection Rapid Response

Early Detection Rapid Response (EDRR) is part of all the action alternatives. Under this approach new or currently unknown infestations may be treated using the range of methods analyzed in this EIS on sites similar to those presently proposed for treatment. PDFs would protect soil properties by constraining treatment methods according to site specific conditions.

Cumulative Effects

Soil productivity is protected by the PDF allowing only one herbicide treatment a year of suflometron methyl, which has detrimental effects to soil organisms and therefore soil productivity. Picloram would only be used once every two years to let this persistent herbicide degrade. These herbicides have half-lives of 90 days and 10-100 days depending on soil conditions. While the proposed project has sufficient safeguards to protect soil microbes, this project along with other herbicide treatments occurring on adjacent lands has the potential of multiplying effects. If, for example, an adjacent landowner was aerially spraying picloram and it drifted onto a National Forest site that was broadcast sprayed one month earlier, the cumulative effect could be significant to soil microbes.

It could also potentially be delivered to a nearby stream if the area treated had high clay content in the soil and a significant rain event occurred. While it is not probable that all of those circumstances would occur, it is still possible. If duplicate applications occurred the effects would be localized and small compared to the total Project Area. Furthermore, PDF B1 (see Section 2.3.3) ensures that Forest staff coordinates with owners and managers of neighboring lands. Such coordination would make duplicate treatment a very remote possibility.

Additional cumulative effects may occur where repeated herbicide application change plant community structure. In Ortega's monitoring (2005b), repeated applications of picloram cumulatively led to an increase in cheatgrass even though knapweed cover decreased. The new forest standards 12 and 13 (USDA 2005b) suggest a long term strategy is used to evaluate these circumstances and restoration considered. Seeding with native and naturalized species may reduce the invasibility of treated sites.Biocontrol agents spreading from adjacent lands onto National Forest system lands would likely have the beneficial effects of reducing weeds. Invasive plants killed by such agents would also contribute organic matter to soils.

Alternative B is unlikely to have significant effects to soil or water resources and therefore is unlikely to approach a threshold of concern, or contribute to significant cumulative effects. No adverse cumulative effects are expected from implementation of this alternative.

Alternative C – No Broadcast within Riparian Conservation Habitat Areas

Direct and Indirect Effects to Soils

The effects of this alternative are the same as for Alternative B except within RHCAs. Where approximately 50 percent of the acres within the RHCA could be broadcast under Alternative B, all 5,560 acres of potential herbicide treatment would be limited to hand or spot spray under Alternative C.

Most of these treatment areas are along roads more than 100 feet from streams. The direct effect would be less potential for herbicide contact with soil. There would be less effect to non target plants that add soil cover. With no broadcast spray within the riparian area there would be less potential effect to soil organisms within these areas.

Cumulative Effects

Cumulative effects are the same as discussed under Alternative B.

Alternative D – No Aerial Application

Direct and Indirect Effects to Soils

The effect of this alternative would be the same as for Alternative B except for 675 acres proposed for aerial application. These areas would be treated by other methods. Region 6 Invasive Plant FEIS considers aerial spraying a higher risk than other methods due to potential for drift to nontarget areas. As aerial spray is generally a broadcast method, more herbicide contacts soil than from spot treatments. This alternative is designed to use more targeted methods to treat these areas. More targeted methods mean less contact of herbicide to soil so less chance of effecting soil organisms in these areas. There would be less chance of damage to nontarget plants and soils, thus this alternative would have less potential to negatively affect soil biological communities and protective groundcover.

Cumulative Effects

Cumulative effects are the same as discussed under Alternative B.

Effects to Water Resources

Alternative A – No Action

Direct and Indirect Effects to Water Resources

Under this alternative no additional management of invasive plants would occur other than what is identified under the existing 1995 EA decision for the Umatilla NF to Manage Noxious Weeds, except manual and mechanical treatments, which can occur anywhere. No aerial application of herbicides is allowed. Invasive plants would continue to grow on sites where their treatment is currently not authorized by a NEPA analysis. Invasive plants are often less effective for stream bank stabilization than deeper rooted native plant species. Most invasive plants also provide less stream-shading than native hardwoods and conifers.

No herbicide application takes place within 100 feet of water under this alternative. Under this alternative there is negligible chance of herbicide drift into streams. Only two herbicides are available for use under this alternative. Picloram is of high concern for aquatic resources but preferred in some situations because it is a selective herbicide which kills only certain plants and has a residual effect to repress reestablishment of target invasive species. Glyphosate is the other choice, is nonspecific and kills all vegetation.

Cumulative Effect

This alternative is covered under previous NEPA projects. Treatments would occur on an extremely small percentage of any watersheds in the Project Area.

Potential direct and indirect effects from treatments are so insignificant and temporary that treatment under No Action does not contribute to significant cumulative effects. Lack of treatment would allow the continued spread of invasive plants and the associated changes in ecosystems.

Alternative B – Proposed Action

Direct and Indirect Effects to Water Resources

Up to 5,560 acres of treatment, including chemical treatment could take place in RHCAs. Almost 50 percent could be broadcast sprayed and the other 50 percent treated by spot or hand methods. In reality, most of these areas have only discontinuous infestations of invasive plants, but, as acres of infestations change year to year; analysis is done as if all acres within a treatment area are infested.

None of the treatments are extensive enough under any alternative to effect peak flows, low flows or water yield. Methods used for treatment would have negligible effect on water infiltration into soil and associated surface runoff. No 5th field watershed has more than 2.5 percent proposed for treatment and most have less than one percent. This amount is much too small an area to show effects to flows from treatment.

Generally, small areas would be treated along streams. As most invasive plants provide little shade, removal of these plants is unlikely to have any measurable effect to stream temperature. As these methods target individual plants, the risk from spot or hand application of herbicides to native riparian vegetation is small. Increasing native forbs and grasses would improve bank stability and potential for narrower, deeper channels, potentially reducing water temperature over time. Where passive restoration occurred, native vegetation would slowly become reestablished. Where restoration was applied, re-establishment of native vegetation could occur more quickly; possibly within a couple of years.

Where manual methods remove invasive plants near streams there could be minor loss of ground cover and soil disturbance leading to erosion, and a minor localized increase in fine sediments particularly if vegetation is removed from stream banks. This increase would only last a season until vegetation became re-established and is not considered significant. Many treatment sites are small and would reseed naturally with existing native vegetation. Restoration would allow sites lacking a native vegetation seed source to re-vegetate to control erosion.

Project Design Features also minimize the chance of herbicides reaching streams or wetlands through drift, runoff, or leaching into soils. Buffer widths vary depending on herbicide aquatic risk ranking (established in the Regional Invasive plant FEIS) and application method. PDFs and label requirements prohibit use of the more mobile herbicides on shallow soils. This would protect groundwater, particularly in areas where shallow soils cover fractured bedrock.

Glyphosate and imazapyr are the only herbicides used for spot spraying up to waters edge along perennial channels. Glyphosate is highly water soluble but because it adheres tightly to soils is unlikely to be carried into a stream unless the soil particle is carried into the stream. This is unlikely to happen during the late spring or summer when herbicides would be applied because there is less rain in the summer and more vegetation growth to hold soil particles in place. If glyphosate is carried into a stream by runoff it preferentially stays with the soil over partitioning into water. Imazapyr is only moderately water soluble and forest field studies have not found it very mobile in soils (Appendix B).

Herbicides entering surface water through surface runoff are also expected to be minimal, since targeted spot spraying techniques would be used to apply herbicide within 100 feet of surface water. This would minimize the amount of herbicide reaching the ground surface as well as minimize the potential for herbicide drift. No herbicides considered high risk to aquatic resources would be broadcast within 100 feet of streams and none would be spot sprayed within 50 feet of streams (Table 7, Table 8, Table 9).

Some streams within road corridors have treatment areas that parallel both the road and the stream with many continuous acres of treatment within the aquatic influence zone. In reality these areas have invasive plants scattered among other vegetation along the stream. To model a worst case scenario a few of these areas were modeled for site specific soil types and rainfall with the SERA spreadsheet. For NF Astonin River and Little Phillips Creek clay soils were modeled due to the compacted road conditions near the streams within the treatment areas. In addition, the model was run for a hypothetical site with the highest rainfall on the Forest and a sandy soil, the soil most likely to allow runoff into the stream. Only aquatic glyphosate and aquatic imazapyr were modeled with the high rainfall and sandy soil as they are the only herbicides allowed for spot spray treatments below bankfull, and PDFs do not allow the use of clopyralid on sandy soils.

NF Asotin Creek has up to 81 acres of treatment of scotch thistle on 3.9 miles along the trail that follows the creek and tributaries within 100 feet of the stream channel. In reality the scotch thistle is probably patchy and covering less than 25 percent of the acres within the treatment area at this time. Modeling limitations include: modeling only the 50 feet closest to the channel and 1.6 miles of stream channel, and assumes broadcast spray, not spot spray. The broadcast spray would over estimate concentrations in the stream. PDF H16 requires that no more than 10 acres of treatment would occur within the aquatic influence zone of a stream within any year. This would keep treatment at this site within the modeled parameters.

Analysys of these sites indicates all HQ values were below 1; therefore, no herbicide concentrations in water reached a levels of concern for sensitive fish (Table 46) The R6 2005 FEIS notes that as HQ increases above 1, the margins of safety decrease compared to the most sensitive toxic effect shown in laboratory studies.

Domestic Water Supplies

Water sources, including those in campgrounds, recreational homes, and individual special use permit would be protected by PDF-H13, which requires that herbicide use would not occur within 100 feet of wells or 200 feet of spring developments.

Roads

There are 836.2 miles of road within treatment areas. Of these, 183 miles (21%) are within RHCAs and proposed for chemical treatments. Roads and their associated ditchlines are often connected to streams and during storm events can carry herbicide to streams; however, much of the Umatilla National Forest system roads comply with regional road standards in that drainage structures are in place that divert runoff away from streams. Still, some roads with connected ditchlines are within RHCAs. Under this alternative, broadcast application of herbicides (both boom and hand) are allowed within the outer part of the RHCA. To minimize risk to aquatic resources, PDF H3 requires that no high risk herbicides would be broadcast within RHCAs. Therefore, for the 183 miles of road identified within RHCAs, picloram, non-aquatic triclopyr (Garlon 4), non aquatic glyphosate, and sethoxidim would not be used.

Though the probability of a large rain storm happening after application is low at any particular site, this additional protection measure would ensure that high risk herbicides are not delivered to streams in concentrations that exceed levels of concern.

Aerial Application

Aerial application of herbicide would occur on the Pomeroy District covering approximately 675 acres on 17 sites ranging in size from 1 to 290 acres. Most of the acres are in one area of 625 acres where both yellow starthistle and spotted knapweed are found. There are approximately 195 acres of grasslands with most of the area in open ponderosa pine forest. There are also small areas of lodgepole pine, grand fir and mixed forest types,. The herbicide to be applied aerially would be clopyralid. Clopyralid is a selective herbicide that would preserve soil cover by not harming nontarget vegetation such as pines, firs and grasses.

There are another set of small sites totaling 62 acres. These sites are scattered along the Little Tuconnon River. There are only three acres classified as grasslands with the rest of the cover a mixture similar to the larger site described above. Clopyralid would be used in these areas also.

Given the soil protection provided by non-target vegetation, erosion and associated sediment delivery to streams would be minor and short-term (1 to 2 years).

As drift is a concern with aerial application AGDISP was used to model drift from aerial application of herbicides. AGDISP was first developed by NASA, improved by the USDA Forest Service and implemented by the Spray Drift Task Force and the U.S. Environmental Protection Agency into a regulatory version (Teske et al.2003).

Site specific conditions for aerial application of the Umatilla National Forest were modeled. In general, for aerial application at these sites, the helicopter would be flown at 10 to 25 feet off the ground when spraying grasslands. However, there is a section of the treatment area with up to 30% tree cover. For safety reasons if this area is sprayed the pilot may need to fly higher when near trees. The higher release heights are more of a concern.

Spray application height, wind speed and droplet size are the three most significant factors impacting drift distance and the potential to affect non-target areas. To model worst case scenarios, cross wind speed and droplet size were kept at the highest wind speed allowed (8mph) and a coarse spray droplet size (500 µm) commonly used for aerial application of herbicides and the smallest droplet size allowed in this project (PDF F-6). Three release heights were modeled for the largest aerial site. See Appendix F for more details on aerial modeling.

The first run was for open grassland with a spray height of 25 feet and the following runs were with a spray height of 35 and 50 feet respectively with the other conditions remaining the same.

Conditions

- Eight mile an hour cross winds toward the stream
- Median droplet size is approximately 500 microns
- Release height 25, 35 and 50 feet off the ground

Results

As expected, drift became greater as the release height increased. At a 25 foot release height there was minimal drift. At a 35 foot release height the maximum deposition was displaced 25 feet downwind with a large amount of deposition up to 50 feet downwind.

At a 50 foot release height the maximum herbicide deposition was displaced approximately 50 feet downwind with a large amount of deposition up 150 feet downwind.

For example, for a small stream directly downwind of the spray area, 300 feet from the last swath, with no interception from vegetation (ground cover 1 foot tall) the concentration of clopyralid in the stream varied between 0.21 ppb for the conditions at 25 feet spray height and 6.15 ppb at a spray height of 50 feet. This is well under the 5000 ppb considered a concern for fish. However, the purpose of this project is to treat invasive terrestrial plants, not to treat streams or other sensitive areas and to minimize offsite deposition to sensitive areas such as streams or non-target vegetation, SOLIs or other sensitive areas under the worst case scenario conditions the following design criteria would be used to lower drift.

Two options could be used 1) Table 40 lists conditions where an increased buffer width is required. 2) Low drift technology (i.e. nozzle design) and/or additives that maximize deposition to the intended target and minimized drift into non-target and sensitive areas as directed in PDFs.

Either method would increase the effectiveness of the buffer for sensitive areas and streams. Drift cards would be used to track the effectiveness of the buffers.

Table 40 - Additions to buffer widths under specified conditions

Buffer Widths	25 foot Release Height	35 foot Release Height	50 foot Release Height
Buffer width at 6-7 mph	Designated buffer	Add 1 swath widths to buffer	Add 2 swath widths to buffer
Buffer width at 7-8 mph	Designated buffer	Add 2 swath widths to buffer	Add 3 swath widths to buffer

Alternatively use low drift technology, ie nozzle design and/or additives that ensure little to no drift into stream buffers or sensitive areas as directed in PDFs.

Water contamination from aerial herbicide drift is a large concern. The following Project Design Features are included to address this concern by minimizing risk for aerial herbicide drift and contamination to waterways:

- E2 requires that aircraft fueling occurs outside RHCAs
- F5 requires that herbicide applications occur when winds are between 2 and 8 miles per hour
- F6 requires coarse droplet size to minimize drift
- F8 requires that aerial units be ground checked and water features marked and buffered before application
- F8 and Tables 7, 8, 9 require buffers of 300 feet on perennial or wet intermittent streams and wetlands, and 100 feet buffers are required on dry channels.
- F8 Additional buffers or drift reduction methods are required in winds over 5 mph with flight heights over 30 feet as shown in Table 40 above

Based on buffer effectiveness documented by Rashin and Graber (1993) and Dent and Robben (2000) concentrations of herbicides reaching streams are expected to be well below concentrations of concern to beneficial uses. Spray cards would be used to track the effectiveness of the stream buffers.

Lakes, Wetlands and Floodplains

There are approximately 19 acres of treatment proposed within 100 feet of lakes or reservoirs on the Forest. The main invasive plants to be treated are diffuse knapweed and Canadian thistle. Treatments are proposed near three waterbodies, generally at campgrounds.

Most of these treatment acres are at Jubilee Lake, which proposes approximately 17 acres of chemical treatment of Canadian thistle around the 92 acre lake. PDF H10 requires that no more than half the perimeter, or 50 percent of the vegetative cover, or 10 contiguous acres around a lake or pond would be treated with herbicides in any 30-day period. This PDF reduces exposure to herbicides for aquatic organisms by providing some untreated areas as refugia. Buffers minimize the potential for herbicides to move into surface water. Buffers displayed in Chapter 2, Table 7, Table 8, and Table 9, minimize the potential for herbicides to move into surface water as described above in the section on general effects of herbicides on water.

The most effective herbicides for Canadian thistle are clopyralid, picloram, chlorsulfuron and glyphosate (best in the fall). No broadcast applications would occur within 100 feet of the lake. Picloram and chlorsulfuron could only be spot sprayed to within 50 feet of the lake. Clopyralid (considered low aquatic risk) could be spot sprayed to within 15 feet of the high water mark of the lake. Aquatic glyphosate and aquatic imazapyr could be spot sprayed up to the edge of the water. Adverse effects to beneficial uses of the lake are unlikely with these specific protection measures in place.

While the PDFs make it highly unlikely that herbicide concentration in water would reach a level of concern, high rainfall soon after application could deliver herbicide to the lake. To model this scenario the SERA worksheet was rerun for specific rainfall and soils for this area for clopyralid (most likely to be used where allowed), and the two aquatic formulations available for spot spray closer to the lake. No concentrations of concern were reached for any herbicide. Use of PDFs further lowers potential for higher concentrations of herbicides near the lakes. Therefore treatments are unlikely to affect functioning of wetlands or waterbodies or to contribute to significant adverse effect of beneficial uses.

To control the infestation the treatments would continue over several years, with fewer acres needing treatment each year. Wetlands would be treated using non-herbicide methods where such treatments are likely to be effective.

Early Detection Rapid Response

Early Detection Rapid Response (EDRR) is part of all the action alternatives. Under this approach new invasive species or currently unknown infestations may be treated using the range of ground based methods analyzed in this EIS, on sites similar to those presently proposed for treatment. PDFs limit types and methods of treatments and types of herbicides by aquatic risk within RHCAs and would minimize the risk of treating these new or undiscovered infestations.

Aerial application of herbicides would not be allowed in the EDRR process. If treatment sites or types of treatment were not within the range of the ground based treatments discussed above, then additional analysis would occur under another NEPA document. Two examples would be if there was a need to use different herbicides than the 10 discussed in this document, or a need to treat emergent vegetation.

The regional invasive plant FEIS classified aerial spraying of herbicide a high risk treatment method (USFS 2005b). The risk is related to lack of control for applying herbicide.

Unpredictable weather patterns can lead to adverse effects where herbicide is applied near buffered areas. Wind speeds and direction can change quickly leading to more drift to waterways and nontarget plant species and soil. Aerial spraying on steep forest sites may have increased risk drift from alternating wind currents in addition to higher risk for herbicide movement from overland flow. Furthermore, stream buffers may be difficult to maintain since stream channels can be hard to identify in some forest environments. Given these uncertainties, aerial spraying is a high risk tool for use under EDRR.

Cumulative Effects

Only the land and roads within the National Forest system would be treated in the action alternatives proposed by this EIS. The Forest, however, is intermingled with other federal, state, county, and private ownerships.

Management activities and actions on neighboring lands may contribute to spread or containment of invasive plants on National Forest system lands, and vice versa.

Chemical treatments are scattered across the watershed making it unlikely that herbicide concentrations would be additive with similar treatments at the watershed scale. The potential for cumulative effects is negligible due to the implementation of PDFs that limit direct and indirect effects, the scattered nature of the treatments, and the dilution over time and space by mixing and addition of inflow downstream.

Table 41 - Watersheds with the largest percent of proposed chemical treatments

Watershed Name	Watershed Acres	Proposed Treatment					
		Biocontrol	Chemical Acres	Manual Acres	Total Acres	Percent of Total Treatment	Percent of Chemical Treatment
Asotin Creek	208532	1	2104	0	2105	1.0	1.0
Looking Glass Creek	60527	264	889	0	1153	1.9	0.0
Meachem Creek	114158	1019	1798	2	2820	2.5	1.6
Wall Creek	128327	30	1723	2	1756	1.4	1.3

Herbicides are commonly applied on lands other than National Forest system lands for a variety of agricultural, landscaping and invasive plant management purposes. Herbicide use occurs on tribal lands, state and county lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. No requirement or central reporting system exists to compile invasive plant management information on or off National Forests in Oregon or Washington. Accurate accounting of the total acreage of invasive plant treatment for all land ownerships is unavailable.

The risk of adverse effects of invasive plant treatments have been minimized by the Project Design Features (PDFs). These limit the possibility of cumulative effects of treatment by minimizing direct and indirect effects.

Another possible concern is duplicating herbicide application in an RHCA that is near a land ownership boundary where herbicide treatments could be occurring. If duplicate applications occurred, effects level of concern could be approached. Project Design Feature B1 (see Section 2.3.3) ensures that Forest staff coordinates with owners and managers of neighboring lands. Such coordination would make duplicate treatment a very remote possibility.

Biocontrol agents spreading from adjacent lands onto National Forest system lands would likely have the beneficial effect of reducing weeds. Invasive plants killed by such agents would have no effect on water resources.

Alternative B is unlikely to have significant effects on water resources and therefore is unlikely to approach a threshold of concern or contribute to significant cumulative effects. No adverse cumulative effects are expected from implementation of this alternative.

Alternative C – No Broadcast within Riparian Habitat Conservation Areas

Direct and Indirect Effects

The effects from treatments under this alternative are the same as for Alternative except for the 3,022 acres within the RHCAs available for broadcast of herbicides. Potentially these areas would be treated with mechanical or manual methods. As the main methods are mowing and cutting or pulling weeds, and the areas to be treated are between 100 and 300 feet from a stream, effects from treatment on streams would be negligible. If these acres were treated with herbicide then spot or hand methods of application would be used under Alternative C. Spot spraying is more targeted to specific plants; therefore, there would be less herbicide in contact with soil and available for runoff into streams. There would be less nontarget vegetation removed so more groundcover would be available in these areas lowering the potential for sediment delivery to streams.

Cumulative Effects

The cumulative effects are the same as those discussed under Alternative B

Alternative D – No Aerial Application

Direct and Indirect Effects

The effects from treatment under this alternative are the same as for Alternative B except for 675 acres proposed for aerial application. These acres would need to be treated by other methods. Under this alternative there would be lower risk of herbicide contaminating water due to drift.

Cumulative Effects

The cumulative effects are the same as discussed under Alternative B.

3.5 Aquatic Organisms and Habitat

3.5.1 Introduction

Invasive plants are displacing native plants, and have the potential to destabilize streams, reducing the quality of fish and wildlife habitat and degrading natural areas in the Umatilla National Forest. Invasive plants found growing adjacent to or within aquatic influence areas can invade, occupy, and dominate riparian areas and indirectly impact aquatic ecosystems and fish habitat.

Invasive plants can change stand structure and alter future inputs of wood and leaves that provide the basic foundation of the aquatic ecosystem food webs. Native vegetation growth may change as a result of infestation, and the type and quality of litter fall, and quality of organic matter may decline, which can alter or degrade habitat for aquatic organisms.

Under the Proposed Action, infested areas would be treated with an initial prescription and retreated in subsequent years, if needed, until the site was restored with desirable vegetation. Herbicide treatments would be part of the initial prescription for most sites; however, use of herbicides would be expected to decline in subsequent entries as a result of effective treatment. Ongoing inventories would confirm the location of specific invasive plants and effectiveness of past treatments. Treatment prescriptions would be strict enough to ensure that adverse effects are minimized, while flexible enough to adapt to changing conditions over time. Future infestations will be treated using an Early Detection/Rapid Response protocol.

This DEIS has been prepared to consider the site-specific environmental consequences of treating invasive plants over the next 5 to 15 years (until invasive plant objectives are met or until changed conditions or new information warrants the need for a new decision). This EIS is tiered to a broader scale analysis (the Pacific Northwest Region Invasive Plant Program – Preventing and Managing Invasive Plants Final Environmental Impact Statement and the accompanying Record of Decision (2005), hereby referred to as the R6 2005 EIS, and R6 2005 ROD.

The R6 2005 ROD added management direction relative to invasive plants to the Umatilla National Forest Plan. The management direction applied to the broader Forest invasive plant program, establishing goals, objectives and standards for public education and coordination, prevention of the spread of invasive plants during land uses and activities, reducing reliance on herbicides over time, and treatment and restoration.

Methodology for Analysis

This analysis is tiered to the 2005 R6 Invasive Plant FEIS and ROD. A primary focus of the site-specific analysis was development of Project Design Features (PDFs) to insure compliance with standards adopted by R6 as well as Forest standards and guidelines. Information used to design criteria to minimize effects and the method of comparison of alternatives was the same as that used for water and soil (see Section 3.4.1 above).

Herbicide concentrations derived from SERA herbicide risk assessments were used with the GLEAMS worksheet as an indicator of potential herbicide delivery to water. The GLEAMS worksheet developed for the SERA risk assessments was run for site specific conditions (rainfall, soil type, and herbicide) on the Forest. GLEAMS is a model used as a tool to evaluate the impact of management decisions (such as herbicide use) on water quality. The model can be used to estimate herbicide exposure for aquatic species in worst-case scenarios.

As the GLEAMS model was originally an agriculture model, all parameters used are not compatible with treatments for the Forest. The model assumes broadcast treatment along a small perennial stream. The treatment is 50 feet wide and 1.6 miles long. This would overestimate herbicide in streams on the Forest as no broadcast is proposed within 100 feet of a perennial stream. In steeper areas the model may underestimate the herbicide delivery as it assumes a 10 percent slope, although much of the Forest has a higher slope. The model also assumes even rainfall every ten days, which is very different than the rainfall patterns for the Forest.

When specific treatment areas were modeled, the upper limit of rain was set as high as 75 inches to attempt to model a larger summer storm.

3.5.2 Affected Environment

The Project Area includes the Umatilla National Forest. This section discusses Watershed conditions for each of the 4th Field HUCs; Threatened, Endangered and Sensitive fish species and their habitat are also described.

Watershed Condition

Table 42 displays the relative distribution of the invasive plants proposed for treatment at the 5th field watershed scale. The Meachum Creek watershed has the greatest proportion of infested acres being proposed for treatment (about 2.5 percent of that watershed is proposed for treatment).

Table 42 - Fifth Field Watersheds within Umatilla National Forest Proposed for Treatment

Fifth Field Watershed Name	HUC	Acres	Acres of Invasive Plants	Percent Watershed to Treat	Treated Acres in RHCAs*	TES Fish Present*
Asotin Creek	1706010302	208,532	2105	1.0%	380	SRS, SRC,BT,
Upper Grande Ronde River	1706010401	133,777	98	0.07%	0	NF
Meadow Creek	1706010402	116,100	44	0.04%	7	NF
Grande Ronde River/Five Points Creek	1706010404	87,630	78	0.008%	13	NF
Willow Creek	1706010408	53,565	162	0.3%	73	NF
Lookingglass Creek	1706010410	60,527	1153	1.9%	132	SRS, SRC, BT
Grande Ronde River/Cabin Creek	1706010411	108,389	1018	0.9%	447	SRS
Grande Ronde River/Grossman Creek	1706010601	114,787	1108	1.0%	129	SRS, SRC, BT
Wenaha River	1706010603	189,224	958	0.5%	155	SRS, SRC, BT
Lower Grande Ronde River	1706010607	160,794	370	0.2%	69	SRS, SRC
Pataha Creek	1706010705	118,434	176	0.1%	28	NF
Upper Tucannon River	1706010706	140,811	762	0.5%	199	SRS, SRC, BT
Upper Walla Walla River	1707010201	101,385	234	0.2%	22	MCS, BT
Mill Creek	1707010202	76,051	906	1.2%	141	MCS, BT
Upper Touchet River	1706010203	146,115	1128	0.8%	104	MCS, BT
Upper Umatilla River	1707010301	86,765	1410	1.6%	239	MCS, MCC, BT
Meacham Creek	1707010302	114,158	2820	2.5%	367	MCS, MCC, BT
Birch Creek	1707010306	182,206	505	0.3%	176	MCS

Fifth Field Watershed Name	HUC	Acres	Acres of Invasive Plants	Percent Watershed to Treat	Treated Acres in RHCAs*	TES Fish Present*
Upper Butter Creek	1707010309	206,658	199	0.1%	21	NF
Upper Willow Creek	1707010401	94,088	340	0.04%	176	NF
Rhea Creek	1707010403	145,967	2	0.001%	0	NF
Upper North Fork John Day River	1707020201	71,525	17	0.02%	9	MCS
Granite Creek	1707020202	94,513	277	0.3%	169	PL, WCT, MCS, MCC, BT
North Fork John Day River/Big Creek	1707020203	105,881	344	0.3%	277	PL, MCS, MCC
Desolation Creek	1707020204	69,675	126	0.2%	21	WCT, MCS, MCC, BT
Upper Camas Creek	1707020205	104,623	539	0.5%	297	MCS, MCC, BT
Lower Camas Creek	1707020206	157,015	815	0.5%	158	PL, MCS, MCC
North Fork John Day River/Potamus Creek	1707020207	185,288	1772	1.0%	388	PL, MCS, RT, MCC
Wall Creek	1707020208	128,327	1756	1.4%	606	MCS, RT
Lower North Fork John Day River	1707020210	117,016	12	0.01%	1	NF
Camp Creek	1707020302	125,940	1166	0.9%	344	NF
Lower Middle Fork John Day River	1707020305	60,635	2	0.003%	0	NF
Lower John Day River/Kahler Creek	1707020401	197,919	1676	0.8%	339	RT
Upper Rock Creek	1707020411	177,121	567	0.3%	74	NF
Total			**24,643****		**5560**	

*Riparian Habitat Conservation Areas (RHCA) are based on designated PACFISH buffers as delineated in GIS.
*SRC=Snake River Chinook, MCC=Middle Columbia Chinook, SRS=Snake River Steelhead, MCS=Middle Columbia Steelhead, BT= Bull Trout, RT=Redband Trout, WCT=Westslope Cutthroat Trout, MS=Margined Sculpin, PL=Pacific Lamprey, NF=No TES Fish Present
**24,643 acres is slightly different from 24,649 acres displayed elsewhere. This minor difference can be explained as rounding errors.

Umatilla Subbasin (17070103)

Streamside vegetation in the upper watershed consists of conifers, deciduous trees and shrubs, and grass. Riparian conditions are generally good at higher elevations. At lower elevations, brush, grass, and deciduous trees are the major types of bank vegetation. Riparian conditions at mid-elevations have been impacted by livestock grazing, road and railroad construction. Riparian areas at lower elevations are in generally poor condition as a result of extensive farming operations (CTUIR 1990a). Riparian vegetation may have been influenced extensively by past beaver (*Castor canadensis*) activity. Current beaver activity is very limited.

Some streams in the Subbasin are in relatively pristine condition while others have felt the impacts of a considerable amount of human activities. Pristine stream segments are mostly under public ownership and are managed by the Forest Service. Examples of these include the North Fork Umatilla River and its tributaries, which are within the North Fork Umatilla Wilderness Area; North Fork Meacham Creek, the upper seven miles of the South Fork Umatilla River, and their tributaries, which are part of the Hellhole Roadless Area; and East Fork Meacham and its main tributary, Owsley Creek.

Steelhead are widely distributed within the Umatilla River Subbasin. The Oregon Department of Fish and Wildlife (ODFW) and CTUIR have maintained an extensive hatchery steelhead program in the Subbasin since 1981. The origins of the current hatchery stock are from within the Subbasin, although releases of Skamania, Hells Canyon, and Fall River stocks occurred from 1967 to 1970. Smolt release sites include volitional releases from acclimation ponds at Bonifer on Meacham Creek (RM 2) and Minthorn Springs on the Umatilla River (RM 63). The hatchery fish are managed under the Oregon Department of Fish and Wildlife's (ODFW) Wild Fish Management Policy (WFMP) Type II hatchery program. The interaction between hatchery and wild steelhead is undetermined.

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) continue to make efforts to restore salmon in the Umatilla and Walla Walla River systems. These fisheries are a major concern because of cultural uses. Meacham Creek has some of the most productive habitat for steelhead near the Forest boundary. The Tribe constantly monitors Meacham Creek as it is one of the major focus areas for watershed improvement projects.

Lower Grande Ronde River ((17060106)

This watershed includes the Grande Ronde River/Grossman Creek, Wenaha River and Lower Grande Ronde River fifth code watersheds from Table 42.

Aquatic species diversity in the Grande Ronde River Basin has declined in recent years (Umatilla National Forest, 2001). Native anadromous fish species have suffered local extirpation (sockeye salmon, *Oncorhynchus nerka;* coho salmon, *Oncorhynchus kisutch;* early fall Chinook salmon, *Oncorhynchus tshawytscha*). Others have been listed under the Endangered Species Act as Threatened or Endangered (Snake River steelhead, *Oncorhynchus mykiss*; Snake River spring/summer Chinook salmon, *Oncorhynchus tshawytscha*).

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) Draft Environmental Impact Statement (DEIS) identified the Blue Mountains as an area especially important to the genetic integrity of anadromous salmonids.

The ICBEMP DEIS defined aquatic strongholds in the Grande Ronde Basin as key elements for rebuilding and maintaining functioning aquatic ecosystems. Key to rebuilding aquatic ecosystems would be connecting habitat patches with corridors or dispersal habitat and eliminating barriers to ensure that all parts of the regional population interact by allowing individuals to move between patches (ICBEMP Integrated Scientific Assessment, 1996)

Upper Tucannon River (17060107)

This watershed includes the Pataha Creek and Upper Tucannon River fifth code watersheds from Table 42.

The Tucannon Watershed drains approximately 75,000 acres of land and contains approximately 175 miles of perennial streams. There are approximately 30 miles of Class I (anadromous and resident fish) streams, 25 miles of Class II (resident fish) streams, and 120 miles of Class III (other perennial stream) streams.

Vegetation within the Tucannon River Watershed varies with elevation and aspect. South facing slopes and ridge tops contain shallow soils with limited water holding capacity; therefore, vegetation is mainly grass forb or grass shrub mixture with a limited timber component. North facing slopes contain deeper soils with higher water holding capacity and are, therefore, heavily timbered with mixed conifer stands containing firs, spruce, larch and pine. Ponderosa Pine is also common on drier sites at lower elevations. The riparian areas contain moist meadows, cottonwood stands, alder and other shrubs, in addition to dense stands of fir and pine.

The Tucannon Fish Hatchery is located just upstream of Cummings Creek. The channel at the fish hatchery drains approximately 80 percent of the area in the Tucannon Watershed Assessment.

Winter storm run-offs are the main factor responsible for the majority of sediment transportation in the Tucannon River followed by peak snowmelt and summer cloudburst. Other events such as mud avalanches and rain-on snow produce large increases in the amount of sediment transported (SCS, 1982b). Sediment transported in the Tucannon River is composed of silts and clays (suspended) and gravels and cobbles (bedload).

In the Tucannon Subbasin, spring/summer Chinook are restricted to portions of the mainstem Tucannon River, with little or no use of its tributaries. Spawning occurs in the Tucannon River from the mouth of Sheep Creek (RM 52) downstream to King Grade (RM 21). Spawning has not been observed in any Tucannon River tributaries. The Tucannon River is inhabited by steelhead. Cummins Creek has adults that migrate within the Forest boundary. The history of adults in Tumalum Creek is little known. Adults have been known to spawn within the creek but many miles of habitat tend to go subterranean, before the summers end. Adults cannot get to the Forest Boundary. Juvenile steelhead are present in Grub and Hixon Creek, and Little Tucannon. Steelhead are confirmed in Pataha Creek. Complete spawning surveys, however, have not been conducted in the stream. Rearing occurs from RM 23.7 to 45.7 (StreamNet 2004).

Both resident and migratory forms of bull trout occur in the Tucannon River Basin. Radio-tagging studies have shown that bull trout spawn in headwater areas of the Tucannon River and use the remainder of the river for migration.

Bull trout spawning ground surveys have been conducted intermittently since 1990. The headwater areas known to support bull trout spawning include the upper reaches of the mainstem Tucannon (from Panjab Creek to a point above Bear Creek) and upper Tucannon tributaries including Cummings Creek, Sheep Creek, Cold Creek, Bear Creek, Panjab Creek, and several tributaries of Panjab Creek, including Turkey Creek, Meadow Creek, and Turkey Tail Creek. Surveyed areas include various portions of the Tucannon River mainstem (RM 44.6 to RM 58.0), Bear Creek (RM

0.0 – 0.6), Cold Creek (RM 0.0 – 0.8), Panjab Creek (RM 0.0 – 3.8), Meadow Creek (RM 0.0 – 4.9), Turkey Creek (RM 0.0 – 2.1), and Turkey Tail Creek (RM 0.0 – 3.4). Redd counts were as low as 57 in 1991 and as high as 222 in 1999. Redd counts do not cover the same areas consistently enough to be used for definitive population numbers. They merely show a healthy population is present due to number of streams used and habitat areas accessible.

Walla Walla (17070102)

This watershed includes the Upper Walla Walla River, Mill Creek and Upper Touchet River fifth code watersheds from Table 42.

The Walla Walla River Subbasin is located in northeastern Oregon and southeastern Washington. The Walla Walla River drains approximately 1,760 square miles and is a direct tributary to the Columbia River. The Subbasin is composed of three primary streams and several smaller ones. The primary streams are, from north to south, the Touchet River, Mill Creek, and the Walla Walla River (North and South Forks). The Walla Walla River Subbasin contains a total of 1,126,000 acres. Most of the headwater areas within the Subbasin are under public ownership and managed by the Forest Service. These public lands comprise approximately 18 percent of the Subbasin.

The Walla Walla River Subbasin provides spawning and rearing habitat for steelhead trout *Oncorhynchus mykiss* belonging to the middle Columbia River evolutionarily significant unit (ESU) (Busby et al. 1996). The Walla Walla River Subbasin also contains unoccupied habitat for fall Chinook salmon *Oncorhynchus tshawytscha* (Myers et al. 1998). Although the Subbasin is not proposed as critical habitat, it has been designated as ESU due to reintroduction of Snake River Basin Chinook salmon by the Tribe.

North Fork John Day River (17070202)

Includes the Upper North Fork John Day River, Granite Creek, North Fork John Day River/Big Creek, and Desolation Creek, Upper Camas Creek, Lower Camas Creek, and North Fork John Day River/Potamus Creek, Wall Creek and Lower North Fork John Day River fifth code watersheds from Table 42.

The John Day River is un-dammed and has anadromous fish, which are considered genetically pure and minimally mixed with hatchery stock due to straying. According to the North Fork John Day Ecosystem Analysis (1999), fish populations have declined, but the North Fork John Day Subbasin sustains one of the few remaining wild anadromous fish runs in the Mid-Columbia River Basin. The North Fork John Day Subbasin is the most important in terms of water quality and flow contribution to the John Day River. The North Fork John Day Subbasin supplies approximately 60 percent of the water to the John Day Basin and 70 percent of the wild spring Chinook salmon population. Major North Fork John Day tributaries are Cottonwood, Fox, Big Wall, Potamus, Camas, Desolation, and Granite Creeks.

The North Fork John Day River Subbasin is the major producer of wild spring chinook and summer steelhead in the John Day Basin. Approximately 58 percent of the total Basin spring chinook population and 43 percent of the total summer steelhead population are produced in this drainage. In the 1980s, as many of 1,855 adult spring chinook and 8,000 adult summer steelhead have returned annually to the Subbasin to spawn.

In addition, the North Fork John Day is the migratory route for runs traveling to and from the Middle Fork John Day Subbasin. The North Fork John Day drainage also supports warm water and coldwater resident fish populations.

Warm water small mouth bass and channel catfish reside in the North Fork John Day River below RM 22.6 and coldwater resident trout are found throughout the Subbasin. It also supports healthy wildlife populations, including deer and elk herds which winter along the stream corridor.

The middle and upper North Fork John Day Subbasin contains approximately 72 miles of spring chinook spawning and rearing habitat and 700 miles of steelhead habitat. Spring chinook habitat lies between Camas and Baldy Creeks on the North Fork John Day Subbasin, and in the Granite Creek system. Per mile, Granite Creek produces more spring chinook than any other area in the John Day Basin. Located in the North Fork John Day headwaters, this system, which includes Clear and Bull Run Creeks, produces 42 percent of the total John Day spring chinook population. Major steelhead producing streams in the North Fork John Day Subbasin are Cottonwood, Rudio, Deer, Wall, Potamus, Desolation, Granite, Ditch, Mallory, Trout, Meadowbrook, Trail, Olive, Clear, Bull Run, Camas, Beaver, and Big Creeks.

Spring chinook and steelhead production has decreased in the North Fork John Day Subbasin. Increased logging, road building, and poaching activities in the forested uplands probably have contributed to the declining populations. Between 1969 and 1973, biologist counted an annual average of 32 spring chinook redds (spawning beds) per mile in the system. Counts for 1981 to 1985, show spawning-density decreased to an average level of 10 redds per mile. Summer steelhead production also has declined slightly. Declines in spring chinook production are primarily attributable to damn mortality (USDA 1999). The degradation of spawning and rearing habitat has also had a major impact. High summer water temperatures limit juvenile spring chinook distribution.

Past mining operations have left their imprint in the Granite Creek system. Water quality continues to be affected by leaking and leaching of toxic effluent from inactive mines. Some historically productive spawning and rearing habitat remains degraded from dredging, which took place into the 1930s in Granite Creek and into the 1950s in Clear Creek.

Middle Fork John Day River (17070203)

This watershed includes the Camp Creek and Lower Middle Fork John Day River fifth code watersheds from Table 42.

Anadromous and resident fish species are known to inhabit the Middle Fork John Day River (Middle Fork John Day River) Subbasin including tributaries to the Middle Fork John Day River for all or part of their life history. Both resident and anadromous forms of rainbow trout (steelhead/redband), bull trout, mountain whitefish, and spring Chinook salmon are found within this watershed. In addition, sculpins, dace, shiners, and suckers are non-game species found in most streams. Larger tributary streams in the Subbasin are Clear Creek Vinegar Creek, Granite Boulder Creek, Big Boulder Creek, Butte Creek, and Big Creek. These tributaries provide the greatest water yield and late season flows, and lowest late season water temperatures.

Management activities that have impacted streams within the watershed include timber harvest with associated road construction, livestock grazing, and placer and hardrock mining. Habitat quality throughout the watershed is variable; individual reaches may not meet one or more of the minimum habitat objectives such as pools per mile, water temperature, large woody material (LWM) per mile, bank stability, and/or width-to-depth ratios.

Roads Having High Potential for Herbicide Delivery

Roads are the primary vector for invasive plants to enter the Forest. Native soil has been removed along roads, and fill and surfacing have been placed within the road prism. Ditches have been compacted, allowing them to deliver run-off to streams, which may include herbicides used in broadcast treatments along the roads. Road cutbanks can be a combination of disturbed soil and exposed bedrock.

The R6 2005 FEIS describes roadside ditches as an herbicide delivery mechanism; potentially posing a high risk of herbicides reaching concentrations of concern for listed aquatic species (see Chapter 3.5). Ditches may function as an extension of the stream network. Roadside ditches can act as delivery routes or intermittent streams during high rainfalls, or as settling ponds following high rainfall events. Because the Proposed Action includes treatment of road prisms with herbicides, the concern for herbicides being indirectly delivered to waterbodies containing fish via roadside ditchlines was addressed by identifying roads that have a high potential for herbicide delivery.

To reduce the potential for herbicides to come in contact with water via runoff at or near concentrations of concern, the following restrictions would apply to treatments along roads having high potential for herbicide delivery (See Appendix E):

- No broadcast spraying of any herbicide
- No use of picloram or non-aquatic triclopyr
- Only spot or hand select methods of aquatic labeled herbicides or low risk herbides (as defined in this document) would be applied within 15 feet of wet roadside ditches
- Apply appropriate buffer widths to road sections that cross streams (See Table 7, Table 8, and Table 9)

According to the 2004 Umatilla Forest-Scale Roads Analysis Report, the entire road system is fundamentally hydrologically connected to the stream system because roads are part of watersheds. Roads capture and release snow and rain, alter patterns and direction of runoff, erosion rates and processes, and expand the channel network affecting routing of stream discharge. The most hydrologically connected roads cross streams or are located in floodplains and wetlands. For this project, roads considered most hydrologically connected were those located within 100 feet of Class 1 and 2 streams.

An estimated 28.65 miles of roads considered high risk for potential herbicide delivery are proposed for herbicide treatment (See table in Appendix E). Nearly all watersheds on UNF have roads that have a high risk of herbicide delivery; invasive plants are widely scattered along these roads. Roadside treatment areas include compacted ditch lines, disturbed soil and thin soils near exposed bedrock. Due to the extensive reworking of properties of soils along roads, the Soil Resource Inventory (SRI) may be misleading for roadside treatment areas. As roads and ditchlines are compacted, roadside soils are assumed to function with a high runoff rate. Therefore, those roads that have a high potential for herbicide delivery would not be treated by broadcast applications. See Appendix E of this EIS for a list of roads with treatments proposed within 100 feet of fish-bearing streams.

Threatened, Endangered and Sensitive Fish Species and Habitat

The Umatilla National Forest has three Federally Listed fish species and five fish species listed on the Region 6 Sensitive Species list (See Table 43 and Table 44).

Steelhead, Chinook, and chum are under the jurisdiction of NOAA Fisheries, and bull trout fall under the jurisdiction of the US Fish and Wildlife Service.

Table 43 - Threatened, Endangered and Proposed Fish Species and Critical Habitat on Umatilla National Forest

Species - DPS		Status	Listing Status	Critical Habitat
Steelhead (*Oncorhynchus mykiss*)	Snake River Basin	Threatened MIS	Listed on 8/18/97; (62 FR 43937) Status Reaffirmed 6/28/05; (70 FR 37160)	09/02/05 70 FR 52630
	Middle Columbia River	Threatened	Listed on 3/25/99; (64 FR 14517) Status Reaffirmed 6/28/05; (70 FR 37160	09/02/05 70 FR 52630
Chinook Salmon (*Oncorhynchus tshawytscha*)	Snake River Spring/Summer Run	Threatened	Listed on 4/22/92; (57 FR 14653) Status Reaffirmed 6/28/05; (70 FR 37160)	10/25/99 64 FR 57399
	Snake River Fall Run	Threatened	Listed on 6/3/92; (57 FR 23458) Status Reaffirmed 6/28/05; (70 FR 37160)	12/28/93 58 FR 68543
Bull Trout (*Salvelinus confluentus*)	Columbia River	Threatened	Listed on 6/10/98; (63 FR 31647	10/06/04 69 FR 59996

MIS = Management Indicator Species

Table 44 – Sensitive Species on the Umatilla National Forest

Species	Designation
Middle Columbia River Spring Run Chinook Salmon (*Oncorhynchus tshawytscha*)	Sensitive
Redband Trout (*Oncorhynchus mykiss gairdneri*)	Sensitive/MIS
Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*)	Sensitive/MIS
Margined Sculpin (*Cottus marginatus*)	Sensitive

MIS = Management Indicator Species

For purposes of addressing federally listed fish species under the jurisdiction of NOAA Fisheries within the context of their status and life history, only brief summaries from various sources are presented in this document. Additional information related to brief life history information and status of populations at the ESU or DPS scale can be found in the following sources:

- Regional Invasive Plant EIS Fisheries Biological Assessment, Environmental Baseline
- NMFS Federal Register documents (http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/Index.cfm)

Snake River (SR) spring/summer run Chinook salmon (Threatened)

Critical Habitat

Critical habitat was designated for Snake River spring/summer chinook salmon on December 28, 1993 (58 FR 68543). Critical habitat is designated to include river and tributary reaches presently or historically accessible (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams) to Snake River spring/summer chinook salmon in the Snake River basin. Migratory habitat in the Columbia River mainstem from the mouth to the Snake River confluence is also included. Essential habitat consists of four components: spawning and juvenile rearing, juvenile migration, areas for growth and development to adulthood, and adult migration corridors. Essential features of migration corridors are further defined as: substrate, water quality, water quantity, water velocity, cover/shelter, food (juveniles only), riparian vegetation, space, and safe passage conditions.

The main 5th field watersheds on Umatilla National Forest with designated critical habitat are the Lower Grande Ronde River, Asotin River and Upper Grande Ronde River watersheds.

Life History

The Snake River spring/summer chinook ESU includes current runs to the Tucannon River, the Grand Ronde River system, the Imnaha River and the Salmon River (Matthews and Waples 1991). Some or all of the fish returning to several of the hatchery programs are also listed, including those returning to the Tucannon River, Imnaha River, and Grande Ronde River hatcheries and to the Sawtooth, Pahsimeroi, and McCall hatcheries on the Salmon River.

Spring and summer chinook from the Snake River Basin exhibit stream-type life history characteristics (Healey, 1983). Most SR spring/summer chinook salmon enter individual subbasins from May through September. Eggs are deposited in late summer and early fall, incubate over the following winter and hatch in late winter/early spring of the following year. Juvenile SR spring/summer chinook salmon emerge from spawning gravels from February through June (Peery and Bjornn 1991). Typically, after rearing in their nursery streams for about 1 year, smolts begin migrating seaward in April and May (Bugert et al. 1990, Cannamela, 1992). Depending on the tributary and the specific habitat conditions, juveniles may migrate extensively from natal reaches into alternative summer rearing and/or overwintering areas. After reaching the mouth of the Columbia River, spring/summer chinook salmon probably inhabit nearshore areas before beginning their northeast Pacific Ocean migration. Snake River spring/summer chinook return from the ocean to spawn primarily as 4 and 5 year old fish, after 2 to 3 years in the ocean. A small fraction of the fish return as 3-year-old ‘jacks’, heavily predominated by males.

Many of the Snake River tributaries used by spring and summer chinook runs exhibit two major features: extensive meanders through high elevation meadowlands and relatively steep lower sections joining the drainages to the mainstem Salmon (Matthews and Waples, 1991).

The combination of relatively high summer temperatures and the upland meadow habitat creates the potential for high juvenile salmonid productivity. Historically, the Salmon River system may have supported more than 40 percent of the total return of spring and summer chinook to the Columbia system (e.g., Fulton 1968).

Action Area Information

Lower Grande Ronde River Subbasin, approximately 25 percent of which is within the Umatilla National Forest, and another 25 percent of which is within the Wallowa-Whitman National Forest, has 14 major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including Grande Ronde River, Wenaha River, Butte Creek, Crooked Creek, Joseph Creek, Elk Creek, Swamp Creek, Davis Creek, Cottonwood Creek, Peavine Creek, Mud Creek, McAllister Creek, Tope Creek, and Wildcat Creek Wenaha River holds roughly 26 miles of anadromous fish habitat inside Umatilla National Forest system land. Lower Snake/Asotin Subbasin has two major streams that contain more than five miles of anadromous fish habitat inside the National Forest, including Snake River (WWNF) and Asotin River (UNF). Asotin River holds roughly 10 miles of anadromous fish habitat inside Umatilla National Forest system land.

Lower Snake/Tucannon Subbasin, approximately 10 percent of which is within Umatilla National Forest, has one major stream, Tucannon River, which holds roughly 13 miles of anadromous fish habitat inside the National Forest system land. Upper Grande Ronde River Subbasin approximately 10 percent of which is within the Umatilla National Forest, has 18 major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including Grande Ronde River, Meadow Creek, Burnt Corral Creek, McCoy Creek, Indian Creek, Dark Canyon, Spring Creek, Five Points Creek, Sheep Creek, Clear Creek, Beaver Creek, Limber Jim Creek, Lookingglass Creek, Little Lookingglass Creek, and Phillips Creek. Lookingglass Creek holds roughly 7 miles of anadromous fish habitat inside Umatilla National Forest system land.

Snake River (SR) fall-run Chinook salmon (Threatened)

Critical Habitat

Critical habitat was designated for Snake River fall chinook salmon on December 28, 1993, (58 FR 68543). Critical habitat for the listed ESU is designated to include river reaches presently or historically accessible (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams) to Snake River fall chinook salmon in the Columbia River from its mouth upstream to the confluence of the Columbia and Snake Rivers; all Snake River reaches from the confluence of the Columbia River, upstream to Hells Canyon Dam; the Palouse River from its confluence with the Snake River upstream to Palouse Falls; the Clearwater River from its confluence with the Snake River upstream to its confluence with Lolo Creek; the North Fork Clearwater River from its confluence with the Clearwater River upstream to Dworshak Dam.

Essential habitat consists of four components: spawning and juvenile rearing, juvenile migration, areas for growth and development to adulthood, and adult migration corridors. Essential features of migration corridors are further defined as: substrate, water quality, water quantity, water velocity, cover/shelter, food (juveniles only), riparian vegetation, space, and safe passage conditions.

The main 5th field watersheds on Umatilla National Forest with designated critical habitat are the Lower Grande Ronde River and Asotin Creek watersheds.

Life History

Snake River fall chinook spawn above Lower Granite Dam in the mainstem Snake River, and in the lower reaches of major tributaries entering below Hells Canyon Dam. Adult fall chinook enter the Columbia River in July and August. The Snake River component of the fall chinook run migrates past the Lower Snake river mainstem dams in September and October. Spawning occurs from October through November. Juveniles emerge from the gravels in March and April of the following year. Downstream migration generally begins within several weeks of emergence (Becker, 1970, Allen and Meekin, 1973), and juveniles rear in backwaters and shallow water areas through mid-summer before smolting and migrating to the ocean—thus they exhibit an ocean-type juvenile history. Once in the ocean, they spend 1 to 4 years (though usually 3 years) before beginning their spawning migration. Fall returns in the Snake River system are typically dominated by 4-year-old fish.

Fall chinook returns to the Snake River generally declined through the first half of this century (Irving and Bjornn 1991). In spite of the declines, the Snake River basin remained the largest single natural production area for fall chinook in the Columbia drainage into the early 1960s (Fulton 1968). Spawning and rearing habitat for Snake River fall chinook was significantly reduced by the construction of a series of Snake River mainstem dams. Historically, the primary spawning fall chinook spawning areas were located on the upper mainstem Snake River. Currently, natural spawning is limited to the area from the upper end of Lower Granite Reservoir to Hells Canyon dam and the lower reaches of the Imnaha, Grande Ronde, Clearwater and Tucannon Rivers.

Action Area Information

Lower Grande Ronde River Subbasin, approximately 25 percent of which is within Umatilla NF, has 10 major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including Grande Ronde River, Wenaha River, Butte Creek, Crooked Creek, Joseph Creek, Elk Creek, Davis Creek, Cottonwood Creek, Mud Creek and Wildcat Creek.

Wenaha River holds roughly 26 miles of anadromous fish habitat inside the Umatilla National Forest. Lower Snake/Asotin sub-basin includes the Asotin River, which has 10 miles of anadromous fish habitat inside Umatilla National Forest system land. Lower Snake/Tucannon Subbasin, approximately 10 percent of which is within the Umatilla National Forest, has one major stream, Tucannon River, which holds roughly 13 miles of anadromous fish habitat inside National Forest system land.

Middle Columbia River (MCR) steelhead (Threatened)

Critical Habitat

Critical habitat was designated for Middle Columbia River steelhead on September 2, 2005 (70 FR 52630). NMFS designates critical habitat based on physical and biological features that are essential to the listed species. Essential features of designated critical habitat are: (1) substrate, (2) water quality, (3) water quantity, (4)water temperature, (5) water velocity, (6) cover/shelter, (7) food for juveniles, (8) riparian vegetation, (9) space, and (10) safe passage conditions (50 CFR 226.212).

The three freshwater primary constituent elements of critical habitat are:

1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;

2) Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;
3) Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

Recent designated critical habitat on the Umatilla National Forest includes the stream channels in each designated reach, and a lateral extent as defined by the ordinary high water line (Sept. 2, 2005; 70 FR 52629). The primary constituent elements essential for conservation of listed ESUs are those sites and habitat components that support one or more fish life stages, including freshwater spawning sites, freshwater rearing sites, and freshwater migration corridors.

The main 5th field watersheds on Umatilla National Forest with designated critical habitat are the Upper Walla Walla River, Mill Creek, Upper Touchet River, Upper Umatilla River, Meacham Creek, Birch Creek, Upper North Fork John Day River, Granite Creek, North Fork John Day River/Big Creek, Desolation Creek, Upper Camas Creek, Lower Camas Creek, North Fork John Day River/Potamus Creek, Wall Creek and Lower North Fork John Day River watersheds.

Life History

Major drainages in this ESU are the Deschutes, John Day, Umatilla, Walla-Walla, Yakima, and Klickitat river systems. Almost all steelhead populations within this ESU are summer-run fish, the exceptions being winter-run components returning to the Klickitat and Fifteen Mile Creek watersheds. A balance between 1- and 2-year-old smolt emigrants characterizes most of the populations within this ESU. Adults return after 1 or 2 years at sea.

Most fish in this ESU smolt at two years and spend one to two years in salt water before re-entering fresh water, where they may remain up to a year before spawning. Age-2-ocean steelhead dominate the summer steelhead run in the Klickitat River, whereas most other rivers with summer steelhead produce about equal numbers of both age-1- and 2-ocean fish. Juvenile life stages (i.e., eggs, alevins, fry, and parr) inhabit freshwater/riverine areas throughout the range of the ESU. Parr usually undergo a smolt transformation as 2-year-olds, at which time they migrate to the ocean. Subadults and adults forage in coastal and offshore waters of the North Pacific prior to returning to spawn in their natal streams. A non-anadromous form of O. mykiss (redband trout) co-occurs with the anadromous form in this ESU, and juvenile life stages of the two forms can be very difficult to differentiate. In addition, hatchery steelhead are also distributed within the range of this ESU.

Recent estimates of the proportion of natural spawners of hatchery origin range from low (Yakima, Walla Walla, and John Day Rivers) to moderate (Umatilla and Deschutes Rivers). Most hatchery production in this ESU is derived primarily from within-basin stocks.

Action Area Information

Walla Walla Subbasin, approximately 10 percent of which is within Umatilla NF, has four major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including North Fork Walla Walla River, South Fork Walla Walla River, North Fork Touchet

River, and Mill Creek. The South Fork Walla Walla River holds roughly 13 miles of anadromous fish habitat inside the National Forest.

Umatilla Subbasin, approximately 15 percent of which is within Umatilla National Forest, has six major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including North Fork Umatilla River, South Fork Umatilla River, Ryan Creek, Meacham Creek, North Fork Meacham Creek, and Pearson Creek. Meacham Creek holds roughly 15 miles of anadromous fish habitat inside National Forest system land.

North Fork John Day Subbasin, approximately 50 percent of which is within the Umatilla National Forest has 20 major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including North Fork John Day River, Big Wall Creek, Wilson Creek, Ditch Creek, Mallory Creek, Potamus Creek, Camas Creek, Fivemile Creek, Hidaway Creek, Granite Creek, Clear Creek, Olive Creek, Lake Creek, Crane Creek, Desolation Creek, South Fork Desolation Creek, East Fork Meadow Brook Creek, Winom Creek, and Big Creek. North Fork John Day River holds roughly 33 miles of anadromous fish habitat inside the Umatilla National Forest.

Snake River Basin (SRB) Steelhead (Threatened)

Critical Habitat

Critical habitat was designated for Snake River steelhead on September 2, 2005 (70 FR 52630). NMFS designates critical habitat based on physical and biological features that are essential to the listed species. Essential features of designated critical habitat are: (1) substrate, (2) water quality, (3) water quantity, (4)water temperature, (5) water velocity, (6) cover/shelter, (7) food for juveniles, (8) riparian vegetation, (9) space, and (10) safe passage conditions (50 CFR 226.212). The three freshwater primary constituent elements of critical habitat are:

1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;
2) Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;
3) Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

Recent designated critical habitat on the Umatilla National Forest includes the stream channels in each designated reach, and a lateral extent as defined by the ordinary high water line (Sept. 2, 2005; 70 FR 52629). The primary constituent elements essential for conservation of listed ESUs are those sites and habitat components that support one or more fish life stages, including freshwater spawning sites, freshwater rearing sites, and freshwater migration corridors.

The main 5th field watersheds on Umatilla National Forest with designated critical habitat are the Asotin Creek, Upper Grande Ronde River, Meadow Creek, Grande Ronde River/Five Points Creek, Willow Creek, Lookingglass Creek, Grande Ronde River/Cabin Creek, Grande Ronde

River/Grossman Creek, Wenaha River, Lower Grande Ronde River and Upper Tucannon River watersheds.

Life History

The Snake River historically supported more than 55 percent of total natural-origin production of steelhead in the Columbia River Basin. It now has approximately 63 percent of the basin's natural production potential (Mealy, 1997). The Snake River steelhead ESU is distributed throughout the Snake River drainage system, including tributaries in southwest Washington, eastern Oregon and north/central Idaho (NMFS, 1997a).

Snake River steelhead migrate a substantial distance from the ocean (up to 1,500 km) and use high elevation tributaries (typically 1,000-2,000 m above sea level) for spawning and juvenile rearing. Snake River steelhead occupy habitat that is considerably warmer and drier (on an annual basis) than other steelhead ESUs. Snake River basin steelhead are generally classified as summer run, based on their adult run timing patterns. Summer steelhead enter the Columbia River from late June to October. After holding over the winter, summer steelhead spawn during the following spring (March to May). Managers classify up-river summer steelhead runs into to groups based primarily on ocean age and adult size upon return to the Columbia River. A-run steelhead are predominately age-1 ocean fish while B-run steelhead are larger, predominated by age-2 ocean fish.

With one exception (the Tucannon River production area), the tributary habitat used by Snake River steelhead ESU is above Lower Granite Dam. Major groupings of populations and/or subpopulations can be found in (1) the Grande Ronde River system; (2) the Imnaha River drainage; (3) the Clearwater River drainages; (4) the South Fork Salmon River; (5) the smaller mainstem tributaries before the confluence of the mainstem; (6) the Middle Fork salmon production areas, (7) the Lemhi and Pahsimeroi valley production areas and (8) upper Salmon River tributaries.

The A-run populations are found in the tributaries to the lower Clearwater River, the upper Salmon River and its tributaries, the lower Salmon River and its tributaries, the Grand Ronde River, Imnaha River, and possibly the Snake River's mainstem tributaries below Hells Canyon Dam. B-run steelhead occupy four major subbasins, including two on the Clearwater River (Lochsa and Selway) and two on the Salmon River (Middle Fork and South Fork); areas that are for the most part not occupied by A-run steelhead. Some natural B-run steelhead are also produced in parts of the mainstem Clearwater and its major tributaries. There are alternative escapement objectives of 10,000 (Columbia River Fisheries Management Plan) and 31,400 (Idaho) for B-run steelhead. B-run steelhead, therefore, represent at least 33 persecent and as much as 60 percent of the production capacity of the ESU.

B-run steelhead are distinguished from the A-run component by their unique life history characteristics. B-run steelhead were traditionally distinguished as larger fish with a later run timing. The recent review by the U.S. v. Oregon Technical Advisory Committee (TAC), a group that monitors adult salmon and steelhead escapement in the Snake River Basin, indicated that different populations of steelhead do have different size structures, with populations dominated by larger fish (i.e., greater than 77.5 cm) occurring in the traditionally defined B-run basins. Larger fish occur in other populations throughout the basin, but at much lower rates. Evidence suggests that fish returning to the Middle Fork Salmon River and Little Salmon River have a more equal distribution of large and small fish. B-run steelhead also are generally older. A-run steelhead are predominately 1-ocean fish, whereas most B-run steelhead generally spend 2 or more years in the ocean before spawning. The differences in ocean age are primarily responsible for the differences in the size of A- and B-run steelhead. However, B-run steelhead are also thought to be larger at any given age than

A-run fish. This may be due, at least in part, to the fact that B-run steelhead leave the ocean later in the year than A-run steelhead and thus have an extra month or more of ocean residence when growth rates are thought to be greatest.

Action Area Information

Lower Grande Ronde River sub-basin, approximately 25 percent of which is within the Umatilla National Forest, has 10 major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including Grande Ronde River, Wenaha River, Butte Creek, Crooked Creek, Elk Creek, Swamp Creek, Davis Creek, Cottonwood Creek, Mud Creek and Wildcat Creek. Wenaha River holds roughly 26 miles of anadromous fish habitat inside the Umatilla National Forest.

Lower Snake/Asotin Subbasin has one major stream that contains more than five miles of anadromous fish habitat inside the Umatilla National Forest. Asotin River holds 10 miles of anadromous habitat inside the National Forest system land. Lower Snake/Tucannon Subbasin, approximately 10 percent of which is within Umatilla National Forest, has one major stream, Tucannon River, which holds roughly 13 miles of anadromous fish habitat inside National Forest system land.

Upper Grande Ronde River Subbasin, approximately 10 percent of which is within the Umatilla National Forest, has 14 major streams that contain more than five miles of anadromous fish habitat inside National Forest system land, including Meadow Cr., Burnt Corral Cr., McCoy Cr., Indian Cr., Dark Canyon, Spring Creek, Five Points Creek, Sheep Creek, Clear Creek, Beaver Creek, Limber Jim Creek, Lookingglass Creek, Little Lookingglass Creek, and Phillips Creek. Lookingglass Creek holds roughly 7 miles of anadromous fish habitat inside the Umatilla National Forest.

Columbia River Bull Trout

This section is taken directly out of the R6 2005 FEIS Fish BA so as not to recreate information.

The FWS BOs for the FS LRMPs as amended by the NWFP and the FS LRMPs as amended by the PACFISH and INFISH provided a general description of the status of bull trout in the NWFP (USDI, 1998 and USDI, 2004). The draft Bull Trout Recovery Plan provides information on the distribution and abundance of bull trout in all Distinct Population Segments (DPS) in the conterminous United States, and offers the most recent status information for the species by recovery unit (USDI, 2002). Of the 23 recovery units for bull trout, 16 extend into NF lands. Chapters 2, 5 to 14, and 20 to 24 of the Draft Recovery Plans describe the current distribution and abundance of the recovery units considered in this BA. Reasons for decline for each recovery unit are identified within draft Bull Trout Recovery Plans.

Detailed accounts of life history, taxonomy and behavior can be found in the final rule listing the Columbia River and Klamath River populations of bull trout as threatened (USFWS, 1998b), and in the determination of threatened status for bull trout in the conterminous United States (USFWS, 1999a) for Coastal-Puget Sound, and the Status of Oregon’s bull trout; distribution, life history, limiting factors, management considerations, and status (Buchanan et al., 1997).

The FWS has draft recovery plans for the Columbia River and Klamath River DPSs (USFWS 2002a) and the Coastal-Puget Sound DPS (USFWS 2004a). Through these efforts, the FWS has converted bull trout subpopulations into “core areas.” Core areas represent a combination of habitat that provides all elements for the long-term security of bull trout and the presence of bull trout inhabiting core habitat.

Thus, core areas form the basis on which to gauge recovery within a recovery unit. Thus, a core area, by definition, is considered habitat occupied by bull trout and serves as a biologically discrete unit upon which to base bull trout recovery. Within core areas, groups of bull trout or local populations which spawn in various tributaries are generally characterized by relatively small amounts of genetic diversity within a tributary, but high levels of genetic divergence between tributaries (Chapter 1, recovery plan). Individual local populations may come and go or expand and contract over time, but the focus of the draft recovery plan is maintaining all existing core areas.

Critical Habitat

Critical habitat was designated by the FWS for the Columbia River DPS bull trout on October 6, 2004 (69 FR 59996) (USFWS 2004b). Lands not designated as critical habitat for Columbia River Basin bull trout include those that do not meet the requirement of needing special management or protection and are excluded due to the exercise of the Secretary of Interior's Authority under section 4(b)(2) of the ESA.

On September 21, 2004, the FWS designated 2,812 km (1,748 mi) of streams and 24,781 ha (61,235 ac) of lakes in Oregon, Idaho, and Washington as critical habitat for bull trout. Within the Columbia River Basin, 1,136 km (706 mi) of streams in Oregon and 1,186 km (737 mi) of streams in Washington were designated as critical habitat (USFWS 2004b).

The FWS determined that PACFISH, INFISH, the Interior Columbia Basin Ecosystem Management Project (ICBEMP) strategy, and the Northwest Forest Plan (NWFP) Aquatic Conservation Strategy (ACS) provide conservation, adequate protection and special management for the primary constituent elements (PCEs) essential for bull trout. Protection is at least comparable to designating critical habitat. As a result, those lands are not being designated critical habitat as they do not meet the statutory definition. In many specific ways these plans are superior to a designation in that they require enhancement and restoration of habitat, acts not required by the designation.

Areas related to the scope of this BA and exempt from designated critical habitat are national forest (NF) lands under the Northwest Forest Plan. However, downstream impacts from activities on NF lands are still possible and are assessed appropriately.

The FWS critical habitat designation identified those physical and biological features of the habitat that are essential to the conservation of the species and that may require special management consideration or protection. These physical and biological features include, but are not limited to:

- Space for individual and population growth
- Space for normal behavior; food, water, or other nutritional or physiological requirements
- Cover or shelter
- Sites for breeding, reproduction, or rearing of offspring
- Habitats that are protected from disturbance or are representative of the historic geographical and ecological distribution of a species

All areas proposed as critical habitat for bull trout are within the historic geographic range of the species and contain one or more of these physical or biological features essential to the conservation of the species. The FWS also included a list of known primary constituent elements with the critical habitat description. The primary constituent elements may include, but are not limited to, features such as spawning sites, feeding sites, and water quality or quantity. The FWS determined the primary constituent elements for bull trout from studies of their habitat requirements, life-history characteristics, and population biology, as outlined above. These primary constituent elements are:

- Permanent water having low levels of contaminants such that normal reproduction, growth and survival are not inhibited
- Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence
- Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures
- Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine substrate less than 0.63 cm (0.25) in diameter and minimal substrate embeddedness are characteristic of these conditions
- A natural hydrograph, including peak, high, low and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations
- Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity
- Migratory corridors with minimal physical, biological, or chemical barriers between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows
- An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish
- Few or no predatory, interbreeding, or competitive nonnative species present

Life History and Habitat Description

Biology

Bull trout exhibit both resident and migratory life-history strategies (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear one to four years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard1989, Goetz 1989), or in certain coastal areas, to saltwater (anadromous) (Cavender 1978; McPhail and Baxter 1996; WDFW et al., 1997). Resident and migratory life-history forms may be found together but it is unknown if they represent a single population or separate populations (Rieman and McIntyre 1993). Either form may give rise to offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993). The multiple life-history strategies found in bull trout populations represent important diversity (both spatial and genetic) that help protect these populations from environmental stochasticity.

The size and age of bull trout at maturity depends upon the life-history strategy and habitat limitations. Resident fish tend to be smaller than migratory fish at maturity and produce fewer eggs (Fraley and Shepard 1989; Goetz, 1989). Resident adults usually range from 150 to 300 millimeters (6 to 12 inches) total length (TL). Migratory adults however, having lived for several years in larger rivers or lakes and feeding on other fish, grow to a much larger size and commonly reach 600 millimeters (24 inches) TL or more (Pratt 1985; Goetz 1989).

The largest verified bull trout was a 14.6-kilogram (32-pound) adfluvial fish caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982).

Size differs little between life-history forms during their first years of life in headwater streams, but diverges as migratory fish move into larger and more productive waters (Rieman and McIntyre 1993).

Ratliff (1992) reported that bull trout under 100 mm (4 inches) in length were generally only found in the vicinity of spawning areas, and that fish over 100 mm were found downstream in larger channels and reservoirs in the Metolius River Basin. Juvenile migrants in the Umatilla River were primarily 100-200 mm long (4 to 8 inches) in the spring and 200-300 mm long (8 to 12 inches) in October (Buchanan et al., 1997). The age at migration for juveniles is variable. Ratliff (1992) reported that most juveniles reached a size to migrate downstream at age 2, with some at ages 1 and 3 years. Pratt (1992) had similar findings for age-at-migration of juvenile bull trout from tributaries of the Flathead River. The seasonal timing of juvenile downstream migration appears similarly variable.

Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. The species is iteroparous (i.e., can spawn multiple times in their lifetime) and adults may spawn each year or in alternate years (Batt 1996). Repeat-spawning frequency and post-spawning mortality are not well documented (Leathe and Graham 1982; Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1996) but post-spawn survival rates are believed to be high.

Bull trout typically spawn from late August to November during periods of decreasing water temperatures (below 9 degrees Celsius/48 degrees Fahrenheit). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989; Pratt 1992; Rieman and McIntyre 1996). Migratory bull trout frequently begin spawning migrations as early as April and have been known to move upstream as far as 250 kilometers (km) (155 miles) to spawning grounds in Montana (Fraley and Shepard 1989; Swanberg 1997). In Idaho, bull trout moved 109 km (67.5 miles) from Arrowrock Reservoir to spawning areas in the headwaters of the Boise River (Flatter 1998). In the Blackfoot River, Montana, bull trout began spring spawning migrations in response to increasing temperatures (Swanberg, 1997). Depending on water temperature, egg incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to emergence of fry may surpass 220 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992; Ratliff and Howell 1992).

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton, and small fish (Boag 1987; Goetz 1989; Donald and Alger 1993). Adult migratory bull trout feed on various fish species (Leathe and Graham 1982; Fraley and Shepard 1989; Brown 1992; Donald and Alger 1993). In coastal areas of western Washington, bull trout feed on Pacific herring (Clupea pallasi), Pacific sand lance (Ammodytes hexapterus), and surf smelt (Hypomesus pretiosus) in the ocean (WDFW et al., 1997).

Habitat Affinities

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components that influence the species' distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and availability of migratory corridors (Fraley and Shepard, 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and Buchanan 1992; Pratt 1992; Rieman and McIntyre 1993, 1995; Rich 1996; Watson and Hillman 1997).

Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), individuals of this species should not be expected to simultaneously occupy all available habitats (Rieman et al., 1997).

Bull trout are found primarily in cold streams, although individual fish are found in larger, warmer river systems throughout the Columbia River Basin (Fraley and Shepard 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman et al., 1997). Water temperature above 15 degrees Celsius (59 degrees Fahrenheit) is believed to limit bull trout distribution, a limitation that may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989; Rieman and McIntyre 1995).

Spawning areas are often associated with cold-water springs, groundwater infiltration, and the streams with the coldest summer water temperatures in a given watershed (Pratt 1992; Rieman and McIntyre 1993; Rieman et al., 1997; Baxter et al., 1999). Water temperatures during spawning generally range from 5 to 9 degrees Celsius (41 to 48 degrees Fahrenheit) (Goetz 1989). The requirement for cold water during egg incubation has generally limited the spawning distribution of bull trout to high elevations in areas where the summer climate is warm. Rieman and McIntyre (1995) found in the Boise River Basin that no juvenile bull trout were present in streams below 1613 m (5000 feet). Similarly, in the Sprague River Basin of south-central Oregon, Ziller (1992) found in four streams with bull trout that "numbers of bull trout increased and numbers of other trout species decreased as elevation increased. In those streams, bull trout were only found at elevations above 1774 m [5500 feet]."

All life-history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Pratt 1992; Thomas 1992; Rich 1996; Sexauer and James 1997; Watson and Hillman 1997). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that, because of the need to avoid anchor ice in order to survive, suitable winter habitat may be more restricted than summer habitat. Maintaining bull trout habitat requires stability of stream channels and of flow (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989; Pratt 1992; Pratt and Huston 1993).

Preferred bull trout spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989). In the Swan River, Montana, abundance of bull trout redds was positively correlated with the extent of bounded alluvial valley reaches, which are likely areas of groundwater to surface water exchange (Baxter et al., 1999). Survival of bull trout embryos planted in stream areas of groundwater upwelling used by bull trout for spawning were significantly higher than embryos planted in areas of surface-water recharge not used by bull trout for spawning (Baxter and McPhail 1999). Pratt (1992) indicated that increases in fine sediment reduce egg survival and emergence.

Migratory corridors link seasonal habitats for all bull trout life-history forms. For example, in Montana, migratory bull trout make extensive migrations in the Flathead River system (Fraley and Shepard 1989), and resident bull trout in tributaries of the Bitterroot River move downstream to overwinter in tributary pools (Jakober 1995). The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre 1993; M. Gilpin, in litt., 1997; Rieman et al., 1997). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed, or stray, to non-natal streams. Local bull trout populations that are extirpated by catastrophic events may also become re-established by migrants.

Action Area Information

Bull trout are found in the following **fifth field** and *sixth field* watersheds on the Umatilla National Forest:

- **Asotin Creek** *(North Fork Asotin Creek)*
- **Desolation Creek** *(North Fork Desolation Creek)*
- **Grande Ronde River/Grossman Creek** *(Elbow Creek, Grande Ronde River/Bear Creek*
- **Granite Creek** *(Clear Creek)*
- **Lookingglass Creek** *(Little Lookingglass Creek, Upper Lookingglass Creek, Lower Lookingglass Creek)*
- **Meacham Creek** (Boston Canyon, Camp Creek, North Fork Meacham Creek),
- **Mill Creek** *(Upper Mill Creek,*
- **Upper Touchet River** *(Upper North Fork Touchet River)*
- **Upper Tucannon River** *(Cummings Creek, Little Tucannon River, Tucannon River Headwaters, Panjab Creek)*
- **Upper Umatilla River** *(Bear Creek, North Fork Umatilla River, Buck Creek, Ryan Creek, South Fork Umatilla River, Thomas Creek)*
- **Upper Walla Walla River** *(North Fork Walla Walla River, Upper South Fork Walla Walla River, Middle South Fork Walla Walla River)*
- **Wenaha River** *(Upper South Fork Wenaha River, Lower South Fork Wenaha River, Wenaha River/Rock Creek, Lower Butte Creek, Upper Butte Creek, Wenaha River/Cross Canyon, Upper Crooked Creek, Lower Crooked Creek, Lower Wenaha River, First Creek)*

Middle Columbia River Spring Run Chinook Salmon (Sensitive)

Middle Columbia River spring run Chinook salmon are stream-type salmon that spawn in the Klickitat, Deschutes, John Day, and Yakima Rivers.

Historically, spring-run populations from the Hood, Walla Walla, and Umatilla Rivers may have also belonged in this ESU, but these populations are now considered extinct. MCR spring run Chinook salmon emigrate to the ocean as yearlings and apparently migrate far off-shore, as they do not appear in appreciable numbers in any ocean fisheries. The majority of adults spawn as 4-year-olds, with the exception of fish returning to the upper tributaries of the Yakima River, which return predominantly at age 5. Populations are genetically distinguishable from other stream-type chinook salmon in the Columbia and Snake Rivers. Streams in this region drain desert areas east of the Cascades (Columbia Basin Ecoregion) and are ecologically differentiated from the colder, less productive, glacial streams of the upper Columbia River Spring-Run ESU and from the generally higher elevation streams of the Snake River.

Redband Trout (Sensitive)

Inland redband trout are the same species as steelhead (O. mykiss) and juveniles cannot be distinguished phenotypicaly. Isolated populations of O. mykiss above longstanding natural passage barriers (and barring hatchery introductions) may be reasonably assumed to be resident redbands.

Redband trout are sensitive to changes in water quality and habitat. Redband trout of interior Oregon basins are believed to be best adapted to cold (less than 21° C), clean water, but a few Great Basin populations possess a hereditary basis to function at high temperatures (Behnke 1992). Adult redband trout are generally associated with pool habitats, although various life stages require a wide array of habitats for rearing, hiding, feeding, and resting. Pool habitat is important refugia during low water periods.

Spawning success decreases as fine sediment increases. The quantity and quality of pool and interstitial habitat also decrease as fine sediment increases. Other important habitat features include healthy riparian vegetation, undercut banks, and LWD (large woody debris).

Spawning occurs during the spring, generally from March to June. Redds tend to be located where velocity, depth and bottom configuration induce water flow through the stream substrate, generally in gravels at the tailouts of pools. Water temperatures influence emergence of fry, which is typically from June through July.

Redband trout are widely distributed across Oregon east of the Cascade Mountains. According to the Umatilla Forest GIS data, redband trout are found within the Project Area in the North Fork John Day River/Potamus Creek, Wall Creek and Lower John Day River/Kahler Creek watersheds. They are also found in the Tucannon and Asotin watersheds (S. Reinecke Pers. Comm.).

Westslope Cutthroat Trout (Sensitive)

Westslope cutthroat trout inhabit small mountain streams, main rivers, and large natural lakes. They require cool, clean, well-oxygenated water and prefer large pools and slow velocity areas. Juveniles of migratory populations may spend 1-4 years in their natal streams, and then move (usually in spring or early summer, and/or in fall in some systems) to a main river or lake where they remain until they spawn (Spahr et al. 1991, McIntyre and Rieman 1995). Many fry disperse downstream after emergence (McIntyre and Rieman 1995). Juveniles tend to overwinter in interstitial spaces in the substrate. Larger individuals congregate in pools in winter.

Westslope cutthroat trout spawn in small tributary streams on clean gravel substrate where mean water depth is 17-20 cm and mean water velocity is 0.3-0.4 m/sec.

They tend to spawn in natal stream (see McIntyre and Rieman 1995). Adfluvial populations live in large lakes in the upper Columbia drainage and spawn in lake tributaries. Fluvial populations live and grow in rivers and spawn in tributaries. Resident populations complete the entire life history in tributaries. All three life-history forms may occur in a single basin (McIntyre and Rieman 1995). Migrants may spawn in the lower reaches of the same streams used by resident fishes. Maturing adfluvial fishes move into the vicinity of tributaries in fall and winter and remain there until they begin to migrate upstream in spring. Of migratory spawners, some remain in tributaries during summer months but most return to the main river or lake soon after spawning (Behnke 1992).

Westslope cutthroat trout are native to the upper Missouri River drainage in Montana, extreme northwestern Wyoming, and southern Alberta; the Salmon, Clearwater, and Spokane (including the Coeur d'Alene and St. Joe drainages) river drainages in Idaho; and the Clark Fork and Kootenai river drainages in Idaho, Montana, and British Columbia (Spahr et al. 1991); also westward to the Cascade

Mountains as disjunct populations, for example, in the Lake Chelan drainage in Washington, the John Day River drainage in Oregon (where limited hybridization with redband trout apparently has occurred), and elsewhere in mid-Columbia tributaries (Behnke 1992), including the Methow, Entiat, and Wenatchee river Basins in Washington (McIntyre and Rieman 1995).

According to Umatilla Forest GIS data, westslope cutthroat trout occur within the Project Area in the Granite Creek and Desolation Creek subwatersheds.

Margined Sculpin (Sensitive)

Margined sculpin appear adaptable to a wide variety of currents and substrates (Lee et al. 1980). In areas where they are not competing with other species of sculpins, they are typically found in moderate to rapid current on rubble or gravel substrate. They probably spawn in the spring like most other sculpins.

Margined sculpin occurs in the Columbia River drainage from the Tucannon and Walla Walla River systems, Washington, to the Umatilla River system, Oregon. They are fairly common within that small range (Page and Burr 1991).

3.5.3 Environmental Consequences

This section discusses the general effects of herbicide use for invasive plant treatments to fish and other aquatic organisms as well as the specific effects of the No Action and Action Alternatives. Much of the effects discussion is incorporated from Risk Assessments and the Fisheries BA completed for the Region 6 2005 Final Environmental Impact Statement for the Regional Invasive Plant Program and associated documents. A full discussion of the Herbicide Risk Assessments in regard to proposed treatments can be found in the Fisheries Report available in the Project Record. A discussion of toxicity indexes and hazard quotients of chemicals and surfactants are disclosed in Appendix E.

General Effects of Herbicide Use for Invasive Plant Treatments

Fish and other aquatic organisms have the potential to be adversely affected by contact with concentrations of herbicide that exceed levels of concern in water. For example, herbicides applied near a stream could inadvertently contact aquatic invertebrates that rely on terrestrial plants to fulfill their life cycle and thus reduce the availability of food for fish. Herbicides can alter the structure and biological processes of both terrestrial and aquatic ecosystems; these effects of herbicides may have more profound influences on communities of fish and other aquatic organisms than direct lethal or sublethal toxic effects (Norris et al. 1991). Herbicides used for aquatic invasive plant control have been shown to affect aquatic ecosystem components, however concentration of herbicides coming in contact with water following land-base treatments are unlikely to be great enough to cause such changes (ibid). Since this project does not include treatment of emergent aquatic plants, effects from aquatic invasive plant control are not a concern.

Sublethal effects can include changes in behaviors or body functions that are not directly lethal to the aquatic species, but could have consequences to reproduction, juvenile to adult survival, or other important components to health and fitness of the species. Or, sublethal effects could result from effects to habitat or food supply.

Residues in food from direct spraying are not likely to occur since herbicides would not be applied to emergent aquatic vegetation. Drift from herbicides used on terrestrial vegetation may affect aquatic vegetation at low concentrations, however they show little tendency to bioaccumulate and are likely to be rapidly excreted by organisms as exposure decreases (Norris et al. 1991).

Therefore, while the herbicides considered for use in this project may kill individual aquatic plants, aquatic habitats and the food chain would not be adversely impacted because the amount of herbicide that could be delivered is relatively low in comparison with levels of concern from SERA Assessments and the duration to which any non-target organism (including aquatic plants) would be exposed is very short-lived and impacts to aquatic plants would be very localized.

The application rate and method, along with the behavior of the herbicide in the environment, influence the amount and length of time an herbicide persists in water, sediment, or food sources. Once in contact, the herbicide must be taken up by the organism and moved to the site of biochemical action where the chemical must be present in an active form at a concentration high enough to cause a biological effect (Norris et al. 1991).

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 aquatic organisms can be reduced by choosing herbicides with lower potential for toxic effects when exposure may occur. Exposure of federally listed fish 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. Project Design Features included in the Proposed Action are expected to minimize potential exposures to federally listed fish.

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 (includes fish) are discussed first, followed by a discussion of the effects of the active ingredients.

The movement, persistence, and fate of an herbicide in the environment determine the likelihood and the nature of the exposure fish and other aquatic organisms will receive. Stream and lake sediments may be contaminated with herbicides by deposition of soils carrying adsorbed herbicides from the land or by adsorption of herbicides from the water (Norris et al. 1991). Persistence of the herbicide is the predominant factor affecting its presence in the soil.

Stream and lake sediments may be contaminated with herbicides by deposition of soils carrying adsorbed herbicides from the land or by adsorption of herbicides from the water (ibid).

Effects of Active Ingredients in Herbicide to Aquatic Organisms

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 discountable effects. Table 45 lists the toxicity indices for fish used for the R6 2005 FEIS BA. Values in bold are the values used to assess risk to fish from acute exposures. Indices represent the most sensitive endpoint from the most sensitive species for which adequate data are available. Numbers in bold indicate the toxicity index used in calculating the hazard quotient for exposures to listed fish. Generally, the lowest toxicity index available for the species most sensitive to effects was used. Measured chronic data (NOEC) was used when they were lower than 1/20th of an acute LC50 because they account for at least some sublethal effects, and doses that are protective in chronic exposures are more certain to be protective in acute exposures.

Table 45 - Toxicity Indices for Listed Fish

Herbicide	Duration	Endpoint	Dose	Species	Effect Noted at LOAEL
Chlorsulfuron	Acute	NOEC	**2 mg/L** (1/20th of LC50)	Brown trout	LC50 at 40 mg/L
	Chronic	NOEC1	3.2 mg/L	Brown trout	rainbow trout length affected at 66mg/L
Clopyralid	Acute	NOEC	**5 mg/L** (1/20th of LC50)	Rainbow trout	LC50 at 103 mg/L
	Chronic				none available
Glyphosate (no surfactant)	Acute	NOEC	**0.5 mg/L** (1/20th/LC50)	Rainbow trout	LC50 at 10 mg/L
	Chronic	NOEC	2.57 mg/L2	Rainbow trout	Life-cycle study in minnows; LOAEL not given
Glyphosate with POEA surfactant	Acute	NOEC	**0.065 mg/L** (1/20th of LC50)	Rainbow trout	LC50 at 1.3 mg/L for fingerlings (surfactant formulation)
	Chronic	NOEC	0.36 mg/L	salmonids	estimated from full life-cycle study of minnows (surfactant formulation)
Imazapic	Acute	NOEC	**100 mg/L**	all fish	at 100 mg/L, no statistically sig. mortality
	Chronic	NOEC	100 mg/L	fathead minnow	No treatment related effects to hatch or growth
Imazapyr	Acute	NOEC	**5 mg/L** (1/20th LC50)	trout, catfish, bluegill	LC50 at 110-180 mg/L for North American species
	Chronic	NOEC	43.1 mg/L	Rainbow	“nearly significant” effects on early life stages at 92.4 mg/L
Metsulfuron methyl	Acute	NOEC	10 mg/L	Rainbow	lethargy, erratic swimming at 100 mg/L
	Chronic	NOEC	**4.5 mg/L**	Rainbow	standard length effects at 8 mg/L

Herbicide	Duration	Endpoint	Dose	Species	Effect Noted at LOAEL
Picloram	Acute	NOEC	**0.04 mg/L** (1/20th LC50)	Cutthroat trout	LC50 at 0.80 mg/L
	Chronic	NOEC	0.55 mg/L	Rainbow trout	body weigh and length of fry reduced at 0.88 mg/L
Sethoxydim	Acute	NOEC	**0.06 mg/L** (1/20th LC50)	Rainbow trout	LC50 of Poast at 1.2 mg/L
	Chronic	NOEC			none available
Sulfometuron methyl	Acute	NOEC	7.3 mg/L	Fathead minnow	No signs of toxicity at highest doses tested
	Chronic	NOEC	**1.17 mg/L**	Fathead minnow	No effects on hatch, survival or growth at highest doses tested
Triclopyr acid	Acute	NOEC	**0.26 mg/L** (1/20th LC50)	Chum salmon	LC50 at 5.3 mg/L3
	Chronic	NOEC	104 mg/L	Fathead minnow	Reduced survival of embryo/larval stages at 140 mg/L
Triclopyr BEE	Acute		**0.012 mg/L**	Bluegill sunfish	LC50 at 0.25 mg/L
	Chronic4	NOEC	104 mg/L	Fathead minnow	Reduced survival of embryo/larval stages at 140 mg/L
NPE Surfactants	Acute5	NOEC	0.2 mg/L (1/20th LC50)	fathead minnow, rainbow trout	LC50 at 4.0 mg/L
	Chronic6	NOEC	1.0 mg/L	trout	no LOEL given

1 Chronic value for brown trout (sensitive sp.) was estimated using relative potency in acute and chronic values for rainbow trout, and the acute value for brown trout.
2 Estimated from minnow chronic NOEC using the relative potency factor method (SERA Glyphosate 2003).
3 Using Wan et al. (1989) value for lethal dose
4 Chronic and subchronic data for triclopyr are limited to triclopyr TEA. No data is available for triclopyr BEE.
5 Exposure includes small percentage of NP and NP1-2E (Bakke, 2003).
6 Chronic exposures are from degredates NP1EC and NP2EC, because NPE breaks down rapidly and NPECs are more persistent (Bakke, 2003).
NOEC = No Observable Effect Concentration
LOAEL – Lowest Observed Adverse Effect Level

Results of the exposure scenarios as applied to listed fish on the Umatilla National Forest are displayed below in Table 46. The R6 2005 FEIS Fish BA displayed the results by placing stars (*) and diamonds (♦) where there was an exceedence in the level of concern (LOC). For purposes of this BE the table of stars and diamonds has been modified to show the hazard quotients (HQ) value in order to exemplify the magnitude of difference between typical and high application rates, and aquatic and non-aquatic formulations. Where table cells display “--“and no number means that there was no exceedence in level of concern. The LOC exceedences occur when the HQ value exceeds 1. Exceedences in LOC indicate occasions where the expected exposure concentration (EEC) is greater than the no observable effect concentration (NOEC) value used for that aquatic species group, which may lead to an indirect effect to listed aquatic species if conditions were similar to what was modeled in the SERA risk assessments. To calculate a HQ, simply take the ratio of EEC/NOEC values. Toxicity indices used in the R6 2005 FEIS for aquatic organisms are NOEC values, refer to table above.

Two types of indirect effects are possible, those toxic to the listed aquatic species, and those mediated by toxic effects to an ecosystem component that is part of the Primary Constituent Elements (PCE) or associated essential habitat features.

Table 46 - Hazard Quotient Values for Acute Exposure Estimates for Sensitive Aquatic Organisms from the R6 2005 FEIS Broadcast Spray Scenarios

Aquatic Species Group	Application Rate	Chlorsulfuron	Clopyralid	Glyphosate w/o surfactant*	Glyphosate with surfactant	Imazapic	Imazapyr*	Metsulfuron Methyl	Picloram	Sethoxydim	Sulfometron Methyl	Triclopyr TEA*	Triclopyr BEE	NPE surfactant
Fish	High	--	--	6	43	--	--	--	5	3	--	15	125	--
	Typical	--	--	2	12	--	--	--	2	2.5	--	1.5	13	--
Aquatic invertebrates	High	--	--	--	2.5	--	--	--	--	--	--	--	1.8	--
	Typical	--	--	--	--	--	--	--	--	--	--	--	--	--
Algae	High	5	--	--	3.1	--	5	--	--	--	3	9.5	214	--
	Typical	--	--	--	--	--	2	--	--	--	--	--	21	--
Aquatic macrophytes	High	1064	--	--	--	1.4	8	9	2	--	36	9.5	214	--
	Typical	234	--	--	--	--	3	2	--		4		21	

'--' Predicted concentrations less than or equal to the estimated or measured 'no observable effect concentration' at both typical and high application rates.
'*' Aquatic formulations analyzed in the R6 2005 FEIS.

The exposure scenarios do not account for factors such as timing of application, animal behavior and feeding strategies, animal presence within a treatment area, or other relevant factors such as site-specific conditions. However, the SERA risk assessments do represent a worst-case scenario that is a good benchmark for assessing true concerns with actual application. Results of triclopyr exposures take into account the strict limitations on use identified in the forest plan standards, which makes the exposure scenarios implausible or impossible. Table 46 displays the results of exposure if all "worst-case" conditions reflected in the scenario occur, which is highly unlikely for Umatilla National Forest.

In Appendix E, the Chronic and Acute Exposures section focuses on the probability and magnitude of acute exposures from herbicide treatments based on results from the SERA risk assessments Table 46 above). It also contains a summary of herbicide characteristics in soil in order to gain a better understanding of the probability of adverse effects to aquatic organisms should the herbicide come in contact with water.

Effects of Surfactants

Appendix 3c of the SERA 2003 risk assessment summarizes the available ecological information from all of the Material Safety Data Sheets (MSDS) for the formulations that are labeled for forestry applications. It is apparent that these formulations fall into relatively clear groups. The most toxic formulations appear to be Credit Systemic, Credit, Glyfos, Glyphosate, glyphosate Original, Prosecutor Plus Tracker, Razor SPI, Razor, Roundup Original, Roundup Pro Concentrate, and

Roundup UltraMax. It may be presumed that these formulations contain the most toxic surfactants. Other formulations such as Aqua Neat, Aquamaster, Debit TMF, Eagre, Foresters' Non-Selective Herbicide, Glyphosate VMF, and Roundup Custom are much less acutely toxic (See Appendix E of this EIS, and the BE for this EIS (available in the Project Record at the Umatilla National Forest in Pendleton, OR), for more details about surfactants).

For the SERA 2003 risk assessment, the uncertainties involving the presence or absence of a surfactant and the possibly differing effects of using various surfactants cannot be resolved with certainty. The R6 2005 FEIS addresses this uncertainty through Standard #18.

Effects of the Alternatives

Alternative A – No Action

Direct and Indirect Effects

Manual, mechanical, cultural and biological treatments would continue under an existing decision from the Umatilla National Forest 1995 EA for the Treatment of Noxious Weeds. Under this alternative less than seven percent of known sites would be treated with herbicide, leaving a heavy reliance on manual treatments, which in many cases is cost prohibitive. Repeated manual treatments may effectively control small, isolated populations of certain plants, however associated labor, time and cost may make manual treatments less practical and effective, especially when treating large infestations.

The decision made in the "95 EA" allows use of glyphosate and picloram on up to 125 acres per year. Picloram is a high risk herbicide for aquatic resources but is preferred in many situations because it is a selective herbicide that represses reestablishment of target invasive species. Glyphosate is nonspecific and kills all vegetation.

According to the soil and water analysis for this EIS, there could be a short-term reduction in soil cover for the areas treated. This localized reduction in cover would increase treated areas vulnerability to soil erosion. The effects would be minimal given the small amount of land treated, especially within Aquatic Influence Zones, and the scattered nature of the treatments. These effects would last approximately one season until vegetation became re-established. Most invasive plants provide less stream-shading than native hardwoods and conifers and less bank stabilization than deeper rooted native vegetation.

Invasive plants would continue to grow on sites where treatment is currently not authorized by a NEPA analysis. There is no mechanism in Alternative A that allows for Early Detection Rapid Response (EDRR). No broadcast application takes place within RHCAs under the No Action Alternative so there is little chance of herbicide drift into streams.

Cumulative Effects

This alternative is covered under the decision made for the 1995 EA. Treatments would occur on an extremely small percentage of any watersheds in the Project Area. Direct and indirect effects are so insignificant and temporary that treatment under No Action could not plausibly contribute to significant cumulative effects.

Alternative B – Proposed Action

Direct and Indirect Effects

Non-herbicide Treatment Methods

All invasive plant treatments can result in some erosion, stream sedimentation, and disturbance to aquatic organisms if carried out over a large enough area. Sedimentation can cover eggs or spawning gravels, reduce prey availability, and harm fish gills. Soil can also become compacted and prevent the establishment of native vegetative cover. All invasive plant treatments can reduce insect biomass, which would result in a decrease in the supply of food for fish and other aquatic organism. Reductions in cover, shade, and sources of food from riparian vegetation could result from herbicide deposition in a streamside zone (Norris et al. 1991).

Riparian vegetation affects habitat structure in several important ways. Roots of riparian vegetation hold soil, which stabilizes banks, prevents addition of soil run-off to water bodies with subsequent increases in turbidity or filling substrate interstices, and helps to create overhanging banks. Riparian and emergent aquatic vegetation can provide hiding cover or refuge for fish and other aquatic organisms where native plants have been replaced.

Manual, Mechanical, Site Restoration and Revegetation Methods

Manual and mechanical treatments related to the Proposed Action are described as methods that may include brush cutters, or other machinery with various types of blades to remove plants. Manual methods include the use of hand-operated tools (e.g., axes, brush hooks, hoes, shovels, hand clippers) to dig up and remove noxious species (USDI 2003).

Direct and indirect effects of manual and mechanical treatments were analyzed in the R6 2005 FEIS (Appendix J). Public scoping issues about these treatments were not raised. Manual treatments, such as lopping or shearing, cause an input of organic material (dead roots) into the soil. As the roots are broken down in the soil food web, nutrients will be released. Rainfall may cause these nutrients to be lost to surface runoff or to groundwater. Bare soils combined with high nutrient levels provide ideal conditions for the establishment of many invasive species. In lower intensity infestations, non-target vegetation could provide erosion control as well as a seed source for establishing native vegetation. In areas with larger amounts of bare soil, PDFs require restoration activities to reestablish native vegetation. The intent is to re-establish competitive local, native vegetation post-treatment in areas of bare ground.

The presence of people or crews with hand-held tools along streambanks could lead to localized, sediment/turbidity to fish habitat because of trampling, soil sloughing due to stepping on banks and removal of invasive plant roots. However, amounts of potential localized sediment/turbidity would be negligible because the invasive plant populations in RHCAs on the Umatilla National Forest are not extensive enough to result in significant sediment/turbidity and emergent vegetation will not be treated. Effective invasive plant treatment and restoration of treated sites would improve the function of riparian areas and lead to improved fish habitat conditions.

The Proposed Action would benefit aquatic ecosystems to the extent they effectively restore riparian habitats, especially habitats adjacent to fish bearing streams. The impacts of invasive plants on these habitats can last decades, while the impacts of treatment tend to be short term. Passive and active restoration would accelerate native vegetative recovery in treated sites.

Removal of plant roots along a streambank will cause some ground disturbance and may introduce some sediment to streams. For example, weed wrenching of scotch broom may loosen soil and cause minor amounts of erosion for approximately one season until vegetation was reestablished. These minor amounts of erosion would be negligible once contact with water is made. Under the Proposed Action, significant removal of riparian invasive species would not occur because of the proposed use of herbicides reducing the potential for significant soil disturbance.

Using mowing equipment on existing roads is not expected to impact soils. Soil compaction eliminates soil pores and so reduces water infiltration, aeration, and the ability of plants to root effectively. However, the limited amount of mechanical treatment proposed eliminates risk of extensive soil impacts.

While the relative amounts of manual and mechanical treatments vary, the differences in terms of effects from such treatments are negligible. Other mechanical treatments, such as the use of motorized hand tools, are expected to have effects similar to manual treatments.

Turbidity and Sediment

Manual, mechanical, and restoration treatment activities that incorporate substantial ground-disturbing activities in riparian areas may lead to increased erosion and stream sedimentation. Persistence of increased turbidity depends on the size of the suspended particle and velocity of the water. Impacts related to fine sediment depends on the amount of fine sediment introduced and the holding capacity of the surface water. Increased turbidity can reduce feeding ability or gill function in some fish species and fine sediments can cover eggs or spawning gravels. Effects to listed aquatic species will vary with the proximity of the species and their habitat to the treatment area, the sensitivity of the listed species to turbidity and fine sediment, and the size of the area treated.

Manual, mechanical, and restoration treatments include activities such as hand pulling, mowing, brushing, seeding, and planting. Manual treatments within 100 feet of streams with listed species would occur along the North Fork John Day River, Third Creek, Camas Creek and Alder Creek. The amount of sediment created by these non-herbicide treatments is anticipated to be insignificant because the methods of treatments do not include ground disturbing activities by heavy equipment. Ground disturbing activities by hand pulling and planting will cover a relatively small area and any sediment created at these sites would be quickly dispersed in the large volume of water. In addition, the only listed fish species at the location of treatment are bull trout and Middle Columbia steelhead, therefore Snake River steelhead, Snake River Chinook salmon, and Middle Columbia Chinook salmon would not be exposed to effects from treatments at these sites.

Temperature

Aquatic species have specific needs in terms of water temperature. Increasing water temperature may decrease the dissolved oxygen in water which may affect metabolism and food requirements. Many factors influence water temperature including shade, discharge, channel morphology, air temperature, topography, stream aspect, and interactions with ground water. Shade is the factor that has the potential to be impacted by non-herbicide treatments.

Manual, mechanical, and restoration treatments of some invasive plant species (such as knotweed) may decrease riparian vegetative shading in some areas, thereby increasing the amount of solar radiation striking the water. This may result in a warming effect but many other factors in addition to shade affect water temperature. A significant amount of vegetation would need to be removed to change water temperature in the stream, and shade would have to be provided only by the invasive plant removed.

The only known treatment sites that would remove invasive vegetation directly adjacent to water are the Camas Creek and Alder Creek sites. The amount of vegetation that will be removed at these sites is not enough to measurably impact stream temperature and therefore listed fish will not be exposed to the effects of increased stream temperature from treatments at this site.

Herbicide Treatments

Herbicide treatments proposed for use may result in some minor amounts of herbicide coming in contact with water where there may be fish present, however; the likelihood of the amount being at a level of concern is low. The Project Design Features (PDFs) and Buffers (See Chapter 2.2.3 of the EIS) minimize or eliminate the potential for any herbicide to reach a threshold of concern for listed and sensitive fish species. The Proposed Action would not apply herbicides directly to any stream for purposes of treating aquatic weeds that are floating or submerged in any situation. There are no sites with emergent vegetation proposed for treatment; therefore the potential for high concentrations causing acute toxicity effects is extremely remote.

An accidental spill could result in concentrations of herbicides that could harm aquatic organisms. The Proposed Action includes Project Design Features that would reduce the likelihood and impact of a spill. The Proposed Action allows only certified applicators that have gone through various courses and training to properly use herbicides in a safe manner.

The Proposed Action includes limitations on the type and application method of herbicides in Aquatic Influence Zones and along roads that have high potential for herbicide delivery to streams. The PDFs included in the Proposed Action apply to known sites and those detected in the future. In both cases, the limitations in the PDFs are expected to ensure that herbicide use will not exceed a level of concern for aquatic organisms tested by the SERA risk assessments.

Buffers act as a safety zone to limit the potential for herbicides coming in contact with water at concentrations of concern for aquatic resources through leaching, run-off, or drift. The buffers included in the Proposed Action become more restrictive within Aquatic Influence Zones, especially when water is present. PDFs and buffers were developed based on label advisories, SERA "worst case" risk assessments, previous Section 7 Consultation for the R6 2005 FEIS, Neil Berg's 2004 study of broadcast drift and run off to streams, as well as monitoring data from other herbicide applications projects.

No broadcast applications of herbicides would occur within 100 feet of perennial and wet intermittent streams, lakes, or wetlands, or on roads that have a high potential for herbicide delivery. The majority of herbicides have 50-foot buffers for spot treatments, except for low risk and aquatic labeled herbicides. Spot applications of aquatic labeled formulations of glyphosate and imazapyr may be used up to the water's edge or within 15 feet of isolated standing water present in roadside ditches that are outside the stream buffer. Spot applications of aquatic labeled triclopyr may not be used within 15 feet of perennial and wet intermittent streams or other waterbodies.

Spot applications of aquatic formulations of glyphosate and imazapyr are not likely to result in harmful amounts coming in contact with water and harming fish, invertebrates, and algae. Some aquatic plants would be damaged at the immediate spot spray locations. Glyphosate would not be applied directly to water for weed control, but if it does enter the water it is bound tightly to dissolved and suspended particles and to bottom sediments and becomes inactive.

The Proposed Action limits broadcast application of herbicide to the following situations:

- Outside established buffers for aquatic influence zones along perennial/intermittent streams and other waterbodies (buffers differ by chemical, based on risk factors)
- Outside established buffers when water is present within roadside ditches
- On roads that do not have a high potential for herbicide delivery (see PDF H4)

Analysis of the Effects

Herbicide applications may occur near streams utilized by ESA listed fish species found in the project area. Physiological responses from exposure to herbicides proposed for use are probably similar between bull trout, salmon and steelhead.

Herbicide characteristics and basic hazard identification to aquatic organisms for each herbicide proposed for use is discussed above. The herbicides with a greater likelihood of coming in contact with water are the aquatic formulations of glyphosate, imazapyr, and triclopyr. Therefore, the focus of the quantitative analysis included in this report is on the aquatic formulations. Quantitative analysis of the non-aquatic formulations is covered in the R6 2005 FEIS and is incorporated by reference.

Higher Risk Treatment Scenarios on the Umatilla National Forest

Higher risk treatment scenarios are defined as situations where herbicide exposure could exceed a level of concern for listed fish. Higher risk treatment scenerios also include aerial application of herbicide. Many treatment areas on UNF are within riparian areas and along roads with potential to deliver herbicide to streams. As discussed previously, broadcast treatments would not occur within 100 feet of a wet stream or 50 feet of a dry stream. The treatment methods and herbicides proposed for use within the Aquatic Influence Zone are far less likely to deliver herbicide at levels of concern than broadcasting. Results from the risk assessments far overestimate the amount of herbicide likely to enter surface waters for proposed treatments because actual treatments will not broadcast spray 10 acres immediately adjacent to streams and the Proposed Action contains PDFs that restrict application methods and rates near water. For more information about how risks are abated see Table 6.

Analysis of Higher Risk Scenario 1

The following ten 6th-field watersheds contain at least ten acres of estimated treatment within the Aquatic Influence Zones. In all cases, the existing treatment sites were found to be small and scattered throughout the watersheds. The PDFs and buffers appear to sufficiently reduce risks to a low level, even if all these treatments were to occur simultaneously (unlikely). One of the 6th field watersheds listed below does not contain any federally listed fish, refer to Table 10 in the BE for a complete listing of federally listed fish by 6th field watershed.

Lick Creek – Approximately 17 acres of treatment lie with the aquatic influence zone. One road within this watershed is associated with high risk for delivery of herbicide to streams, with specific PDFs applying. There are no federally listed fish in the Lick Creek 6th field watershed.

North Fork Asotin Creek – Approximately 62 acres of treatment lie within the aquatic influence zone. None of the roads in this watershed are associated with high risk for delivery of herbicides to streams. Federally listed fish include Snake River Steelhead, Snake Rriver Chinook Salmon and Bull Trout.

Little Lookingglass Creek – Approximately 26 acres of treatment lie within the aquatic influence zone. Two roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Snake River Steelhead and Bull Trout.

Phillips Creek - Approximately 150 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Snake River Steelhead

Lower Crooked Creek - Approximately 45 acres of treatment lie within the aquatic influence zone. No roads within this watershed are associated with high risk for delivery of herbicides to streams. Federally listed fish include Bull Trout.

Lower Wenaha River - Approximately 15 acres of treatment lie within the aquatic influence zone. No roads within this watershed are associated with high risk for delivery of herbicides to streams. Federally listed fish include Snake River Steelhead, Snake Rriver Chinook Salmon and Bull Trout.

Little Tucannon River - Approximately 35 acres of treatment lie within the aquatic influence zone. Three roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Snake River Steelhead, Snake Rriver Chinook Salmon and Bull Trout.

Thomas Creek - Approximately 29 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead, Middle Columbia Chinook Salmon and Bull Trout.

Butcher Creek - Approximately 66 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Pearson Creek - Approximately 50 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Texas Bar - Approximately 28 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead and Middle Columbia Chinook Salmon.

Bowman Creek - Approximately 39 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Lane Creek - Approximately 14 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead and Middle Columbia Chinook Salmon.

East Fork Meadow Creek - Approximately 15 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Meadow Brook - Approximately 12 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Upper Ditch - Approximately 29 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Upper Potamus - Approximately 14 acres of treatment lie within the aquatic influence zone. Two roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Alder/Upper Skookum - Approximately 70 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Middle Big Wall - Approximately 28 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Swale Creek - Approximately 13 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Upper Wilson - Approximately 21 acres of treatment lie within the aquatic influence zone. Many roads within this watershed are associated with high risk for delivery of herbicides to streams, with specific PDFs applying. Federally listed fish include Middle Columbia Steelhead.

Analysis of Higher Risk Scenario 2

Aerial application is proposed in three 6th field watersheds;

Little Tucannon River – Approximately 37 acres are estimated for treatment within this watershed, however none of these acres are within the aquatic influence zone These acres are not concentrated within a single part of the watershed. Specific PDFs apply to aerial treatments, including no application with 300 feet of fish-bearing streams. This watershed includes Snake River steelhead, Snake River Chinook salmon and bull trout.

Middle North Fork Touchet River – Approximately 632 acres are estimated for treatment within this watershed, however none of these acres are within the aquatic influence zone. In fact, the treatment site is more than a mile from the nearest fish-bearing stream. Specific PDFs apply to aerial treatments, including no application with 300 feet of fish-bearing streams. There are no listed fish within this watershed.

Headwaters Tucannon River – Approximately 7 acres are estimated for treatment within this watershed, however, none of these acres are within the aquatic influence zone. In fact the treatment site is almost a mile from the nearest fish-bearing stream. Specific PDFs apply to aerial treatments, including no application with 300 feet of fish-bearing streams. This watershed includes Snake River steelhead, Snake River Chinook salmon and bull trout.

SERA Risk Assessment Worksheets

Some streams within road corridors have treatment areas that parallel both the road and the stream with many continuous acres proposed for treatment within the aquatic influence zone. In reality most of these areas have pockets of invasive plants within a much larger assembly of native vegetation along the stream. To model a worst case scenario a few of these areas were modeled for site specific soil types and rainfall with the GLEAMS spreadsheet. In addition, the model was run for the highest rainfall on the Forest with sandy soil, the soil most likely to allow runoff into the stream (Table 47). Only aquatic glyphosate and aquatic imazapyr were modeled with the high rainfall and sandy soil as they are the only herbicides allowed for spot spray treatments below bankfull.

NF Asotin River has up to 81 acres of treatment of scotch thistle on 3.9 miles of the River and tributaries within 100 feet of the stream channel. Modeling limitations include: modeling only the 50 feet closest to the channel and 1.6 miles of stream channel, and assumes broadcast spray, not spot spray.

The results of this analysis indicate all HQ values were below one; therefore, no levels of concern were exceeded for sensitive fish. The R6 2005 FEIS notes that as HQ increases above one, the margins of safety decrease, compared to the most sensitive toxic effect shown in laboratory studies.

Table 47 - Water contamination rates (mg/L per lb/acre), peak concentrations in water, and range of Hazard Quotients for worst case scenario on the Umatilla NF for aquatic glyphosate, aquatic imazapyr, and aquatic triclopyr at the typical application rate

Herbicide/ location	Annual Precipitation (inches)	Peak Water Contam. Rate (mg/L per lb/acre)	Range of Concentration in water (dose) (mg/L)	Toxicity Index for Listed Fish (mg/L)	Range of Hazard Quotients
Glyphosate (2 lbs/acre)					
NF Asotin River	20-24	0.001 to 0.011	0.002 to 0.022	0.5	4E-03 to 4E-02
Little Phillips Creek	32-56	0.01 to 0.035	0.02 to 0.07	0.5	0.04 to 0.14
Dry, Intermittent Channel, Sandy Soil	25-75	0.0191 to 0.09854	0.03821 to 0.19854	0.5	0.0764 to 0.3942
Jubilee Lake	48-56	0.0031 to 0.00425	0.0062 to 0.0085	0.5	0.0726 to 0.211
Imazapyr (0.45 lbs/acre)					
NF Asotin River	20-24	0.0001 to 0.00042	0.000024 to 0.000019	0.135	0.0002 to 0.001
Little Phillips Creek	32-56	0.00021 to 0.00096	0.000095 to 0.00043	0.135	0.0007 to 0.003
Dry, Intermittent Channel, Sandy Soil	25-75	0.0000691 to 0.00035	0.0003.11 to 0.0001057	0.135	0.0002 to 0.0008
Jubilee Lake	48-56	0.000019 to 0.000021	0.0000086 to 0.0000095	0.135	6E-05 to 7E-05
Chlopyralid (1 lbs/acre)					
NF Asotin River	20	0.0045 to 0.0093	0.0015 to 0.0303	5.15	0.0003 to 0.0006
Little Phillips Creek	32-56	0.008 to 0.011	0.0019 to 0.0039	5.15	0.0004 to 0.0007
Dry, Intermittent Channel, Sandy Soil	Not allowed According to PDFs and buffers				
Jubilee Lake	48-56	0.013 to 0.0204	0.0046 to 0.032	5.15	9E-04 to .6E-03

Sources: Precipitation records from USGS, local site knowledge; SERA 2003, 2004.

It is highly unlikely that the low values modeled in the worksheets would even be approached given that treatment methods within buffers established by PDFs for each herbicide/surfactant are limited to spot and hand/select methods. Hand selective treatment methods have a much less likelihood of herbicides coming in contact with water than spot spray (which far reduces exposure potential compared to broadcast treatment).

Aerial Herbicide Treatments

Aerial application is proposed for 675 acres on the Pomeroy District. The primary overstory in these areas is ponderosa pine with small numbers of lodgepole pine and grand fir, and grasslands. The herbicide most likely to be applied is clopyralid. It is a selective herbicide that would leave soil cover by not harming nontarget vegetation such as pines, firs and grasses. The dead plants would also be left on site contributing to ground cover. Erosion and associated sediment delivery to streams would be minimal and transitory.

Of more concern is water contamination from drift during aerial spray. Project Design Features were designed to control drift and overspray of headwater streams. PDF E3 requires that fueling would not occur in RHCAs; F5 requires that herbicide applications occur when winds are between 2 and 8 miles per hour; F6 requires coarse droplet size to minimize drift; F7 requires that aerial units be ground checked and water features marked and buffered before application. Buffers of 300 feet are required on perennial or wet intermittent streams and wetlands, and 100 feet buffers are required on dry channels. Based on buffer effectiveness documented by Rashin and Graber (1993) and Dent and Robben (2000) concentrations of herbicides reaching streams are expected to be well below concentrations of concern to beneficial uses.

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, minimizes the magnitude and intensity of impacts. An herbicide transportation and handling plan is a project requirement. This plan would address spill prevention and containment.

EDRR

Early Detection Rapid Response (EDRR) allows for newly identified or currently unknown invasive plant infestations to be treated using the range of methods analyzed in the Umatilla Invasive Plant FEIS 2006, on sites similar to those presently proposed for treatment. PDFs would protect aquatic resources by constraining treatment methods according to site specific conditions.

The analysis for treatments within the aquatic influence zone for EDRR is summarized below. Included is the basis for treatment caps with respect to EDRR.

Treatments above bankfull - The basis of the analysis for treatments from bankfull to upland are the HQ’s from the SERA risk assessment scenario worksheets and the assumptions of the worst-case scenario (10 contiguous acres of broadcast spray, adjacent to a 1.8 cfs stream, sparsely vegetated). Ten contiguous acres of treatment in a 6th field subwatershed are not likely to exceed the HQ’s calculated for the NF Asotin River, Little Phillips Creek and Jubilee Lake sites. Ten acres of infestation spread out in patches (not contiguous) throughout a 6th field sub-watershed are also not likely to exceed the HQ’s in the SERA risk assessment scenario because there is more water and less herbicide in each patch area than that estimated in the scenario. Based on knowledge of rainfall patterns, stream sizes, fish species present, it is reasonable to expect that treatments within the riparian/aquatic influence areas within a 6th field subwatershed would not exceed the HQ’s estimated by the SERA risk assessment worksheet calculations. To provide a limit to the extent of treatment and herbicide exposure for projects implemented under EDRR where there are federally listed fish or designated critical habitat, no more than 10 acres per year within the riparian area of any 1.5 mile stream reach within a 6th field watershed would be treated at a single time.

Proximity, Probability, and Magnitude of Effects from Herbicide Use

By using the analysis above, the effects to each ESA listed fish species and habitat can be described by further analyzing factors of proximity, probability, magnitude, duration, nature, distribution, frequency, and timing of the Proposed Action. Habitat pathway indicators discussed in this analysis for herbicide use is “chemical contaminants” and “sediment/turbidity”. The Proposed Action had no causal mechanisms to affect any other matrix indicators; therefore this analysis will address only those indicators mentioned above. This section complements the designated critical habitat analysis.

Chemical Contaminants Indicator

Baseline information for this indicator within the UNF is “properly functioning” for the majority of watersheds. Watersheds identified as “at unacceptable risk” for the chemical contaminants indicator are the Walla Walla and Umatilla River subbasins, refer to project BA.

Walla Walls Subbasin – The Oregon Department of Environmental Quality's and the Washington Department of Ecology's 1996 303(d) lists of water quality-limited waterbodies (DEQ 1996, DOE 1996) were used as data sources for this indicator. DEQ does not list any stream in the Walla Walla River subbasin as being water quality-limited for chemical contamination or nutrients. The DOE lists Mill Creek for excess amounts of chlorine, nitrogen, and phosphorus, and lists the Walla Walla River for excess amounts of a variety of agricultural chemicals. The DOE does not specify any particular sections of the streams as containing these contaminants, but the nature of the pollutants suggests that they are present only in lower stream reaches in the subbasin. Forest Service water quality testing has not found these contaminants to be present on the Forest. For this reason, this indicator was judged to be properly functioning for the four subpopulation checklists but was judged to be functioning at unacceptable risk for the combined checklist. However, it should be noted that these contaminants may not be at concentrations of concern during the winter months when steelhead and fall chinook would normally be using these lower stream reaches.

Umatilla River Subbasin - DEQ does not list any stream in the upper Umatilla River, Meacham Creek, or Pearson Creek as being water quality-limited for chemical contamination or nutrients. This indicator was judged to be properly functioning for the three main steelhead PAs. This parameter was judged to be not properly functioning for the subbasin as a whole due to elevated phosphorus levels in two stream reaches (DEQ 1996).

It is expected that the baseline condition will not change as a result of the Proposed Action. The discussions below complement the analysis for designated critical habitat.

Proximity of Streams toTreatment Areas

Many of the treatment areas are on or near roads that cross either perennial or intermittent streams on UNF. For the purpose of analyzing close proximity of treatment areas to listed fish, streams containing listed fish that flow through treatment areas were identified, and a width of 100ft from the stream up into the riparian area was used to identify treatment areas that may be located immediately adjacent to a stream (i.e., up to bankfull) with listed fish. A total of 158 treatment areas have been identified that include areas within 100 ft of streams with ESA fish (Table 48).

Many mainstem rivers, such as Grande Ronde River and Tucannon River serve as migration corridors to pacific salmon and bull trout. Tributaries to these mainstem rivers provide spawning and rearing habitat. For fall Chinook, juveniles will not typically be found in freshwater on UNF because they migrate to salt water immediately upon emergence. Most of the spawning and rearing for bull trout occurs in the headwaters, and typically in the lower reaches only adults can be find.

Herbicide application is expected to occur on the streambanks in close proximity to rearing and migration habitat within the rivers listed in Table 48, however no treatments would occur below the ordinary high water mark. Spring chinook salmon may occasionally utilize some of these stream reaches for spawning. Steelhead and Chinook share a majority of the rivers, while other fish are limited on habitat based on their ability to access tributaries or quality of habitat available.

Table 48 - Herbicide Treatment Areas on the UNF within 100 feet of Streams with Listed Fish

Fifth Field Watershed Name	Stream Name	Treatment Site Identification	Treatment Type	Listed Fish Species* present within Stream*
Asotin Creek	Charlie Creek	614045279	Herbicide	SRS
	North Fork Asotin Creek	614400194	Herbicide	SRS, SRC, BT
Lookingglass Creek	Little Lookingglass Creek	6140601365	Herbicide	SRS ,BT
	Mottet Creek	6140600747	Herbicide	SRS
		6140600054	Herbicide	SRS
Grande Ronde River/Cabin Creek	Phillips Creek	06140600577	Biocontrol	SRS
		06140600773	Herbicide	SRS
		06140600781	Herbicide	SRS
		06140601318	Biocontrol	SRS
		06140601319	Biocontrol	SRS
		06140601320	Herbicide	SRS
		06140601321	Herbicide	SRS
		06140601322	Herbicide	SRS
		06140601323	Biocontrol	SRS
		06140601534	Herbicide	SRS
	Little Phillips Creek	06140600393	Herbicide	SRS
Wenaha River	Third Creek	06140600141	Manual	BT
		06140600142	Herbicide	BT
		06140600138	Herbicide	BT
	Crooked Creek	06140600144	Herbicide	SRS, SRC, BT
		06140600146	Herbicide	SRS, SRC, BT
		06140600153	Herbicide	SRS, SRC, BT
		06140600155	Herbicide	SRS, SRC, BT
		06140600241	Herbicide	SRS, SRC, BT
		06140600242	Herbicide	SRS, SRC, BT
		06140600244	Herbicide	SRS, SRC, BT
		06140600263	Herbicide	SRS, SRC, BT
	Wenaha River	06140600157	Herbicide	SRS, SRC, BT
		06140600508	Herbicide	SRS, SRC, BT
		06140600268	Herbicide	SRS, SRC, BT
Lower Grande Ronde River	Menatchee Creek	06140600236	Herbicide	SRC
Upper Tucannon	Unnamed Trib to	06140600236	Herbicide	SRS, BT

Fifth Field Watershed Name	Stream Name	Treatment Site Identification	Treatment Type	Listed Fish Species* present within Stream*
River	Tucannon River	06140600162	Herbicide	SRS, BT
	Little Tucannon River	06140600056	Herbicide	SRS, BT
		06140600057	Herbicide	SRS, BT
		06140600075	Herbicide	SRS, BT
	Tucannon River	06140600075	Herbicide	SRS, SRC, BT
		06140600083	Herbicide	SRS, SRC, BT
		06140600088	Herbicide	SRS, SRC, BT
		06140600099	Herbicide	SRS, SRC, BT
	Panjab Creek	06140600098	Herbicide	SRS, BT
Upper Walla Walla River	South Fork Walla Walla River	06140600229	Herbicide	MCS, BT
		06140600183	Herbicide	MCS, BT
Mill Creek	Low Creek	06140601356	Biocontrol	BT
	Tiger Creek	06140600261	Herbicide	MCS
		06140600271	Herbicide	MCS
Upper Touchet River	North Fork Touchet River	06140600176	Herbicide	MCS
Upper Umatilla River	North Fork Umatilla River	0614066928	Herbicide	MCS, MCC, BT
	Umatilla River	06140601361	Herbicide	MCS, MCC, BT
		06140601380	Herbicide	MCS, MCC, BT
	South Fork Umatilla River	06140600099	Herbicide	MCS, MCC, BT
		06140600166	Herbicide	MCS, MCC, BT
		06140601776	Herbicide	MCS, MCC, BT
Meacham Creek	Meacham Creek	06140600706	Herbicide	MCS, MCC, BT
Birch Creek	Pearson Creek	06140600221	Herbicide	MCS
		06140600305	Herbicide	MCS
		06140600308	Herbicide	MCS
		06140600309	Herbicide	MCS
Upper North Fork John Day River	Unnamed Trib to North Fork John Day River	06140600483	Herbicide	MCS
		06140600484	Biocontrol	MCS
Granite Creek	Granite Creek	06140500109	Herbicide	MCC, MCS
		06140500140	Herbicide	MCC, MCS
		06140500241	Herbicide	MCC, MCS
		06140500289	Herbicide	MCC, MCS
		06140500390	Herbicide	MCC, MCS
		06140500391	Herbicide	MCC, MCS
		06140500392	Herbicide	MCC, MCS
		06140500492	Herbicide	MCC, MCS
		06140500108	Herbicide	MCS
		06140500111	Herbicide	MCS
		06140500219	Herbicide	MCS
		06140500248	Herbicide	MCS
		06140500571	Herbicide	MCS
		06140500546	Herbicide	MCC, MCS
	Lick Creek	06140500155	Herbicide	MCS
		06140500195	Herbicide	MCS

Fifth Field Watershed Name	Stream Name	Treatment Site Identification	Treatment Type	Listed Fish Species* present within Stream*
	Squaw Creek	06140500559	Herbicide	MCS
	Ten Cent Creek	06140500492	Herbicide	MCS
	Unnamed Trib to Granite Creek	06140500047	Herbicide	MCS, MCC
		06140500048	Herbicide	MCS, MCC
		06140500337	Herbicide	MCS, MCC
North Fork John Day River/Big Creek	North Fork John Day River	06140500103	Herbicide	MCS, MCC
		06140500125	Herbicide	MCS, MCC
		06140500135	Herbicide	MCS, MCC
		06140500142	Herbicide	MCS, MCC
		06140500147	Herbicide	MCS, MCC
		06140500186	Herbicide	MCS, MCC
		06140500226	Herbicide	MCS, MCC
		06140500236	Herbicide	MCS, MCC
		06140500237	Herbicide	MCS, MCC
		06140500324	Herbicide	MCS, MCC
		06140500413	Herbicide	MCS, MCC
		06140500416	Herbicide	MCS, MCC
		06140500419	Herbicide	MCS, MCC
		06140500420	Herbicide	MCS, MCC
		06140500421	Herbicide	MCS, MCC
		06140500423	Herbicide	MCS, MCC
		06140500425	Herbicide	MCS, MCC
		06140500430	Herbicide	MCS, MCC
		06140500432	Herbicide	MCS, MCC
		06140500434	Herbicide	MCS, MCC
		06140500435	Herbicide	MCS, MCC
		06140500436	Herbicide	MCS, MCC
		06140500437	Herbicide	MCS, MCC
		06140500438	Herbicide	MCS, MCC
		06140500440	Herbicide	MCS, MCC
		06140500442	Herbicide	MCS, MCC
		06140500443	Herbicide	MCS, MCC
		06140500457	Herbicide	MCS, MCC
		06140500485	Herbicide	MCS, MCC
		06140500610	Herbicide	MCS, MCC
	Texas Bar Creek	06140500466	Herbicide	MCS
Desolation Creek	Desolation Creek	06140500038	Herbicide	MCS, MCC
		06140500045	Herbicide	MCS, MCC
		06140500451	Herbicide	MCS, MCC
		06140500591	Herbicide	MCS, MCC
		06140500594	Herbicide	MCS, MCC
Upper Camas Creek	Lane Creek	06140500225	Herbicide	MCS
	Bear Wallow Creek	06140500080	Herbicide	MCS
	Camas Creek	06140500012	Herbicide	MCS
		06140500576	Manual	MCS
	Bowman Creek	06140500280	Herbicide	MCS
	Hideaway Creek	06140500069	Herbicide	MCS, MCC
		06140500599	Herbicide	MCS, MCC

Fifth Field Watershed Name	Stream Name	Treatment Site Identification	Treatment Type	Listed Fish Species* present within Stream*
Lower Camas Creek	Fivemile Creek	06140500004	Herbicide	MCS
	Sugarbowl Creek	06140500004	Herbicide	MCS
North Fork John Day River/Potamus Creek	Ditch Creek	06140203122	Herbicide	
		06140203121	Herbicide	MCS
	Mallory Creek	06140203080	Herbicide	MCS
	Potamus Creek	0614026885	Herbicide	MCS
		0614026853	Herbicide	MCS
	Hinton Creek	06140500166	Herbicide	MCS
	West Fork Meadow Brook Creek	06140500060	Herbicide	MCS, MCC
		06140500215	Herbicide	MCS, MCC
		06140500298	Herbicide	MCS, MCC
	East Fork Meadow Brook Creek	06140500517	Herbicide	MCS
Wall Creek	Wilson Creek	06140200591	Herbicide	MCS
		06140201428	Herbicide	MCS
		06140203029	Herbicide	MCS
		06140203030	Herbicide	MCS
	Big Wall Creek	06140201068	Herbicide	MCS
		06140201427	Herbicide	MCS
		06140201430	Herbicide	MCS
		06140203023	Herbicide	MCS
		06140203027	Herbicide	MCS
		06140200717	Herbicide	MCS
	South Fork Big Wall Creek	06140203021	Herbicide	MCS
	Indian Creek	06140203059	Herbicide	MCS
	Little Wall Creek	06140201119	Herbicide	MCS
		06140201121	Herbicide	MCS
		06140203063	Herbicide	MCS
		06140200452	Herbicide	MCS
	Alder Creek	06140200229	Herbicide	MCS
		06140202953	Manual	MCS
	Unnamed Trib to Alder Creek	06140200176	Herbicide	MCS
	Swale Creek	06140200180	Herbicide	MCS
		06140200187	Herbicide	MCS
		06140203070	Herbicide	MCS

Probability of Herbicide Exposure (increased chemical contaminants)

The probability that an ESA listed fish will be exposed to non aquatic formulations of herbicide is very low. The probability of being exposed to the aquatic formulation of triclopyr is also very low. However, there is a possibility of being exposed to aquatic formulations of glyphosate and imazapyr but the probability of being exposed at levels of concern is very low. Glyphosate and imazapyr have a low propensity for leaching, but can enter water by other means such as overspray, drift, or erosion of contaminated soil. This probability is discussed by potential exposure vector below:

Water contamination from hand/select methods: The probability of hand-select methods resulting in herbicides coming in contact with water is low.

The plant begins to take in the herbicide immediately after it is applied directly to a leaf or stem with the use of approved binding surfactants. Overland transport to the water column from stem injections is unlikely because the injected herbicide is contained within the plant stem. Transfer through the stem to the roots might allow some herbicide to enter the soil, but it is likely to adhere to soil particles or is degraded by soil microbes before leaching into the ground water. In addition, other general protection measures of the applicators themselves result in a very low risk of water contamination.

Water contamination from drift: The ability to contaminate water varies with the herbicide application method. For example, spot and hand application methods substantially reduce the potential for loss of non-target vegetation because there is little potential for drift. Drift is most associated with broadcast treatments and can be mitigated to some extent by the applicator. Droplet size is key to drift as larger droplets are heavier and therefore less affected by wind and evaporation. Figure 5 demonstrates the relationship between droplet size and buffer distance. As droplet size increases, the distance herbicide may travel in concentrations sufficient to harm plants decreases.

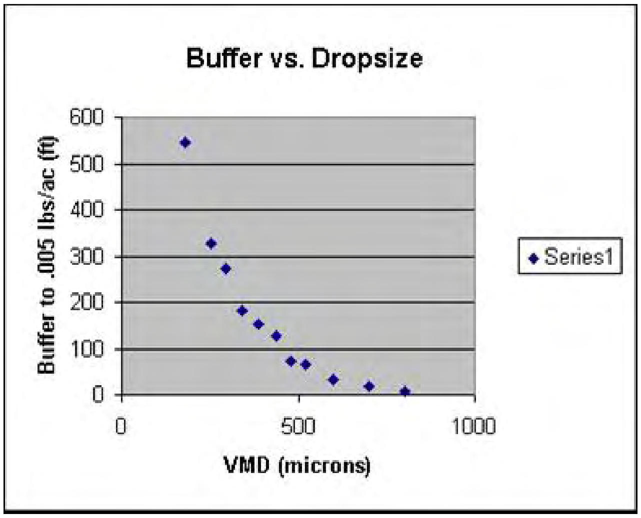
Dr. Harold Thistle, a physical scientist from the USDA in Morgantown, WV, specializes in computer modeling of herbicide drift. He modeled the potential for glyphosate to impact non-target vegetation from drift. The model predicted a 100-foot broadcast buffer would prevent glyphosate from harming plant species that are further away.

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. Wind speed restrictions also substantially contribute to a reduction in drift (Spray Drift Task Force, 2001). By simply changing the type of nozzle (diameter of pore size) used during broadcast treatments, the drift potential of herbicide can be effectively and substantially decreased as the droplet size forced out the nozzle is increased in size.

Spray nozzle pressure, the amount of water applied with the herbicide, and herbicide release height are also controllable determinants of drift potential. Weather 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 smaller particles as they fall through the air. They reduce the percentage of smaller, lighter particles that are the size most apt to drift.

Marrs, R.H., in the 1989 publication, “Assessment of the Effects of Herbicide Spray Drift on a Range of Plant Species of Conservation Interest,” examined the distances drift affected non-target vascular plants using broadcast treatment methods similar to those considered in this analysis. Their observations are consistent with drift-deposition models in which the fallout of herbicide droplets has been measured. The maximum safe distance at which no lethal effects were found was 20 feet, but for most herbicides the distance was 7 feet. Generally, damage symptoms were found at greater distances than lethal effects, but in most cases there was rapid recovery by the end of the growing season. No effects were seen to vascular non-target vegetation further than 66 feet from the broadcast treatment zone. Little information is available for how drift distances may effect non-vascular non-target vegetation. The distance spray drift will travel can vary substantially based on wind speed, topography, temperature, the herbicide applied, and the vegetation present, see Figure 10 this section.



Drift is the most likely vector for herbicides coming in contact with water from riparian area treatment sites. Some locations may have some invasive plants such as reed canary grass, or purple loosestrife growing on streambanks above ordinary high water that would be treated with a spot-spray. Such areas are limited in spatial extent, and given the distance between target vegetation and water, it is likely that much of the herbicide will have been sprayed on to the plant.

Figure 10 – Droplet Size and Drift Distance

In addition, roads that have a high potential for herbicide delivery have been identified and have added restrictions, such as no broadcasting.

Since there will be no herbicide applied directly to the water column for purposes of treating submerged or emergent vegetation the probability of even fine droplets coming in contact with water is low.

Water contamination from contaminated soil: Riparian treatments are limited in spatial extent, and given the restrictions noted above, it is likely that much of the herbicide will have either adhered to the soil or broken down not being available for transport into the water. See previous sections for more information on herbicide properties. The probability of water contamination from contaminated soil is low.

Water contamination from an accidental spill: Concentrations of herbicides in the water as a result of an accidental spill depend 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). 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. This plan would address spill prevention and containment.

Extensive monitoring of herbicide application using similar treatment methods has occurred over the last few years in NW Oregon and Western Washington. All personnel applying the herbicides are well trained and licensed. No accidental spills have been reported. The risk of an accidental spill under the Proposed Action is extremely low.

Probability of exposure to aquatic organisms: The probability of localized effects to individual aquatic plants is low since no treatments are proposed within the bankfull channel. Spot applications of aquatic formulations of glyphosate and imazapyr on streamside vegetation are not likely to result in harmful amounts coming in contact with water and harming fish, invertebrates, and algae.

The use of glyphosate will not be applied directly to water for weed control, but if it does enter the water it is bound tightly to dissolved and suspended particles and to bottom sediments and becomes inactive. The probability of exposure to aquatic organisms is low.

Direct Mortality due to Trampling: The project does not propose treatments on emergent vegetation that would require applicators to enter the water, therefore the risk of disturbing spawning adults or stepping on redds is very low.

Magnitude of the Effect

The severity and intensity of herbicides coming in contact with streams containing ESA listed fish is variable due to different application techniques and specific herbicide properties. The severity and intensity of the effect will depend on the size of stream, type of waterbody, herbicide type and its properties. Any treatment of emergent vegetation proposed in the future would require additional NEPA anlaysis.

Hand/select Methods: The magnitude of hand-select methods resulting in water contamination is discountable because the application will be directed to a leaf or stem, and the herbicide and surfactant will quickly bind to the plant material. The magnitude is predicted to be extremely low from any droplets that come in contact with water.

Drift: Drift is the most likely vector for herbicides coming in contact with water from treatments within riparian areas. However, the magnitude of drift compared to an aerial application or broadcast application, such as what was analyzed above in the SERA risk assessment worksheets, immediately adjacent to a stream is extremely low. Label restrictions, restrictions on application rate, type of herbicide, application method restrictions, buffers, and the use of a surfactant all factor in to limiting the potential amount of drift. In addition, roads that have a high potential for herbicide delivery have been identified and have added restrictions, such as no broadcasting. The magnitude of drift is expected to be very low.

Contaminated soil: Riparian treatments are limited in spatial extent, and given the restrictions on methods and type of herbicide, it is likely that much of the herbicide will have either adhered to the soil or broken down not being available for transport into the water. The intent of the Proposed Action is to apply herbicide to a plant, not to the soil. Any amount of herbicide that would indirectly come in contact with the soil as a result of drift or droplets is expected to be insignificant; therefore the magnitude of contaminated soil would be low.

Accidental spill: The probability of an accidental spill for this project is low. If a spill were to occur, the magnitude is limited by Project Design Features, where only daily use quantities of herbicides will be transported to the project site, transport via watercraft will require extra precautions, impervious material will be placed over mixing areas in such a manner as to contain any spills associated with mixing/refilling, and the requirement that a spill kit will be on site during all herbicide application

Aquatic Organisms: The potential to reach toxicity levels for each trophic level under spot and hand/select applications with glyphosate and imazapyr is low. Localized effects would not disrupt aquatic ecosystem function of the aquatic food web because spot applications of aquatic formulations of glyphosate and imazapyr are not likely to result in harmful amounts coming in contact with water and harming fish, invertebrates, and algae. However, some aquatic plants could be damaged if enough herbicide comes in contact with the aquatic plant. It is believed that the magnitude of effect to fish as a result of local aquatic plant mortality is extremely low because there will not be enough herbicide coming in contact with water to result in extensive aquatic plant mortality.

Trampling: The probability of stepping on a redd while wading across a stream to access either the opposite streambank is low. Should an individual wade across a stream and accidentally step on a redd, then there is the possibility of impacting individual eggs in the gravel. The magnitude of effect from accidentally stepping on a redd is limited to the amount of eggs in the gravel that are impacted from the actual weight of the person and disturbance to the redd itself (i.e., shifting of the gravel, etc), thus leading to a negative impact to individual egg(s). An egg can be dislodged and eaten by a predator, or smashed between gravel or amongst other eggs, which can impede successful development of eggs. Although there are few scenerios where workers would need to cross a live stream, each egg has the potential to contribute to the overall success of a returning population, therefore, the magnitude of effect from accidentally stepping on a redd is high. (Magnitude is high)

Distribution: Refer to Table 48 for a list of treatment sites within aquatic influence zones. Effects, if they occur, would be limited in scope and widely scattered due to the patchy nature of the infestations. The distribution of effects will be small and scattered throughout UNF.

Frequency: The proposed treatments would occur over the next 15 year period and the acreage treated is expected to decline as long as funding is available and patches are eradicated. The programmatic nature of the Proposed Action is the treatment of future unknown infestations. It is expected that the frequency of herbicide use will be low given that treatment of invasive plants is an activity composed of integrated methods (i.e., mix of non-herbicide and herbicide methods) to facilitate effectiveness.

Duration: Any herbicides coming in contact with water are expected to be short-term events that subside quickly due to the stream volumes moving through the area (pulse effect). Herbicide coming in contact with smaller streams containing extensive riparian infestations is a high risk because of the need for simultaneous treatment and lower volumes of water. Given the properties of glyphosate and imazapyr, it is unlikely that these two active ingredients would persist long enough in the environment to harm ESA fish. A simultaneous treatment is believed to be a short-term event whose effects subside immediately because of the herbicide properties and factors that push a concentration up would be off-set by those that push the concentration down.

Timing: Most of the treatments would likely occur in the summer when eggs of all the listed species would not be in the gravel and only rearing life stages are present. However, there is a potential for some treatments to occur in fall or spring when chinook salmon or steelhead may be spawning adjacent to treatment sites. There is also the potential for some treatments to occur in late summer or early fall when bull trout are spawning. Since no treatments are proposed below bankfull, there is a low probability of accidentally stepping on a redd and displacing spawning fish.

Summary of Effects to the Chemical Contamination Indicator

Treatment of emergent vegetation with aquatic formulations of glyphosate and imazapyr may lead to some minor amounts of herbicide droplets coming in contact with water. Fish may be exposed to these minor amounts of herbicide in smaller streams, especially when treatment needs to take place during spawning activities. The need to treat during spawning or accidentally stepping on a redd is limited in spatial and temporal extent. Fish in the mainstem of rivers and streams may not be exposed because of the river's large flow and density of fish during time of treatment. Smaller streams however, do not have as much flow and may not dilute herbicides as quickly. Fish in smaller streams tend to be juveniles and fry, and are also lower in density, thus lowering the potential for exposure. Although there is a probability for herbicide to come in contact with water in proximity to ESA fish, the magnitude of the effect from the amount of herbicide ESA fish are exposed to is low.

The magnitude of effect from disturbance to breeding/spawning and/or accidentally stepping on a redd is also low, since no emergent vegetation is proposed for treatment.

Restrictions on method, type, and location serve to limit the potential amount of herbicides that may come in contact with water where fish or other aquatic organisms are present, even if an unexpected storm occurred shortly after treatment. The amount of herbicide that would be available for runoff, leaching and/or drift is necessarily limited by restrictions on broadcast use. Spot and hand/select treatments do not have high potential to deliver herbicide because the treatments are directed at target vegetation and herbicide is quickly taken up by the plant.

The likelihood of meeting or exceeding levels of concern for fish is extremely low because herbicide use in the aquatic influence zone is limited to typical application rates, application methods are restricted to spot or hand/select, buffers on broadcast applications and other methods, Project Design Features, and low potential for herbicides proposed for use near water to move through soils.

Sediment/turbidity

The presence of people or crews with spot spray or hand/select tools along streambanks could lead to localized, sediment/turbidity to fish habitat because of trampling, soil sloughing due to stepping on banks. However, amounts of potential localized sediment/turbidity would be negligible because the invasive plant populations on the Umatilla National Forest are not extensive enough to result in significant sediment/turbidity. Effective invasive plant treatment and restoration of treated sites would improve the function of riparian areas and lead to improved fish habitat conditions.

Under the Proposed Action, significant removal of riparian invasive species would not occur because of the proposed use of herbicides reducing the potential for significant soil disturbance. While the relative amounts of spot and hand/select methods vary, the differences in terms of effects from such treatments are negligible.

Proximity

The amount of sediment created by herbicide treatments is anticipated to be insignificant because the methods of treatments do not include ground disturbing activities by heavy equipment. There will be no ground disturbing activities associated with spot or hand/select methods.

Probability and Magnitude

There is a possibility that some minor bank erosion may occur in locations where invasive plants have taken over a streambank, especially in smaller streams. For example, killing knapweed with an herbicide would devegetate a portion of the streambank and result in a loss of roots that help to hold soil particles together. This may expose streambanks at higher flows and result in some erosion. The total spatial extent of heavy infestations along streambanks within the action area is low. The amount of sediment released into any particular stream reach would depend on how extensive a particular invasive plant patch is and how close the invasive plant is to the actual wetted perimeter of the channel. Exposed streambanks are expected to revegetate during the spring/summer following treatment. In addition, site restoration and revegetation methods preclude erosion as a result of herbicide treatment. It is expected that most patches would be relatively small and any erosion negligible.

The probability of sedimentation and turbidity as a result of herbicide treatments is extremely low, therefore the magnitude of effect to listed fish and/or critical habitat is low.

GLEAMS Model Estimates for Blue Mountains Ecotype

The R6 FEIS Fisheries BA considered whether ecosystem conditions associated with a variety of bioregions (ecotypes) might affect herbicide concentrations/hazards predicted using the GLEAMS model. The BA found that risk assessment modeling tends to estimate water contamination rates adequately for undisturbed forested vegetation types within the Blue Mountains ecotype (Umatilla National Forest fits this ecotype). Modeling an agricultural field would more adequately model the other vegetation types and would tend to underestimate water contamination rates in these circumstances. At higher stream flows (larger stream channels or wet season flow conditions), risk assessment model predictions tend to overestimate the herbicide concentration in most local streams. For smaller streams, other factors considered have a more pronounced effect than for larger streams.

Based on the modification of the SERA GLEAMS stream herbicide concentration predictions by local factors in the Canyon Creek area, results in the R6 2005 FEIS identified the potential for increase in concern with picloram, glyphosate, and triclopyr for fish. There was also an increase in concern for aquatic macrophytes with chlorsulfuron, glyphosate, imazapic, metsulfuron methyl, triclopyr and picloram; for invertebrates with glyphosate and triclopyr, and for aquatic plants with chlorsulfuron, glyphosate (with surfactant only), metsulfuron methyl, picloram and triclopyr. The R6 2005 Record of Decision (ROD) specifically limited triclopyr to spot and hand methods (no broadcast of triclopyr allowed as per standard 16) to avoid scenarios of concern related to triclopyr.

In general, situations that increased concern for potential effects to aquatic species from the level of risk stated in the SERA risk assessments occurred for smaller stream channels with steeper side slopes, with risk increasing at higher altitudes. Conversely, risk lower than that stated in the risk assessments was identified for larger stream channels at lower altitude, and possibly in smaller stream channels with sideslopes less than 10 percent.

Slopes in the Canyon Creek watershed are generally the 10 percent modeled, and herbicide delivery to streams could be expected to increase significantly. Local soil types do not appear to markedly change expected herbicide delivery for most herbicides likely to be applied in the watershed, except in disturbed areas using highly soluble herbicides that do not bind well with soil particles, such as picloram and chlorsulfuron.

Because all of the action alternatives avoid broadcasting within 50 feet of any stream (wet or dry), the GLEAMS model would still overestimate the amount of herbicide that would enter water, because:

- Spot and selective methods would only be used within 100 feet of wet streams and 50 feet of dry streams. These methods substantially reduce potential for off site impacts, drift, and other herbicide delivery mechanisms to water (runoff, leaching). Applicators can immediately respond to site conditions to ensure PDFs are followed as planned.
- The model does not account for vegetation uptake of herbicide (the entire label rate is assumed to be subject to run off). The herbicides allowed for use within the Aquatic Influence Zone are rapidly taken up by plants and/or bind to soil and would not be available for runoff soon after application.
- PDFs do not allow broadcast on roads with high potential to deliver herbicide, which also significantly reduces the potential for herbicides to reach streams in concentrations predicted by the GLEAMS model scenarios.

Previous Monitoring Studies

Berg, N. (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 1to 3 mg/m3) (ibid).

In South Carolina, 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, 2003). No detection limits were given.

Even smaller buffers have successfully protected water quality. For example, where imazapyr was aerial sprayed without a buffer, the stream concentration was 680 mg/ml. With a 15-meter buffer, the concentration was below detectable limits (Berg, 2004). No detection limits were given.

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 (ibid.) as would occur under the Proposed Action. If a large rainstorm occurs sediment contaminated by herbicide could be carried into streams.

Project Design Features require no forecast rain for 24 hours after application to allow the herbicide to adhere to the plant, give time for the plant to uptake the herbicide and to minimize risk of herbicide being washed from the plant.

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 forest is heavily vegetated so there is less bare soil for movement by wind.

Designated Critical Habitat

Invasive plant treatment would have many beneficial effects on critical habitat for federally listed fish species. In the long-term, treatment of invasive weeds on the Umatilla National Forest would increase native vegetation growth and successional patterns leading to cover and food. Thus, it improves essential habitat features for federally listed fish species. Potential downstream effects to critical habitat for bull trout are not likely given the PDFs that limit the potential for herbicide concentrations coming in contact with water where fish are present. Information here complements the analysis provided for non-herbicide treatment methods.

In 1996, NMFS developed a methodology for making ESA determinations for individual or grouped activities at the watershed scale, termed the "Habitat Approach". A Matrix of Pathways and Indicators (MPI) was recommended under the Habitat Approach to assist with analyzing effects to listed species. The MPI was used by the Umatilla National Forest in previous years to analyze project effects on listed fish species.

When using the MPI, project effects to the Pathways (significant pathways by which actions can have potential effects on anadromous salmonids and their habitats) and Indicators (numeric ratings or narrative descriptors for each Pathway) are used to determine whether Proposed Actions would damage habitat or retard the progress of habitat recovering towards properly functioning condition.

The Sept. 2, 2005 designated critical habitat Primary Constituent Elements (PCEs) pertinent for analysis on the Umatilla National Forest's freshwater habitats include spawning sites, rearing sites, and migration corridors. The Habitat Approach's Matrix of Pathways (MPI) has numerous habitat-associated Indicators that closely "cross-walk" with the PCEs of the Sept 2, 2005 designated critical habitat. Table 49 displays a "cross-walk" between the MPI and PCEs used to assess effects on designated critical habitat.

Table 49 - MPI for Primary Constituent Elements Crosswalk

Primary Constituent Elements	Matrix of Pathways and Indicators
Spawning Habitat, as defined by water quality, water quantity, substrate	**Water Quality**: Temperature, Suspended Sediment, Substrate, Chemical Contaminants and Nutrients **Flow/Hydrology**: Change in Peak/Base flows **Habitat Elements**: Substrate/Embeddedness
Rearing as defined by adequate water quantity and floodplain connectivity	**Channel Conditions and Dynamics**: Floodplain connectivity **Flow/Hydrology**: Change in Peak/Base flow
Rearing as defined by adequate water quality and forage	**Water Quality**: Temperature, Substrate **Habitat Elements**: Large Woody Debris, Pool Frequency and Quality, Off-channel Habitat
Rearing as defined by adequate natural cover	**Habitat Elements**: Large Woody Debris, Pool Frequency and Quality, Large Pools, Off-channel Habitat
Migration as defined by habitat free of artificial obstructions, and adequate water quality, water quantity, and natural cover	**Habitat Access**: Physical Barriers **Water Quality**: Temperature **Flow/Hydrology**: Change in Peak/Base flow **Habitat Elements**: Large Woody Debris, Pool Frequency and Quality, Large Pools

The following is an analysis of the effects on Primary Constituent Elements of the Sept. 2, 2005 designated critical habitat, as determined via analysis of MPI indicators. Please refer to the hydrology analysis for effects on Riparian Condition and Water Quality, Lakes, Wetlands and Floodplains.

Habitat Indicator Effects

- **Pathway: Water Quality**
- **Indicator: Temperature**
- **PCE Crosswalk: Spawning, Rearing, Migration habitat PCEs**

Stream temperature is controlled by many variables at each site. These include topographic shading, stream orientation, channel morphology, discharge, air temperature, and interactions with ground water, none of which would be influenced by invasive plant treatments.

Treatment of invasive plants using integrated methods, specifically herbicides, along small streams may increase solar radiation at a localized level (i.e. on a small portion of a stream) if invasive plants are the only source of shade. Where invasive plants provide the only source of shade on small streams, removing 100 percent of the shade producing cover can change forest floor microclimates and water temperature at the localized level.

However, the precise effects to water temperature from treating invasive plants would depend on the size of the stream, how close to the stream a treatment site is, how much is treated along the stream, and what vegetation is currently available to shade the stream.

Removal of invasive plants from the banks of small, intermittent streams would not affect temperature because they are dry during the hottest time of the year, relative size of the infestation is small within context of the watershed, and more than likely there is overstory canopy present. Conditions would have to mimic post wildfire in order to impact stream temperatures.

On larger perennial streams, a significant amount of vegetation would need to be removed to change water temperature and shade would have to be provided only by the invasive plant removed – a situation that is not likely on the Umatilla National Forest. 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 prohibit broadcast applications within 100 ft. of wet perennial and intermittent waterbodies, and along roads that have a high likelihood of transporting herbicides to streams to prevent any potential adverse affects to stream channels or water quality conditions. This PDF will protect overhanging vegetation and smaller trees that are currently providing shade closest to the stream and other waterbodies. The treatment of invasive plants outside of the 100 ft buffer should have no affect on stream temperature because it is unlikely that vegetation growing 100 feet from the stream is providing enough shade to influence water temperature.

The US Environmental Protection Agency under the Clean Water Act (CWA) of 1972 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.

For water quality limited streams on National Forest lands, the Forest Service provides information, analysis, and site-specific planning efforts to support state processes to protect and restore water quality. The Regional Pacific Northwest Region Invasive Plan EIS and the Umatilla National Forest Plan both include standards and guidelines and other management measures designed to protect and improve water quality. This project adheres to all of the above protection measures and adds site specific design criteria to further protect water quality, meeting the requirements of the Clean Water Act.

There are eleven streams the Umatilla Invasivive Plants treatment area on the 303d list (See Table 35 in Chapter 3.4.2 above). All are listed for temperature.

- **Pathway: Water Quality**
- **Indicator: Sediment/Turbidity**
- **PCE Crosswalk: Spawning habitat PCEs**

Herbicide treatment methods that would be utilized within the Aquatic Influence Zone include spot-spray and hand applications. These treatment methods are unlikely to produce sediment because very little ground disturbance would take place.

Manual and mechanical treatments are also unlikely to contribute sediment. Manual labor such as hand pulling may result in localized soil disturbance, but increases of sediment to streams would likely be undetectable. Not all vegetation in a treated area would be pulled or removed, so some ground cover plants would remain. Not all sediment from pulling weeds along roads would reach a stream because many relief culverts intercept ditch flow and drain it on to the forest floor away from streams. Handpulling is very labor intensive and costly. Thus, few acres per year could be treated using this technique across a watershed.

When compared to the total acres within a watershed, project-related soil disturbance from handpulling would be negligible.

Utilizing a combination of manual, mechanical and herbicide treatments, rather than manual alone, would limit the potential for excessive trampling of streambanks.

- **Pathway: Water Quality**
- **Indicator: Chemical Contaminants/Nutrients**
- **PCE Crosswalk: Spawning habitat PCEs**

The most likely routes for herbicide delivery to water are potential runoff from a large rain storm soon after application, especially from treated roadside ditches as well as drift from aerial spraying. Project Design Features were designed to control drift and overspray of headwater streams. PDF E3 requires that fueling would not occur in RHCAs. F5 requires that herbicide applications occur when winds are between 2 and 8 miles per hour. F6 requires coarse droplet size to minimize drift. F8 requires that aerial units be ground checked and water features marked and buffered before application. Buffers of 300 feet are required on perennial or wet intermittent streams and wetlands, and 100 feet buffers are required on dry channels. Based on buffer effectiveness documented by Rashin and Graber (1993) and Dent and Robben (2000) concentrations of herbicides reaching streams are expected to be well below concentrations of concern to beneficial uses.

Boom or hand broadcast treatments with Aquatic Influence Zones would be limited to herbicides posing low levels of concern for aquatic organisms. Herbicides considered high risk to aquatic organisms would not be applied using any method within 15 feet of ditches that feed streams, or 50 to 100 feet from intermittent streams, even when ditches or intermittent streams are dry. These buffers are considered adequate to minimize herbicide concentrations in water because, buffer studies in forested areas (Berg, 2005) show that buffers greater than 25 feet commonly lower herbicide concentrations below any threshold of concern and often below detectable limits.

Glyphosate and imazapyr are the only herbicides used for spot spraying below bankfull along perennial channels. Glyphosate is highly water soluble, but because it adheres tightly to soils is unlikely to be carried into a stream unless the soil particle is carried into the stream. This is unlikely to happen during the late spring or summer when herbicides would be applied because there is less rain in the summer and more vegetation growth to hold soil particles in place. Imazapyr is only moderately water soluble and forest field studies have not found it very mobile in soils (Soil and Hydrology Analysis).

Herbicides entering surface water through surface runoff are also expected to be minimal, since targeted spot spraying techniques would be used to apply herbicide within 100 feet of surface water. This would minimize the amount of herbicide reaching the ground surface as well as minimize the potential for herbicide drift. No herbicides considered high risk to aquatic resources would be broadcast within 100 feet of streams and none would be spot sprayed within 50 feet of streams

- **Pathway: Channel Condition & Dynamics**
- **Indicator: Floodplain Connectivity**
- **PCE Crosswalk: Rearing habitat PCE**

Some invasive plant treatments can have positive effects on floodplains and streambanks when infestations of invasive plants on valley bottom areas are removed. Valley-bottom infestations often encroach on floodplains where road-related and recreational activities have led to the establishment of invasive plant populations.

Removal of such infestations is expected to benefit aquatic and terrestrial communities in the long term by increasing floodplain area available for nutrient, sediment and large wood storage, and flood flow refugia. There is no risk of negatively impacting channel condition and dynamics as a result of treating invasive plants.

- **Pathway: Habitat Access**
- **Indicator: Physical Barriers**
- **PCE Crosswalk: Migration habitat PCE**

Invasive plant treatments will not create physical barriers or otherwise degrade access to aquatic habitat.

- **Pathway: Habitat Elements**
- **Indicator: Substrate/Sediment**
- **PCE Crosswalk: Spawning, Rearing habitat PCEs**

Invasive plant treatments are not expected to affect substrate composition. All PDFs that minimize sediment would be implemented, such as no heavy equipment within riparian areas. These practices would reduce, but not eliminate sediment. Some sediment may enter stream channels as a result of extensive manual labor and could result in exposed soils. The amount of sediment that enters a stream is expected to be small, infrequent, of short duration, and at a localized level. Localized increases in fine sediment in gravels or along channel margins may be seen at the immediate treatment site. However, substrate quality would not decrease over time because treatment of invasive plants would not result in a chronic sediment source. Diffuse and spotted knapweeds are found along many streams in the Forest. Lacey et al. (1989) reported higher runoff and sediment yield on sites dominated by knapweed versus sites dominated by native grasses. Therefore reestablishment of native vegetation would provide long-term benefit to sediment levels in aquatic habitat.

- **Pathway: Habitat Elements**
- **Indicator: Large Woody Debris, and Pool Area, Quality and Frequency**
- **PCE Crosswalk: Spawning habitat PCE**

Treatment of invasive plants would not impact pool area, quality and frequency. Treatment of invasive plants in RHCAs would not impact current wood debris in streams. The PDF that establishes a 100 foot buffer for broadcast applications provides protection to the recruitment of conifer seedlings within riparian areas which will sustain channel and habitat features in the future. Controlling invasive plants would allow for reestablishment of native vegetation, allowing riparian stands over time to develop larger recruitment trees, increasing the size and quantity of inchannel debris. The use of spot-spray applications of aquatic glyphosate and aquatic imazapyr may result in some minor non-target vegetation impact because of drift. However, the amount necessary to drift into the entire riparian area and kill trees is not possible with spot-spray applications.

- **Pathway: Flow/Hydrology**
- **Indicator: Change in Peak/Base Flows**
- **PCE Crosswalk: Spawning, Rearing, Migration habitat PCEs**

None of the treatments are extensive enough under any alternative to effect peak flows, low flows or water yield. Methods used for treatment would have negligible effect on water infiltration into soil and associated surface runoff.

No 5th field watershed has more than 2.5 percent proposed for treatment and most have less than one percent. This amount is much too small an area to show effects to flows from treatment

Cumulative Effects

Cumulative effects include the effects of future State, tribal, other federal, local or private actions that are reasonably certain to occur within the action area of the Federal action subject to consultations (50 CFR 402.02). The “reasonably certain to occur” clause is a key factor in assessing and applying cumulative effects and indicates, for example, actions that are permitted, imminent, have an obligation of venture, or have initiated contracts (U.S. Fish and Wildlife Service and National Marine Fisheries Service, 1998). Past and present impacts of non-Federal actions are part of the environmental baseline.

Only the land and roads within the National Forest system would be treated in the action alternatives proposed by this EIS. The Forest, however, is intermingled with other federal, state, county, and private ownerships. Management activities and actions on neighboring lands may contribute to spread or containment of invasive plants on National Forest system lands, and vice versa.

Herbicides are commonly applied on lands other than National Forest system lands for a variety of agricultural, landscaping and invasive plant management purposes. Herbicide use occurs on tribal lands, state, county and other Federal lands, private forestry lands, rangelands, utility corridors, road rights-of-way, and private property. No requirement or central reporting system exists to compile invasive plant management information on or off National Forests in Oregon or Washington. Therefore, accurate accounting of the total acreage of invasive plant treatment for all land ownerships is unavailable. However, risk assessments indicate no measurable amounts would be in the waters adjacent to the treatment area. Project PDFs also are designed to reduce the chance of drift reaching streams minimizing direct and indirect effects. Treatments from this project would not likely cause a measurable change when combined with treatments on private lands.

Local County Noxious Weed Boards continue to focus on priority weeds that pose a risk to high valued areas, such as riparian corridors and recreational lakes. It is expected that joint partnerships between the Umatilla NF and local counties would work cooperatively to treat invasive plants. Forest Service standards described in this document will be incorporated into official participating agreements, challenge cost-shares, and in contract clauses. All contracts require an inspector to ensure that Forest Service standards are being met.

The Proposed Action is unlikely to have significant effects to fish and their habitat. It is unlikely that effects from proposed treatments would approach a threshold of concern; therefore, the Proposed Action would not contribute to significant cumulative effects.

Alternative C – No Broadcast within Riparian Habitat Conservation Areas (RHCAs)

Direct and Indirect Effects

The effects from treatments under this alternative are analogous to those of Alternative B except no broadcast would occur within RHCAs. Alternative B proposes 2,743 acres of broadcast within the RHCAs. Potentially these areas would be treated with mechanical or manual methods under Alternative C.

Not broadcasting herbicides within RHCAs would reduce the potential for contamination of water; however, utilizing manual and mechanical methods within these treatment areas could increase risk of sediment delivery to streams. As the main methods are mowing and cutting or pulling weeds, and the areas to be treated are between 100 and 300 feet from a stream, effects from manual and mechanical treatment on streams would be negligible. These areas could also potentially be treated with herbicides using spot or hand methods of application. Spot spraying is more targeted to specific plants; therefore less non-target vegetation would be removed resulting in more groundcover. Retaining as much groundcover as possible would lower the potential for sediment delivery to streams. Spot spraying also reduces the amount of herbicide that comes in contact with soil resulting in less herbicide available for runoff into streams.

Cumulative Effects

The cumulative effects are the same as those discussed under Alternative B

Alternative D – No Aerial Application of Herbicide

Direct and Indirect Effects

The effects from treatments under this alternative are analogous to those of Alternative B except no aerial application of herbicides would occur. Alternative B proposes 675 acres of aerial application. These acres would need to be treated by other methods. Under this alternative there would be a lower risk of herbicide contaminating water due to drift, however many of these areas are in remote locations where manual and mechanical treatments would not be feasible due to cost or safety. In those areas no treatment would occur and invasive plants would be allowed to spread.

Cumulative Effects

The cumulative effects are the same as discussed under Alternative B.

Effects Determinations

The effects determinations below are based on effects that have a reasonable probability of occurring due to invasive plant treatments within the action area, and conducted according to the Standards in the R6 FEIS and Project Design Features in the action alternatives.

The potential for sublethal effects to fish from herbicide exposure was considered and addressed in the R6 2005 FEIS. Because there is insufficient data on the herbicides included in the action alternatives to conclude that there may or may not be sublethal effects, the 1/20th of the NOEC values were used in the SERA risk assessments to account for the potential of sub-lethal effects from those herbicides that could potentially reach streams with listed and sensitive fish. The lack of information on sub-lethal effects did not affect our ability to make determinations of effects to listed species because of the degree of risk for herbicides coming in contact with water at levels of concern.

Effects from the action alternatives are expected to vary because of proximity to water, species occurrence, life stage present, and herbicide properties. Some treatments completely outside of the aquatic influence zone with no mechanism for herbicide delivery fall under a "no effect" determination. However, spot treatments up to the water's edge and along intermittent streams have the potential to deliver aquatic glyphosate and aquatic imazapyr to water.

These treatments are not likely to adversely affect fish and their habitat because treatments have been designed to minimize introduction of herbicide into aquatic habitats as well as avoid substantial amounts of sedimentation. Toxic levels of herbicides are unlikely to enter streams or lakes due to the ability to alter application methods and distance from water, timing, active ingredients and formulations, and other project design features.

Effects to immediate streamside cover cannot be avoided and there may be small droplets of aquatic glyphosate and aquatic imazapyr coming in contact with water. For example, treatment of riparian species growing along the streambank (above ordinary high water) may result in insignificant amounts of aquatic glyphosate and aquatic imazapyr in water 24 hours after treatment. Any treatment method, could introduce minor amounts of sediment and/or herbicide into adjoining waters as result of spot/hand applications, manual/mechanical plant removal, stream bank trampling, and planting. Effects from these activities are expected to be insignificant and therefore, discountable.

Herbicide Treatment, Non-Herbicide Treatment, and EDRR

Table 50 - Effects Determination for Herbicide Treatments, Non-Herbicide Treatments, and EDRR

Species	Status	Determination
Snake River Basin Steelhead	Threatened	MA-NLAA
Middle Columbia River Steelhead	Threatened	MA-NLAA
Snake River Spring/Summer Run Chinook Salmon	Threatened	MA-NLAA
Snake River Fall Run Chinook Salmon	Threatened	MA-NLAA
Columbia River Bull Trout	Threatened	MA-NLAA
Middle Columbia River Spring Run Chinook Salmon	Sensitive	MII
Redband Trout	Sensitive	MII
Westslope Cutthroat Trout	Sensitive	MII
Margined Sculpin	Sensitive	MII

NE=No Effect; MA-NLAA = May Affect, Not Likely to Adversely Affect; MA-LAA = May Affect, Likely to Adversely Affect
NI = No Impact; MII = May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing; LRLV = likely to result in a loss of viability in the planning area, or in a trend toward federal listing.

Rationale for Determination

- Assumptions used for analyzing the worst case situations on UNF are beyond the Proposed Action (PDFs and buffers) and ground conditions on UNF, thus grossly overestimating potential exposures.
- Invasive plant treatments (herbicide and non-herbicide) and site preparation for revegetation can result in insignificant amounts of localized sediment due to trampling and removal of plant roots,
- Some herbicides could be introduced into the water indirectly from spot-spray and may impact aquatic plants at the immediate site. However, it is unlikely that a significant amount of aquatic

plants would be adversely affected to the degree of impacting an entire food chain in the aquatic ecosystem and indirectly harming a fish.

- Within the aquatic influence zone, aquatic formulations of glyphosate or imazapyr would be spot sprayed on plants, and could be indirectly delivered to water. However, spot applications reduce the potential to reach any expected exposure concentration of concern.
- Invasive plant treatments could temporarily reduce streamside vegetation (albeit non-native and low quality) that provides cover for fish. However, it is unlikely that removal of invasive plants providing cover along streams containing federally listed fish would lead to significant losses of cover. Removal would be localized (plants surrounding target plant) and overhead story would still provide cover via shade and future input of woody material.
- The potential for non-aquatic formulations of herbicide coming in contact with water is very low under the Proposed Action
- Biological controls will not influence any of the pathways for effects to federally listed fish or their habitat.
- Project Design Features significantly reduce the potential for herbicides coming in contact with water where there are federally listed fish present, if any were to come in contact with water the amounts would be far below levels of concern and potentially not at detectable levels.
- Localized effects from invasive plant treatments will be insignificant and discountable, yet still allow for restoration of important native riparian habitat.
- Water flow in streams quickly dilutes herbicide, reducing the potential for herbicide exposure, and dissipates any sedimentation as a result of invasive plant treatments and revegetation.
- Transitory water quality impact, if any, would be limited to the point of contact with water and not an entire stream reach
- No emergent vegetation is proposed for treatment.
- EDRR does not include aerial herbicide application.

NE=No Effect; MA-NLAA = May Affect, Not Likely to Adversely Affect; MA-LAA = May Affect, Likely to Adversely Affect
NI = No Impact; MII = May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing; LRLV = likely to result in a loss of viability in the planning area, or in a trend toward federal listing.

Determination for Critical Habitat

Under existing Forest Service standards and guidelines, projects implemented under the Proposed Action cannot have a negative impact, in the long term, on riparian-dependent resources or ecological processes in RHCAs at the watershed scale. Each project must maintain or restore the physical and biological processes required by riparian dependent-resources at the watershed scale or broader to comply with PACFISH.

The potential, site-specific effects from implementation of the action alternatives on critical habitat was evaluated when addressing effects to Riparian Condition and Water Quality, Lakes, Wetland, and Floodplains (in Hydrology section).

The implementation of PDFs in the Proposed Action will reduce adverse affects to listed species' habitats during herbicide and non-herbicide treatment methods to a minimum, as discussed below and throughout this BE.

Water Quality Indicators: Changes in water temperature resulting from herbicide use to control invasive plants would be negligible to non-existent. Invasive plants provide little to no shade to streams, and the risk for adverse affects to native vegetation is low with backpack or hand operated sprayers. Removal of solid vegetation stands by herbicide treatment may result in short-term, insignificant increases in surface erosion that will diminish as vegetation re-establishes treated areas. No large-scale changes in land cover conversions or stand structure (e.g. timber to grass) will result from chemical invasive plant control as proposed in this project. Herbicide treatment of invasive plants is expected to result in a low risk of water contamination because of standards in the R6 FEIS, with additional PDFs in the Proposed Action. Site-specific soil characteristics, proximity to surface water and local water table depth were used to determine herbicide formulation, size of buffers, and application method and timing. Only those herbicides registered for aquatic use are allowed near streams or surface water with limitation on application and timing.

Habitat Access Indicators: Implementation of the Proposed Action would not create physical barriers to listed aquatic species.

Habitat Element Indicators: Implementation of the Proposed Action would not significantly affect substrate, large woody debris, pool quality, off-channel habitat, and refugia at the watershed scale. Large trees that provide shade and large wood would not be impacted by the use of herbicides as proposed under the Proposed Action.

Channel Condition Indicators: Implementation of the Proposed Action would result in reduction of invasive plants within riparian areas and along streambanks. Any impacts to streambank stability are expected to be localized, of low intensity and duration, and not significantly affecting fish habitat. Reduction of invasive plants along streambanks and riparian areas will benefit native plant species and result in improved streambank stability and riparian condition in the long-term.

Flow/Hydrology Indicators: Implementation of the Proposed Action is expected to result in no measurable effect to peak/base flow or water yield of watersheds.

Watershed Condition Indicators: No new roads or watershed scale disturbances are expected to result from the use of herbicides to treat invasive plants.

Invasive and noxious plants are a threat to overall watershed ecological condition. Long-term beneficial effects from the reduction of invasive plants in riparian areas, wetlands, and streams and subsequent increases in desirable vegetation will result in improved watershed conditions. The effect determination for proposed critical habitat of Columbia River Bull Trout, Snake River Spring/Summer Run Chinook Salmon, Snake River Fall Run Chinook Salmon, Snake River Basin Steelhead, and Middle Columbia River Steelhead is “may affect, but not likely to adversely affect.” These determinations are based on potential effects to the primary constituent elements, including the following:

- Although, invasive plant treatment projects may be conducted in close proximity to designated critical habitat, the potential to impact any of the PCEs at significant levels is very low.
- Invasive plant treatment projects are not expected to create sediment that may adversely affect embeddedness and availability of suitable substrate in localized areas.
- Only aquatic formulations of glyphosate and imazapyr are likely to come in contact with water inhabited by listed fish and amounts or concentrations would more than likely be negligible or below a level of concern, and will not impact available food resources.
- Non-aquatic formulations of herbicides are not likely to enter streams with designated critical habitat because of buffers and restrictions of herbicide use on roads that have high potential for herbicide delivery.

Invasive plant treatments are not expected to create significant amounts of sediment leading to direct or indirect adverse effects to habitat. Any increase in sediment would be localized given that herbicides would be used as opposed to heavy machinery. Manual and mechanical removal is not expected to create measurable amounts of sediment. Invasive plant treatments conducted in critical habitat would help to restore or maintain the native riparian vegetation that is essential to maintaining the primary constituent elements of the critical habitat in the long-term.

Conclusion

The R6 2005 FEIS and Fisheries Biological Assessment analyzed the risk of herbicide use to aquatic plants, algae, macroinvertebrates and fish, including listed species. The analysis relied on SERA Risk Assessments (1997a, 1997b, 1999a, 1999b, 2001a, 2001c, 2003a, 2003b, 2003c, 2003d, 2003e, 2003f) to determine effects to fish and other aquatic organisms if herbicide is delivered to streams and other water bodies. The Project Design Features (PDFs) listed in Chapter 1 were developed to avoid scenarios of concern to fish species of local interest considering the R6 2005 FEIS analysis and local conditions. These restrictions go beyond label requirements by limiting the amount and type of herbicide that may be used adjacent to waterbodies or along roads with high potential to deliver herbicide to streams and other water bodies. The only herbicides proposed for use where there is a likelihood of indirect delivery to water are aquatic formulations of glyphosate, imazapyr, and triclopyr. Refer to Table 7, Table 8 and Table 9 for buffers and acceptable use of herbicides adjacent to waterbodies. For example, spot application within 15 feet of streams is limited to the aquatic formulations of glyphosate and imazapyr.

Herbicides can disappear from treated water by dilution, adsorption to bottom sediments, volatilization, absorption by plants and animals or by dissipation. Dissipation refers to the breaking down of an herbicide into simpler chemical compounds. Herbicides can dissipate by photolysis (broken down by light), hydrolysis, microbial degradation, or metabolism by plants and animals. Both dissipation and disappearance are important considerations to the fate of herbicides in the environment because even if dissipation is slow, disappearance due to processes such as adsorption to bottom sediments makes a herbicide biologically unavailable. For example, glyphosate is not applied directly to water for weed control, but when it does enter the water it is bound tightly to dissolved and suspended particles and to bottom sediments and becomes inactive, posing a very low risk to fish, the aquatic food web, and critical habitat.

The likelihood that fish or other aquatic organisms may be impacted under the worst-case situations analyzed for the Proposed Action is very low. Any use of herbicide in Aquatic Influence Zones or along roads with high potential to deliver herbicides is associated with some risk, however the degree of risk is very low given the Project Design Features for the Proposed Action.

Adverse effects to fish under the worst case situations are not likely to occur because any herbicide or sediment that came in contact with water, regardless of the amount, would be quickly washed downstream and diluted. Based on the R6 2005 FEIS, the potential to reach levels of concern for invertebrates and aquatic plants is expected to be low and herbicides coming in contact with water as a result of the Proposed Action would more than likely be insignificant. Therefore, impacts to the aquatic food web are not likely and therefore, indirect effects to fish are discountable.

Project Design Features minimize and avoid concentrations of herbicide exceeding a level of concern coming in contact with fish and other aquatic organisms because:

- Established buffers along perennial and intermittent streams greatly reduce the potential for drift of herbicide to surface waters;

- No broadcasting of herbicides are allowed along roads that have a high potential for herbicide delivery, thereby significantly reducing the potential amount of herbicides delivered to streams via road-side ditches;
- Broadcast spray of triclopyr is prohibited, thereby greatly reducing risk of triclopyr coming in contact with surface waters;
- With the eliminated potential for concern for increased risk to aquatic species, the potential for effects to the aquatic food web is greatly reduced.

The potential for herbicides to enter streams in concentrations that are near or exceed thresholds of concern for federally listed fish and impacting aquatic ecosystems is very low. Therefore, the degree of risk is low and discountable. Whether known sites or new sites are treated following the Proposed Action, it is unlikely that the Forest will reach the most ambitious conceivable treatment scenario identified in the Proposed Action. In addition, the PDFs are likely to minimize or eliminate the risk of adverse affects.

Magnuson-Stevens Fishery Conservation and Management Act – Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a Federal fisheries management plan.

Essential Fish Habitat is defined in the Act as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” Essential Fish Habitat includes all freshwater streams accessible to anadromous fish (Chinook, coho, and pink salmon), marine waters, and inter-tidal habitats. The objective of this EFH assessment is to determine whether or not the Proposed Action “may adversely affect” designated EFH for relevant commercially, federally-managed fisheries species within the Project Area.

Umatilla National Forest may incorporate an EFH assessment into the analysis for this EIS pursuant to 40 CFR section 1500. NEPA and ESA documents prepared by the Umatilla National Forest should contain sufficient information to satisfy the requirements in 50 CFR 600.920(g) for EFH assessments and must clearly be identified as an EFH assessment.

Identification of Essential Fish Habitat

Pursuant to the MSA the Pacific Fisheries Management Council (PFMC) has designated EFH for federally managed fisheries within the waters of Washington, Oregon, and California. Designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km) (PFMC, 2004, 1998).

Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable artificial barriers (as identified by the PFMC, 2003), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years) (PFMC, 2003). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border (PFMC, 2003).

Detailed descriptions and identifications of EFH are contained in the fishery management plans for groundfish (PFMC 2004), coastal pelagic species (PFMC 1998), and Pacific salmon (PFMC, 2003).

The geographic extent of EFH on Umatilla National Forest is specifically defined as all currently viable waters and most of the habitat historically accessible to Chinook salmon within the watersheds identified in Table 10. Salmon EFH excludes areas upstream of longstanding naturally impassible barriers (i.e., natural waterfalls in existence for several hundred years). Salmon EFH includes aquatic areas above all artificial barriers.

Effects of the Proposed Action

The MSA defines adverse effects as any impact, which reduces the quality and/or quantity of Essential Fish Habitat. Non-herbicide treatment methods would have very localized effects to soil at the project scale. Herbicide treatment methods may result in insignificant amounts of herbicides coming in contact with water as a result of drift and runoff from roadside ditches. Effects from both non-herbicide and herbicide treatment methods would not impact those waters necessary for spawning, breeding, feeding, or growth to maturity because there is no treatment of emergent or submerged invasive plants and the predicted amount of herbicide coming in contact with water is well below levels of concern. As discussed above in the Effects Analysis section Chinook salmon would not be adversely affected because:

- The quantity of EFH will not be reduced
- The quality of EFH will be maintained and not degraded

PDFs will be applied and Northwest Forest Plan standards would be met. Conservation measures and management alternatives are listed in the Pacific Coast Salmonid Plan that help conserve and enhance salmon EFH. These measures should be applied unless more specific or different measures based on the best and most current scientific information are developed prior to, or during, the EFH consultation process and communicated to the appropriate agency. The PDFs in the Proposed Action are more detailed measures and should take the place of ones listed in the Pacific Coast Salmonid Plan. However, there may be conservation measures that are different and complement the PDFs.

As described in detail in the Effects Analysis section of this BE, the exclusion of heavy machinery from the Proposed Action will not result in impacts to sediment and cover. The use of non-herbicide methods as described in the Proposed Action is not expected to reduce the quality and/or quantity of EFH. The use of herbicide treatments as described in the Proposed Action and analyzed in this BE is not expected to reduce the quality and/or quantity of EFH.

Conclusion

The Proposed Action is not expected to adversely affect EFH for Pacific salmon species listed in Table 51. The Proposed Action is expected to impove long-term essential fish habitat conditions in locations currently infested with invasive plants.

Table 51 - Potential Effects to Commercially Important Fish Species Under the Proposed Action

Species	Magnuson-Stevens EFH Determination
Snake River Spring/Summer Run Chinook Salmon	No Effect
Snake River Fall Run Chinook Salmon	No Effect

3.6 Recreation

3.6.1 Introduction

Invasive Plants and Recreation Resources

Recreational activities are influenced by, and have influence on, the rate and degree of invasive plant spread in campgrounds, trails, wilderness areas, and wild and scenic rivers of the Umatilla National Forest. Recreationists move in and out of these forest settings, inadvertently transporting seeds and propagating plant parts throughout the forest as well as across and between landscapes.

Heavy use areas such as trailheads, parking lots and riparian areas can be denuded of their native vegetation, creating prime environment for invasive plants to seed. The most likely vectors of invasive plant spread are roads, trails and riparian corridors (R6 2005 FEIS).

Invasive plants can detract from the desirability of using recreation sites and participating in certain recreational activities. For example, stiff plant stalks, thorns, sharp bristles, and allergies created by invasive plants can prevent humans from walking, sitting, setting up camp, and finding a place to fish or tie up a raft (R6 2005 FEIS). Recreation use associated with hunting such as off-highway vehicle (OHV) use, dispersed camping, wilderness and back country access using pack stock all increase substantially the likelihood of spreading invasive plants.

This section will describe the affected environment and analyze the effects of the proposed project and alternatives on the recreation resource and congressionally designated areas. The analysis will evaluate the impacts of invasive plant treatment methods on recreation in the general forest, developed recreation sites, and trails. Congressionally designated areas include wild and scenic rivers and wilderness areas. The effects on the outstandingly remarkable values, water quality and free flowing characteristics of designated and eligible wild and scenic rivers and the effects on wilderness character will be evaluated. Invasive plant treatment methods are described in detail in Chapter 2 of the Draft Environmental Impact Statement (DEIS).

3.6.2 Affected Environment

Congressionally Designated Areas

Wilderness

Wilderness is to be managed according to the 1964 Wilderness Act, which directs agencies to protect wilderness character (1964 Wilderness Act, Section 2(a) and Section 4(b)). Four qualities, derived from the Definition of Wilderness (Section 2(c) of the 1964 Wilderness Act), define wilderness character:

- **Untrammeled** – wilderness is essentially unhindered and free from modern human control or manipulation
- **Natural** – wilderness ecological systems are essentially free from the effects of modern civilization
- **Undeveloped** – wilderness is essentially without permanent improvements or modern human occupation

- **Outstanding opportunities for solitude or a primitive and unconfined type of recreation** – wilderness provides opportunities for people to experience solitude or primitive and unconfined recreation, including the values of inspiration and physical and mental challenge (USDA 2005).

There are three designated wilderness areas on the Umatilla National Forest; the Wenaha-Tucannon, the North Fork Umatilla, and the North Fork John Day. Invasive plants have been identified in all three. Invasive plants within wilderness are typically found at trailheads, along trails, riparian areas, and near popular dispersed camping sites. Invasive plant infestations within wilderness areas are minor compared to the general forest acres. Infestations outside wilderness boundaries have the potential to spread into wilderness areas and threaten wilderness values.

Invasive plants have adverse effects on wilderness character as they can disrupt natural processes. Invasive plants may alter natural plant communities, interact in unknown ways with native wildlife species, and alter ecological processes such as plant community dynamics and disturbance processes such as fire. This potential change in ecological condition can threaten the natural integrity of the wilderness and the values for which it was designated. The presence of invasive weeds is typically a result of human use.

Weed infestations are typically associated with human activities such as grazing, pack stock use, trails; activities that create disturbed conditions that allow weeds to establish.

The 1964 Wilderness Act presents managers with direction that creates a dilemma regarding what to do about invasive plants. Section 2 (a) of the Act provides direction to preserve natural conditions in wilderness. Section 2 (c) of the Act defines wilderness as an area where earth and its community of life are “untrammeled”. Untrammeled is interpreted to mean uncontrolled, unconfined, not restrained by people; protected from human control or at least intentional manipulation. The dilemma that this direction creates regarding what to do about invasive plants is that managers must choose either to preserve natural conditions by actively manipulating wilderness to reduce or eliminate invasive plants, or to keep wilderness free from intentional human manipulation, but lose natural conditions due to the changes caused by invasive plants. This analysis will describe effects of invasive plant treatments and the effects of invasive plants on wilderness character.

The Pacific Northwest Region Invasive Plant Program Final Environmental Impact Statement (FEIS) identified wilderness as an area of special concern and it is in the highest priority treatment category (R6 2005 FEIS). The Record of Decision (ROD) approved herbicide use as a potential tool in designated wilderness throughout the region (R6 2005 ROD).

The ROD also amended all forest plans in the region; requiring use of certified weed-free feed for all pack and saddle stock used on National Forest system lands. As of January 2007, certified weed-free feed or pelletized feed is required in all wilderness and wilderness trailheads on National Forest lands in the Pacific Northwest Region. This will help prevent further introduction of invasive weeds into the wilderness through stock feed. This requirement is being phased in to allow recreationists time to adjust to the change and due to lack of available weed-free hay certification programs in Washington and a limited program in Oregon.

Wenaha-Tucannon Wilderness

The primary recreation activity within the Wenaha-Tucannon Wilderness has traditionally been elk hunting with a large number of hunters packing in on horses each fall. Overall use is considered light to moderate with the majority of use occurring during hunting season.

Recently, however, there has been an increase in anglers and backpackers during the summer and early fall months.

There are approximately 158 acres of invasive weed infestations identified within the Wenaha-Tucannon Wilderness. The largest concentrations are located near the Three Forks Trailhead and along the Three Forks and the Crooked Creek Trails. These trails are popular with horseback riders and people packing in for big game hunting.

North Fork Umatilla River Wilderness

The North Fork Umatilla River Wilderness is the smallest wilderness on the Forest, and currently there are only 17 acres of invasive plant sites identified. There are extensive infestations identified and mapped along roads outside the wilderness boundary. Minor infestations are located at access points such as Umatilla Forks Campground, Buck Creek, and Corporation Organizational Camp. These infestations have potential to spread and threaten wilderness values.

North Fork John Day Wilderness

The North Fork John Day Wilderness is comprised of four separate units, three on the North Fork John Day District, Umatilla National Forest, and one on the Baker Ranger District, Wallowa-Whitman National Forest. Use of this wilderness is typically light and increases during the big game hunting seasons.

There are approximately 22 acres of invasive plant infestations identified within the North Fork John Day Wilderness, Umatilla National Forest. There are minor infestations that have been identified and mapped along roads outside the wilderness boundary. The most significant infestations are along FR 1035 which accesses Granite Creek Trail. and FR 5506 which accesses Oriental Creek Campground and the trailhead for Big Creek, Corral Creek and North Fork John Day River Trails.

Table 52 – Wilderness Areas and Acres of Invasive Plants

Wilderness Name and Acres		Acres Invasive Plants
Wenaha-Tucannon	177,432	158
North fork Umatilla	20,435	17
North Fork John Day	107,058	22
Total Acres	**304,925**	**197**

Wild and Scenic Rivers

The Wild and Scenic Rivers Act was enacted to preserve in a free-flowing condition, rivers which possessed outstandingly remarkable values such as scenic, recreational, geologic, fish and wildlife, historic or cultural. Congress declared that it was important to manage certain rivers in their free flowing condition, and to manage them and their immediate environment to protect those qualities for the benefit and enjoyment of present and future generations.

In the planning process for the Umatilla National Forest, the Forest Service also identified rivers that are eligible for designation as wild and scenic rivers.

Designated and eligible rivers are assigned a classification of wild, scenic, or recreational. Characteristics of these classifications are:

- **Wild -** Rivers or sections of rivers that are free of impoundments, generally inaccessible except by trail (no roads), with watersheds or shorelines essentially primitive, with little or no evidence of human activity and having unpolluted waters.
- **Scenic -** Rivers, or sections of rivers, that are free of impoundments, having shorelines or watersheds largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- **Recreational –** Rivers or sections of rivers that are readily accessible by road or railroad, may have some development along the shoreline, and may have had some impoundment or diversion in the past.

Forest Service Manual 2354.42 provides direction for resource protection and management activities in WSR corridors. FSM 2354.42(l) Forest Pest Management states “Control forests pests in a manner compatible with the intent of the Act and management objectives of contiguous National Forest System lands.” Invasive plants can alter the ecology and recreation setting within WSR corridors, impacting the outstandingly remarkable values for which it was designated.

Segments of the Grande Ronde, the North Fork John Day and the Wenaha Rivers have been designated as part of the National Wild and Scenic River system (WSR). Desolation Creek, Granite Creek, North Fork Asotin Creek and the Tucannon River are identified as eligible WSR’s. The river management corridor typically extends one quarter mile from the riverbank on each side of the designated segment. Invasive plant species have been found in all three river corridors. The presence of invasive species along the river corridor can detract from the aesthetic and recreational opportunities and impact the values for which the river has been designated. Acres in WSR corridors that occur in wilderness would be subject to laws, standards and project design features pertaining to wilderness. The following table summarizes each river and the outstandingly remarkable values for which it was designated.

Table 53 - Wild and Scenic Rivers on the Umatilla National Forest and their Outstandingly Remarkable Values

River Name	Wild (mi.)	Scenic (mi.)	Recreation (mi.)	Outstandingly Remarkable Values
Grande Ronde River	17.4		1.5	Scenery, Recreation, Fisheries, Wildlife
Wenaha River	18.7	2.7	0.2	Scenery, Fisheries, Geology
North Fork John Day River	27.8	10.5	15.8	Scenery, Recreation, Fisheries, Wildlife, Cultural Resources
Desolation Creek (Eligible)		21.5		Recreation, Botanical/Ecological
Granite Creek (Eligible)		7.9		Fisheries
North Fork Asotin Creek (Eligible)		18.0		Fisheries
Tucannon River (Eligible)	9.1	4.6	8.6	Recreation, Fisheries, Cultural/Historic, Botanical/Ecological

Grande Ronde WSR

The Grande Ronde River receives moderate to heavy use by rafters and kayakers during spring and summer seasons with the heaviest use occurring on weekends and holidays. The wild segment of the river that occurs on National Forest system lands has limited vehicle access. The put-in and take out sites are located on, and managed by, the Bureau of Land Management and state agencies.

Dispersed camping occurs along the river on National Forest system lands in conjunction with multi-day raft trips.

There are 28 acres of invasive plants identified within the WSR corridor, the majority of which is leafy spurge within the riparian area. The infestations are typically small sites, less than two acres each. The sites are located along the entire length of the wild segment of the river. There are no invasive plants identified in the recreation segment of the river.

North Fork John Day (NFJD) WSR

The NFJD River has Wild, Scenic and Recreation designations on the Umatilla National Forest. The Wild segment is within the North Fork John Day Wilderness. Use along this segment is typically by foot or horseback along the NFJD River Trail. The Scenic section follows Forest Road 5506 from the Big Creek trailhead to Texas Bar. The Recreation section follows Forest Highway 55 from Texas Bar past Tollbridge Campground. Use along both these segments consists of dispersed camping along the road and river during summer, with use increasing during big game hunting season. There is some float use on the river during early spring run-off, with use declining after mid June.

There are approximately 179 acres of invasive plants identified along the NFJD WSR. The majority of invasive plant acres are within Recreation and Scenic designations. The invasive plants are predominantly associated with the road right of way within the managed river corridor. Thirty acres identified in the Wild segment of the river are primarily along 1.5 miles of the NFJD River Trail, closest to the wilderness trailhead at the end of FR 5506. The remaining five acres are scattered small sites along the NFJD River Trail and Crane Creek Trail.

Wenaha WSR

The Wenaha WSR receives light use due to its remote character. The Wild segment is located in the Wenaha-Tucannon Wilderness and is accessible by pack stock or foot along the Wenaha River Trail.

There are approximately 20 acres of invasive plants along the Wenaha WSR; 15 acres within the Wild segment associated with the Wenaha River Trail and the Cross Canyon Trails, and five acres within the Recreation segment that is part of a larger area outside of the forest boundary on Bureau of Land Management and state lands.

Desolation Creek - WSR Eligible

Desolation Creek is proposed as a recreation river along its entire length. The area provides dispersed camping opportunities, hiking and big game hunting.

There are approximately 27 acres of invasive plants identified along this creek. They are primarily associated with the road corridors of Forest Highway 34 and 10. There are also infestations near Tollbridge Campground at the confluence with the North Fork John Day River.

Granite Creek - WSR Eligible

Granite Creek is proposed as a recreation river. This creek is considered high quality spawning grounds for Chinook salmon. The Granite Creek Trail is a popular access to the North Fork John Day Wilderness Area.

There are approximately 108 acres of invasive plants along this creek. They are primarily associated with the FR 1035 road corridor and Granite Creek Trail.

North Fork Asotin Creek - WSR Eligible

The North Fork Asotin Creek is proposed as a scenic river. It contains native Chinook, bull trout and steelhead. NF Asotin Creek Trail follows the length of the creek. Use on the trail includes motorcycle, mountain bike, foot and horse use.

There are approximately 159 acres of invasive plants identified along its banks. The majority of the invasive plants are along the NF Asotin Creek Trail from the forest boundary to the junction with Pinkam Trail.

Tucannon River - WSR Eligible

The Tucannon River has segments proposed as wild, scenic and recreation. The river is popular for camping, sight-seeing, fishing and wildlife viewing.

There are approximately 116 acres of invasive plants identified primarily along the scenic segment. The majority of invasive plants are associated with the FR 4712 road corridor.

Table 54 - Wild and Scenic Rivers, Designation, and Acres of Invasive Plants

Wild and Scenic River Name and Designation		Acres of Invasive Plants
Grand Ronde	Recreation	0
	Wild	28
Grand Ronde Total		**28**
NFJD	Recreation	45
	Scenic	98
	Wild **	35
NFJD Total		**179**
Wenaha	Recreation	5
	Wild **	15
Wenaha Total		**20**
Desolation Creek (Eligible)	Recreation	**27**
Granite Creek (Eligible)	Recreation	**108**
North Fork Asotin Creek (Eligible)	Scenic	**159**
Tucannon River (Eligible)	Scenic	**116**
Grand Totals		**637**

Developed Recreation Sites

The Umatilla National Forest has 32 developed recreation facilities that have invasive plants within the managed use area of the site. These sites include campgrounds, trailheads, winter sports areas, cabin rentals, interpretive sites and organizational camps. Many of the invasive plant sites are small, less than one acre. Fairview Campground and Woodward Campground have the largest area to be treated at 10.3 and 18.9 acres, respectively.

There are 17.2 acres of invasive plant infestations associated with winter sports and snow play areas (toboggan, and sledding area). Weeds associated with these areas are typically located near parking lots or along access roads. There are no recreation facilities associated with the winter sports areas during the snow-free season. Use of these areas during snow-free seasons, as dispersed sites, is incidental.

The following table shows developed recreation sites by ranger district, site name and acres of invasive plants.

Table 55 - Ranger District, Developed Recreation Site Name, and Acres of Invasive Plants

Ranger District and Site Name		Acres of Invasive Plants
Heppner	Bull Prairie Campground	6.2
	Fairview Campground	10.3
	Penland Lake Campground	0.2
	Coalmine Hill Campground	0.1
	Ditch Creek Guard Station Rental	0.5
Heppner Totals		**17.3**
Pomeroy	Alder Thicket Campground	2.6
	Pataha Campground	0.1
	Meadow Creek Trailhead	0.9
	Panjab Trailhead	2.8
	Tucannon Trailhead	0.6
	Rose Spring Winter Sports Area	2.5
Pomeroy Totals		**9.5**
North Fork John Day	Bear Wallow Campground	2.2
	Big Creek Meadows Campground and Trailhead	0.2

Ranger District and Site Name		Acres of Invasive Plants
	Driftwood Campground	2.3
	Gold Dredge Campground	2.7
	Oriental Campground & Trail Head	1.1
	Tollbridge Campground	0.3
NFJD Totals		**8.8**
Walla Walla	Jubilee Lake Campground	4.6
	Target Meadows Campground	2.4
	Umatilla Forks Campground	1.6
	Woodland Campground	1.6
	Woodward Campground	18.9
	Fry Meadows Guard Station Rental	0.2
	Burnt Cabin Trailhead	0.5
	Whitman Route Interpretive Site	4.3
	Corporation Organizational Camp	1.9
	Buck Creek Organizational Camp	0.1
	Andies Prairie Snow Play Area	4.3
	Bone Springs Winter Sports Area	3.7
	Spout Springs Ski Area	5.8
	Ruckle Junction Winter Sports Area	0.1
	Woodland Snow Play Area	0.8
Walla Walla Totals		**50.8**
Grand Total		**86.4**

Trails

Non-motorized and motorized trails are considered high spread potential sites for invasive plants. Trail corridors are defined as the area 100 feet on either side of the trail tread. Invasive plant acres that are in trail corridors within wilderness areas or WSR are included in wilderness or WSR acres. All other invasive plant acres that occur outside the trail corridor are included in the general forest area.

Non-Motorized

There are approximately 613 miles of non-motorized trails on the forest. Non-motorized trail types include pack and saddle trails, hiking trails and cross-country ski trails. Pack and saddle trails and the feed, straw and disturbance associated with such use can facilitate the establishment and spread of invasive plants. There are approximately 404 acres of invasive plant infestations within non-motorized trail corridors outside of wilderness areas and WSR corridors.

Motorized

Motorized trails include off-highway vehicles (OHV) motorcycle and snowmobile trails. OHV trails and “cross country” use can create the conditions that are favorable for invasive plant establishment and subsequent spread by vehicle use (Lacey et al 1997).

Snowmobile trails are typically on roads that are not plowed during winter seasons. Invasive plant acres along snowmobile trails are included in the general forest area as roads.

There are approximately 50 acres of invasive plant infestation within motorized trail corridors. The following table summarizes the acres of invasive plants by trail type. Acres along trails within wilderness areas and wild and scenic river corridors are not included in these totals.

Table 56 - Trail Types and Acres of Invasive Plants

Trail Type	Acres of Invasive Plants
OHV/Motorcycle	50
Hiking/Pedestrian	23
Pack and Saddle	211
Cross Country Ski	170
Total	**454**

General Forest Area

The general forest area, for the sake of this writing, is considered all areas not within a developed recreation site boundary, designated wilderness, wild and scenic river corridor, or trail corridors. The majority of invasive plant sites within the general forest area occur along roads. Roads are considered to be high spread potential areas.

There are currently 6,846 miles of forest roads that are determined to be needed for long-term motor vehicle use on the Umatilla National Forest. The Forest has jurisdiction for 4,957 miles while approximately 1,889 miles have county, state, BLM, or private jurisdiction (USDA 2004).

Recreational access to the forest is the predominant use of the transportation system. Driving for pleasure is a primary use of the forest (USDA 2003).

Dispersed recreation sites are typically along roads and have developed due to repeated use by recreationists. These site types are not usually inventoried, signed, or have any other use controls associated with them other than access. Repeated use by recreationists can create the conditions that favor invasive plant establishment and spread.

Overall incidence of summer dispersed camping is moderate, and is associated with OHV riding and river use. Dispersed camping during the hunting season would be considered high with camps occurring along many roads. Many hunter campsites have been used by the same hunting group year after year.

Approximately 23,272 acres of invasive plants have been identified in the general forest area. The general forest acres are derived from the total acres of invasive plants identified (24,236 acres) minus the acres within the boundaries of congressionally designated areas, trail corridors and developed recreation sites. The following table summarizes acres of invasive plants by recreation type.

Table 57 - Recreation Areas, General Forest and Acres of Invasive Plants

Recreation Area	Acres of Invasive Plants
Wilderness	197
WSR	227
Developed Recreation	86
Trails	454
General Forest Area	23,272
Grand Totals	**24,236**

3.6.3 Environmental Consequences

Effects Common to Recreation for the No Action Alternative

The 3,154 acres of invasive plants approved for treatment under existing decision documents (USDA 1995) have proven ineffective in controlling the spread of invasive plants (see Botany Report). Though new infestations of invasive plants can be treated using mechanical and manual methods they have proven to be ineffective at controlling the Forestwide spread of invasive plants.

Effects Common to Recreation for all Action Alternatives

Direct Effects

Visitors may notice invasive plant treatments when traveling through the forest by car, OHV, foot, pack stock or water craft. The size of the invasive plant site being treated and the type of treatment being used would determine how noticeable the treatment is.

Chemical application methods vary from individual plant application to broadcast spraying. Wicking and stem injection treat individual plants and only target plants would be affected. Spot spraying would target individual plants but overspray may affect adjacent vegetation. Broadcast spraying would treat an area and all plants within the site may be affected depending on the herbicide. Broadcast application could include hand spreading and spraying from vehicle mounted tanks. Individual plant application would use less chemical agent overall.

Visitors that are concerned about exposure to herbicides may be more accepting of individual plant application methods, especially in high use areas and gathering areas for berries and mushrooms.

Chemical treatments may leave dead vegetation that would be noticeable for several days to several weeks. Individual plant treatments would be less noticeable than broadcast treatments overall. These effects would be of short duration, typically one growing season.

Physical treatments include manual and hand mechanical treatments. Manual treatments may show signs of disturbed earth from digging or grubbing out root systems. Hand mechanical treatments may leave evidence of cut vegetation due to mowing, weed whipping and roadside brushing. These effects are commonly seen by the visitor on and off the forest and are not expected to detract from their overall recreation experience in the general forest areas. These effects would be of short duration, typically one growing season.

Biocontrol measures would not be noticeable to the casual forest visitor. It is a long term method of treatment that does not eradicate the invasive plant, but instead keeps the population in check so that native species can compete.

Eradicating invasive plants can make areas more desirable for recreation. Invasive plants that have characteristics such as thorns, bristles, stiff plant stalks and chemical irritants would be treated, making areas more inviting to recreationists. Recreationists may appreciate a more natural landscape with intact native vegetation.

Early Detection/Rapid Response (EDRR) is a treatment strategy that allows managers to rapidly respond to new or expanding invasive plant sites. The Treatment Decision Tree (See Figure 8, Chapter 2) provides a decision process for determining treatment methods for invasive plant sites. Areas treated under EDRR would be subject to all regional and forest standards. Effects to recreation would be similar to those described above and within the categories described below.

Indirect Effects

All sites and areas that are treated with herbicides would be posted to inform forest visitors what herbicide was used, when it was applied and how long the herbicide would persist in the area before breaking down. Visitors would be able to make informed decisions concerning their comfort level with recreating in an area where herbicides have been recently applied.

People may decide not to recreate in areas where herbicides have been applied. The greatest impact to visitors would be if they were not aware that herbicides had been applied in their destination recreation area. Standard 23 of the Regional FEIS provides for public notification through various media but it is impossible to contact all potential visitors prior to them arriving on the forest. Posting signs at key access points would alert visitors to the presence of herbicides; however notification upon arrival may disrupt a visitor’s plans and activities. Similar recreational opportunities exist across the forest so a visitor may, if desired, be able to find a substitute place to recreate. This may provide an opportunity for forest visitors to explore new areas.

Effects on Congressionally Designated Areas

Alternative A - No Action Alternative

Under this alternative, approximately eight acres within wilderness that is currently approved for treatment would continue to receive treatments. Invasive plants have spread substantially beyond these sites. Without treatment of new invasive plant sites, populations that have become established within wilderness would continue to spread. By not aggressively treating weeds, wilderness character would remain "untrammeled" and free from human manipulation; however, the spread of invasive plants may change the character of the ecosystem such that they threaten the apparent naturalness and natural integrity of the wilderness.

Approximately 0.4 acres within WSR corridors would continue to be treated under this alternative. Invasive plants have spread beyond these sites. Invasive plants can detract from the outstandingly remarkable values for which the WSR's were designated. These include scenery, recreation, fisheries, wildlife, botanical, ecological, cultural and geological values. Refer to their respective reports for detailed descriptions of impacts invasive plants have on these resources.

Effects Common to all Action Alternatives

Wilderness

To best preserve the wilderness resource, alternatives will be evaluated for their potential effects on the four qualities of wilderness character previously mentioned: Untrammeled, natural, undeveloped, and outstanding opportunities for solitude or a primitive and unconfined type of recreation. The untrammeled quality is the extent to which wilderness ecosystems remain free from modern human manipulation. Natural integrity is the extent to which long-term ecological processes are intact and operating. The undeveloped quality is a measure of how natural the environment appears and how free it is from any structures or developments. The outstanding opportunities for solitude or a primitive and unconfined type of recreation are subjective values defined as isolation from the sights, sounds and presence of others, and the developments and activities of people. Primitive recreation opportunities are those that allow the recreationists to use backcountry skills, knowledge and abilities that do not rely on developed facilities, mechanical transport or motorized equipment.

Invasive Plant Treatment and Transport Methods in Wilderness

Approximately 197 acres of invasive plants are identified within wilderness areas. These acres are located along trails that access the wilderness areas. Treatment methods that may be utilized include non-mechanical hand treatments such as hand-pulling or use of hand tools for cutting, digging and grubbing. Herbicide treatments may use application methods such as wicking, stem injection, spray bottle, hand pressurized pumps, battery or solar powered pumps and propellant based systems such as those that use pressurized carbon dioxide. Gas-powered, motorized pumps and aerial application of herbicides are not proposed as application methods in wilderness under any of the proposed alternatives including for EDRR.

Approved herbicide application methods described above are considered acceptable herbicide application methods within wilderness without further analysis of the Wilderness Act's prohibitions on use of motorized equipment.

Battery or solar powered pumps are considered motorized equipment. These devices are used to apply herbicides from horseback mounted spray systems.

Solar panels and/or batteries to operate pumps may be evident on pack stock. These types of pumps are quiet and would not impact opportunities for solitude or a primitive and unconfined type of recreation in wilderness.

Use of herbicides as a treatment method is estimated to be 80 percent effective in reducing invasive plants with one treatment application (see Botany Report).

Treatment is most effective when herbicides are applied during the active growing season of the plant, typically May through July. Areas would be treated one to two times per year during the growing season to effectively eliminate the invasive species at that site. Where continued disturbance occurs such as at trailheads and popular campsites annual treatments may be necessary to prevent the re-establishment of invasive plants and subsequent spread.

Visitors may feel their wilderness experience is degraded if they happen to visit a treatment site during treatment due to encounters with weed treatment crews. While important to those visitors it affects, it is a short-term impact, lasting one to several days at each site per year, depending on its size. Effects on visitor's wilderness experience can be minimized through public notification and treating areas during low visitor use periods.

Use of wilderness on the Umatilla National Forest is typically low during the summer and it increases during the fall big game hunting season. Invasive plant treatments typically occur during the summer growing season. Some visitors may appreciate encountering people working with pack stock in the wilderness. "Packing in" is a traditional skill that many people associate with wilderness.

Proposed methods to transport people and supplies to carry out invasive plant treatments include non-mechanized methods considered acceptable within wilderness including backpack and pack stock use. These types of traditional transport methods used within wilderness do not require additional analysis of the Wilderness Act's prohibitions on use mechanical transport. Use of helicopters or other mechanized methods to transport supplies and people to carry out invasive plant treatments is not proposed under any alternative or EDRR.

Figure 11 – Contract worker spraying invasive plants in the Wilderness from horseback

Picture by Leigh Dawson

Untrammeled

Treatment of invasive weed infestations within wilderness can be viewed as human manipulation on the landscape. Evidence of human manipulation can detract from the “untrammeled” feel of wilderness.

There will be short-term evidence of weed treatments including dead or wilting plants and areas of disturbed soils where plants have been pulled up or grubbed out. Where plants are dead or dying, some people may recognize that herbicides were sprayed.

These effects may not appear natural to the forest visitor. Hikers and pack stock users are typically traveling at a slow pace and these changes may be noticeable. Biocontrol measures would be not be noticeable to the casual visitor and would not affect the apparent naturalness of the area.

The amount of area proposed to be treated in wilderness is very small; approximately 197 acres of 304,925 acres in wilderness on the forest. Effects would be localized to the treatment areas and effects to the wilderness ecosystem are limited to these treatment areas. Regional standards and project design features are in place to protect ecological resources including non-target botanical species, water, soils, fisheries and wildlife. Refer to the botany, hydrology, soils, fisheries and wildlife reports for details concerning the effects of invasive plants and the effects of invasive plant treatments on these resources. Apparent naturalness of treatment areas will improve as the evidence of invasive plants decreases and they are replaced with native vegetation.

Natural

Aggressive treatment of weeds in the wilderness would improve natural integrity under all alternatives. Invasive weed treatments would decrease establishment and expansion of invasive species in wilderness areas, and allow native vegetation and ecological processes to continue. Apparent naturalness of treated areas would improve as the evidence of invasive plants decreases and they are replaced with native vegetation.

Early Detection/Rapid Response treatment strategy would allow managers to treat infestations within wilderness quickly while the infestation is still small. This strategy would reduce the opportunity for the spread of invasive plants within wilderness, protecting the natural integrity or the wilderness. In addition, treating areas while small will reduce the visual effects of treatments. Impacts to apparent naturalness would be less.

Undeveloped

No new developments, facilities, or structures are proposed by any alternatives. There would be no impact to the undeveloped quality of wilderness.

Outstanding Opportunities for Solitude or a Primitive and Unconfined Type of Recreation

Forest visitors may encounter workers applying herbicides using hand sprayers, backpack or horseback sprayers in the wilderness. The sounds from battery or solar powered electric pumps would be localized to the treatment area and would not disrupt entire watersheds. Visitors may also encounter worker digging, grubbing or pulling invasive plants. These encounters may affect some people’s sense of remoteness and their opportunity for solitude. This effect would be short term, typically one to several days, and backcountry crews treating weeds would be small (typically 1-4 people). Duration of effects would depend on size of invasive plants site being treated.

Early Detection/Rapid Response treatment strategy would allow managers to treat invasive plants while the infestation is still small. Treatment methods and duration would be less intrusive to the forest visitor if areas are treated when small. Less time would be necessary for workers to be in an area, reducing the opportunity for forest visitors to encounter work crews. New infestations would be treated 1-2 times per year until the invasive weeds were eliminated.

Under EDRR, treatment methods would be limited to non-mechanical hand treatments and herbicide application methods as described previously.

Wilderness trailheads would be posted, informing visitors that herbicides have been or will be sprayed in the area. This may cause the visitor to recreate elsewhere, reducing their opportunity to engage in wilderness recreation. Invasive plant treatments overall would not detract from the opportunity for primitive recreation. Effects would be the same under Early Detection/Rapid Response treatment strategy.

Wild and Scenic Rivers

The presence of invasive plants and treatments of them may impact the outstandingly remarkable values for which the rivers were designated or deemed eligible. Outstandingly remarkable values include scenery, recreation, geology, fisheries, wildlife, and botany/ecology, historic or cultural resources. Effects of invasive plants and invasive plant treatments on resource values other than recreation are covered in their respective resource report. Each resource area has identified Project Design Features to protect their resource.

Regional standards and Project Design Features are in place for herbicide use near water to protect water quality. Refer to the hydrology and soils sections of the analysis for detailed information concerning these resources.

The Wenaha River has outstandingly remarkable values of scenery, fisheries and geology. Granite Creek and North Fork Asotin Creek are noted for their fisheries resource. Refer to those respective resource reports for details. The Wenaha River and a portion of Granite Creek are located within wilderness. Effects of invasive plants and visitor perceptions of treatments along these rivers would be the same as those described for wilderness.

The NFJD, Grande Ronde, Desolation Creek and Tucannon River have recreation identified as an outstandingly remarkable value, in addition to other resource values mentioned above. See Table 54 for those values and refer to the respective resource reports for detailed information regarding these resources.

Visitors may notice dead vegetation due to herbicide application when traveling forest roads or when floating rivers. Effects to these rivers and the outstandingly remarkable value of recreation would be similar to those effects common to recreation for all action alternatives.

Early Detection/Rapid Response treatment strategy would allow managers to treat infestations within WSR corridors quickly while the infestation is still small. This strategy would reduce the opportunity for the spread of invasive plants within WSR corridors, protecting the outstandingly remarkable values for which they were designated or deemed eligible.

Alternative B - Proposed Action

Approximately 184 acres of 197 acres are proposed to be treated with herbicides in wilderness. The remaining treatments are five acres of biocontrol and eight acres of manual treatment. The effects on the wilderness character qualities of untrammeled, natural, undeveloped, and outstanding opportunities for solitude or primitive and unconfined recreation would be the same as described for all action alternatives. Broadcast application from horseback mounted pumps could be an application method utilized. Larger areas of vegetation may be treated and dead and dying plants may be more noticeable to forest visitors, reducing the apparent naturalness. The following table summarizes the acres of invasive plants to be treated by treatment method.

Table 58 - Wilderness Areas and Acres of Proposed Treatments

Wilderness Name and Acres		Acres of Proposed Treatments				
		Biocontrol	Chemical	Chemical Riparian	Manual	Total
Wenaha-Tucannon	177,432	0	66	84	8	158
North fork Umatilla	20,435	0	5	12	0	17
North Fork John Day	107,058	5	13	4	0	22
Total Acres	**304,925**	**5**	**84**	**100**	**8**	**197**

Approximately 616 acres of 637 acres would be treated with herbicides in WSR corridors. The majority of these acres occur in riparian areas. There are 19 acres of biocontrol and two acres of manual treatments proposed under this alternative.

Effects would be the same as those for all action alternatives. The following table summarizes the acres of invasive plants to be treated by treatment method.

Table 59 - Wild and Scenic Rivers, Designation, and Acres of Proposed Treatments

Wild and Scenic River Name and Designation		Acres of Proposed Treatments				
		Biocontrol	Chemical	Chemical Riparian	Manual	Total
Grand Ronde	Recreation	0	0	0	0	0
	Wild	0	0	28	0	28
Grand Ronde Total		**0**	**0**	**28**	**0**	**28**
NFJD	Recreation	0	17	28	0	45
	Scenic	0	7	91	0	98
	Wild **	2	0	32	2	35
NFJD Total		**2**	**24**	**151**	**2**	**179**
Wenaha	Recreation	0	5	0	0	5
	Wild **	0	2	13	0	15
Wenaha Total		**0**	**7**	**13**	**0**	**20**
Desolation Creek (Eligible)	Recreation	**0**	**19**	**8**	**0**	**27**
Granite Creek (Eligible)	Recreation	**6**	**77**	**25**	**0**	**108**
NF Asotin Creek (Eligible)	Scenic	**0**	**0**	**159**	**0**	**159**
Tucannon River (Eligible)	Scenic	**11**	**3**	**102**	**0**	**116**
Grand Totals		**19**	**130**	**486**	**2**	**637**

**These acres occur in designated wilderness and would be subject to laws, standards and project design features pertaining to wilderness.

Alternative C- Restricted Use – No Broadcast Herbicide Application in Riparian

Of the 637 acres identified for herbicide treatment in wilderness and WSR, 486 acres are within the riparian zone. Most access into the wilderness is along trails that follow the riparian area of streams and rivers. By using methods other than broadcast spraying, less herbicide would be used overall. Individual plants would be targeted and resulting dead vegetation would be less noticeable. Potential for impacts to non-target plants would be reduced, reducing the effects on untrammeled and natural wilderness character qualities.

Application of herbicide to individual plants is typically more work intensive. There may be more workers in the wilderness for more days than if broadcast methods were used. Visitors may feel a loss of solitude due to the presence of workers in the wilderness.

Impacts to WSR and the outstandingly remarkable values of fisheries, botany, ecology and wildlife would be reduced by eliminating broadcast spraying in riparian areas. Potential impacts to non-target plants, delivery of herbicides to water and subsequent impacts on fish would be reduced. Refer to the respective resource reports for details about this alternative.

By using methods other than broadcast spraying, less herbicide would be used overall. Individual plants would be targeted and resulting dead vegetation would be less noticeable to forest visitors. Impacts to recreation as an outstandingly remarkable value of WSR's would be the same as those common to recreation for all action alternatives.

Alternative D- No Aerial Application

There are no aerial treatments proposed in congressionally designated areas under Alternative D. The direct and indirect effects would be the same as those common to all action alternatives.

Effects on Developed Recreation Sites

Alternative A - No Action Alternative

Approximately 13 acres of invasive plants in five developed recreation sites would continue to be treated under current decision documents in Alternative A. These sites include Alder Thicket, Woodland, Woodward and Tollgate Campgrounds and Spout Spring Winter Sports/Ski Area. New invasive plant infestations would be treated by manual methods. These treatments have proven ineffective and it is likely invasive plants would spread. Developed sites are considered high spread potential sites. Humans, the vehicles they use, pets and pack stock, associated with developed recreation sites would continue to be vectors spreading invasive plants and propagating plant parts.

Effects Common to all Action Alternatives

Many campgrounds, rental cabins, trailheads and picnic site are destination recreation sites. Recreation visitors that have made plans to use a certain facility may find that herbicides have been applied within or near the site. Recreationists may choose to recreate elsewhere due to the presence of herbicides.

Alternative B - Proposed Action

Approximately 86 acres in 32 out of 39 developed recreation sites would be treated with herbicides in Alternative B. If all developed recreation sites were treated at the same time, recreationists that do not want to be exposed to herbicides would have a limited choice of facilities to use. This scenario is not likely due to program priorities, budget constraints and different weed species require treatments at different times of the year.

The regional FEIS Standard 21 prohibits aerial application of herbicides within 300 feet of a developed recreation facility. No invasive plant sites in or adjacent to developed recreation facilities would receive aerial application of herbicides including new infestations treated under EDRR.

If new infestations were found near developed sites and aerial application was determined to be the most effective method of application, indirect effects may be noise disturbance to visitors due to aerial application near developed sites. Aerial applications typically occur in the early morning or late evening hours when wind velocities are low. These are typically times when visitors are relaxing in camp. The following table summarizes the acres of invasive plants to be treated by treatment method.

Table 60 – Ranger District, Site Name and Acres of Proposed Treatments

Ranger District and Site Name		Acres of Proposed Treatments			
		Biocontrols	Chemical	Chemical Riparian	Total
Heppner	Bull Prairie Campground	0	6.2	0	6.2
	Fairview Campground	0	10.3	0	10.3
	Penland Lake Campground	0	.2	0	.2
	Coalmine Hill Campground	0	.1		.1
	Ditch Creek Guard Station Rental	0	.5	0	.5
Heppner Totals		**0**	**17.3**	**0**	**17.3**
Pomeroy	Alder Thicket Campground	0	2.6	0	2.6
	Pataha Campground	0	0	.1	.1
	Meadow Creek Trailhead	0	0	.9	.9
	Panjab Trailhead	0	0	2.8	2.8
	Tucannon Trailhead	0	0	.6	.6
	Rose Spring Winter Sports Area	0	2.5	0	2.5
Pomeroy Totals		**0**	**5.1**	**4.4**	**9.5**
North Fork John Day	Bear Wallow Campground	0	0	2.2	2.2
	Big Creek Meadows Campground and Trailhead	0	0	.2	.2
	Driftwood Campground	0	0	2.3	2.3

Ranger District and Site Name		Acres of Proposed Treatments			
		Biocontrols	Chemical	Chemical Riparian	Total
	Gold Dredge Campground	0	0	2.7	2.7
	Oriental Campground & Trail Head	0	1.1	0	1.1
	Tollbridge Campground	0		.3	
NFJD Totals		**0**	**1.1**	**7.7**	**8.8**
Walla Walla	Jubilee Lake Campground	0	4.6	0	4.6
	Target Meadows Campground	0	2.4	0	2.4
	Umatilla Forks Campground	0	0	1.6	1.6
	Woodland Campground	0	0	1.6	1.6
	Woodward Campground	0	18.9	0	18.9
	Fry Meadows Guard Station Rental	0	.2	0	.2
	Burnt Cabin Trailhead	.5	0	0	.5
	Whitman Route Interpretive Site	0	4.3	0	4.3
	Corporation Organizational Camp	0	0	1.9	1.9
	Buck Creek Organizational Camp	0	0	.1	.1
	Andies Prairie Snow Play Area	0	0	4.3	4.3

Ranger District and Site Name		Acres of Proposed Treatments			
		Biocontrols	Chemical	Chemical Riparian	Total
	Bone Springs Winter Sports Area	0	3.7	0	3.7
	Spout Springs Ski Area	0	0	5.8	5.8
	Ruckle Junction Winter Sports Area	0	.1	0	.1
	Woodland Snow Play Area	0	0	.8	.8
Walla Walla Totals		**.5**	**34.2**	**16.1**	**50.8**
Grand Totals		**.5**	**57.7**	**28.2**	**86.4**

Alternative C- Restricted Use – No Broadcast Herbicide Application in Riparian

Alternative C would have the same effects as the Proposed Action however; the 28 acres in riparian zones would receive an individual plant method application of herbicide or an alternate treatment type. Overall, less herbicide would be used by targeting individual plants. There would be less chance for herbicide to drift to the areas commonly used by visitors such as picnic tables, campsites, water sources and bathroom facilities.

Alternative D- No Aerial Application

There are no aerial treatments are proposed in or adjacent to developed recreation sites in Alternative D. This alternative would have the same effect as those described in the Proposed Action.

Effects on Trails

Alternative A - No Action Alternative

Approximately 92 acres of 454 acres of known invasive plants within trail corridors would be treated. Additional invasive plant sites would not be treated. Trails are considered high spread potential sites and it would be expected that existing and new infestations would continue to spread along trail corridors.

Effects Common to all Action Alternatives

Direct Effects

Non-motorized trail users such as hikers and pack stock users are typically traveling at a slow pace and dead vegetation immediately adjacent to trails would be noticeable. Non-motorized trails users may be more likely to come in contact with vegetation treated with herbicides by walking along recently treated trail areas.

Motorized trail users will also notice dead vegetation but should pass through an area faster than non-motorized users. Motorized trail users would be less likely to come in contact with vegetation treated with herbicides as the trail tread is maintained to a width that accommodates the motorized vehicle.

Indirect Effects

Trailheads would be posted alerting recreationists to the fact that herbicides have been applied to vegetation along the trail. This may cause recreationists to choose to recreate elsewhere, regardless of the trail type.

Alternative B - Proposed Action

Approximately 454 acres of invasive plants within trail corridors would be treated under this alternative. Of this, 345 acres would be treated with herbicides, 107 acres treated with biocontrol measures and two acres would receive manual treatments.

There are three treatment areas proposed for aerial application of herbicides that occur along non-motorized trails. One site (#06140400086) occurs along Salter Trail and is approximately seven acres in size. Two sites occur along Hixon Canyon Trail (#061404000495 and #06140400051). The first site is five acres and the other is three acres.

The Salter and Hixon Trails would be directly impacted by this alternative. The trails would have to be closed during the aerial spraying operations for safety reasons. Users would be displaced to other trails. The closure would be short term, lasting during the aerial spraying operation. These trails receive low use during the regular summer season; however use increases during big game hunting season. The following table summarizes the acres of invasive plants to be treated by treatment method.

Table 61 - Trail Type and Acres of Proposed Treatment

Trail Type	Acres of Proposed Treatments				
	Biocontrol	Chem	Chem-Riparian	Manual	Total
OHV/Motorcycle	26	13	11	0	50
Hiking/Pedestrian	0	22	1	0	23
Pack and Saddle	24	87	98	2	211
Cross Country Ski	57	112	1	0	170
Total	**107**	**234**	**111**	**2**	**454**

Alternative C- Restricted Use – No Broadcast Herbicide Application in Riparian

This alternative would have the same effects as the Proposed Action, however; approximately 111 acres that are proposed for chemical treatment in riparian areas would be treated with non-broadcast herbicide methods or an alternate treatment type.

Alternative D- No Aerial Application

The effects of Alternative D would be the same as those described for the Proposed Action, however; areas identified for aerial application would receive an alternate method of herbicide application or treatment type. The trails would not have to be closed for aerial spraying operations, however; herbicide would most likely be applied by another broadcast spraying method.

Effects on General Forest Area

Alternative A - No Action Alternative

Of 24,649 acres of known invasive plants, only 3,154 acres would be treated under the No Action Alternative. The remaining acres could be treated by manual methods. Manual treatments are less practical and effective for treating large infestations. Invasive plants would be expected to continue to spread throughout the forest.

Effects Common to all Action Alternatives

Direct Effects

Approximately 23,275 acres of the general forest area would be treated for invasive plants. Approximately 19,461 acres would be treated with herbicides. These acres occur along roads, quarries, rangelands, parking areas and dispersed sites as well as forest lands. These acres are not associated with destination recreation facilities, trails, wilderness or Wild and Scenic Rivers.

The forest visitor is most likely to encounter invasive plant treatments while traveling through an area on a forest road. Visitors may notice dead vegetation, signs informing visitors that an area has been treated with herbicides or people with equipment applying herbicides.

Visitors gathering mushrooms, berries and other forest products may be displaced to areas where herbicides have not been applied. Refer to the Pacific Northwest Region Final Environmental Impact Statement, Preventing and Managing Invasive Weeds, 2005 for discussion of human health and safety regarding exposure to herbicides.

Indirect Effect

Indirect effects would be similar to those described as common to recreation for all action alternatives.

Alternative B - Proposed Action

Treatments will utilize all available tools, including biocontrols, chemical, mechanical, aerial and manual methods. Approximately 675 acres of aerial application or herbicide are proposed on the Pomeroy District. The majority of chemical aerial application acres are in one contiguous 631-acre block. This site is in the Jim Creek area, west of Forest Highway 46, near the forest boundary. This area would be closed to the public during aerial operations and posted to inform visitors that herbicides have been applied. The area would be closed to public access only during the aerial application operations. This impact would be short term. Other effects would be similar to those described as common to recreation for all action alternatives. The following table summarizes the acres of invasive plants to be treated by treatment method.

Table 62 - Recreation Areas, General Forest and Acres of Proposed Treatment

Recreation Area	Biocontrol	Chemical	Chemical Riparian	Manual	Total
Wilderness	5	84	100	8	197
WSR	19	130	486	2	637
Developed Recreation	1	57	28	0	86
Trails	107	234	111	2	454
General Forest Area	3785	14626	4835	29	23275
Grand Totals	**3917**	**15131**	**5560**	**41**	**24649**

Alternative C- Restricted Use – No Broadcast Herbicide Application in Riparian

This alternative would have the same effects as the Proposed Action; however; approximately 5,560 acres that are proposed for chemical treatment in riparian areas would be treated with non-broadcast herbicide methods or an alternate treatment type.

Alternative D- No Aerial Application

This alternative would have the same effects as the Proposed Action, except the 675 acres identified for aerial application of herbicide would be treated with alternative, applicable methods.

Cumulative Effects

The cumulative effects discussion considers past, present and reasonably foreseeable actions that occur within the Project Area. These actions include existing, ongoing and planned vegetation management, grazing and recreation activities. A discussion of the cumulative actions considered in this analysis is included in Chapter 3.1.2.

The cumulative effects Project Area for the recreation resource is the Umatilla National Forest and other public lands within and adjacent to the forest boundary. Recreationists move between public lands regardless of managing agency for recreation purposes.

Short term effects are associated with invasive plant treatment methods, especially use of herbicides, and the impact they have on the recreationist's desire to recreate in an area. Long term effects are related to the presence of invasive plants and how they may alter the natural environment or detract from the desirability of using recreation sites and participating in certain recreational activities.

The effects to recreation associated with invasive plant treatments are short term. It is unlikely that all recreation facilities, trails, wilderness areas or WSRs would be treated for invasive plants at the same time. Recreationists that are displaced due to their concern about herbicide exposure can recreate in alternate facilities or other areas. Similar recreation opportunities would be available on the forest and adjacent public lands or some private land that may not have been treated with herbicides.

3.7 Effects of Herbicide Use on Workers and the Public

3.7.1 Introduction

The effect of herbicides on human health is a primary public issue. 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. However no exposures exceeding a threshold of concern are predicted. Chemistry of the herbicides considered and the mechanisms by which exposures might occur are the basis of this prediction.

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 for this project to ensure that herbicide and surfactant application rates and methodologies minimize or eliminate exposures of concern.

The R6 2005 FEIS relied on professional risk assessments completed by Syracuse Environmental Research Associates, Inc (SERA) using peer-reviewed articles from the open scientific literature and current EPA documents, including Confidential Business Information. The SERA Risk Assessment full citations are listed in Chapter 3.1.5. Appendix Q of the R6 2005 FEIS provides detailed information about the human health hazards of the herbicides considered for invasive plant treatments.

The following terminology describes relative toxicity of herbicides proposed for use.

Exposure Scenario: The way a person may be exposed to herbicides' active ingredients or additives. The application rate and method influences how much herbicide an organism may be exposed to.

Threshold of Concern: A level of exposure below which the potential for adverse effects to an organism is low. This level was made more conservative in the R6 2005 FEIS to add a margin of safety to the risk assessment process (see Figure 3, section 3.1.2).

Hazard Quotient (HQ): The Hazard Quotient (HQ) is the amount of herbicide or additives to which an organism may be exposed divided by the exposure threshold of concern. An HQ less than or equal to one indicates an extremely low level of risk and therefore. A HQ less than one indicates a level below a threshold of concern.

The basis for risk assessment consists of the following parts:

1. Hazard Characterization	What are the dangers inherent with the chemical?
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 may be discounted (known carcinogen) if the exposure and dose are below any level of concern (EPA's standard of acceptable risk of less than one in one million for cancer causing chemicals). For instance, some high rates and high doses of herbicides exposure may cause liver damage, but without this combination the risk is actually very low. Some of the herbicides are of such low toxicity that a person could neither be exposed to, nor consume enough herbicide to have an observable negative effect.

3.7.2 Affected Environment

Many people live near, spend time, work in, drink water from, or depend on forest products from the Umatilla National Forest. Public concern for drinking water quality in municipal watersheds these watersheds is high.

These people may be inadvertently exposed to chemicals from proposed invasive plant treatment. Municipal watersheds dispersed and developed recreation areas (trailheads, campgrounds, picnic areas, recreation sites, work centers, etc) and special forest product collection areas are currently near invasive plant sites.

Special forest products such as blackberries, huckleberries, salal, bear grass, mushrooms and herbs are gathered for personal use and commercial sale. Some of these products like St. John's wort are gathered but most are not. People who harvest special forest product may have more contact with sprayed vegetation than other Forest visitors.

People who gather special forest products tend to be ethnically diverse. A recent unpublished study of commercial permit holders demonstrated that the largest ethnic groups involved with forest product gathering were Hispanics and Southeast Asians (Khmer, Khmer Krom, Laotian and Vietnamese).

Infested sites are scattered and occupy less than three percent of the national forest lands. Invasive plant treatments are implemented in partnership with the local counties.

Crews mostly come from the communities near the national forest. Herbicide applicators are licensed and well-trained in safe handling and application practices.

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 proposed for use 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 below the threshold of concern (HQ values ranged from 0.01 to 1).

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. A PDF eliminates 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. Non-NPE surfactants would always be favored where effective.

Chronic (daily over 90 days) worker exposure was also considered in SERA Risk Assessments. Chronic exposures do not rise to the levels of concern because the herbicide ingredients are water-soluble and therefore rapidly eliminated from the body.

3.7.3 Environmental Consequences

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. Appendix Q shows Risk Assessment results assuming a human contacts sprayed vegetation or herbicide or consumes sprayed vegetation, contaminated water, and/or fish.

Direct Contact

Members of the public could come into direct contact with herbicides that are aerially applied. Project Design Features would eliminate most potential for exposure by notifying the public prior to application, limiting which herbicides can be applied aerially (triclorpyr cannot) and limiting aerial spraying to conditions that would minimize drift.

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. For all herbicides except triclopyr, even if a person were directly sprayed with herbicide applied at typical broadcast rates, chemical exposure would not exceed a level of concern.

Exposures exceeding a conservative level of concern could occur if a person accidentally contacts vegetation spot-sprayed with triclopyr (especially Garlon 4). However, such contact is implausible because no broadcast spraying with triclopyr would occur under any alternative.

The R6 2005 ROD added Standard 16 to the Umatilla National Forest Plan to only allow spot or hand/selective treatment if triclopyr is used.

The use of Garlon 4 is further limited by the PDF (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).

Gathering areas, campgrounds and administrative sites may be closed immediately 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.

Non-target, native berries or mushrooms may be affected by drift or runoff. Members of the public, for example could eat huckleberries that have herbicides on them due to drift.

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 very conservative threshold of concern (Hazard Quotient greater than one).

Appendix Q 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 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).

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, into which herbicide residues have contaminated 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.

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. However, no mushrooms are target species and Project Design Features are in place to protect fungi. Whenever herbicide treatment is going to happen, 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 existing multi-lingual mushroom gathering permit material to eliminate inadvertent exposures if appropriate. Some areas may be closed to gathering following treatment to avoid exposures. Even given plausible inadvertent exposures, the HQ values would not exceed the threshold of concern.

Direct and Indirect Effects of the Alternatives

No Action

The herbicides and herbicide applications approved in No Action were previously analyzed in the 1995 EA and found to pose no significant potential risks to health for workers or the public.

Action Alternatives

All alternatives similarly resolve issues related to human health. No individual worker or public exposures of concern are predicted for any alternative. Alternative C has the least risk of adverse effects from herbicide use of all action alternatives because it eliminates broadcast spraying applications in riparian areas. While this is primarily to protect riparian and aquatic ecosystems from exposure, it would also reduce potential exposure to workers applying herbicides and lower possible exposure of members of the public by reducing the overall amount of herbicide applied. Alternative D reduces the risk of human exposure by eliminating aerial spraying which has some potential of human exposure due to drift. As previously stated despite that potential exposure, even if it does occur it would not likely, under any scenario rise to a level of concern.

Alternative B would have the greatest risk of human exposure because it proposes the greatest amount of broadcast spraying. 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 B and the other action alternatives.

3.8 Range

3.8.1 Introduction

Invasive Plants and Range Resources

Presently 74 percent of the Umatilla National Forest is appropriated into range allotments (1,038,829 acres). There are 48 cattle allotments in which 94 percent of the invasive species sites (1948 of the 2067) are located totaling approximately 80 percent of the infested acres forest wide (19,770 acres of the total 24,649 infested acres forest wide). Approximately 74 percent (2,000 of the 2,770 acres) of acres approved for treatment in the 1995 EA are located in active allotments. Thirty eight percent of these allotments have recently evaluated noxious weed issues under the current forest plan standards. Table 63 lists the allotment name, acreage, present use, and the invasive weed acres.

3.8.2 Affected Environment

Direct impacts of invasive species to grazing animals, include nitrate poisoning from Canada thistle in ruminants, fatal poisoning of horses from Russian knapweed and yellow starthistle, excessive salivation and diarrhea in cattle from leafy spurge (Knight and Walter 2003). Domestic and wild grazing animals contribute to invasive plant establishment and spread through selective eating, redistribution of invasive plant seeds in scat, skin or fur, and hooves, and soil disturbance, therefore creating conditions favorable for seed germination. Historically, several intentional and unintentional introductions of invasive plants into native plant communities have been associated with livestock management, resulting in widespread invasions (Baker, 1974; Sheley and Petroff, 1999). Healthy and vigorous vegetation capable of resisting weed invasion is possible through proper grazing methodologies (Sheley, et al., 1996).[4]

Current Trends

Presently 74 percent of the Umatilla National Forest is appropriated into range allotments (1,038,829 acres). There are 48 cattle allotments in which 94 percent of the invasive species sites (1948 of the 2067) are located totaling approximately 80 percent of the infested acres forest wide (19,770 acres of the total 24,649 infested acres forest wide). Approximately 74 percent (2,000 of the 2,770 acres) of acres approved for treatment in the 1995 EA are located in active allotments. Thirty eight percent of these allotments have recently evaluated noxious weed issues under the current forest plan standards. Table 63 lists the allotment name, acreage, present use, and the invasive weed acres.

[4] For a complete review of the influence of ungulates on non-native plant invasions in forests and rangelands, see the Regional FEIS, Appendix D, PNW Causal Paper Ungulates. This paper presents the current understanding in the Region with respect to ungulates as contributors to the spread of invasive plants. Selective foraging, effects of site disturbance or alteration, and knowledge gaps and future research needs are discussed.

Table 63 - Range allotments and invasive weed acres

Range Allotment	Use (A=active, V=vacant)	District	Forest Service lands allotment acres	Number of Invasive species sites	Number of Invasive Species present within allotment1	Acres of invasive species
ASOTIN	A	Pomeroy	39,076	41	10	1,592
BROCK	A	WW	942	2	2	2
BUTCHER CREEK	A	NFJD	10,890	4	5	34
CENTRAL DESOLATION	A	NFJD	14,133	19	5	70
COALMINE	A	Heppner	6,919	2	3	2
COLLINS BUTTE	A	Heppner	20,099	75	6	519
COOPER CREEK	A	NFJD	4,443	1	2	2
CUNNINGHAM	A	NFJD	43,726	12	35	58
DITCH CREEK	A	Heppner	37,545	110	7	1,121
EDEN	A	WW	40,753	177	13	1,328
F. G. WHITNEY	A	NFJD	52,237	58	7	674
GOODMAN	V	WW	30,908	49	16	425
HARDMAN	A	Heppner	23,918	77	6	472
HIDAWAY	A	NFJD	31,901	25	8	131
HUTCHISON	A	NFJD	1,697	0	0	0
INDIAN CREEK	A	NFJD	77,387	63	9	1,523
JIM CREEK	A	Pomeroy	104	2	1	95
JOHNSON	V	NFJD	399	1	1	1
KLONDIKE	A	NFJD	23,642	35	10	500
LITTLE WALL	A	Heppner	37,312	78	4	475
LUCKY STRIKE	A	NFJD	17,115	25	5	575
MACKEE	V	Pomeroy	38	0	0	0
MATLOCK	A	NFJD	10,706	5	2	88
MCDONALD SPRING	A	NFJD	139	0	0	0
MONUMENT	A	Heppner	19,099	35	4	99
NORTH END	A	WW	126,221	406	20	3,614
NORTH FORK	V	NFJD	683	0	0	0
PEDRO	V	NFJD	643	0	0	0
PEOLA	A	Pomeroy	22,973	31	10	625
POMEROY	A	Pomeroy	21,225	127	11	811
POTAMUS	V	NFJD	350	1	3	0
SPRING CANYON	V	NFJD	165	0	0	0
SPRING MOUNTAIN	A	WW	33,688	96	11	1,302
STONEHILL	A	Umatilla NF	2,945	0	0	0
SWALE CREEK	A	Heppner	27,057	35	4	378
SWISS FLAT	V	NFJD	174	0	0	0
TAMARACK	A	Heppner	19,438	70	5	856
TEXAS BAR	A	NFJD	58,803	69	11	229
THOMPSON FLAT	A	NFJD	6574	12	5	29
TOUCHET	V	WW	22,735	19	8	445
TROUT MEADOWS	CLOSED	NFJD	25,934	3	1	9
WALLA WALLA	V	WW	28,805	32	12	326

Range Allotment	Use (A=active, V=vacant)	District	Forest Service lands allotment acres	Number of Invasive species sites	Number of Invasive Species present within allotment1	Acres of invasive species
WENAHA	V	Pomeroy	14,919	17	8	36
WENATCHEE	A	Pomeroy	6,271	20	5	231
WESTERN DESOLATION	A	NFJD	13,400	19	5	130
WINLOCK	A	Heppner	5,149	35	4	288
YELLOW JACKET	A	Heppner	17,229	60	4	675
TOTAL	**47**		**1,038,829**	**1,948**		**19,770**

Data for allotment acreages were derived from Umatilla National Forest INFRA database (9_14_06). Overlay of invasive weed sites were completed using Umatilla National Forest corporate database (BMP_Prov)

Diffuse and spotted knapweed, Canada thistle, and houndstongue are invasive species that are most prevalent in the allotments forest-wide (Table 65), and mostly found along roads. Disperal vectors for houndstongue seed (burs) are primarily by cattle. It is also thought that deer, elk and other small mammals readily disperse houndstongue seed, but minor compared to cattle (Clerck-Floate 1997). Canada thistle is found along many of the roads especially in the Asotin allotment on the Pomeroy district. In many instances cattle and other browsers will avoid areas where invasive weeds are prevalent in large monocultures, and move to areas where there is better forage. In areas where occasional invasive species occur with other desirable species it is highly likely that these animals would ingest some invasive weed seed and disperse viable seed in feces. Some weed seeds are destroyed within the gastrointestinal tract; however, leafy spurge and spotted knapweed seeds can pass thru sheep, goats, and mule deer and some of the seeds remain viable (Lacey et al. 1992). Leafy spurge seed was shown to be viable in feces 10 days post ingestion by mule deer. Long-lived seeds and hard seeded species of dicots and grasses consumed by grazers have been reported to survive passage thru gastrointestinal tracts of cows and grizzly bears (Janzen 1984). It is suggested that land managers control movement of domestic rumunants, and that these animals should not be moved from infested areas to uninfested areas where viabile seed is present on the stems. Alternatively, the animals could be confined into a dry lot for 5 to 10 days to allow any viable weed seeds to pass ensuring no futher dispersal of invasive seed is possible (Sheley and Petroff 1999).

Watering systems such as troughs and tanks with frequent animal visitation and other range structural improvements where the ground is disturbed and invasive species can be easily established and dispersed represent approximately 387 acres of the high potential spread areas. Additionally, cattle often exhibit trailing behavior along fence lines that can result in disturbed areas for invasive species to establish. Estimates of fence lines with potential trailing impacts from cattle is suggested to be approximately 50 percent of fence lines in allotments forest-wide (M. Bulthuis 2006). This estimate would suggest that there is approximately 1,900 additional acres where invasive species could establish. Presently, there are 70 invasive weed sites (representing 113 acres) near fences (10 foot fence line corridor) located within the 50 allotments along the 3,133 miles of fence on the Umatilla National Forest (Umatilla NF GIS database 10/06).

Table 64 - Invasive species acres in Umatilla National Forest grazing allotments -

Invasive Species[1]	Estimates of Total Acres infested[2]
Diffuse knapweed	8807
Canada thistle	4355
Houndstongue	2413
Spotted knapweed	2078
St. John's wort	1368
Scotch thistle	220
Yellow starthistle	189
Common burdock	170
Sulphur cinquefoil	165
Dalmation toadflax	82
Tansy ragwort	72
Whitetop	44
Musk thistle	42
Leafy spurge	21
Scotch broom	6
Russian knapweed	3
Medusa head	3
Rush skeletonweed	0
Orange hawkweed	0

1 For Scientific names see botany report
2 These acreages are gross acres where areas are delineated by the outer perimeter of the weed infestation and may contain significant areas that are not currently occupied by weeds.

Table 65 - Invasive species in all allotments across the Umatilla National Forest -

Range improvement	Number of improvements forest-wide (all allotments)	Acres in high spread
Water system (spring, metal trough or tank with concrete bottom)	337	385
Handling facility	1	1.5
Fence lines	3,133 miles	113 current 1,908 potential[1]
Total	**N/A**	**500**

These acerages are gross acres where areas are delineated by the outer perimeter of the weed infestation and may contain significant areas that are not currently occupied by weeds.
1 Based on 10' wide path along 50% of fencelines

3.8.3 Environmental Consequences

Direct and Indirect Effects

This section will present the direct and indirect effects analysis for range resources. Issues presented during public scoping and effects related to range resources will be presented by alternative.

The regional FEIS amended the existing forest plan, therefore, all action alternatives require incorporation of invasive plant prevention practices in annual operating instructions/plans and allotment management plans. The incorporation of these prevention practices are expected to reduce environmental impacts of livestock grazing forest wide. Ultimately, invasive plant prevention practices may result in some reduction to livestock grazing, but prevention of invasive plants is only one of several resource protection measures that reduce grazing such as consideration; multiple factors including range condition, stream protection, and endangered species management will also influence allotment management. For complete discussion of these practices in relation to range resources see the Regional FEIS, Chapter 3 (USDA 2005a). The effects analysis described in this document analyze effects of the alternatives on grazing allotment permittees and range resources. As Project Design Feature N1 states, adjustments suggested to protect range resources will be addressed through existing administrative mechanisms such as grazing allotment management plans, grazing permits, etc. Suggestions to address invasive plants or their potential introduction may include:

- 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 and could include resting of pastures resulting in reduction of livestock use and output
- Passive restoration of native plant communities, which could requires allotment resting for one to two seasons potentially reducing 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

An actual reduction in Animal Unit Month (AUMs) attributed to invasive plant management cannot be quantified at the project scale due to unavailable data, variability between allotments, and the ongoing process of Allotment Management Plan revision.

Table 66 - Comparison of factors affecting ability of alternatives to reduce invasive species spread on grazing allotments on the Umatilla National Forest

Comparison Factors	Alt A – No Action	Alt B Proposed Action	Alt C. Restricted Riparian	Alt D. No Aerial Broadcast Treatment
Loss of native plant communities and plant bio-diversity	+++	+	++	++
# of herbicide formulations available for use	2	10	10	10
Acres of invasive plant that could be treated within existing allotments (all methods – Manual, Biocontrol, and/or Herbicide)	3,154	20,040	20,040	20,040
Acres of invasive plant sites that could be treated with herbicides either alone or in combination with other techniques within allotments	742	16,898	16,989	16,898
EDRR (including herbicide use)	No	Yes	Yes	Yes
Treatment Effectiveness (derived from Botany report)	Low	Highest	High	High
% of Total Forest Landbase Treated with Chemicals (all identified acres/annually)[3]	Apprx: 0.12%, <0.008% annually	Apprx: 1.5%, 0.3% annually	Apprx: 1.5%, 0.3% annually	Apprx: 1.5%, 0.3% annually

Alternative A - 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. Currently, approximately 2,000 acres in grazing allotments are approved for treatment under the existing 1995 EA

Invasive plants are currently damaging the ecological integrity of lands within and outside these allotments. Despite management direction in the 1995 EA, invasive plants continue to increase and occupy previously uninfested areas. Invasive plants spread at a rate of 8-12 percent annually (USDA 2005) within National Forest system lands and neighboring areas, affecting all land ownerships (See existing condition section in the Botany report, available in the Project Record, for estimates of invasive species growth forest wide based on current treatment effectiveness). As the current conditions change, and as invasive species continue to spread via common dispersal methods, management activities such as livestock grazing will be affected. Livestock and their human managers have the potential to spread invasive species. As the spread of invasive species becomes more obvious to the public, they will put more pressure on public land managers to restrict vectors the spread invasive species. This includes livestock and livestock operations.

Under current, allowable treatments, invasive weeds would likely continue to displace palatable native vegetation and could reduce forage on grazing allotments. Activities within allotments will continue to serve as seed dispersal vectors as these invasive species sites continue to grow. Loss of native plant communities may continue to occur as invasive weeds occupy and out-compete native species. Once invasive species begin to dominate these communities, a loss of species diversity, composition, and ecosystem function could occur.

Noxious weeds would likely continue to spread into areas that are not currently infested, such as recently burned areas. Once weeds become established, these areas would likely serve as weed seed source for other areas of the forest and nearby non-National Forest System lands.

Toxic species such as Canada thistle and leafy spurge would continue to increase under the no action alternative. Most of the Canada thistle is along roadsides and grazing animals would likely avoid these areas in search of more palatable forage elsewhere. Leafy spurge is only documented on 20 acres across the forest and even with the potential for spread it is likely cattle will avoid these areas and no impacts to cattle from toxic properties from either of these two species would occur with this alternative.

This alternative would not meet the desired future condition of the area which is to "retain healthy native plant communities that are diverse and resilient, and restore ecosystems that are being damaged, and to provide high quality habitat for native organisms throughout the forest, and assure that invasive plants do not jeopardize the ability of the forest to provide goods and services communities expect" (See Chapter 1.2). Invasive species will continue to spread as documented from past inventories compared to the current inventories.

Alternative B (Proposed Action)

This alternative proposes to address problems posed by invasive plants that compromise our ability to manage native ecosystems on the Forests. New management direction and tools made available for use in Region 6 will be utilized. Analysis will tier to the R6 Invasive Plant Program Final Environmental Impact Statement (USDA, 2005), including the use of the newly approved herbicides as described in the document. There is a need to reduce the extent of specific invasive plant infestations on the 2,069 known weed sites, and to protect uninfested areas using Early Detection Rapid Response.

Long-term effects of invasive weed treatments on the 48 affected grazing allotments (approximately 20,000 acres) would be the retention of currently available forage, reduction in spread from existing and unknown future sites, and recovery of native vegetation in areas currently impacted by invasives. Because these treatments are anticipated at a rate of approximately 4,000 acres per year and treatment sites will be prioritized at each individual district level there may be some short-term 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. Operators may experience experience a slight loss of grazing opportunity however, many of the grazing strategies within allotments have deferred rotations and by focusing invasive weed treatments to the pastures during the resting phase would avoid most all potential impacts to operators

Some herbicides have label use restrictions that will be followed regarding livestock grazing and/or slaughtering post herbicide treatment and subsequent exposure. As mentioned previously, treating pastures that are currently in rest due to grazing management rotations would eliminate any potential effects. If movement of livestock is not possible and pastures or allotments require treatment while animals are present all label use restrictions will be followed in addition to PDFs that require permittee notification prior to any proposed aerial application. Notification and coordination should also occur during annual operating instruction/plan meetings and by posting/signing areas to be treated prior to and after treatment (USDA 2005b). For aerial herbicide application within allotments, permittees would be notified of proposed expected timeframes for treatment to allow the option to remove animals. No adverse effects to large mammals were found from direct spray of herbicides that could be applied aerially at the highest expected rates (R6 EIS 2005 SERA Risk Assessment-Effects to Wildlife). Of the 675 acres proposed for aerial herbicide treatment, there are presently 287 acres proposed within grazing allotments and could be additional sites in the future. Most aerial sites are located in steep terrain with limited access areas where livestock generally do not prefer however, PDFs would provide additional protection in the event stay grazing animals were present in areas (see PDFs N1, N2 in Section 2.3.3 above).

Under the Proposed Action it is acknowledged that more chemicals would be used in the environment while effectively treating invasive species (See Chapter 2.2.3) compared to the No Action Alternative. 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. Minimal to no effects are anticipated to grazers or operators due to strict adherence to label handling directions and spill containment protocols in the unlikely event of a spill. There has been a concern that livestock grazing is a major cause of non-native plant invasions (Belsky and Gelbard 2000) and that removal of livestock would reduce much of the cause of invasive species spread. No manipululative studies with appropriate treatments and controls have rigorously tested this hypothesis. Additionally, no known manipulative experiments of grazing effects of wild ungulates on non-native plant species dynamics have been done (Parks et al. 2005). Scientific support is growing for the hypothesis that large herbivores facilitate the invasion and establishment of non-native plants, however, substantial controversy exists about the specific process in time and space and the associated predictions of effects.

Under this alternative treatment of invasive species including eradication at some locations, would allow grazing activities to remain much as they are under current conditions and would meet the desired future conditions within the project area. Additional benefits to this alternative would be the reduction of potential spread of invasive species into uninfested disturbed areas such as fencelines. Also, early detection and response for any newly established invasive species would occur. Compared to the no action alternative the impacts, especially long-term impacts, to permittees would potentially be reduced, because native and desirable non-native vegetation would increase. The treatment of existing and future documented sites under this alternative would positively affect range resources.

Alternative C - Riparian Restriction

Alternative C would meet the same objectives as Alternative B, but intends to minimize impacts from chemical use in riparian areas by not allowing broadcast herbicide treatments within riparian areas. This alternative would not allow broadcast herbicide treatments in approximately 2,005 riparian acres in allotments. This means that any invasive species that are presently known or discovered in the future could only be treated with manual spot treatments and in accordance with all PDF’s (see section 2.3.3).

Impacts to livestock and operators would be similar to those described in alternative B, but the potential for exposure of livestock and livestock managers will be slightly decreased as less chemical will be used within riparian areas. The potential for reestablishment of species with seed present in the riparian area soil seed bank are greater because riparian areas may not be as effectively treated as allowed under Alternative B.

Alternative D - No Aerial Herbicide Application

Alternative D would meet the same objectives as Alternative B, but would avoid potential effects from drift by not allowing aerial application of herbicides. Because the 287 acres of grazing allotment may still be treated by other methods, little impact to forage availability is expected. It is anticipated that these existing infestations will likely recover to native vegetation in the future, however, the treatment method may not be as effective or recovery of vegetation may not happen as quickly as suggested in the proposed alternative. Livestock do not prefer to graze on steep slopes where most aerial treatments are proposed, therefore, impacts from no aerial herbicide treatments would likely have little to no effect.

By not aerially treating, the potential for exposure to livestock and livestock managers will be reduced. Other benefits of this alternative would be the same as the Alternative B.

Cumulative Effects

The cumulative effects spatial Project Area is the Umatilla National Forest and nearby adjacent Tribal, private, state and other federal lands. The time frame of the analyses includes the past 20 years and the next 15 years which is expected to be the life expectancy of this document. Invasive species have been present and programs existed to treat them on the Forest prior to the past 20 years. However, most Land Resource Management Plans in the late 1980s and early 1990s did not recognize the specific details of the ecologic implication of invasive plants

Past, Present and Reasonably Foreseeable Future Actions

Past management activities on the Forest in combination with the conservative approach to controlling invasive weeds has resulted in an increase in infested acres and impacts to ecosystem integrity. Various activities such as recreational use, road use, fire and its associated management activities, other management activities, grazing, and climatic events such as drought are all documented to contribute to the potential for establishment and spread of invasive species. All of these activities have contributed to the increase in invasive species within the Umatilla National Forest.

Present and reasonably foreseeable future actions will continue to provide opportunities for invasive species to establish. The Regional FEIS estimates that invasive species will continue to spread at a rate of 8-12 percent annually (USDA 2005). Expected treatment effectiveness of all methods approved within the Regional FEIS including the site specific treatment methods evaluated in alternatives B, C, and D would increase treatment effectiveness to 80 percent compared to the 35 percent effectiveness presently reported (see Botany report). For a full discussion of direct indirect and cumulative effects to native vegetation that is tightly linked to grazing see effects analysis in the Botany report. Because impacts to grazing are tightly linked to the health of native vegetation Roads will continue to be a major conduit for invasive plants.

Forest Service projections suggest that recreation uses of National Forests will continue to increase, and other land management and use activities such as grazing, vegetation management, fuels management (Healthy Fuels Initiative), and fire suppression will continue to cause ground disturbances and contribute to the introduction, spread and establishment of invasive plants on National Forest system lands (USDA, 2005).

Land uses and development on lands adjacent to or outside National Forest boundaries will likely continue to contribute to the potential for invasive species to be distributed in the Forest. For example, the use of invasive plants by landowners for landscaping, while small individually, can collectively result in significant impacts, especially along riparian corridors (USDA Forest Service 2005).

Cumulative effects to grazing and range management of this project by alternative are listed in Table 67 Cumulative effects are expected to be positive for alternatives B, C and D because more aggressive treatments combined with Early Detection Rapid Response activities and cooperative efforts with other federal, state and private landowners will reduce the potential for additional spread and loss of available forage.

Table 67 - Cumulative Effects on Grazing and Range Management within the Project Area

Alternative	Effects on Grazing and Range Management
Alternative A **No Action**	Over time infested areas will continue to increase and forage plants will be reduced through displacement and reduced ecosystem health. As conditions change over time within the allotments, livestock use will likely be reduced thru additional NEPA allotment analysis to prevent the further spread of invasive species.
Alternative B **Proposed Action**	Some limitations on livestock grazing may occur. 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 C **Riparian Restrictions**	Same as the Proposed Action.
Alterntaive D **No Aerial Herbicide Application**	Same as the Proposed Action.

Irreversible and Irretrievable Commitment of Resources

Implementation of Alternatives B, with appropriate environmental protection would not result in irreversible or irretrievable loss of range resources. Implementing Alternative A (No Action) would likely result in eventual irreversible impacts on grazing resources as weeds would continue to spread and invade in and around the proposed treatment areas. Implementing Alternative C&D would likely result in eventual irreversible impacts on grazing resources as weeds would continue to spread and invade in and around the proposed treatment areas that are treated with methods not as effective as those proposed in Alternative B, however, at a level much lower level of loss compared to the no-action alternative.

3.9 Project Costs and Financial Efficiency

3.9.1 Introduction

The Pacific Northwest Region published the programmatic *Pacific Northwest Region Invasive Plan Program Preventing and Managing Invasive Plants FEIS* in April 2005 and a Record of Decision (ROD) for Invasive Plant Program Management on October 11, 2005. This decision amended all Forest Plans in the Region, adding new direction for the containment, control, or eradication of invasive plant species. The Forest Plan calls for using prevention practices, various mechanical and hand treatments, and an updated list of herbicides to effectively address invasive plant threats (USDA 2005a; USDA 2005b).

In addition to the direction provided above, the 1990 Land and Resource Management Plan for the Umatilla National Forest includes the following goals tied to the social and economic environment:

- “Provide land and resource management that achieves a more healthy and productive forest and assists in supplying lands, resources, uses, and values which meet local, regional, and national social and economic needs.”
- “Promote human resources, civil rights, and community development within the zone of influence of the Forest. Promote cooperation and coordination with individuals, groups, landowners, Forest users, Native American tribes, and state and Federal agencies in forest management, and community and economic development.”

Methodology

The Project Area is the ten counties most directly influenced by the Umatilla National Forest. Four counties in southeast Washington; and six counties are in northeast Oregon. The time frame used for the analysis of direct, indirect, and induced economic effects is approximately seventeen years. This is the estimated period of time required to achieve purpose and need based on projections developed using the assumptions described below.

Projected Costs

In order to compare the alternatives, implementation costs were estimated based on a uniform set of assumptions. The cost estimates displayed in this report should not be assumed to be exact. They are an approximation intended to provide a method for comparing alternatives. Regardless of which alternative is selected, costs will vary from year to year based on factors such as annual budget allocations, the annual operating plan, the conditions present in the sites scheduled for treatment, opportunities for cost savings afforded by partnerships with Forest stakeholders, and the availability of external funding.

The area to be treated annually is generally constrained by budget allocations. For the analysis purposes, annual treatments were estimated to average 4,000 acres. However, the cost of treatments at various levels was estimated to determine annual and long-term costs should budget levels vary from those projected. Many variables affect the cost of treatment activities, including: treatment methods (e.g., mechanical, manual, herbicide, etc.); method of herbicide application (e.g., aerial, broadcast spraying, spot application, etc.); species, and site conditions. Many of the sites to be treated are likely to require repeated entries; the phenology of individual invasive species and the effectiveness of a given treatment influence the number of entries that may be needed. It is expected that in some cases, multiple treatment methods may be employed on the same site. For example, a site with multiple species may be treated with spot application of herbicide to address one species, and physical treatments, such as hand pulling to address other species. In some cases a combination of treatment options are proposed, such as manual, mechanical, and/or herbicide. On these acres, one treatment method may be utilized initially, with another method used for follow-up treatments, such as herbicide treatments applied in year one followed by manual treatments in year two.

To estimate cost impacts, two analyses were conducted. The first estimate is the total undiscounted cost to treat all affected acres one time together with the cost of associated monitoring. For this estimate, no effort was made to approximate the acres of re-treatment, acres of spread, or Early Detection Rapid Response (EDRR). While the dollar value developed should not be construed as the total project cost, it is useful for the purposes of comparing alternatives. The result of this calculation was then divided by the estimated number of acres effectively treated. Treatment effectiveness under Alternative A was estimated at 25 percent of acres treated based forest experience utilizing the current treatment strategy. Treatment effectiveness under the action alternatives was estimated at 80 percent of acres treated based on commercially acceptable standards.

The second cost estimate examines the discounted annual and long-term costs and the projected time to achieve control of all inventoried sites at the projected annual treatment level of 4,000 acres. A discount rate of 4 percent was assumed. To address the potential of unanticipated funding changes, a variety of other annual treatment levels greater than and less than 4,000 acres were also estimated. Annual inventory and monitoring costs were incorporated as well. Because the time required to attain containment or control of inventoried infestations would vary, depending on the level of annual treatment, the net annual equivalent cost is displayed to provide a comparison between various treatment levels and time horizons among the alternatives.

- The average efficacy of the more limited suite of treatment methods available under the no action alternative (Alternative A) was estimated at 25 percent based on the assessment of past treatment activities on the Forest
- Average efficacy of the suite of treatment methods available for use under the action alternatives (Alternatives B, C, and D) was assumed to be 80 percent based on commercially acceptable standards
- The weeds that survive the first round of treatments are retreated in the next and succeeding years, with the same rate of efficacy
- Weed spread was assumed to be 10 percent on untreated sites and 5 percent once treatment activities were begun.
- Under Alternative A, the application of treatment methods on acres identified for treatment using manual, mechanical, and/or herbicide is approximated based on the five-year average. From 2001 through 2005, 65 percent of treatments utilized manual and mechanical methods and 35 percent utilized herbicide ground applications (see Table 68).
- Under Alternatives B, C, and D, acres identified for treatment using manual, mechanical, and/or herbicide were projected to be treated primarily with herbicides initially and as population size is decreased, manual and mechanical methods would be used. Treatment costs per acre were estimated based on an assumption of 90 percent herbicide and 10 percent manual or mechanical (see Table 68).
- Costs per acre for treatment activities are estimated using regional averages adjusted for local costs variances and are displayed in Table 68:

Table 68 - Cost per acre of invasive species treatment methods

Treatment Method	Cost per Acre
Manual/Mechanical Treatments	$340
Biological Treatments	$70
Aerial Herbicide Treatments	$42
Ground Broadcast and Spot Herbicide Treatments (Avg.)	$100
Ground Spot Herbicide Treatments only	$125
Manual/Mechanical and/or Herbicide Treatments – Alternatives B, C, and D	$124
Manual/Mechanical and/or Herbicide Treatments – Alternatives A*	$256
Inventory and Monitoring	$47

* Because of restrictions on the use of herbicides under the no action alternative, the cost to treat acres identified for manual, mechanical, and or herbicide treatment methods is higher than would occur under the action alternatives as described above.

These costs represent estimated open market costs and do not necessarily equate to actual Forest Service expenditures. In some cases, actual Forest Service costs per acre may be lowered through the use of Forest Service crews, cooperative agreements, partnerships, and external funding. The use of these alternative approaches can only be determined on a case by case basis, taking into consideration available funding, funding sources, and the areas and species to be treated from year to year. It is not possible to accurately anticipate the scale of cost savings that may be achieved. Use of the costs listed above provides a "worst case" scenario that allows for a consistent, relative comparison of costs between the alternatives.

Jobs and Income

Estimates of total industry output and jobs potentially supported under each alternative are calculated through the use of IMPLAN, using data for 2003. IMPLAN is an economic modeling program originally developed by the Forest Service in cooperation with the Federal Emergency Management Agency and the Bureau of Land Management. IMPLAN has since been privatized and is now provided by Minnesota IMPLAN Group (MIG). IMPLAN utilizes a database of basic economic statistics constructed by MIG. Information for this database was obtained from major government sources such as the Bureau of Economic Analysis, County Business Patterns, REIS, Bureau of Labor Statistics, U.S. Census, etc., and converted to a consistent format using widely accepted methodologies.

An IMPLAN Project Area model was used to determine the employment and income consequences through the economy of one-million-dollar changes for each kind of impact. The results are called response coefficients. Because input-output models are linear, multipliers or response coefficients need only be calculated once per model and then applied to the direct change in output. Effects were estimated by multiplying the response coefficients by estimated cost of treatment activity. Specifications for developing response coefficients and levels of dollar activity are stated below.

Herbicide Treatment - The economic sector (a group of industries or businesses producing the same or similar products or services) which reflects the economic activities associated with invasive plant treatment services is Agricultural Services, designated in IMPLAN as Sector 18. One million dollars of exports were modeled through Sector 18, to determine a response coefficient. The cost of a contract to conduct herbicide treatments was estimated based on the assumptions described above, which was then multiplied by the appropriate response coefficient to determine total economic impact.

Federal Salary Impacts - Forest Service employment costs by alternative were estimated based on the assumptions described above. Salary impacts result from Forest employees spending a portion of their salaries locally. IMPLAN includes a profile of personal consumption expenditures for several income categories. The average annual compensation for employees involved in the implementation of the alternatives is approximately $25,000 to $60,000. Only a portion of which is take home pay. One million dollars was modeled using this expenditure profile to determine a response coefficient.

Federal Expenditure Impacts- An average of Forest obligations by budget object code for actual expenditures in Fiscal Years 2002, 2003, and 2004 were obtained from the National Finance Center through the agency's Inventory and Monitoring Institute to estimate how the budget expenditures would be spent. Non-salary expenditures were determined by using this budget object code information. This profile was input into the IMPLAN model for non-salary expenditures. Purchases by the Federal Government were treated as new money coming into the local economy from outside the model area. Sales to the federal government were treated in the same manner as exports; money coming from outside the model area. As above, one million dollars was modeled using this expenditure profile to determine a response coefficient.

3.9.2 Affected Environment

The impact of invasive plants is many and varied. They can poison livestock and pets, contribute to increased fire hazards, compete with desirable plants, reduce the suitability of wildlife habitats, and change the nature and composition of plant communities. The cost of controlling these invaders impacts both private and public budgets. A report prepared for the Oregon Department of Agriculture by The Research Group in 2000, estimated that 21 of the 99 weeds listed as noxious in Oregon reduced the State's total personal income by about $83 million. This was equated to approximately 3,329 annual jobs lost to Oregon's economy. It was estimated that these 21 species cost the citizens of Oregon a total of about $100 million per year at that time. The effect of all 99 noxious weeds was likely significantly greater (The Research Group 2000). This analysis addresses the treatment of 24,649 acres of invasive plant species on the Umatilla National Forest. Eleven species present on the Forest were included in the Oregon study.

The Forest most directly influences ten counties: Asotin, Columbia, Garfield, and Walla Walla in Washington; and Grant, Morrow, Umatilla, Union, Wallowa, and Wheeler in Oregon. The local economy and lifestyle tend to revolve around agriculture, ranching, government, and the timber industry. Portions of Umatilla and Morrow counties along the Columbia River in Oregon are more industrialized (USDA 1990). The population in these counties is displayed in Table 69 (US Census Bureau 2000).

Table 69 - Project Area Population by County (2000 Census)

Location	Population
Grant County, OR	7,935
Morrow County, OR	10,995
Umatilla County, OR	70,548
Union County, OR	24,530
Wallowa County, OR	7,226
Wheeler County, OR	1,547
Asotin County, WA	20,551
Columbia County, WA	4,064
Garfield County, WA	2,397
Walla Walla County, WA	55,180
Project Area Total Population	204,973

As displayed in Table 70, the majority of Project Area residents (83 percent) are White, followed by Hispanic or Latino (11.9 percent), and American Indian (1.7 percent) (US Census Bureau 2000).

Table 70 - Race and Ethnicity by County (2000 Census)

Location	White	Black or African Am.	Am. Indian or Alaska Native	Asian	Native Hawaiian & Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino*
Grant County, OR	94.6%	0.1%	1.6%	0.2%	0.04%	0.08%	1.4%	2.1%
Morrow County, OR	71.9%	0.1%	1.3%	0.4%	0.08%	0.4%	1.4%	24.4%
Umatilla County, OR	77.5%	0.7%	3.2%	0.7%	0.07%	0.2%	1.5%	16.1%
Union County, OR	93.1%	0.4%	0.8%	0.8%	0.6%	0.4%	1.4%	0.2%
Wallowa County, OR	95.7%	0.03%	0.7%	0.2%	0.04%	0.1%	1.4%	1.8%
Wheeler County, OR	92.5%	0.06%	0.5%	0.3%	0%	0%	1.6%	5.1%
Asotin County, WA	94.5%	0.2%	1.2%	0.5%	0.02%	0.08%	1.6%	2.0%
Columbia County, WA	90.7%	0.2%	0.8%	0.4%	0.05%	0%	1.5%	6.4%
Garfield County, WA	96.1%	0%	0.4%	0.6%	0.04%	0.04%	0.8%	2.0%
Walla Walla County, WA	78.8%	1.6%	0.7%	1.1%	0.2%	0.2%	1.7%	15.7%
Project Area	83.0%	0.8%	1.7%	0.8%	0.2%	0.2%	1.5%	11.9%

* Hispanic or Latino persons may be of any race.

Per capita incomes in the counties of the Project Area range from a low of $15,803 in Morrow County, OR to a high of $17,748 in Asotin County, WA.

This is lower than the 2000 per capita incomes for both Oregon and Washington at $20,940 and $22,973 respectively. The percentage of the Project Area population with incomes below poverty level is displayed by race in Table 71. Poverty levels are highest among minority populations.

Table 71 - Project Area Population below Poverty Level by Race, 2000 Census

Race/Ethnicity	Percentage Below Poverty Level
White	12.4%
Black or African American	22.3%
American Indian & Alaska Native	21.5%
Asian	15.1%
Native Hawaiian & Other Pacific Islander	32.1%
Some Other Race	26.9%
Two or More Races	23.7%
Hispanic or Latino*	26.2%

*Hispanic or Latino may be of any race.

Although many members of the public desire commodity uses of the National Forest, increasingly, forest users are placing a greater importance on non-commodity values such as the aesthetic, recreational, and spiritual aspects of the forest. Visual resource qualities not only attract visitors, but are appreciated by local residents as an aesthetic value that enhances the local lifestyle and culture. Likewise, the recreation opportunities afforded by the National Forest attract visitors and residents. A variety of special places such as scenic areas, scenic byways, wild and scenic rivers, wilderness areas, and research natural areas contribute to the educational, interpretive, and other recreational experiences available within the Umatilla National Forest (USDA 2004). These opportunities contribute to the desirability of the area as a place to live and also attract visitors who support the local tourism industry.

Invasive species are threatening native plant communities throughout the forest. Currently, over half of the watersheds on the forest have a high risk of noxious weed invasion and spread (USDA 2004). Noxious weed infestations are of concern to both those who desire commodity uses and those who place a higher value on non-commodity uses. Both groups want a healthy ecosystem; however, some members of the public believe that the use of herbicides presents an unacceptable risk to the health of non-target native plants, wildlife, and humans. Concern has also been expressed that the use of herbicides is too costly relative to agency budgets and the value of the lands treated.

Tribal Interests

The Umatilla maintains government to government relations with numerous American Indian tribes who have treaty reserved or Executive Order rights on the Forest. These rights include fishing, hunting, gathering, and trapping. The tribes with rights on the Umatilla National Forest include:

- Confederated Tribes of the Umatilla Indian Reservation
- Confederated Tribes of the Warm Springs
- Nez Perce Tribe
- Confederated Tribes and Bands of the Yakama Indian Nation of the Yakama Reservation
- Burns Paiute Tribe
- Shoshone-Bannock, Shoshone-Paiute Tribes of the Duck Valley Reservation
- Fort McDermitt Paiute and Shoshone Tribes

- Fort Bidwell Indian Community of Paiute Indians
- Klamath Tribes
- Joseph Band of Nez Perce-Colville Confederated Tribes (USDA 2004)

Tribal members utilize native plant species for a variety of cultural uses such as food, medicine, dress, basketry, and ceremonial purposes. Wildlife and fish are harvested for subsistence and traditional cultural uses. Invasive plants may interfere with rights granted to Native American Tribes. Invasive plants can crowd out plants traditionally gathered and can impact wildlife and fish. Additionally, the potential for human health impacts through contact with or consumption of plants and animals exposed to herbicides as a result of treatment activities are a concern. There is also a potential for treatment activities to impact traditional cultural properties or grave sites.

3.9.3 Environmental Consequences

Alternative A – No Action Alternative

The Umatilla National Forest has been treating invasive plants under direction found in the 1995 decision implementing the *Umatilla National Forest Environmental Assessment for the Management of Noxious Weeds*. This program of treatment would continue under the No Action Alternative. The treatment methods recommended in the 1995 EA took a conservative approach, requiring years of manual or mechanical treatments on a site prior to the use of herbicides. It did not provide the ability to respond quickly to new infestations because the process only applied to those sites known at the time of the 1995 decision. The 1995 decision identified approximately 3,154 acres for treatment. Estimated acres by treatment method are displayed in Table 72.

Table 72 - Alternative A Estimated Acres by Treatment Method

Treatment Methods	Acres
Manual and/or mechanical and/or Chemical (broadcast and/or spot) – Upland areas	1,252
Chemical Treatment in Riparian Habitat Conservation Areas (spot only – includes wicking and wiping)	522
Biocontrol – All areas	1,339
Manual only – All areas	41
Total Acres Treated	**3,154**

Herbicide applications in the 1995 decision approved the use of glyphosate, dicamba, or picloram, and no herbicide applications were allowed within 100 feet of streams or standing water. Picloram was prohibited from use in riparian areas, and dicamba could only be used on drier sites or transitional uplands further than 100 feet from water. Aerial applications were not approved.

Although, the 2005 Regional Invasive FEIS ROD approved a list of ten herbicides for use in Region 6, it restricted the use of Dicamba.

Direct and Indirect Effects of Alternative A

Under this alternative, invasive treatment activities would continue to utilize a conservative approach as authorized under the 1995 decision for the management of noxious weeds. Priority would be placed on the use of physical treatment methods. The use of herbicides would be limited to Glyphosate or Picloram and would be utilized only after other methods of treatment have failed. Treatments would be applied to the 3,154 acres analyzed in the 1995 decision.

Past experience with these treatment methods has resulted in a rate of effectiveness of only 25 percent (Laufman 2006). The potential for spread from these areas would remain unchanged from the existing condition. Additionally, the remaining inventoried acres of invasive species would go untreated and would likely continue to spread at an estimated rate of 4 to 6 percent per year.

Those opposed to the use of herbicides due to concerns about impacts to non-target native plant communities, wildlife, and human health would favor this alternative over the action alternatives, however; many stakeholders would perceive adverse effects. Those who value commodity values and uses of the Forest would see declining resource conditions and biodiversity as invasive species continue to spread. Invasive species can drastically reduce livestock carrying capacity (Asher and Spurrier 1998). Likewise, those who place a higher worth on non-commodity resources would also see a decline in the values they seek. Forage production on Forest rangelands would be reduced, adversely impacting habitat capability to support wildlife as well as reducing forage available for domestic livestock. In a report to the Governor of Idaho Weed Summit in 1998, Jerry Asher and Carol Spurrier of the Bureau of Land Management cite numerous studies that found that populations of native wildlife species declined as habitats became dominated by non-native plant species (Asher and Spurrier, 1998). Scenic areas, scenic byways, wild and scenic rivers, wilderness areas, and research natural areas are adversely affected as invasive species spread, resulting in the loss of native species and biological diversity. These impacts may reduce the recreational and/or educational value of these areas to some users. In severe cases, some users may relocate their activities to other areas of the forest or to other public lands (Asher and Spurrier 1998).

Neighboring private and public lands would be adversely impacted as invasive species populations spread to their lands from the Umatilla National Forest. Land values would be reduced (Asher and Spurrier 1998)and costs to control infestations for neighboring land owners or administrative agencies (federal, state, and local governments) would be increased.

American Indian Tribes with interests in the Umatilla National Forest would be adversely impacted. Populations of native plant species used for cultural purposes such as food, medicine, dress, basketry, or ceremonial activities may be reduced as a result of the spread of invasive species. The spread of invasive species (Asher and Spurrier 1998) from the Forest to Tribal trust lands would adversely impact Tribal interests. In the long-term, invasive species populations may threaten traditional gathering areas. The potential for the exposure of tribal members to herbicides is lowest under this alternative. Approximately 2,774 acres could potentially be treated with herbicides. This represents approximately 0.2 percent of the National Forest system lands administered by the Umatilla National Forest.

Economic Effects

Assumptions used for the development of cost estimates are described under “Methodology” above. The undiscounted cost of implementing treatments on all affected acres one time in one year is estimated at $641,695 in 2006 dollars. This estimate includes inventory and monitoring costs. It is estimated that treatments would be effective on 25 percent of treated acres. The average cost per effectively treated acre is the highest under this alternative at an estimated $814 per acre.

Discounted annual treatment costs at various levels of annual treatment are provided in Table 73 below. A variety of annual treatment levels were analyzed in order to assess required levels of funding, should the funding level of future budgets change. In the case of the No Action Alternative, annual treatment levels could not exceed 3,154 acres. At this level of annual treatment, discounted net annual equivalent costs, including inventory and monitoring, are estimated at $133,700.

Because treatments would be limited to the same 3,154 acres each year, other inventoried infestations would remain untreated and would continue to spread, therefore the existing invasive plant populations on the Forest would never be contained or controlled under this alternative. Without treatment, the remaining inventoried infestations would likely spread at an estimated annual rate of 8 to 12 percent (Laufmann 2007). At an average of 10 percent annually, by year 20, infested acres could increase by more than 525 percent of the currently affected acres. As the scope and size of the infestation continues to grow, future costs to contain or control the growing population of invasive species would continue to escalate.

Table 73 - Years to contain or control forest-wide infestations and annual treatment costs under Alternative A in 2006 dollars – (Shaded line represents the projected annual treatment level)

Annual Acres Treated	Net Annual Equivalent Cost (Discounted)	Years to Contain or Control Inventoried Infestations and Discounted Total Cost Average Rate of Spread = 10 percent on untreated sites and 5 Percent once treatgments begin	
		Years	Cost ($1000s)
2,500	$132,920	Would not achieve	Unlimited
3,000	$126,115	Would not achieve	Unlimited
3,154	**$133,700**	**Would not achieve**	**Unlimited**

1 For the purposes of analysis, projections assumed 25% effectiveness of treatments, and a 10% rate of spread from untreated acres. Infestations were considered controlled when projections for remaining inventoried acres reached 0 acres.
2 Using the assumptions regarding treatment effectiveness and rate of spread described earlier under “Methodology” it was estimated that the acres approved for treatment under the 1995 EA would be controlled in 31 years at a total discounted cost of $3,296,350 at projected annual treatment levels. However, remaining inventoried sites would not be treated and would continue to spread. As a result, potential costs to contain or control would continue to grow until future containment action is initiated.

Some annual costs may be covered through external funding sources, which historically have averaged approximately $120,000. This level of external funding has largely been dependent on Title II funding, which terminated in 2006. Currently, proposals have been initiated in Congress to extend this funding and an extension was proposed in the President’s budget. However, if Title II funding is not extended by Congress, external funding sources would likely total approximately $25,000 annually. The balance of expenditures would need to be covered through appropriated funding.

The economic activity potentially stimulated through implementation of Alternative A is estimated in the form of jobs and income. In addition to direct impacts, each economic sector produces indirect and induced effects, in varying degrees, depending on the spending patterns within each industry. A sector’s total economic impact is made up of its direct, indirect, and induced effects, as well as other factors.

Businesses that provide invasive plant treatment services response to the demand for the services they provide by employing a sufficient number of positions to produce the appropriate level of service needed to meet demand. The services or output produced and the employment required to produce that level of output are the direct effects of that business on the economy. In order to produce the output included in the direct effects, the businesses providing invasive plant treatment must purchase supplies and services from other industries. The output and employment stimulated in other industries by these purchases are indirect effects. In addition to the direct and indirect effects, induced effects represent the output and employment stimulated throughout the local economy as a result of the expenditure of new household income generated by direct and indirect employment.

Part of the monies spent by businesses such as those providing invasive plant treatment services may be spent outside of the local economy. The money expended outside the local economy is often referred to as leakage as the dollars spent outside the local area "leak" out of the local economy. By the same token economic activity is introduced when goods and services produced within the local economy are exported. In other words those from outside the area purchase goods and services produced within the local area, thereby bringing new money into the local economy.

IMPLAN attempts to estimate these complex economic relationships in order to approximate the effects on the economy as a whole. Multipliers were developed as a means to estimate the change in direct, indirect, and induced effects as a result of the level of demand for invasive plant treatment services. These multipliers also take into account the effects of leakage and exports.

The following table displays the potential employment and income that may be supported within the local economy as a result of implementing Alternative A. The figures displayed in the second column (Total to Contain/Control Acres Proposed for Treatment) represent the total impact over the life of the alternative. The estimated average annual impact is displayed in the third column. The impact of inventory and monitoring activities are included. The employment figure presented represents potential full-time, part-time, and/or seasonal positions.

Table 74 - Alternative A Estimated Job and Income Impacts

Impact	Total to Contain/Control Acres Proposed for Treatment[1]	Average Annual Impact
Jobs	105	3
Labor Income ($1,000s)	$2,673	$86

1 Using the assumptions regarding treatment effectiveness and rate of spread described earlier under "Methodology" it was estimated that the acres approved for treatment under the 1995 EA would be controlled in 31 years.

Many other anticipated economic costs and benefits are not easily converted to dollar amounts. In addition to job and income benefits, there would be additional intangible and difficult to quantify economic benefits and costs. Some of those include

- Maintenance of biodiversity on those acres successfully treated
- Loss of biodiversity on those acres not treated or on which treatments are ineffective
- Reduced forage for wildlife as well as domestic cattle grazing as a result of the spread of invasive species
- Spread to adjacent lands as discussed above
- Increased future costs to the Forest Service to treat invasive species infestations that have continued to spread unchecked

Other potential benefits and costs under this alternative are discussed in detail in specialist reports for other affected resources.

Environmental Justice

Alternative A was assessed to determine whether there would be a disproportionately adverse impact to minority or low-income populations in accordance with Executive Order 12898 (President 1994). No concerns relative to disparate impacts to minority or low income populations were identified through scoping. However, American Indian tribes may be disproportionately affected because they are dependent on native plants for cultural and traditional uses. The racial composition of work crews implementing treatment activities are expected to be generally similar to that of the Project

Area population, with a potential for a slightly higher percentage of minorities. Work crews may experience injury during manual treatments or may be exposed to chemical treatments.

The National Visitor Use Monitoring survey asked visitors to categorized themselves into one of seven race/ethnicity categories. The results for the Umatilla indicated that of Forest visitors sampled from October 2002 through September 2003, showed that 96.9 percent of visitors indicated they were white. Approximately 3.5 percent of visitors sampled indicated Native American, 1.8 percent indicated Asian, 0.8 percent indicated Hispanic or Latino, and 0.4 percent indicated Pacific Islander (USDA 2004a).

Native American plant areas are likely at greater risk due to the spread of invasive species under Alternative A than under the other alternatives. Native plants important for cultural uses could potentially be crowded out of some areas forcing Native American users to seek these resources in other areas of the forest or on other land ownerships. Populations of culturally important plants could be decreased to the point of being insufficient to meet demand. Visitors from other racial or ethnic backgrounds or low income visitors seeking to supplement family incomes may also be impacted as areas important for berry picking, mushroom gathering, or other gathering activities would be adversely impacted by the spread of invasive species.

The potential for human exposure to herbicides is lowest under this alternative for all user groups due to the limitations on the implementation of chemical treatment activities. However, herbicide treatments over the last five years have averaged approximately 2,600 acres annually, including the re-treatment of some acres. Similar treatments would continue under Alternative A. These acres of treatment represent approximately 0.2 percent of the National Forest System (NFS) lands administered by the Umatilla National Forest. Herbicide application methods would be selected to not only ensure effective results, but to minimize movement offsite in soil, water, or wind.

The R6 ROD amended the Umatilla Forest Plan to incorporate standards for the implementation of herbicide treatment activities. The R6 ROD and FEIS (USDA 2005a; USDA 2005b) found that the potential for adverse human health and safety impacts from herbicide use would be adequately resolved through adherence these standards. Additionally, the R6 ROD amended the Umatilla Forest Plan (USDA 1990; USDA 2005b) to incorporate requirements to ensure timely public notification and that signs are posted to inform the public and forest workers of herbicide application dates and the name of herbicides used. If requested, individuals may be notified in advance of spray dates. These measures would provide visitors who wish to avoid any potential for herbicide exposure with the information they need to do so.

Worker exposure to herbicides and risks associated with physical treatment methods would be minimized through strict adherence to health and safety requirements for all workers. Application of any herbicides to treat invasive plants would be performed or directly supervised by a State or Federally licensed applicator. Herbicide transportation and handling safety plan would be developed and implemented for all treatment activities.

Based on the above analysis, American Indian tribes may be disproportionately affected because they are dependent on native plants for cultural and traditional uses. No other disproportionate adverse impacts to minority or low income groups are anticipated under this alternative.

Cumulative Effects of Alternative A

Although private land owners and federal, state, and local governments administering lands adjacent to the Forest will continue invasive plant treatment activities, implementation of Alternative A would allow continued increase in the occurrence and spread of infestations on these lands.

Untreated infestations on the Forest would lead to a long-term decline in the health and sustainability of native plant communities. The resulting decrease in biological diversity and reduction in the economic and social returns natural plant communities provide adversely impacts all stakeholders.

Costs incurred by adjoining land ownerships to treat invasive plant infestations would likely continue to escalate as a result of the increasing likelihood and scale of the spread of these species from untreated areas of the Umatilla National Forest. Additionally, deferring the treatment of invasive plant populations would result in increased future costs to the Forest Service and thus to tax payers to treat larger, more widespread populations that would continue to develop over time.

Alternative B – Proposed Action

Alternative B proposes to control, contain, or eradicate invasive plants on existing sites or newly discovered infestations. Various types of treatments would be used including the use of herbicides, physical, and biological methods. Treatments are proposed for existing or new infestations including new plant species that currently are not found on the Forest. The preferred treatment method would be determined using a decision matrix based on local (District) priority plant species and site location, and input from local weed managers. Species priority and treatment response is based on:

- Previous and ongoing efforts made to control the species
- The invasive nature of the species
- Newly detected infestations

Current inventory indicates there are approximately 24,649 acres of invasive plant infestations on the Forest. The actual locations of treatment would typically include rangelands, timber harvest areas, roads, and road rights-of-way, along trail routes, dispersed and developed recreation sites, and other disturbed sites (for example; fires, flood events, and rock sources). Treatments may include seeding with desirable grass and forb species to assist site rehabilitation. Restoration treatments requiring ground disturbing activities would necessitate additional site specific analysis. The determination of actual treatment methods applied at each site is displayed in Chapter2, Figure 1, The Decision Tree.

Ongoing inventory and monitoring would look for new infestations of invasive plants, or new locations of existing weeds. Newly discovered infestations or sites would likely receive a high priority for treatment to eradicate the invasive plants while the infestation is small and easily treatable (See Treatment Decision Tree, Figure 1). This strategy of detecting and treating new infestations is called Early Detection Rapid Response.

The estimated acres by treatment method are detailed in the following table.

Table 75 - Alternative B Estimated Acres by Treatment Method

Treatment Methods	Acres
Manual and/or mechanical and/or Chemical (broadcast and/or spot) – Upland areas	14,456
Chemical Treatment in Riparian Habitat Conservation Areas (broadcast)	3,022
Chemical Treatment in Riparian Habitat Conservation Areas (spot only – includes wicking and wiping)	2,538
Biocontrol – All areas	3,917
Manual only – All areas	41
Aerial only	675
Total Acres Treated	**24,649**

The number of acres proposed for treatment in any given year would depend on funding and the success of past treatments. On-going monitoring of the site would provide the information needed to decide the follow-up treatment methods required. In any given year it is anticipated that approximately 4,000 acres would receive treatment with herbicide, manual, mechanical, or biocontrol methods.

Direct and Indirect Effects of Alternative B

Under this alternative, invasive treatment activities would include herbicides, physical (hand pulling, hand tools, and mechanical treatments), and biological methods. Herbicides utilized would be those approved for use in the R6 ROD (USDA 2005b). These include herbicide formulations containing one or more of the following ten active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. All herbicide application methods are allowed including wicking, wiping, injection, spot, and broadcast, as permitted by the product label. Only chlorpyralid would be applied aerially. 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.

Treatment effectiveness under this alternative would be expected to approach 80 percent or higher. All acres inventoried for treatment would eventually be treated, however expected budget allocations would limited treatment activities to approximately 4,000 acres annually. Priority sites determined to be high would be treated first. As infestations are effectively treated, management would be initiated on new acres each year. Herbicides could potentially be applied to approximately 20,690 acres, or approximately one percent of National Forest system lands administered by the Umatilla National Forest. However, annual estimated treatment activities (approximately 4,000 acres) represent 0.3 percent of National Forest system lands annually.

Effects of herbicides permitted under this alternative to non-target plant species, wildlife, and human health and safety were evaluated in the Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants Final Environmental Impact Statement (R6 FEIS) (USDA 2005a). The R6 FEIS approved a limited number of herbicides for use and found that the potential for harm to non-target plants, plant pollinators, wildlife, and human health and safety would be adequately resolved by adherence to the standards incorporated in the Umatilla Forest Plan through amendment by the R6 ROD. The findings of that analysis are incorporated by reference. Nonetheless, perceptions of the potential for harm are likely to persist among many members of the public. Prior to implementation of herbicide treatment projects, National Forest system staff would ensure timely public notification. Treatment areas would 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. Regardless, those opposed to the use of herbicides would likely oppose this alternative.

Many stakeholders would perceive beneficial effects under this alternative. Treatments of invasive species are expected to be considerably more effective than have been experienced under the existing program (No Action Alternative). Those who place importance on the commodity values and uses of the Forest would benefit from improved resource conditions and biodiversity as invasive species are effectively treated. Likewise, those who place a higher worth on non-commodity resources would also see an improvement in the values they seek. Forage production on Forest rangelands would be maintained and gradually increased as the occurrence of invasive species is reduced.

Habitat capability to support wildlife and provide forage for domestic livestock would gradually improve following implementation of this alternative.

The important native species and biological diversity within scenic byways, wild and scenic rivers, wilderness areas, and research natural areas would be maintained and improved as implementation progresses. The recreational and/or educational values of these areas would be maintained or improved.

Neighboring private and public lands would be benefited because the likelihood for spread of invasive species from the Umatilla National Forest would be reduced. The potential for adverse impacts to land values as a result of infestations of invasive species would be reduced and costs to control infestations for neighboring land owners or administrative agencies (federal, state, and local governments) would likely decrease over time with the reduced potential for spread from National Forest system lands.

The potential for invasive plant species to adversely impact populations of native plant species used for cultural purposes such as food, medicine, dress, basketry, or ceremonial activities would be reduced through implementation of Alternative B. The potential for spread of invasive species from the Forest to Tribal trust lands would be reduced.

The potential for the exposure of tribal members to herbicides is highest under this alternative. However, per the analysis and findings of the R6 FEIS as discussed above, no adverse human health impacts are anticipated (USDA 2005a). Nonetheless, perceptions of the potential for harmful effects would likely persist. Project Design Features (Chapter 2 EIS) require public notification prior to implementation of treatment activities and posting of signs with the dates of treatment and herbicides used will aid those who desire to avoid herbicide exposure.

Economic Effects

The cost of this alternative was calculated as though all acres were to be treated one time within one year. The estimated undiscounted cost of implementing treatments on all affected acres one time is estimated at $3,887,460 in 2006 dollars. This estimate includes inventory and monitoring costs. At the estimated rate of effectiveness of 80 percent of treated acres, the average cost per effectively treated acre is the lowest of the alternatives considered at an estimated $197 per acre under this alternative.

Discounted annual treatment costs at various levels of annual treatment are provided below in Table 76. Because future budgets could increase or decline, a variety of annual treatment levels were analyzed in order to assess the effects on long-term costs as well as the time required to achieve the purpose and need. At the target annual treatment level of 4,000 acres, the discounted net annual equivalent cost is estimated at $539,030. After assuming an estimated rate of spread of 10 percent, with 80 percent effectiveness of treatments, the projected time required to control existing populations is 17 years at a total discounted cost of approximately $6,823,790 dollars.

Table 76 - Years to contain or control forest-wide infestations and annual treatment costs under Alternative B in 2006 dollars (Shaded line represents the projected annual treatment level)

Annual Acres Treated	Net Annual Equivalent Cost (Discounted)	Years to Contain or Control Inventoried Infestations and Discounted Total Costs Average Rate of Spread = 10 Percent	
		Years	Discounted Cost ($1000s)
2,500	$408,600	Would not achieve	N/A
3,000	$475,960	41	$9,516
4,000	**$539,030**	**19**	**$6,824**
5,000	$568,140	15	$6,317
6,000	$616,040	13	$5,782
7,000	$632,500	12	$5,541

*For the purposes of analysis, projections assumed 80% effectiveness of treatments, and a 10% rate of spread from untreated acres. Infestations were considered controlled when projections for remaining inventoried acres reached 0 acres.

Projections were carried out until estimated infestations were reduced to zero for the purposes of analysis. In actual practice, it is very unlikely that all invasive species could be completely eliminated. A certain level of infestation is likely to remain, requiring continuing control efforts. However, much lower levels of ongoing treatment would be required to allow for the continued containment and control of remaining infestations.

Early detection, rapid response (EDRR) would be utilized to address new infestations of currently occurring species or new species at an estimated average cost of $199 per effectively treated acre. Only methods proposed and analyzed through the EIS would be utilized, however, aerial application methods would not be used for EDRR treatments. Implementation of EDRR would reduce future costs and environmental impacts by eliminating or controlling new infestations before they could become established.

As described under Alternative A, some annual costs may be covered through external funding sources, which historically have averaged approximately $120,000. If Title II funding is not extended by Congress, external funding sources would likely drop to a total of approximately $25,000 annually. The appropriated funding would be required to cover the balance of annual expenditures.

The following table displays the potential employment and income that may be supported within the local economy as a result of implementing Alternative B. The figures displayed in the second column (Total to Contain/Control Acres Proposed for Treatment) represent the total impact over the life of the alternative. The estimated average annual impact is displayed in the third column. The impact of inventory and monitoring activities are included. The employment figure presented represents potential full-time, part-time, and/or seasonal positions.

Table 77 - Alternative B Estimated Job and Income Impacts

Impact	Total to Contain/Control Acres Proposed for Treatment[1]	Average Annual Impact
Jobs	326	17
Labor Income ($1,000s)	$8,338	$439

1 Using the assumptions regarding treatment effectiveness and rate of spread described earlier under "Methodology" it was estimated that the acres approved for treatment under Alternative B would be controlled in 19 years.

In addition to job and income impacts, there would be additional intangible and difficult to quantify economic benefits and costs. Some of those include maintenance or improvement of biodiversity, improved forage for wildlife and domestic cattle grazing, and prevention of spread to adjacent lands. Other potential benefits and costs under this alternative are discussed in detail in the specialist reports for other affected resources.

Environmental Justice

Alternative B was assessed to determine whether there would be a disproportionately adverse impact to minority or low-income populations in accordance with Executive Order 12898 (President 1994). No concerns relative to disparate impacts to minority or low income populations were identified through scoping.

The 2004 report of the National Visitor Use Monitoring Results (NVUM) for the Umatilla National Forest estimated that approximately 652,000 people visit the Forest annually, plus or minus 18.6 percent at the 80 percent confidence interval. Of the of Forest visitors sampled from October 2002 through September 2003, 96.9 percent indicated they were white. Approximately 3.5 percent of visitors sampled were Native American, 1.8 percent were Asian, 0.8 percent were Hispanic or Latino, and 0.4 percent were Pacific Islander (USDA 2004a). Of these minority groups, as stated above, Native American visitors may have the greatest potential to be impacted by herbicide applications, however visitors from other racial or ethnic backgrounds or low income visitors seeking to supplement family incomes, also engage in berry picking, mushroom gathering, or other gathering activities on the Umatilla National Forest.

The NVUM survey results indicated that of those surveyed, approximately 23 percent indicated that they participate in gathering forest products, 17 percent engage in fishing, and 28 percent participate in hunting activities at some time during the year.

Risk to Native American cultural plant gathering areas as well as other forest product gathering sites as a result of the spread of invasive species is lowest under Alternative B. The higher rate of effective containment, control, or eradication of invasive species anticipated under this alternative would help to protect native plant areas important to Native Americans and other visitors by reducing the threat of invasive species. There is concern that herbicides treatments could adversely impact non-target, culturally important plants, or wildlife species. Treatments applied to each site would consider the minimization of exposure to non-target species through such means as the method of herbicide application and timing. The R6 FEIS and ROD found that the potential for herbicides to harm non-target plants, plant pollinators, or terrestrial and aquatic wildlife were likely to be resolved by adherence to the standards incorporated in the Umatilla Forest Plan through that decision. In addition, site specific Project Design Features would be in place at the time of treatment to further reduce potential for harm to non-target species.

Some users have expressed concern about the potential for human exposure to herbicides. Low income populations who may hunt, fish, or gather forest products for subsistence or income purposes would have a potential risk of exposure through contact with or consumption of forest products or wildlife exposed to herbicides. The potential for human exposure to herbicides in treatment areas is higher under this alternative than under Alternative A due to the larger number of acres to be treated. However, annual treatments would be limited to approximately 4,000 acres per year, which represents 0.3 percent of the National Forest system lands administered by the Umatilla National Forest.

In total, the area to be treated across the forest through implementation of this alternative represents less than two percent of the acres administered by the Umatilla National Forest. Herbicide application methods would be selected to not only ensure effective results, but to minimize movement offsite in soil, water, or wind.

The R6 ROD amended the Umatilla Forest Plan to incorporate standards for the implementation of herbicide treatment activities. The R6 ROD and FEIS (USDA 2005a; USDA 2005b) found that the potential for adverse human health and safety impacts from herbicide use would be adequately resolved through adherence to these standards. Additionally, the R6 ROD amended the Umatilla Forest Plan (USDA 2005b USDA 1990;) to incorporate requirements that ensure timely public notification and that signs be posted to inform the public and forest workers of herbicide application dates and the name of herbicides used. If requested, individuals may be notified in advance of spray dates. These measures would provide visitors who wish to avoid any potential for herbicide exposure with the information they need to do so.

The racial composition of work crews implementing treatment activities are expected to be generally similar to that of the Project Area population, with a potential for a slightly higher percentage of minorities. Work crews may experience injury during manual treatments or may be exposed to chemical treatments. Worker exposure to herbicides and risks associated with physical treatment methods would be minimized through strict adherence to health and safety requirements for all workers. Application of any herbicides to treat invasive plants would be carried out or directly supervised by a State or Federally Licensed Applicator. Herbicide transportation and handling safety plan would be developed and implemented for all treatment activities.

Based on the above analysis, no disproportionate adverse impacts to minority or low income groups are anticipated under this alternative.

Cumulative Effects of Alternative B

Alternative B would contribute to efforts by private land owners and federal, state, and local governments administering lands adjacent to the Forest to reduce the occurrence and spread of invasive species on these lands. Treatment of infestations on the Forest would lead to long-term improvements in the health and sustainability of native plant communities. Maintenance or improvements in biological diversity would contribute to economic and social returns provided by natural plant communities benefiting all stakeholders. Costs incurred by adjoining land ownerships to treat invasive plant infestations would likely be reduced in the long-term as a result of the reduced likelihood and scale of the spread of invasive species from National Forest system lands. Effective treatment of invasive plant populations would result in decreased future costs to the Forest Service and thus to tax payers as the occurrence of invasive species is reduced and controlled over time.

Alternative C

This alternative is the same as the Proposed Action except that no broadcast spraying of herbicides would be allowed in Riparian Habitat Conservation Areas.

Invasive plant treatment in these areas could be accomplished by spot or hand application of herbicides, or any other non-herbicide treatment method. Estimated acres by treatment method are displayed in Table 78.

Table 78 - Alternative C Estimated Acres by Treatment Method

Treatment Methods	Acres
Manual and/or mechanical and/or Chemical (broadcast and/or spot) – Upland areas	14,456
Chemical Treatment in Riparian Habitat Conservation Areas (spot only – includes wicking and wiping)	5,560
Biocontrol – All areas	3,917
Manual only – All areas	41
Aerial only	675
Total Acres Treated	**24,649**

Direct and Indirect Effects of Alternative C

Direct and indirect effects resulting from the implementation of Alternative C would be the same as described above under Alternative B, except as noted below.

Perceptions of the potential for harm to non-target plant species, wildlife, and human health may be slightly lower than would occur under Alternative B among some members of the public due to the use of more selective herbicide application methods within riparian areas. However, as is true of Alternative B, a limited number of herbicides have been approved for use in the R6 FEIS, which found that the potential for harm to non-target plants, plant pollinators, wildlife, and human health and safety would be adequately resolved by adherence to the standards incorporated in the Umatilla Forest Plan through amendment by the R6 ROD (USDA 2005a; USDA 2005b), and to site specific Project Design Features. The findings of that analysis are incorporated by reference. As under Alternative B, perceptions of the potential for harm would be likely to persist among many members of the public.

Economic Effects

The estimated cost of implementing treatments on all affected acres one time is estimated at $3,616,050 in 2006 dollars. This estimate includes inventory and monitoring costs. At the estimated rate of effectiveness of 80 percent of treated acres, the average cost per effectively treated acre is $201 under Alternative C; this is the highest cost of the action alternatives considered, but lower than Alternative A.

Discounted annual treatment costs at various levels of annual treatment are provided in Table 12 below. Because future budgets could increase or decline, a variety of annual treatment levels were analyzed in order to assess the effects on long-term costs as well as the time required to achieve the purpose and need At the target annual treatment level of 4,000 acres, the net annual equivalent cost is estimated at $549,790. The projected time required to control existing populations, including an estimated rate of spread of 10 percent, with 80 percent effectiveness of treatments is 19 years at a total discounted cost of approximately $6,959,940 dollars.

Projections were carried out until estimated infestations were reduced to zero for the purposes of analysis. In actual practice, it is very unlikely that all invasive species could be completely eliminated. A certain level of infestation is likely to remain, requiring continuing control efforts. However, much lower levels of ongoing treatment would be required to allow for the continued containment and control of remaining infestations.

As described under Alternative A, some annual costs may be covered through external funding sources, which historically have averaged approximately $120,000. If Title II funding is not extended by Congress, external funding sources would likely drop to a total of approximately $25,000 annually. The appropriated funding would be required to cover the balance of annual expenditures.

Table 79 - Years to contain or control forest-wide infestations and annual treatment costs under Alternative C in 2006 dollars. (Shaded line represents the projected annual treatment level.)

Annual Acres Treated	Net Annual Equivalent Cost (Discounted)	Years to Contain or Control Inventoried Infestations and DiscountedTotal Cost Average Rate of Spread = 10 Percent	
		Years	Cost ($1000s)
2,500	$429,165	Would not achieve	N/A
3,000	$485,310	41	$9,703
4,000	**$549,790**	**19**	**$6,960**
5,000	$579,290	15	$6,441
6,000	$628,610	13	$5,900
7,000	$645,550	12	$5,665

*For the purposes of analysis, projections assumed 80% effectiveness of treatments, and a 10% rate of spread from untreated acres. Infestations were considered controlled when projections for remaining inventoried acres reached 0 acres.

Early detection, rapid response (EDRR) would be utilized to address new infestations of currently occurring species or new species at an estimated cost of $203 per effectively treated acre. Only methods proposed and analyzed through the EIS would be utilized, however aerial treatment methods would not be utilized to for EDRR treatments. Implementation of EDRR would reduce future costs and environmental impacts by eliminating or controlling new infestations before they can become established.

The following table displays the potential employment and income that may be supported within the local economy as a result of implementing Alternative C. The figures displayed in the second column (Total to Contain/Control Acres Proposed for Treatment) represent the total impact over the life of the alternative. The estimated average annual impact is displayed in the third column. The impact of inventory and monitoring activities are included. The employment figure presented represents potential full-time, part-time, and/or seasonal positions.

Table 80 - Alternative C Estimated Job and Income Impacts

Impact	Total to Contain/Control Acres Proposed for Treatment[1]	Average Annual Impact
Jobs	335	18
Labor Income ($1,000s)	$8,550	$450

1 Using the assumptions regarding treatment effectiveness and rate of spread described earlier under "Methodology" it was estimated that the acres approved for treatment under Alternative c would be controlled in 19 years.

In addition to job and income impacts, there would be additional intangible and difficult to quantify economic benefits and costs. Some of those include maintenance or improvement of biodiversity, improved forage for wildlife and domestic cattle grazing, and prevention of spread to adjacent lands. Other potential benefits and costs under this alternative are discussed in detail in the specialist reports for other affected resources.

Environmental Justice

Alternative C was assessed to determine whether there would be a disproportionately adverse impact to minority or low-income populations in accordance with Executive Order 12898 (President 1994). Effects under this alternative are the same as described above under Alternative B. Based on the above analysis no disproportionate adverse impacts to minority or low income groups are anticipated.

Cumulative Effects of Alternative C

Cumulative effect under Alternative C would be the same as described above under Alternative B.

Alternative D

This alternative is the same as the Proposed Action except that aerial application of herbicides would not be allowed. Some areas excluded from aerial application of herbicide may not be treated with other methods due to remoteness, terrain, and worker safety issues. Estimated acres by treatment method are displayed in Table 81.

Table 81 - Alternative D Estimated Acres by Treatment Method

Treatment Methods	Acres
Manual and/or mechanical and/or Chemical (broadcast and/or spot) – Upland areas	15,131
Chemical Treatment in Riparian Habitat Conservation Areas (broadcast)	3,022
Chemical Treatment in Riparian Habitat Conservation Areas (spot only – includes wicking and wiping)	2,538
Biocontrol – All areas	3,917
Manual only – All areas	41
Total Acres Treated	**24,649**

Direct and Indirect Effects of Alternative D

Direct and indirect effects resulting from the implementation of Alternative D would be the same as described above under Alternative B, except as noted below.

Perceptions of the potential for harm to non-target plant species, wildlife, and human health may be slightly lower than under Alternative B among some members of the public due to the elimination of aerial application of herbicides and would be similar to those likely to occur under Alternative C. However, as is also true under Alternatives B and C, a limited number of herbicides have been approved for use in the R6 FEIS, which found that the potential for harm to non-target plants, plant pollinators, wildlife, and human health and safety would be adequately resolved by adherence to the standards incorporated in the Umatilla Forest Plan through amendment by the R6 ROD (USDA 2005a; USDA 2005b), and to site-specific Project Design Features. The findings of that analysis are incorporated by reference. As under Alternatives B and C, perceptions of the potential for harm would be likely to persist among many members of the public.

Economic Effects

The estimated undiscounted cost of implementing treatments on all affected acres one time is estimated at $3,942,840 in 2006 dollars. This estimate includes inventory and monitoring costs.

At the estimated rate of effectiveness of 80 percent of treated acres, the average cost per effectively treated acre is $200 under Alternative D. This represents an effective cost per acre that is slightly higher than Alternative B, slightly lower than Alternative C, and considerably lower than Alternative A.

Discounted annual treatment costs at various levels of annual treatment are provided in Table 15 below. Because future budgets could increase or decline, a variety of annual treatment levels were analyzed in order to assess the effects on long-term costs as well as the time required to achieve the purpose and need. At the target annual treatment level of 4,000 acres, the net annual equivalent cost is estimated at $546,950. The projected time required to control existing populations, including an estimated rate of spread of 10 percent, with 80 percent effectiveness of treatments is 17 years at a total discounted cost of approximately $6,924,045 dollars.

Projections were carried out until estimated infestations were reduced to zero for the purposes of analysis. In actual practice, it is very unlikely that all invasive species could be completely eliminated. A certain level of infestation is likely to remain, requiring continuing control efforts. However, much lower levels of ongoing treatment would be required to allow for the continued containment and control of remaining infestations.

As described under the other alternatives, some annual costs may be covered through external funding sources, which historically have averaged approximately $120,000. If Title II funding is not extended by Congress, external funding sources would likely drop to a total of approximately $25,000 annually. The appropriated funding would be required to cover the balance of annual expenditures.

Table 82 - Years to contain or control forest-wide infestations and annual treatment costs under Alternative D in 2006 dollars. (Shaded line represents the projected annual treatment level.)

Annual Acres Treated	Estimated Annual Cost	Years to Contain or Control Inventoried Infestations and Discounted Total Cost Average Rate of Spread = 10 percent on untreated sites and 5 percent after treatments begin	
		Years	Cost ($1000s)
2,500	$427,120	Would not achieve	N/A
3,000	$482,790	41	$9,652
4,000	**$546,950**	**19**	**$6,924**
5,000	$576,315	15	$6,408
6,000	$625,240	13	$5,868
7,000	$641,990	12	$5,624

*For the purposes of analysis, projections assumed 80% effectiveness of treatments, and a 10% rate of spread from untreated acres. Infestations were considered controlled when projections for remaining inventoried acres reached 0 acres.

EDRR would be utilized to address new infestations of currently occurring species or new species at an estimated average cost of $200 per effectively treated acre. Only methods proposed and analyzed through the EIS would be utilized. Implementation of EDRR would reduce future costs and environmental impacts by eliminating or controlling new infestations before they can become established.

The following table displays the potential employment and income that may be supported within the local economy as a result of implementing Alternative D.

The figures displayed in the second column (Total to Contain/Control Acres Proposed for Treatment) represent the total impact over the life of the alternative. The estimated average annual impact is displayed in the third column. The impact of inventory and monitoring activities are included. The employment figure presented represents potential full-time, part-time, and/or seasonal positions.

Table 83 - Alternative D Estimated Job and Income Impacts

Impact	Total to Contain/Control Acres Proposed for Treatment[1]	Average Annual Impact
Jobs	332	17
Labor Income ($1,000s)	$8,493	$447

1 Using the assumptions regarding treatment effectiveness and rate of spread described earlier under “Methodology” it was estimated that the acres approved for treatment under Alternative D would be controlled in 19 years.

In addition to job and income impacts, there would be additional intangible and difficult to quantify economic benefits and costs. Some of those include maintenance of biodiversity or improvement of biodiversity, improved forage for wildlife and domestic cattle grazing, and prevention of spread to adjacent lands. Other potential benefits and costs under this alternative are discussed in detail in the specialist reports for other affected resources.

Environmental Justice

Alternative D was assessed to determine whether there would be a disproportionately adverse impact to minority or low-income populations in accordance with Executive Order 12898 (President 1994).

Effects under this alternative are the same as described above under Alternative B. Based on the above analysis no disproportionate adverse impacts to minority or low income groups are anticipated under this alternative.

Cumulative Effects of Alternative D

Cumulative effect under Alternative D would be the same as described above under Alternative B.

Summary of Effects

Although Alternative A has the lowest net annual equivalent cost among the alternatives analyzed, the average cost per effectively treated acre of $814, is over four times as much as that proposed under the action alternatives. Additionally, approximately 87 percent of currently inventoried infestations would remain untreated under Alternative A allowing the continued spread of invasive species. Therefore, until future action could be taken to arrest the spread of these species, potential long-term costs are unlimited under the no action alternative as existing infestations continue to spread at a rate of 8 to 12 percent annually (Laufmann 2007). For example, in twenty years, assuming an average rate of spread of 10 percent and no treatment efforts beyond those currently authorized, infested acres could grow to approximately 525 percent of current infestations. Deferring treatment for that period of time would result a similar growth in the required future expenditures needed to manage the larger infestation.

Among the action alternatives, Alternative B has the lowest net annual equivalent cost followed by D and then C. Each of the action alternatives are projected contain or control existing inventoried infestations and prevent the spread of invasive species on the Umatilla National Forest. Future treatment costs are minimized under all action alternatives relative to Alternative A.

The analysis of various annual treatment levels reveals that under all alternatives, long-term costs are reduced by implementing as large an annual treatment program as possible within budgetary constraints. Even though annual costs under larger treatment levels increase, long-term costs are reduced because containment and control can be achieved in a shorter period of time, reducing the need for future investments in treatment activities.

Table 84 - Summary of Effects by Alternative

Indicator	Alternative A	Alternative B	Alternative C	Alternative D
Total Cost, One-time Treatment, All Acres	$641,695	$3,887,460	$3,963,010	$3,942,840
Cost per Effectively Treated Acre	$814	$197	$201	$200
Jobs potentially supported to contain or control acres proposed for treatment (total that would occur over life of project)	105	326	335	332
Average Annual Jobs potentially supported	3	17	18	17
Income potentially supported to contain or control acres proposed for treatment, $1,000s (total that would occur over life of project)	$2,673	$8,338	$8,550	$8,493
Annual average Income potentially supported, $1,000s	$83	$439	$450	$447
Projected time to contain or control currently inventoried infestations	Containment or control would not be achieved	19 Years	19 Years	19 Years
Net annual equivalent cost of target treatment program (Discounted)	$133,700	$539,030	$549,790	$546,950
Estimated discounted cost to contain or control currently inventoried infestations ($1,000) at target annual treatment level	Unlimited	$6,824	$6,960	$6,924

Untreated acres under Alternative A would continue to spread resulting in an increasingly rapid decline in resource conditions and biodiversity across the forest and on neighboring lands. Commodity and non-commodity values would continue to decline at ever escalating rates as more and more native species succumb to invasive species. Future efforts to treat invasive species may require increasingly aggressive measures in order to achieve containment or control. The potential costs and socio-economic effects of these future efforts would continue to mount until action is taken to successfully arrest the spread of these species.

The programs of treatment proposed under Alternatives B, C, and D, are projected to result in declining populations of invasive species, allowing the biodiversity of native species to be maintained and enhanced. The adverse economic effects of non-native invasive species would be contained and reduced as the treatment programs proposed reduce the occurrence of these species.

3.10 Heritage Resources

Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to consider the potential effects their undertakings may have on historic properties. The definition of undertaking encompasses all agency decision-making actions including the approval of land management plans such as the Umatilla National Forest Invasive Plants Treatment Draft Environmental Impact Statement (DEIS). The NHPA also compels agencies to consult tribes in determining whether the undertaking has potential to pose an effect on historic properties. Government-to government tribal consultation has been initialized for the Invasive Plant Treatment Plan and will be on-going during project implementation. Under the Programmatic Agreements among the United States Department of Agriculture Forest Service Pacific Northwest Region (Region 6), the Advisory Council on Historic Preservation, and the Oregon (signed June 2004) and Washington (signed April 1997) State Historical Preservation Officer Regarding Cultural Resource Management, yearly Section 106 review of proposed treatments will take place to determine if any protection measures are necessary. Tribes will be notified of annual treatments areas, as stated in Chapter 2, Table 6 - Project Design Features, M1. A **no effect** determination has been made for the Invasive Plant Treatment DEIS. Documentation to this affect will be forwarded to the Oregon and Washington SHPO, in compliance with the National Historic Preservation Act of 1966 (as amended), and the Oregon and Washington Programmatic Agreements.

3.11 Impacts to Cultural Uses and Treaty Rights

3.11.1 Introduction

The following is a summary of information provided by the tribes on their internet sites and/or taken from information and maps prepared for the Interior Columbia Basin project. The intent of the section is to characterize use and interests of the lands managed by the National Forest and in no way is intended to indicate differences between tribal use and culture.

3.11.2 Affected Environment

Confederated Tribes of the Umatilla Indian Reservation: The Cayuse (Weyiiletpuu), Walla Walla (Waluulapan), and Umatilla (Imatalamlama) tribes make up the members of this reservation. Their reservation lands are adjacent to the Umatilla and Wallowa Whitman National Forests and the city of Pendleton, Oregon. Their interest area includes the Malheur River and Malheur and Harney Lakes to the south, the Grande Ronde and lower Snake River in the east and north, the Yakima, John Day, and Umatilla Rivers and the Columbia River from Vantage, Washington, to west of the Dalles, Oregon. Important fisheries rivers include the Grande Ronde, Imnaha, John Day, Tucannon, Walla Walla, Wallowa, Touchet, Umatilla, Columbia, and Minam along with their tributaries. The Tribe has been active with salmon restoration in the Umatilla and Walla Walla Rivers. They have worked locally with several agencies to return water to these two streams in order to maintain migratory routes.

Confederated Tribes of the Warm Springs Reservation: The Wasco Bands, the Warm Springs Bands and the Northern Paiutes are members of the reservation. Their area of interest includes Malheur and Harney Lakes in the southeast to the headwaters of the Deschutes River in the southwest, crossing Mount Hood to west of Portland, Oregon and along the Columbia River to the mouth of the Snake River along with the John Day system. There are historic family connections with the Umatillas and since the co-location of other tribes to the reservation, other family connections have developed. Important streams are the Columbia, Crooked, Deschutes, Hood, and John Day River and Fifteen Mile Creek. Their Treaty ceded the majority of the John Day system to the United States.

Nimi'ipuu (Nez Perce): Their treaty established a reservation for the Nez Perce tribe. The reservation is located along the Clearwater River, east of Lewiston Idaho. Their area of interest includes lands east of the Snake River as far north as Coeur d'Alene, Idaho. It extends westward including the Snake and Palouse Rivers and the Columbia to The Dalles. To the south it includes the North Fork of the John Day to the confluence of the Malheur and Snake Rivers. Important streams include the Clearwater, Grande Ronde, Imnaha, Powder, Rapid, Salmon, Lower Snake, Lochsa, Selway, and Columbia Rivers.

Deep canyons were the traditional Nez Perce lands. They traveled with the seasons relying on the rivers, mountains and prairies for sustenance. In early spring, the women traveled to the lower valleys to dig root crops and the men traveled to the Snake and Columbia rivers to intercept the early salmon runs. In mid-summer all the people of the village moved to higher mountainous areas setting up temporary camps to gather later root crops, fish the streams, and hunt big game. By late fall they settled back into their traditional villages along the Snake, Clearwater, and Salmon rivers. Salmon and other fish, game, dried roots and berries provided winter foods.

The basic roots gathered for winter storage include camas bulb (kehmmes), bitterroot (thlee-tahn), khouse (qawas), wild carrot (tsa-weetkh), wild potato (keh-keet), and other root crops. Fruit collected includes service berries, gooseberries, hawthorn berries, thorn berries, huckleberries, currants, elderberries, chokecherries, blackberries, raspberries, and wild strawberries. Other food gathered includes pine nuts, sunflower seeds, and black moss.

3.11.3 Environmental Consequences

Impacts Common to all Alternatives

Direct and Indirect Effects

Access: Access to the National Forest systems lands would not be impacted by invasive plant treatments. The Forest's Access and Travel Management Plan would not be changed. If an open road or a road permitted for Off Highway Vehicle (OHV) use needs to be closed as part of the effective treatment prescription, a separate analysis would be performed. The proposed invasive plant treatments would not impact access to the forest to exercise treaty rights.

Gathering: (Also see the botany report) When herbicides are used as the selected treatment method, individual tribal members may shift to other locations for gathering cultural plants. Early involvement with the Tribes prior to treatment would allow a schedule to be developed so that gathering could occur prior to treatments or in the case of huckleberries, early enough prior to fruit setting so any residual herbicides would be gone. Most treatments (72 percent of the acres) would occur within 20 feet of a road, disturbed site, or other high use area; occasionally treatments would extend to 100 feet. The areas adjacent to these high use areas do not provide quality habitat for cultural plants and can be easily avoided during gathering. Areas receiving herbicide treatments will be posted with warning signs. Herbicide treatments adjacent to high use areas would have low impacts on the gathering of cultural plants nor would it impact the quantity or quality of the plants collected since the treatment areas can be avoided.

The most extensive invasive plant sites beyond the high use areas have yellowstar thistle. These sites are located in dry grasslands or moist meadows that are potential habitat for cous and camas. Biological control methods are the primary treatment method and would not impact cultural plants or their use. Biocontrol is proposed on approximately 16 percent of the treatment acres. High densities of yellowstar thistle displace native plants and likely would not be strongholds of cultural use plants; these areas are likely to not be used for gathering. Controlling the spread of yellowstar thistle would preserve native plant habitat and reduced yellowstar densities would allow native plants to recover.

If herbicides are used to treat yellowstar thistle, there is an increased possibility of herbicide contact with cultural plants. This can be reduced by the application method. If the site is located in a traditional use area, the treatment could be designed around the target and cultural plant life cycles. If effective, spot treatments could be used; however, the density of yellowstar thistle would normally require broadcast treatments. Since cous and camas normally go dormant between mid July and August on the Forest (depends on elevation and year) it would be possible to treat after the cultural plants are dormant and/or in the fall as yellowstar thistle germinate.

A mixture of methods could be used as well depending on the size of the invasive plant site. For knapweeds growing with lomatiums (cous), it would be possible to pull the knapweed to delay the rosette stage until after the lomatiums are dormant to follow up with herbicide at a later visit. This could be used around rock sources, particularly when other cultural gatherings are planned for the area in early summer.

In the higher elevations where huckleberries are found, the vast majority of invasive plants are associated with roads. Very few invasive plants would be found off the roads because forest cover and herbaceous plants would inhibit invasive plant growth. Any areas treated with herbicide would be posted. Since treatments would be along the road edges and surface, contact with herbicide can be avoided by moving further from the road.

Invasive plant treatments are not expected to impact the gathering of plants, roots, or berries. When herbicides are used, the areas can be avoided. The area treated would be largest the first year with follow-up treatments in later years either covering fewer acres or using non-herbicide methods. Displacement of tribal members would very depending on the success of treatments and the amount of time needed to control or eradicate the target species. Since the treatment is mainly associated with roads and other high use areas, impacts to gathering will be low. Approximately 10 percent of the total acres proposed for herbicide treatment are distant to roads meaning that very little of the Forest landscape outside of high use areas would be impacted by treatments. Informing the tribes of proposed treatments each year would help avoid conflicts and allow the Forest and Tribe to work together if restoration is necessary due to invasive plants displacing cultural plants.

Fish habitat and water quality: Impacts to fisheries habitat are analyzed in the Fisheries Report. The Project Design Features are expected to keep herbicides levels well below levels of concern for fish reproduction or human use. The low levels of herbicide used in riparian areas are not expected to concentrate in fish or create health issues. The Project Design Features would limit activities along stream banks when fish are spawning. Areas of high quality riparian habitat are distant from roads and contain very few sites. These areas would not have any measurable impacts from herbicide use and would continue to function as strongholds for recovery efforts.

Hunting: Impacts to big game are disclosed in the Wildlife Report. Big game or birds are not expected to bioconcentrate herbicides. With the majority of treatments near roads, the potential use of forage treated with herbicide is low.

During the time of treatments, animals would disperse due to the workers being present and noise of equipment. The activity is short duration and would not impact hunting or the populations of game species.

Cumulative Effects

Other than harassing of fish or game from other resource management actions or recreational uses when they occur at the same time as treatment, there would be few cumulative effects expected with other ongoing or reasonable foreseeable future actions. Each action would have its own prevention plan that would reduce the risk for spread of invasive plants. There is a low likelihood of these actions causing a need for additional invasive plant treatments. Other than prescribed fire, very few ground disturbing actions are proposed in the meadow/grassland habitats away from roads. Forest harvest activities would retain cover. Grazing may increase the spread of local invasive plants however allotment management plans reduce this risk by requiring the permittee to inventory and report any new invasive plant sites and taking measures to reduce the risk of carrying invasive plants onto the forest when they turn out in the spring. In some allotments pastures have been closed until the invasive plants can be controlled. These activities will likely cause new invasive plant sites to appear in areas of high use, but the amount is likely much less than 5 percent of the current inventory over the next ten to fifteen years.

Impacts Associated with Alternative C

Direct, Indirect and Cumulative Impacts: Alternative C does not use broadcast spray methods in riparian areas. There would be a slight reduction in the amount of herbicide used near streams but would not be measurable.

More care would be taken to make sure herbicides are applied directly on the target species; however, when target species densities are high, the amount of chemical needed would be similar to broadcast treatments. See the fisheries and water quality reports.

Impacts Associated with Alternative D

Direct, Indirect and Cumulative Impacts: The alternative does not use aerial application methods on 675 acres. There would be little differences in the amount of chemical used when hand treatments are used. Herbicide moving off site by aerial drift would be reduced but immeasurable because Project Design Features already reduce the risk of drift reaching riparian areas. The majority of the sites receiving aerial treatments are small (See map in Appendix B); however, one is approximately 300 acres. Impacts to wildlife that continue to use the 300 acre site after treatments would not change. Hand treatments could break up the site into smaller treatment units, but would extend the amount of time animals are exposed to herbicide. Even with the animals being exposed to chemicals, 300 acres is a small part of their utilizable range which reduces the amount of time animals spend in the area. The site is also remote (this is why the site was proposed for aerial treatment) and not likely to be used for gathering or hunting.

3.12 Irreversible or Irretrievable Use of Resources

No irreversible or irretrievable uses of resources are associated with the Proposed Action of this 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 through the implementation of Forest Plan Standards and Project Design Features disclosed in Section 2.3.3. Such effects would not be permanent.

The No Action Alternative is a continuation of the present invasive plant treatment program. To date while some locations have succeeded in controlling weeds, overall the presence and effect of weeds has spread. In time this could have irreversible/irretrievable effects on range resources, range ecology and the management of programs dependent on range.

3.13 Effects of Short-term uses and Maintenance of Long-term Productivity

Positive effects on site productivity would be expected as native vegetation is restored. Some herbicides have potential to reduce soil productivity; Project Design Features are intended to avoid use of such herbicides where soil productivity may be threatened.

3.14 Consistency with Forest Service Policies and Plans

The proposed project is consistent with all Forest Service policies and existing plans. The laws and policies applicable to this project are listed in Section 1.5 of this DEIS. Policy consistency includes following the Forest Plan (1990) as amended by PACFISH (1995) and the Regional Invasive Plant Program FEIS (2005). This latter document details regional policies applicable to all Forests from Forest Service Manual (FSM 2080) and past regional invasive plan program documents. These are discussed in Sections 2.3, 2.4 and 2.5 in the Regional FEIS (2005).

3.15 Conflicts with Other Plans

No conflicts with existing plans have been noted. A recent lawsuit Washington Toxics Coalition et al. v EPA, regarding the lack of Endangered Species Act consultation on 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.

3.16 Adverse Effects That Cannot Be Avoided

Most of the important issues are resolved through 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:

- Taxpayers will likely be responsible for the costs of some if not all the treatments
- Herbicide toxicity exceeding thresholds of concern are unlikely but possible given an herbicide spill
- Minor to moderate physical injuries due to forestry work are possible
- Local effects on some groups of soil micro-organisms that may be temporarily sensitive to certain herbicide chemicals.
- Some common non-target plants are likely to be killed by their close proximity to treatments. This is most likely with broadcast herbicide treatments and less likely (but possible) for all other treatment methods. The adverse effects of the invasive plants themselves far outweigh the potential for adverse effects of treatment

CHAPTER 4 - List of Preparers, Consultation and Coordination, Glossary, References

4.1 List of Preparers

The following people were the primary authors of this EIS.

Vince Archer
US Forest Service TEAMS Planning Enterprise
B.S. Physical Science, M.S. Soils
Soil Scientist

Sandy Caveny
US Forest Service TEAMS Planning Enterprise
B.S Forest Management
Recreation Specialist

Allison Kuehl
US Forest Service TEAMS Planning Enterprise
M.S. Range Management, B.S. Wildlife
Wildlife Biologist

Julie Laufman
US Forest Service TEAMS Planning Enterprise
PhD. Rangeland Ecosystem Science
Botanist

John Natvig
US Forest Service TEAMS Planning Enterprise
NEPA

Bill Overland
US Forest Service TEAMS Planning Enterprise
BS - Forestry and Natural Resources - California Polytechnic State University, San Luis Obispo, 1993
GIS

Barbara A. F. Ott
US Forest Service TEAMS Planning Enterprise
M.S. Management, B.A. Business Administration
Social Scientist

Janice Schultz
US Forest Service TEAMS Planning Enterprise
Writer/Editor – Project Record

Carol Thornton
US Forest Service TEAMS Planning Enterprise
B.S. Geology, M.S. Hydrology/Hydrogeology
Hydrologist

Chris Tootell
US Forest Service TEAMS Planning Enterprise
BS Natural Resources Conservation; Colorado State U., MS Forest Science; Colorado State U
Interdisciplinary Team Leader – NEPA

Tiffany Vandosall
US Forest Service TEAMS Planning Enterprise
B.S. Biology and Chemistry, M.S. Aquatic Ecology
Fisheries Biologist

4.2 Consultation with Regulatory Agencies

The Forest Service has initiated consultation with the US Fish and Wildlife Service and NOAA Fisheries regarding potential adverse effects on Endangered Species. The consultation is tiered to programmatic consultation at the Regional Scale.

A Biological Assessment will be prepared for the Preferred Alternative. A Record of Decision will not be signed prior to receiving a Letter of Concurrence from the regulatory agencies supporting determinations of Not Likely to Adversely Affect and/or they issue a Biological Opinion describing terms and conditions associated with a determination of Likely to Adversely Affect.

4.3 Consultation with Tribes

Letters were sent to Tribal leaders of the Nez Perce, Confederate Tribes of the Umatilla Indian Reservation (CTUIR), and Confederate Tribes of the Warm Springs Reservation in April of 2006. None of tribes responded to the letter. The Forest had meetings with various tribal resource staff. During these meetings the tribes were supportive of the Forest's efforts to treat invasive plants and being able to use all the tools/methods described in the proposed action. The experience of the CTUIR using aerial treatments for yellowstar thistle is decribed as successful when intergrated with other land owners. The Nez Perce felt that biological treatments should be an intergrated approach used on the landscape. All tribes have a concern about coordinating herbicide treatments with traditional gathering activities and areas. A process will be developed for notifying each tribe when herbicides are being used as required by the Project Design Features in Table 6 of Chapter 2.

4.4 Consultation with Counties

The Forest Service has worked closely with the County Weed Boards. County staff have presented information to the Forest Service (Available in the Project Record) and participated in field visits. The Counties often implement projects for the Forest Service and other land managers in the area and fully support this project.

4.5 Consultation with Others

Many people within and outside the Forest Service helped the team develop and analyze the project. Managers and specialists from the National Forest reviewed analysis documentation and suggested changes.

Public scoping has occurred on this project since 2005. The public has been apprised of project progress through the newspaper, direct mailings, Notices of Intent published in the Federal Register in 2005, the Forest Schedule of Proposed Actions, informal meetings and discussions, and other media.

Many organizations and individuals have expressed interest in the project; everyone who commented during scoping was offered a hard copy or CD containing the DEIS and Appendices.

The full DEIS and Appendices is also available electronically by website: http://www.fs.fed.us/uma/05projects/ or on request (see cover page for more information or to request a CD or hard copy).

Hard copies are available for review at Forest Service offices throughout the area. The DEIS has been sent to the Environmental Protection Agency (who commented during scoping) and other federal and state agencies. The following is a list of individuals, organizations, agencies and tribal governments and groups to whom this DEIS was sent:

Individuals

Mike Zeimantz

Confederated Tribes of the Umatilla Indian Reservation

Armond Minthorn, Cultural Resources
Carey Miller, Cultural Resources Protection Program
Carl Scheeler, Wildlife Program Director
Eric Quaempts, Director Department of Natural Resources
Gary James, Fisheries Program Director
John Barkley, General Council Chair
Rick George, Director Environmental Planning, Rights Protection

Confederated Tribes of the Warm Springs Indian Reservation

Bobby Brunoe, Natural Resources
Delvis Heath Sr.
Joseph Moses
Nelson Wallulatum
Ron Suppah, Chairman Tribal Council
Sally Bird, Program Manager, Cultural Resources Department
Scott Turo, Habitat Biologist

Nimiipuu Tribe

Aaron Miles, Natural Resources
Brooklyn Babtiste, Chairman Natural Resources Subcommittee
Dave Johnson, Fisheries
Don Bryson, Fisheries
Emmit E. Taylor Jr., Fisheries/Watershed
Gary E. Green, Vice Chairman Natural Resources
Ira Jones, Watershed Management
John Degroot, Director of Forestry
Keith Lawrence
Loren Kronemann
Paul Kraynak, Fisheries/Watershed
Ryan Sudbury, Office of Legal Council
Vera Sonnek, Cultural Resources
Samuel N. Penny, Chairman

Back Country Horseman of Washington

Arlyn Boatsman
Cynthia Gauthier
Dan Jennings
Dave Jackson
Dan and Jeanie Chappel
Jeanne Koester
Ken Bailey
Krohn Treversie
Randy Darling

Union County Board of Commissioners

Colleen Macleod
John LaMoreau
Steve McClure

Agencies

Baker County Weed Board
Heppner Ranger District, Environmental Coordinator
Morrow County Road Department
Morrow County Weed District
National Marine Fisheries Service
North Fork John Day Ranger District, Janel Lacey
Pomeroy Ranger District, Terri Jeffreys
Umatilla County Weed Control, Dan Durfey
US Fish and Wildlife Agency, John Kinney
Walla Walla Ranger District, Environmental Coordinator
Washington State Noxious Weed Control Board, Steve McGonical

Individual Organizations

Blue Mountains Biodiversity Project, Karen Coulter
Center for Water Advocacy, Harold Shepherd
Hells Canyon Preservation Council, Mike Medberry
Northwest Coalition for Alternatives to Pesticides, Norma Grier
Oregon Natural Desert Association, Peter M. Lacy
Oregon Wild, Tim Lillebo, Eastern Oregon Field Representative
Sierra Club, Asante Riverwind
Umatilla Basin Watershed Council, Tracy Bosen
Walla Walla Basin Watershed Council
Wallowa County Courthouse
Wallowa Resources, Mark C. Porter

4.6 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. (See also, chronic exposure and cumulative exposure.)

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 organisms are physiologically or structurally suited for survival, growth, and resistance to pests and diseases in a particular environment.

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

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 (AWA) - Areas removed from the suitable timber base through agency direction and land management plans.

Adsorption - The tendency of one chemical to adhere to another material such as soil.

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.

Agency for Toxic Substances and Disease Registry (ATSDR) - Federal agency within the Public Health Service charged with carrying out the health-related analyses under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Superfund Amendments and Reauthorization Act (SARA).

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 13122, 2/3/99). (See also, invasive, noxious, and weed species.)

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. (See also, aerobic.)

Anions - Negatively charged ions in solution e.g., hydroxyl or OH- ion. (See also, cations.)

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.

Annuity - Payment or receipt of a series of equal amounts at stated intervals for a specified number of time periods. An "annuity due" is a series of equal value outputs or inputs occurring for N equal time periods with "payments" made at the beginning of each period.

Anoxia - Literally, "without oxygen." A deficiency of oxygen reaching the tissues of the body especially of such severity as to result in permanent damage.

Aquatic Influence Zone – The inner half of a Riparian Reserve.

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.

Background level - In pollution, the level of pollutants commonly present in ambient media (air, water, soil.)

Bacteria - Microscopic living organisms that metabolize 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 hydroxyl (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 layer 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 (often concentrating in the body fat.)

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 organism to levels greater than in the surrounding water or environment.

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.

Biological control - The use of natural enemies, 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 Biome - 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 - Herbicide treatment method generally used along roads; boom truck spray is directed at target species. Broadcast methods are used for larger infestations where spot treatments would not be effective.

Bryophytes - Plants of the phylum Bryophyta, including mosses, liverworts, and hornworts; characterized by the lack of true roots, stems, and leaves.

Buffer Zone - A strip of untreated land that separates a waterway or other environmentally sensitive area from an area being treated with pesticides.

Candidate species - Those plant and animal species that, in the opinion of the Fish and Wildlife Service (FWS) or National Oceanic and Atmospheric Administration (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.

Chemical Abstracts Service (CAS) Registry Number - An assigned number used to identify a chemical. Chemical Abstracts Service is 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.

Cations - Positively charged ions in a solution. (See also, anion.)

Characteristic Landscape - The naturally established landscape within a scene or scenes being viewed.

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 two years). Chronic exposure studies are used to evaluate the carcinogenic potential of chemicals and other long-term health effects. (See also, acute and cumulative exposure.)

Chronic Reference Dose (RfD) - An estimate of a lifetime daily exposure level (in mg/kg/day) for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects. Chronic RfDs are specifically developed to be protective for long-term exposure to a compound (seven 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).

Competitive seeding **-** Treatment method; most effective after weed populations have been reduced by other control actions.

Congressionally Designated 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. 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 scale-like 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 13122, 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 (CE) - 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 exposure - Exposure resulting from one or more activities that are repeated over a period of time. (See also, acute and chronic exposure.)

Detritus - Loose fragments, particles, or grains formed by the disintegration of organic matter or rocks.

Discount - In economics, discounting is the process of carrying an end value backward in time at compound interest.

Distance Zones - Landscape areas denoted by specified distances from the observer. Used as a frame of reference in which to discuss landscape attributes or the scenic effect of human activities in a landscape.

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.

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); 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 - The portion of a sprayed chemical that is moved by wind off of a target site.

Emergent Vegetation - Plants growing out of or standing in water, in contrast to “submerged aquatic vegetation (SAV),” which grows entirely underneath the waters’ surface.

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 U.S. 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. (Compare to “Indigenous” and “Native.”)

Environmental justice - Executive Order 12898 of February 11, 1994 requires federal agencies, to the greatest extent practicable and permitted by law, to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the commonwealth of the Mariana Islands.

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 – Non-native species; introduced from elsewhere, but not completely naturalized. (See also alien and introduced 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 animals of a specified region or time.

Federally listed species - Formally listed as a threatened or endangered species under the Endangered Species Act. Designations are made by the Fish and Wildlife Service or the National Marine Fisheries Service.

Federal Insecticide and Rodenticide Act (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.

Fertilization - Treatment method involving adding of nutrients, which could improve the success of desirable species; may be limited, depending on species/soil characteristics.

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 is a mechanical method that is effective on seedlings and annuals and can be applied under certain 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.

Game fish - Species like trout, salmon, or bass, caught for sport. Many of them show more sensitivity to environmental change than non-game fish.

Grazing animals - Treatment method which requires matching the invasive species with the appropriate grazer for best success.

Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) – A model which displays herbicide concentrations in streams under a variety of conditions.

Groundwater - The supply of fresh water found beneath the Earth's surface, usually in aquifers, which often supply 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.

Hand/Selective application - Herbicide treatment of individual plants through wicking, wiping, injecting stems, etc., with low likelihood of drift or delivery of herbicides away from treatment sites. This method ensures no herbicide directly contacts soil.

Hand-pulling/Grubbing - Treatment method which is labor-intensive but effective on single plants or on small, low-density infestations.

Hazard Quotient (HQ) - The ratio of the estimated level of exposure to a substance from a specific pesticide application to the RfD 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.

Tribal and Treaty Rights - Native American treaty and other rights or interests recognized by treaties, statutes, laws, executive orders, or other government action, or federal court decisions.

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.

Indigenous - An indigenous species is any which were or are native or inherent to an area. (See also, native.)

Inerts - Anything other than the active ingredient in a pesticide product; not having pesticide properties.

Infested area - A contiguous area of land occupied by, in this case, 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.

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

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 action.

Introduced species - An alien or exotic species that has been intentionally or unintentionally released into an area as a result of human activity. (See also exotic, invasive, and noxious.)

Introduction - "The intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity" (Executive Order 13122, 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 13122, 2/3/99) (See also exotic and introduced species)

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.

Landscape - An area composed of interacting ecosystems that are repeated because of geology, land form, soils, climate, biota, and human influences throughout the area. Landscapes are generally of a size, shape, and pattern which is determined by interacting ecosystems.

Landscape Character - Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique.

Landscape Setting - The context and environment in which a landscape is set; a landscape backdrop. It is the combination of land use, landform, and vegetation patterns that distinguish an area in appearance and character from other areas.

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.)

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, hot foam.)

Microorganisms - A generic term for all organisms consisting only of a single cell, such as bacteria, viruses, protozoa and some fungi.

Minimum tool - Use of a weed treatment alternative that would accomplish management objectives and have the least impact on resources

Modification - A visual quality objective meaning human activities may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground.

Mollusks - Invertebrate animals (such as slugs, snails, clams, or squids) that have a soft, un-segmented 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.

Morbidity - Rate of disease, injury or illness.

Mowing - Invasive plant treatment method which is limited to level/gently-sloping smooth-surface terrain. Treatment timing is critical, and must be conducted for several consecutive years.

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.

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.

National Marine Fisheries Service (NMFS) - The federal agency that is the listing authority for marine mammals and anadromous fish under the ESA.

National Pollutant Discharge Elimination System (NPDES) - As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters.

National Visitor Use Monitoring (NVUM) - A permanent, ongoing sampling system which measures national forest visitor demographics, experiences, preferences, and impressions. A stratified random sample is done for 25% of the National Forest system each year according to a national research protocol. NVUM responds to the need to better understand the use and importance of, and satisfaction with, national forest system recreation opportunities.

National Wilderness Preservation System (NWPS) - The Wilderness Act of 1964 established the national Wilderness Preservation System to ensure that certain federally owned areas in the United States would be preserved and protected in their natural condition. The Act defines a wilderness area, in part, as an area which generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable. Areas included in the system are administered for the use and enjoyment of the American people in such manner as to leave them unimpaired for future use and enjoyment as wilderness.

Native species - With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem (Executive Order 13122, 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.

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.

Non-target species - 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).

Outstandingly Remarkable Value (ORV) - A characteristic of rivers or sections of rivers in the national Wild and Scenic River System. In order for a river to be included in the system, it must possess at least one "outstandingly remarkable" value, such as scenic, recreational, geologic, fish, wildlife, historic, cultural, or other similar features. ORV's 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.**

Partial Retention - A visual quality objective which in general means human activities may be evident but must remain subordinate to the characteristic landscape.

Pathogen - A living organism, typically a bacteria or virus, that causes adverse effects in another organism.

Percolation - 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 two 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, et. al., 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, etc.

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 (greater than seven) is alkaline or basic and a low pH (less than seven) is acidic.

Population - A group of individuals of the same species in an area.

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.

Project Design Features (PDF) - A set of implementation Design Features/features applied to projects to ensure that the project is done according to environmental standards and adverse effects are within the scope of those predicted in this Environmental Impact Statement.

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 (PVT) - The term Potential Vegetation Type 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.

Recreational Rivers - A classification within the national Wild and Scenic River System. Recreational rivers are those rivers, or sections of rivers, that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

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.

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.

Retention - A visual quality objective which in general means human activities are not evident to the casual forest visitor.

Revegetation - The re-establishment of plants on a site - The term 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.

Riparian Area - A geographic area containing an aquatic ecosystem and adjacent upland areas that directly affect it.

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.

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, often measured as a percentage.

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.

Scenery Management - The art and science of arranging, planning, and designing landscape attributes relative to the appearance of places and expanses in outdoor settings.

Scenic - Of or relating to landscape scenery; pertaining to natural or natural-appearing scenery; constituting or affording pleasant views of natural landscape attributes or positive cultural elements.

Scenic Rivers - A classification within the national Wild and Scenic River System. Scenic rivers are those rivers, or sections of rivers, that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

Seen Area - The total landscape area observed based upon landform screening. Seen-areas may be divided into zones of immediate foreground, foreground, middleground, and background. Some landscapes are seldom seen by the public.

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.

Species of Local Interest (SOLI) - Threatened, endangered and proposed species; Regional Forester's Sensitive species, management indicator species, and other rare or endemic species of concern.

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 13122, 2/3/99).

Spot application - Herbicide treatment involving use of a backpack sprayer or other means. Application is aimed at specific target species, with methods of prevention (such as barriers,) to control damage to non-target species.

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

Sub-chronic 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 sub-chronic study is usually performed in two species (rat and dog) by the route of intended use or exposure.

Sub-chronic 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. Sub-chronic toxicity only applies to relatively long-lived organisms such as mammals.

Submerged Aquatic Vegetation (SAV) - Vegetation that lives at or below the water surface; an important habitat for young fish and other aquatic organisms. In contrast to “emergent vegetation,” which is growing out of or standing in water.

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 - "The term 'take' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." (Title 16, Chapter 35, Section 1532, Endangered Species Act of 1973)

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.

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. 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.

Treatment 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.

U.S. Fish and Wildlife Service (US FWS) - The federal agency that is the listing authority for species other than marine mammals and anadromous fish under the ESA.

U.S. Forest Service (USDA FS or USFS) - The federal agency responsible for management of the Nation's National Forest system lands.

Variety Class - A particular level of visual variety or diversity of landscape character.

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.

Viable Population - A 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.

Viewshed - Total visible area from a single observer position, or the total visible area from multiple observer position. Viewsheds are accumulated seen-areas from highways, trails, campgrounds, towns, cities, or other viewer locations. Examples are corridor, feature, or basin viewsheds.

Visual Quality Objective - A desired level of excellence based on physical and sociological characteristics of an area. Refers to degree of acceptable alteration of the characteristic landscape.

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.

Wetland - 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.

Wild and Scenic River System - The Wild and Scenic Rivers Act of 1968 established a system of selected rivers in the United States, which possess outstandingly remarkable values, to be preserved in free-flowing condition. Within the national system of rivers, three classifications define the general character of designated rivers: Wild, Scenic, and Recreational. Classifications reflect levels of development and natural conditions along a stretch of river. Classifications are used to help develop management goals for the river.

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.

Wild Rivers - A classification within the national Wild and Scenic River System. Wild rivers are those rivers, or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted.

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United States Department of Agriculture

Forest Service

Pacific Northwest Region

June 2007

FS14-SO-10-07

Umatilla National Forest

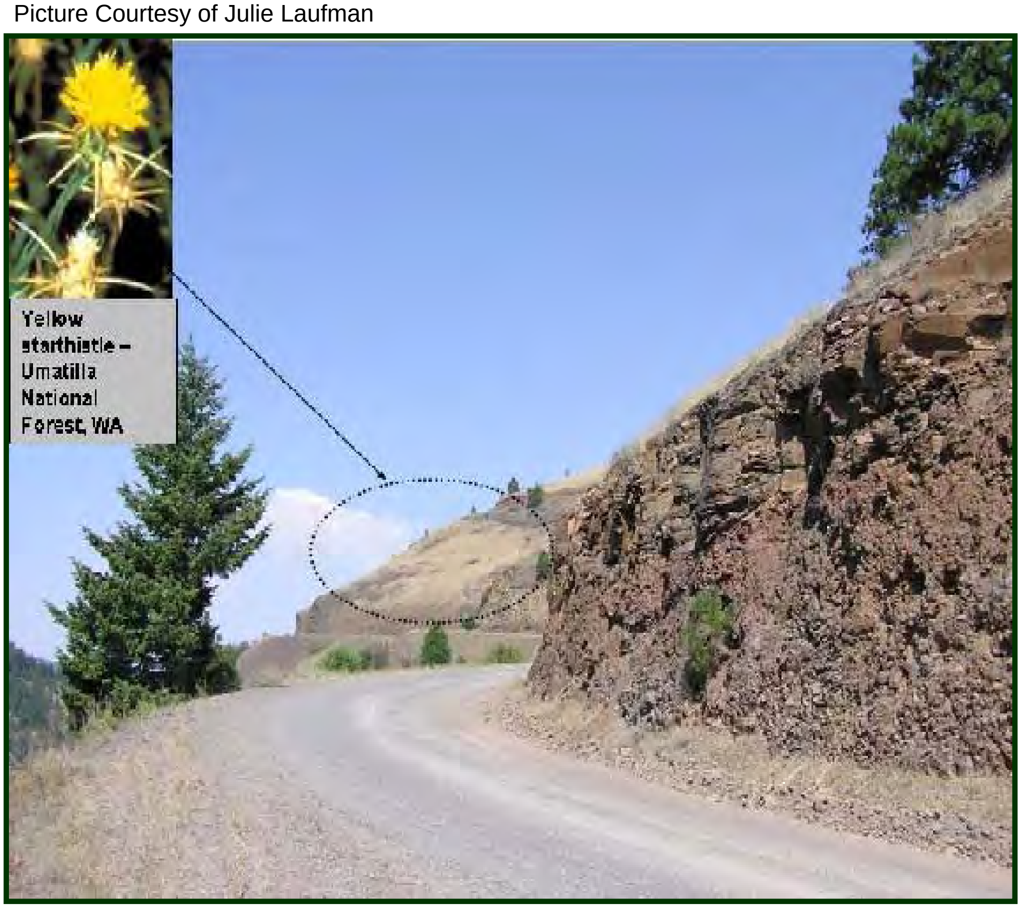
Draft Environmental Impact Statement

Invasive Plants Treatment Project

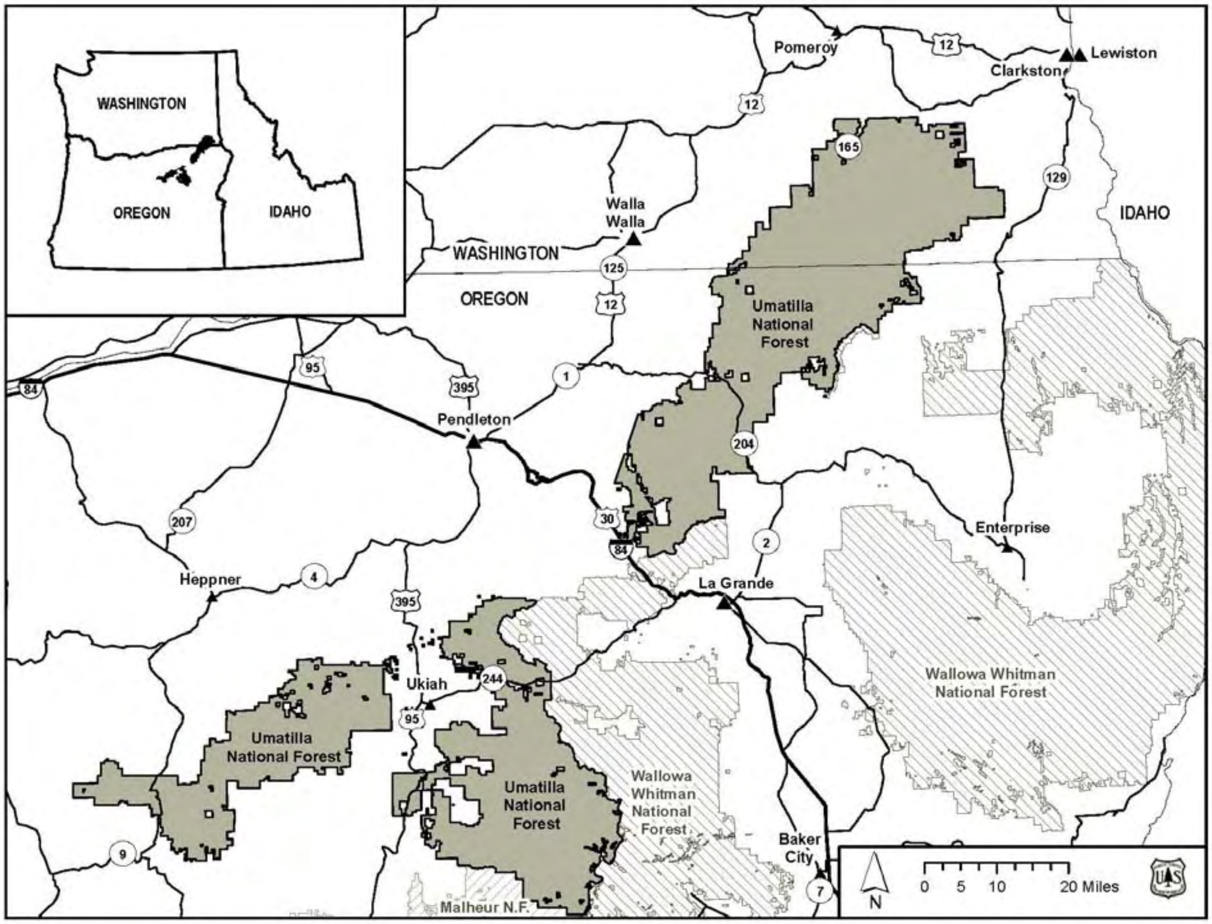
Volume II - Appendices

Counties: Asotin, Columbia, Garfield, and Walla Walla in Washington; Grant, Morrow, Umatilla, Union, Wallowa, and Wheeler in Oregon

Picture Courtesy of Julie Laufman



Umatilla National Forest Vicinity Map



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Appendix A – The Forest Plan

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The Forest Plan

This appendix has management direction from the 1990 Umatilla Forest Land and Resource Management Plan (LRMP) (USDA 1990) as amended by the Pacific Northwest Region Invasive Plant Program, Record of Decision 2005.

The 1990 LRMP goals and objectives that broadly govern the management of national forest lands are listed below. The LRMP also contains Standards and Guidelines that govern management more specifically in each resource area addressed by the goals. The Standards and Guidelines that deal with weeds are also listed in this appendix.

The Forest Plan has a section called “Desired Future Condition.” This section acknowledges that noxious weeds will be part of forest even under desirable conditions. So even under the best scenarios it is understood that noxious weeds will be contained or controlled but in some areas cannot be eradicated completely.

Forest Management Goals (pages 4-1 to 4-3)

Forest management goals are statements providing direction for the future and describing the desired conditions to be achieved. The goals are expressed in broad terms and are timeless in that they have no specific date by which they are meant to be completed. The Umatilla National Forest management goals are to:

Provide land and resource management that achieves a more healthy and productive forest and assists in supplying lands, resources, uses, and values which meet local, regional, and national social and economic needs.

Provide for a broad spectrum of recreation opportunities and experiences and a variety of recreation settings on the National Forest for Forest recreationists.

Provide attractive natural to near-natural settings for Forest users along important highways, roads, trails, and in and around developed and primitive sites.

Preserve, protect, and improve the resources and values of the Forest’s wildernesses.

Protect and enhance the outstandingly, remarkable values and free-flowing condition of the Wild and Scenic Rivers.

Protect and perpetuate special areas and related resources for their unique values

Provide for the protection and preservation of cultural resource values through a program which integrates inventory, evaluation, protection, and enhancement (including interpretation).

Provide, develop, and enhance effective and well-distributed habitats throughout the Forest for all existing native and desired nonnative vertebrate wildlife species.

Provide and manage big game (elk and deer) habitat and its components (cover, forage, and roads) to assist in meeting state wildlife agency population management objectives

Provide and maintain a diverse, well-distributed pattern of fish habitats to assist in doubling anadromous runs in the Columbia River Basin (by the year 2000) in cooperation with Native American tribes, states, and other agencies.

The goal applies to all areas dominated by riparian vegetation, including areas containing anadromous and resident fish habitat, perennial and intermittent stream courses, wetlands, and floodplains.

Maintain or improve habitats for all threatened or endangered plant and animal species on the Forest, and manage habitats for all sensitive species to prevent the species from becoming threatened or endangered.

Manage the forage resources for an improving vegetative trend in areas in less than ‘fair’ condition and for an upward or stable trend for areas in ‘fair‘ or better condition. Provide for forage productivity and make suitable range available for livestock grazing. Increase the level of forage production where cost efficient and consistent with other resource goals.

Provide for diversity of plant and animal communities and species consistent with overall multiple-use objectives for the Forest. Maintain or enhance ecosystem functions to provide for the long-term integrity (stability) and productivity of biological communities.

Provide areas for research and education purposes which are typical of unique natural ecosystems and are in undisturbed or nearly undisturbed condition.

Provide for production and sustained yield of wood fiber and insofar as possible meet projected production levels consistent with various resource objectives, standards and guidelines, and cost efficiency.

Manage Forest lands to maintain or enhance soil and land productivity.

Manage Forest resources to protect all existing beneficial uses of water and to meet or exceed all applicable state and Federal water quality standards. Within the Forest capability, maintain or enhance water quantity, quality, and timing of streamflows to meet needs of downstream users and other resources. Maintain integrity and equilibrium of all stream systems, riparian areas, and wetlands on the Forest. Manage designated municipal supply watersheds to provide water which, with treatment, will result in a satisfactory and safe supply.

Maintain air quality at a level adequate for protection and use of Forest resources and which meets or exceeds applicable Federal and state standards and regulations.

Provide for exploration, development, and production of a variety of minerals on the Forest consistent with various resource objectives, environmental quality, and cost efficiency.

Promote human resources, civil rights, and community development within the zone of influence of the Forest. Promote cooperation and coordination with individuals, groups, landowners, Forest users, Native American tribes, and state and Federal agencies in forest management, and community and economic development.

Provide for the use and occupancy of the Forest by private individuals or Federal, state, and local governments when such use is consistent with Forest management objectives, is in the public interest, and cannot be reasonably served by development on private land.

Provide an optimum pattern of landownership within the Forest considering resource goals and efficiency of managing the Forest.

Provide and manage a safe and economical road and trail system and facilities needed to accomplish the land and resource management and protection objectives on the Forest.

Provide and manage administrative facilities sufficient to serve the public and accomplish land and resource management and protection objectives of the Forest.

Provide and execute afire protection and fire use program that is cost efficient and responsive to land and resource management goals and objectives

Protect forest and range resources and values from unacceptable losses due to destructive forest pests through the practice of integrated resource management

Forest Management Objectives

Noxious Weeds and Poisonous Plants (page 4-32-33; control plan)

Noxious weeds now infest an estimated 6,000 acres of the Forest. Areas of infestation are associated with activities such as timber harvest, road construction, livestock grazing, and recreation. With the planned level of activity, the potential exists for expanded infestations of weeds on the Forest.

Control efforts will be initiated on the Forest. The Forest Noxious Weed Control Plan (November 1989) is incorporated into the Forest Plan by reference and provides direction for inventory and treatment of target species, interagency and landowner coordination, and funding. The methods of treatment will also be in accordance with the direction in Managing Competing and Unwanted Vegetation, FEIS, November 1988. Essentially, the forests are directed to emphasize prevention and natural ecosystem processes, and reduce reliance on herbicides. However, all treatment methods are available. Cost of treatments will vary greatly. Hand methods are approximately four to six times as expensive as chemical treatment, and will not keep up with the current level of infestation under the present budgets. If effective biological controls are found or herbicides used, the problem will be contained or lessened. Otherwise, the problem will get progressively worse. Presently, progress is being lost in all areas in the control of noxious weeds.

Several plant species not classed as noxious weeds (but as poisonous plants) have caused economic loss to livestock. Generally, control efforts have not been initiated on the Forest because these species have not been abundant and forage conditions have been favorable. No control efforts have been carried out in recent years, and none are planned for the future. See Table 4-13 for a list of Forest problem plants.

TABLE 4-13. PROBLEM PLANTS ON THE UMATILLA NATIONAL FOREST

Umatilla National Forest

PRIMARY NOXIOUS WEEDS OCCURRING ON THE FOREST	
Tansy ragwort	(Senecio jacobaea)
Yellowstar thistle	(Centaurea solstitialis)
Dalmation toadflax	(Linaria dalmatica)
Diffuse knapweed	(Centaurea diffusa)
Spotted knapweed	(Centaurea maculosa)
Canada thistle	(Cirsium arvense)
Scotch thistle	(Onopordum acanthium)
Common St Johnswort	(Hypericum perforatum)

4-32

SOME SPECIES OF POISONOUS PLANTS COMMON TO THE UMATILLA NATIONAL FOREST

Deathcamas	(Zigadenus spp.)
Larkspur species	(Delphinium spp.)
Lupine species	(Lupinus spp.)*
Milkvetches or Locoweed species	(Astragalus spp.)**
Water hemlock	(Circuta douglasii)
Prunus (cherry) species	(Prunus spp.)
Wild red baneberry	(Actaea rubra)
Green false hellebore	(Veratrum viride)

* Lupinus sabinii is a documented Sensitive plant species on the Forest, Lupinus biddiet and Lupinus cusickil are suspected to occur on or near the Forest.
** Astragalus arthuri and Astragalus diaphanus are documented Sensitive plant species on the Forest, Astragalus cusickii is suspected to occur on or near the Forest

Under no circumstances would any proposed control efforts target documented or suspected Sensitive plant species.

Forest Plan Standards and Guidelines

Range Improvements standard; (page 4-62)

1. The allotment management plan will implement a cost-effective program, consistent with management objectives. Structural improvements such as fences and water developments, and nonstructural improvements such as burning, seeding, and fertilizing may be used to achieve the management goals. Range improvements will be constructed and maintained with consideration for other resource needs (e.g., wildlife, visuals). Other activities such as predator, noxious weed, and unauthorized livestock controls may be necessary.

Ecosystems & Diversity Standard; (page 4-62)

3. Provide for all seral stages of terrestrial and aquatic plant associations in a distribution and abundance that meets the goal. Early successional stages may be improved through introduced forage species in order to increase production, protect soil resources, and prevent noxious or other undesirable weed invasion.

Pest Management; (4-90*)*

1. Integrated pest management (IPM), prevention, and suppression strategies will be utilized to manage pests within the constraints of laws and regulations and to meet Forest-wide management objectives. Methods may include management practices (cultural or silvicultural); biological, mechanical, manual, prescribed fire, or chemical treatments; or regulatory measures.

2. All pest management suppression project proposals will be analyzed through the NEPA process to select an appropriate suppression response.

3. Where practical, noxious weeds and invader plants will be controlled to prevent threats to adjacent agricultural lands or to prevent unacceptable loss of forest and range productivity.

4. Plans for control of competing and unwanted vegetation including noxious weeds will be in keeping with *Managing Competing and Unwanted Vegetation (FHS) USDA, Forest Service, 1988*. The five-step process, composed of site analysis, strategy selection, project design, action, and monitoring, will be used in managing competing and unwanted vegetation for site specific projects and will be documented in an environmental analysis.

5. Individual project plans will specify licensing approval and public notification requirements for pesticide use on a case-by-case basis.

Management Areas

B1 Wilderness- Range; (page 4-145)

Use of supplemental feeds for recreation livestock will be encouraged over open grazing. Encourage use of feeds that are free of nonindigenous and noxious weed seed.

The following standards have been adopted into the 1990 LRMP from the 2005 R-6 Pacific Northwest Region Invasive Plant Program ROD.

Standards

The following standards and an implementation schedule are included in the Selected Alternative.

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. 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

Appendix 1-3

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. Treat or require treatment of infested sources before any use of pit material. 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.

Appendix 1-4

Standard #	Text of Standard	Implementation Schedule
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.	This standard will apply to herbicide treatment projects as of March 1, 2006.
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] 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.	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.

Standard #	Text of Standard	Implementation Schedule
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.
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.

Appendix 1-6

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Appendix B – Botany

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Herbicide Effects to Plants by Active Ingredient

This section summarizes the effects to plants by active ingredient. Effects are grouped by the mode of action (how the ingredient kills a plant).

Acetolactate Synthase (ALS) Inhibitors

Chlorsulfuron, metsulfuron methyl, sulfometuron methyl, imazapic, and imazapyr work by inhibiting the activity of an enzyme called acetolactate synthase, which is necessary for plant growth. These five active ingredients are very potent herbicides; very low concentrations kill and damage plants. In some circumstances, these ingredients could damage non-target species more readily than the other groups of herbicides proposed. On the other hand, lower concentrations mean smaller amounts of chemical substances are released into the environment.

The active ingredients and commercial formulations could be difficult to use in areas where native plants are a large component of a treatment area. These ingredients could be useful though, in situations where an invasive plant is the dominant cover species, or on some aggressive species that have not been effectively treated by other methods or herbicides.

Chlorsulfuron

Chlorsulfuron (used in Telar or Glean) is both a pre-emergent and post-emergent herbicide (i.e. it effectively inhibits seed germination and damages fully emerged plants). It could affect annual, biennial and perennial broadleaf species. Drift could cause damage to non-target plants at distances greater than 900 feet from the application site during a ground based broadcast application.

Chlorsulfuron is very potent relative to the application rate. The typical application rate proposed by the Forest Service for chlorsulfuron is greater than 6,000 times higher than the No Observed Effect Concentration (NOEC) in vegetative vigor studies on less tolerant species (sugarbeets and onions) (SERA, 2003-chlorsulfuron). This means that extremely small amounts will cause observable damage in these species. The risk assessment stated that a very broad range of sensitivities could occur, with grasses appearing far more tolerant than most other species.

The NOEC values for soil exposure used for seedling emergence testing were found to be substantially higher than the vegetative vigor studies (i.e. it would take a higher concentration of the ingredient to cause an observable effect on emerging seedlings than on vegetative vigor of older plants). Nonetheless, offsite movement of chlorsulfuron in runoff could damage non-target plants under conditions that favor runoff. In arid regions, wind erosion of treated soil could also result in damage to non-target plants (SERA, 2003-chlorsulfuron).

Chlorsulfuron has been shown to reduce non-target plant reproduction in a study done on cherry trees (Fletcher et al., 1993). The authors asserted that cherry tree reproduction displayed high sensitivity even when exposed to small quantities of chlorsulfuron, such as might be found in airborne particles traveling long distances, without altering vegetative growth. They postulated that drifting sulfonylureas might severely reduce both crop yields and fruit development on native plants. The same authors in another study compared three herbicides, atrazine, chlorsulfuron, glyphosate at low application rates (within the range of reported herbicide drift levels) to four other crop plants. Only chlorsulfuron was found to cause reduction in the yields of these crops if plants were exposured at critical stages of development (Fletcher et al., 1996).

Metsulfuron methyl

Metsulfuron methyl (used in Escort XP) is also a potent herbicide. It affects many broadleaf and woody species.

This ingredient could cause damage to non-target plants at distances of up to 500 feet using a ground based broadcast application. For metsulfuron methyl, the typical application rate is greater than 800 times higher than the NOEC for less tolerant plants (onions) (SERA, 2003).

The offsite movement of this ingredient in runoff could damage non-target plants under conditions favorable to runoff, although this is less likely with metsulfuron methyl than chlorsulfuron. In arid regions, wind erosion could also result in damage to non-target species (SERA 2003).

Sulfometuron methyl

Sulfometuron methyl (used in Oust) is a broad-spectrum pre- and post-emergent herbicide. It is less selective than chlorsulfuron or metsulfuron methyl and is effective against broadleaf and grass species. Sulfometuron methyl drift could cause damage to non-target plants at distances greater than 900 feet from the application site during a ground based broadcast application. Typical application rate is greater than 1875 times higher than the NOEC for less tolerant plants. The offsite movement of this ingredient in runoff could damage non-target plants under conditions favorable to runoff. This kind of offsite movement is more likely with sulfometuron methyl than with chlorsulfuron and metsulfuron methyl. In arid regions, wind erosion could also result in damage to non-target species (SERA, 2003).

Imazapic

Imazapic (used in Plateau) is a selective herbicide, but even tolerant plants that are directly sprayed at normal application rates are likely to be damaged (SERA 2003). Affected plants include annual, perennial broadleaf and grass species. Many native bunchgrasses are not affected. Less tolerant species can be affected by drift up to 50 feet from ground applications and up to 100 feet from aerial applications. In clay soils in areas of relatively high rainfall rates, conditions in which runoff is favored, there could be a slight risk to some susceptible terrestrial plants. Imazapic is more selective than imazapyr. It is less likely to harm native plants or plant communities.

Imazapyr

Imazapyr (used in Arsenal, Chopper and Stalker®) is a non-selective herbicide. Tolerant plants that are directly sprayed at normal application rates are likely to be damaged (SERA, 2003-Imazapyr). Less tolerant species can be affected by drift up to 500 feet by imazapyr. Imazapyr can also “leak” out of the roots of treated plants, and therefore can adversely affect the surrounding native vegetation (Tu et al., 2001). When applied in areas in which runoff is favored, damage from runoff appears to pose a greater hazard than drift. Residual soil contamination could be prolonged in some areas. In arid areas, residual toxicity to susceptible plant species could last for several months to several years. Residual contamination could be much shorter in areas of relatively high rainfall (SERA, 2003-Imazypyr).

Synthetic auxins

Picloram, clopyralid, and triclopyr mimic naturally occurring plant hormones called auxins. They kill plants by destroying tissue through uncontrolled cell division and abnormal growth.

Picloram

Picloram (used in Tordon®) is selective for broadleaf and woody plants. It could impact sensitive species at distances of nearly 1000 feet from the application site (SERA, 2003-Picloram).

In their Pesticide Re-registration Fact Sheet (1995), the EPA noted that picloram poses very significant risks to non-target plants. Estimated concentrations of picloram in the environment are hundreds to thousands of times the “level of concern” at which 25 percent of seedlings fail to emerge. The EPA also noted that picloram is highly soluble in water, resistant to biotic and abiotic degradation processes, and mobile under both laboratory and field conditions. They stated that there is a high potential to leach to groundwater in most soils.

Plant damage could occur from drift, runoff, and distant areas where ground water is used for irrigation or is discharged into surface water (EPA, 1995). Labeling restrictions from these findings were implemented to reduce effects. Because picloram persists in soil, non-target plant roots can take up picloram (Tu et al., 2001) and could impact revegetation efforts. Lym et al. (1998) recommended that livestock not be transferred from treated grass areas onto sensitive broadleaf crop areas for 12 months or until picloram has disappeared from the soil without first allowing seven days of grazing on an untreated green pasture. Otherwise, urine may contain enough picloram to injure susceptible plants. To a lesser degree, this can occur with other active ingredients such as glyphosate and imazapic.

Clopyralid

Clopyralid (used in Transline) is more selective than picloram. As with picloram, clopyralid has little effect on grasses, but also does little harm to members of the mustard family. It is effective on the sunflower, legume, nightshade, knotweed and violet families. It is less persistent than picloram. Off-site drift may cause damage to susceptible plant species at distances of about 300 feet from the application site. Wind erosion of treated soil in arid climates could also cause damages in the range of 200 to 900 feet. Use of clopyralid in a roadside revegetation project had mixed results (Tyser et al., 1988). Native grasses increased while native forbs decreased, which is typical for an ingredient that is selective against forbs. However, non-native annual grasses increased in this study.

Triclopyr

Triclopyr (used in Garlon) is a selective systemic herbicide. It is used on broadleaf and woody species. It is commonly used against woody species in natural areas (Tu et al., 2001). Sensitive species could be impacted by drift from 100 feet (typical Forest Service application rate) to 1000 feet (maximum US Forest Service application rate) (SERA, 2003-Triclopyr). Two forms of triclopyr could be used with differing degrees of effects. Triclopyr BEE (butoxyethyl ester) is more toxic to plants than triclopyr TEA (triethylamine salt). Triclopyr BEE formulations are more apt to damage plants from runoff than other formulations. Both formulations have been found to decrease the relative long-term abundance and diversity of lichens and bryophytes. Newmaster et al. (1999) stated drift from triclopyr could affect the sustainability of populations of lichens and bryophytes, where these ingredients reduced abundance. They found that normal application rates (applied aerially) were found to reduce abundance by 75 percent, variable by species. Colonists and drought-tolerant species were more resistant than the mesophytic forest species, which means that herbicide treatments could essentially push back the successional stage on a non-vascular community. Triclopyr was found to inhibit growth of four types of ectomychorrhizal fungi associated with conifer roots at concentrations of 1,000 parts per million (Estok et al., 1989).

EPSP Synthase Inhibitors

Glyphosate **-** preventing plants from synthesizing three aromatic amino acids. The key enzyme inhibited by glyphosate is called EPSP.

Glyphosate

Glyphosate (used in 35 formulations including RoundUp and Rodeo®) is a non-selective systemic herbicide that can damage all groups or families of non-target plants to varying degrees, most commonly from off-site drift. Plants susceptible to glyphosate can be damaged by drift up to 100 feet from the application site at the highest rate of application proposed. More tolerant species are likely to be damaged at distances up to 25 feet (SERA, 2003-glyphosate). Non-target species are not likely to be affected by runoff based on the NOEC for pre-emergent vegetation. Glyphosate strongly adsorbs to soil, and has a low potential to leaching into groundwater systems (SERA, 2003-glyphosate). Because it adsorbs readily to soils, plant roots do not readily absorb it. Non-target species will not be impacted through their roots.

Some field studies have been conducted using glyphosate. Miller et al. (1999) found no effects to plant diversity in an 11-year study on site preparation using herbicides, though the structural composition and perennial species presence were changed. Such differences in overstory and understory vegetation may have ecological implication. For instance, reductions in several species (Vaccinium and Prunus species) in the understory could affect wildlife species dependent on them for food, and could also affect traditional gathering of these species. As discussed in the effects summary of triclopyr, Newmaster et al. (1999) raised concern that drift from glyphosate as well could affect long term sustainability of populations of lichens and bryophytes.

Acetyl CoA Caroxylase (ACCase) Inhibitors

Sethoxydim inhibits acetyl CoA carboxylase, the enzyme responsible for catalyzing an early step in fatty acid synthesis. Non-susceptible species have a different CoA carboxylase binding site, rendering them immune to the effects.

Sethoxydim

Sethoxydim (used in Poast®) kills post-emergent annual and perennial grasses by preventing the synthesis of lipids. Because sethoxydim is water-soluble and does not bind strongly with soils, it can be highly mobile in the environment. Rapid degradation generally limits extensive movement. In water, sethoxydim can be degraded by sunlight within several hours (Tu et al., 2001). For relatively tolerant species, there is no indication that damage from drift would result at distances more than 25 feet from application sites. For susceptible species, there is a possibility of damage no greater than 50 feet from application sites. Runoff could cause damage to susceptible plants in areas of high rainfall (SERA, 2001-sethoxydim).

Common Control Measures

The Table of Common Control Measures (Table 5) in Chapter 2 of the EIS was derived from the document *Common Control Measures for Invasive Plants of the Pacific Northwest* (Mazzu 2005, botanist for the Region 6 Invasive Plants FEIS Team). This is a working document. It is continually updated as new information is acquired.

This publication is Appendix N of the R6 FEIS, and can be viewed online at the Forest Service Region Six Invasive Plants Website: http://www.fs.fed.us/r6/invasiveplant-eis

Pacific Northwest Region Six White Paper - NEPA for Invasive Plant Biological Controls and Compliance with Standard 14

Desser/Bulkin/Spiegel Update July 26, 2006

Purpose: This white paper provides information regarding the use of classical biological control agents as part of integrated invasive plant (noxious weed) management on National Forests in the Pacific Northwest Region. Biological control agents are used when weed eradication is not possible (R6 2005 FEIS Appendix J-9).

Use of Biological Controls for Invasive Plants in the United States: USDA - APHIS (Agricultural Plant Health Inspection Service) approves each step in the importation and release of biological control agents in the United States. 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. This does not include the release of pathogens for weed control, as they are regulated by EPA as biological pesticides. The International Code of Best Practices for Classical Biological Control of Weeds (Balciunas and Coombs 2004) provides further guidance to reduce the risk that unintentional effects may occur from releases.

APHIS completes NEPA, ESA consultation and other technical analysis assuming that biological controls would be distributed throughout North America, to wherever the target species exists. This satisfies the intent of NEPA for the release and distribution of the agent in the United States (Beard and Carbone 2001).

Use of Biological Controls for Invasive Plants in Region 6, Oregon, Washington, Idaho and California: Each state approves releases of biological control agents for invasive plants. Staff from state Departments of Agriculture provides guidance for appropriate releases in each state. The R6 2005 FEIS, including Appendices H and J, compiled up to date information about biological controls in Oregon, Washington, Idaho and California. The R6 2005 FEIS considered the effectiveness, cost and environmental consequences of using biological controls and resulted in the addition of Invasive Plant Treatment/Restoration Standard 14 to all Forest Plans in the Region:

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

The ROD states that Standard 14 was adopted because:

> *"…it reduces the chances of unintended non-target impacts because of the APHIS testing procedures. It also provides for adaptive management if unexpected non-target impacts are discovered. Adopting this standard will address decision factors 1 and 2 better than No Action (no standard)..."*

To help Forests comply with Standard 14, the Regional Office will annually provide a list of agents that may not be released because they do not meet the standard (2006 list attached) in addition to any new and approved biological control agents for invasive plants. Practitioners are encouraged to coordinate with the state experts regarding the selection of agents.

NEPA Requirements have been satisfied by the APHIS and R6 documents. The effects of redistributing biological control agents for invasive plant management according to Standard 14 have been fully disclosed in APHIS and R6 documents. Release of these agents is not considered a site-specific action because “these agents are expected to occupy invasive plant hosts on National Forests regardless of any action the Forest Service may take (Beard and Carbone 2001).”

Table 1 – Attachment Table from White Paper – Biocontrol agents meeting standard 14 of the R6 2005 Invasive Plant ROD

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Aceria [1]	malherbae	Acarina	Eriophyidae	MITE	Field bindweed (may attack Calystegia spp.)	Spotty, isolated sites, Doing well in Wasco County, recommended E of Cascades; warm sites; Not approved in CA due to presence of closely related natives (may infest Calystegia spp.).	Transfer infested leaves/galls during growing season, early season allows mite populations more time to expand.	Stunts plants, reduces flowering, reduces plant density in Texas and Oregon.
Agapeta	zoegana	Lepidoptera	Cochylidae	INSECT	knapweeds (prefers spotted, also diffuse)	Widespread in OR, possible gaps; prefers large plants, scattered density, cooler knapweed sites	Adults with blacklights, early July-September, short adult lifespan; or dig roots.	Reduces biomass and density.
Agrilus	hyperici	Coleoptera	Buprestidae	INSECT	St. Johnswort	Spotty in E OR & WA, disperses well; would use on west side if could establish, established near Medford, use in SW part of region, prefers warm dry with large stems; prone to fungus on wet sites; may want	Sweep adults, June-July; release 100 on well-established plants.	Most infested plants die; will attack plants in shade undamaged by Chrysolina hyperici.

[1] Not approved in CA

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Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
						to redistribute; found on native H. concinnum in CA; 3e3		
Aphthona	abdominalis	Coleoptera	Chrysomelidae	INSECT	leafy spurge	Failed, never recovered in US	Not needed	
Aphthona	cyparissiae	Coleoptera	Chrysomelidae	INSECT	leafy spurge	Widespread; moist, high humidity and Mediterranean, dry summers with sun, sand, rock; Avoid sites with depressions, N aspects, bare ground; larvae need 4 months cold. Canadian research sug. prefers: flowering plants >51 cm, 50-125 stems/sq m., 40-60% sand.	Sweep adults June-July.	Less effective than A.lacertosa; when Aphthona spp. establish reductions in cover, density, aboveground and root biomass occur in 3-5 yrs.

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Aphthona	czwalinae	Coleoptera	Chrysomelidae	INSECT	leafy spurge	Widespread; moist, high humidity and Mediterranean, dry summers with sun, sand, rock; larvae need 4 month cold <4 C.	Sweep adults June-July.	Less effective than and frequently occurs with A.lacertosa,; when Aphthona spp. establish reductions in cover, density, aboveground and root biomass occur in 3-5 yrs.
Aphthona	flava	Coleoptera	Chrysomelidae	INSECT	leafy spurge	Well distributed, spotty establishment; more mesic than A. cyparissiae or A nigriscutis; larvae need 4 month cold period; sunny locations.	Sweep adults July.	Very effective near Bozeman, little impact in many other sites.

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Aphthona	lacertosa	Coleoptera	Chrysomelidae	INSECT	leafy spurge	Widespread; more mesic than other Aphthona spp.;do not redistribute from area where parasitic protozoan Nosema is present	Sweep adults June-July.	Most effective agent on leafy spurge. When it establishes, reductions in cover, density, aboveground and root biomass in 3-5 years. Expected to do well in northern US but not southern.
Aphthona	nigriscutis	Coleoptera	Chrysomelidae	INSECT	leafy spurge	Widespread, may want to move within few miles; larvae need 4 month cold period; maximum sun exposure, well-drained, smaller and more scattered spurge, Stipa spp. sites.	Sweep adults June-July.	Particularly effective in Canada.
Aplocera	plagiata	Lepidoptera	Geometridae	INSECT	St. Johnswort	Warm and dry with long summers; common in E OR & WA, recovered near Camp Sherman, disperses 50 miles.	Sweep larvae in summer, 500 indiv. adequate for release.	Variable; appears to need warm, dry areas with summer long enough to allow two full

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
								generations. Effective in BC.
Bangasternus	fausti	Coleoptera	Curculionidae	INSECT	knapweeds (Diffuse, spotted, and squarrose)	Widespread, hot & dry, low elev.	Transfer adults in the summer.	Can consume up to 100% of seeds in a flower head; attacks other insects in the flower head.
Bangasternus	orientalis	Coleoptera	Curculionidae	INSECT	yellow starthistle	Widespread; cool climates unfavorable.	Sweep or hand pick in summer.	Single larva destroys 50-60% of seeds in a head, but small % of damage at a site.
Botanophila	seneciella	Diptera	Anthomyiidae	INSECT	tansy ragwort	Prefers meadows and openings	Sweep adults in early summer, release 50. Transplant infested plants.	Widespread, along with T. jacobaeae and L. jacobaeae tansy ragwort control attributed to these three agents.
Brachypterolu s	pulicarius	Coleoptera	Nitidulidae	INSECT	toadflax	Accidental, widespread on yellow	Collect adult with sweep net or aspirator	effective in reducing seed production of

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
								yellow toadflax
Bradyrrhoa	gilveolella	Lepidoptera	Pyralidae	INSECT	Rush skeleton weed	Recent release, not established; permit issued 5/02.	Unknown	Can kill aboveground parts, general effectiveness unknown.
Bruchidius	villosus	Coleoptera	Bruchidae	INSECT	Scotch broom, French, Spanish, and Portugese	recent intro, limited avail in W OR & WA,accid in Carolinas, OR wrote petition & tested in OR & WA	Collect and redistribute adults after mating, heavy duty sweep nets or beating sheets. Collectible in OR in 2003.	Reduces seed production and may reduce spread.
Calophasia	lunula	Lepidoptera	Noctuidae	INSECT	toadflax	Not est at high elevations, poss due to cold; warmer sites poss better; does not do well where ant pops high.	One to three generations/yr; transfer larvae.	Widespread near Spokane, ineffective,recently recovered in OR; strong flier; most common on roadside stands, low density in large stands.

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Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Ceutorhynchus	litura	Coleoptera	Curculionidae	INSECT	Canada thistle	Spotty distribution; in sunny areas with competition and U. cardui reduces density; may be effective at very high densities where thistle populations are stressed.	Collect adults from early spring shoots; release in groups of 30-50.	While it reduces overwintering survival of C. thistle, surviving plants provide source for reinfestation. Needs augmentation with another agent.
Chaetorellia	acrolophi	Diptera	Tephritidae	INSECT	knapweeds (spotted preferred, also diffuse, squarrose, purple starthistle)	Spotty distribution,Lane Co, Hood R.; moist habitats in OR; dry, south-facing slopes, scattered plants in Brit.Col.	Clip larvae-infested seed heads in fall or early spring; best to rear adults and separate from other emerging insects, esp predators.	Establishment in some areas difficult due to competition with seed head weevils and moths.
Chaetorellia	australis	Diptera	Tephritidae	INSECT	yellow starthistle	Widespread,spread 50mi/yr; requires nectar source in same area for first generation that emerges prior to C. solstitialis availability.	Sweep adults or collect infested seed heads in late winter and place in new area in spring.	Larval feeding reduces seed production 80-90%.

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Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Chamaesphecia	crassicornis	Lepidoptera	Sessiidae	INSECT	leafy spurge	5 sp.failed in US, not avail.	Unknown	Unknown.
Chamaesphecia	hungarica	Lepidoptera	Sessiidae	INSECT	leafy spurge	not yet established, possible future introductions.	Unknown	May be effective in moist sites.
Chrysolina	hyperici	Coleoptera	Chrysomelidae	INSECT	St. Johnswort	Widespread in mesic; cool moist summers, cold winter w/o snow; does not do well in shade.	Sweep adults early to mid June, release 250+.	Variable; more effective in CA and w OR than ID and WA.
Chrysolina	quadrigemina	Coleoptera	Chrysomelidae	INSECT	St. Johnswort	Widespread in dry; dry summers, mild, moist winters; best in CA climate.	Sweep adults from early flowers, early to mid June, release 250+. Late summer pops female and will not breed w/o males.	Variable, most effective in CA where it was responsible for the weed's removal from the noxious weed list.
Coleophora	klimeschiella	Lepidoptera	Coleophoridae	INSECT	Russian thistle	Widespread, moves on own	Not needed	High parasitism and predation by natives make this ineffective.

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Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Coleophora	parthenica	Lepidoptera	Coleophoridae	INSECT	Russian thistle	Widespread, moves on own	Not needed	Feeding damage has little effect, also heavily attacked by predators and parasitoids.
Cyphocleonus	achates	Coleoptera	Curculionidae	INSECT	knapweeds (spotted preferred, also diffuse)	Prefers lg stems & monoculture stands, well-drained, low, hot, dry, gravel pits	Collect adults Aug-Sept or rear from roots.	Reduces biomass and density.
Cystiphora	schmidti	Diptera	Cecidomyiidae	INSECT	Rush skeleton weed	Widespread, most attack in open locations, well-drained soil, <16" annual precip, yrly ave temp >63F.	Collect galled stems early July to late September; remove seedheads/flowers, tie stems into teepees, set among uninfested plants.	Native parasitoids greatly diminish effectiveness.
Diorhabda	elongata	Coleoptera	Chrysomelidae	INSECT	tamarix	lots of use in E OR when available: Snake and Owyhee R	All stages, nylon mesh sleeves tied on branches may deter predators and dispersal.	Defoliated plants dieback, severe defoliation for 2 years killed some large

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
								plants.
Eriophyes	chondrillae	Acarina	Eriophyidae	MITE	Rush skeletonweed	Widespread, disperses well, found on isolated plants; undisturbed, well-drained, south- and west-facing slopes.	Transfer galled stems July-mid October, success depends on ambient RH, transfer in evening or damp days.	Most effective agent on this weed so far, impact reduced in CA due to predaceous mites.
Eteobalea	intermediella	Lepidoptera	Cosmopterigidae	INSECT	toadflax	released and recovered in MT, unavail yet for redistribution	Sweep in late summer.	Unknown.
Eteobalea	serratella	Lepidoptera	Cosmopterigidae	INSECT	toadflax, yellow	released and recovered in MT, unavail yet for redistribution	Sweep in late summer.	Unknown.
Eustenopus	villosus	Coleoptera	Curculionidae	INSECT	yellow starthistle	Widespread, spreads well, cool climates unfavorable.	Sweep or hand pick adults in June or July.	Feeding on flower heads and buds can cause 90-100% seed reduction in a head.
Exapion	ulicis	Coleoptera	Apionidae	INSECT	gorse	Widespread W OR & WA, all gorse except where gorse and weevil destroyed by fire.	Not needed	May retard the spread of the plant but does not reduce

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
								established density; 30-95% of seedpods attacked.
Exapion	fuscirostre	Coleoptera	Apionidae	INSECT	Scotch broom	Widespread W OR & WA, mod effect, affect 50% seeds; prefers meadows and hills w/S exposure; damp and cold, N face undesirable.	Adults, April and May; release 100-250 adults.	Reduces seed production up to 60%; stand density reduction is questionable.
Galerucella	calmariensis	Coleoptera	Chrysomelidae	INSECT	purple loosestrife	Apparent synergism between two Galerucella spp.: alone G. pusilla density too low for control, G. calmariensis poss limited by dispersal; G. calmariensis attack transfers nutrients to regrowth, which allows G. pusilla to attain high densities. No direct toxic effect of triclopyr amine.	Small releases tend to remain small, releases of 2000 larvae or adults produce outbreaks. Place larval-infested foliage on plants in the new stand.	Widespread, effective, FS may want; biomass at several sites in Oregon and Washington has been reduced by 90%.

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Galerucella	pusilla	Coleoptera	Chrysomelidae	INSECT	purple loosestrife	As above.	Releases of 2000 produce outbreaks. Place larval-infested foliage on plants in the new stand.	Widespread, effective, FS may want; biomass at several sites in Oregon and Washington has been reduced by 90%.
Gymnetron	antirrhini	Coleoptera	Curculionidae	INSECT	toadflax	Biotype approved intro in WA & MT may want to spread but generally common; does not withstand extreme winter cold; avoid releasing where flower feeding beetle (B. pulicarius) is abundant.	Sweep adults in July and August.	40-60% infested seed heads, limited effect on stand density
Gymnetron	linariae	Coleoptera	Curculionidae	INSECT	toadflax, Dalmatian	Recent release, established in WY in rocky sites	Sweep or hand pick in summer.	Unknown.
Hyles	euphorbiae	Lepidoptera	Sphingidae	INSECT	leafy spurge	Numerous intros, failed in OR, occurs in MT, unlikely to be introduced; warm summers,	Hand pick larvae summer to fall, release 500+ on warm, rocky, sandy sites.	Defoliates in midsummer and spurge later refoliates; not

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
						mild winters.		effective, limited by virus in U.S.
Hylobius	transversovittat us	Coleoptera	Curculionidae	INSECT	purple loosestrife, L. alatum also used during testing but use in field unknown.	Spotty, expensive to rear and collect; stands; may dampen rebound after defoliation by Galerucella, helps reduce root reserves of large plants, appears to shift population to younger cohort.	Cut path through infested stand, collect adults with flashlight for 2 hours after sunset along path. Weevils drop when disturbed. Release 25-100 at sites with large plants.	Feeds on root storage reserves, believed to complement leaf beetle damage.
Larinus	minutus	Coleoptera	Curculionidae	INSECT	knapweeds (diffuse, meadow, spotted, squarrose, C. arenaria, and Calcitrapa spp.)	Widespread, may want to move within few miles; hot, dry areas.	Adult sweep net, hand pick, aspirate in early summer	Heavy defoliation can result in stunting and death; larvae consume entire flower head contents. Dramatic reductions in MT,OR & WA.

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Larinus	obtusus	Coleoptera	Curculionidae	INSECT	knapweeds (spotted and meadow, occ diffuse)	Limited distribution, priority on meadow in E OR; prefers spotted knap.; prefers slightly moist sites.	Sweep at 10% bloom, do not move larvae and pupae in seed heads as this moves different species and biotypes.	Defoliation and seed feeding; populations increase slowly.
Larinus	curtus	Coleoptera	Curculionidae	INSECT	yellow starthistle	Widespread in E OR & WA, does poorly on westside, may need redistribution in spots in E; cool climates unfavorable.	Sweep or hand pick adults at 10% bloom, late June to early August.	Larval feeding can reduce seed production by 100%.
Leucoptera	spartifoliella	Lepidoptera	Lyonetiidae	INSECT	Scotch broom	Widespread	Not recommended	Host density changes not documented; heavily parasitized in OR & WA, may increase susceptibility to pathogens.
Longitarsus	jacobaeae	Coleoptera	Chrysomelidae	INSECT	tansy ragwort	Sunny pastures below 800 meters, survives cold where snow keeps ground from freezing deeply.	Collect adults with vacuum from infested rosettes after first fall rains; sweep net bolted plants; transfer 100-500.	Widespread; one of three agents attributed with ragwort control in OR.

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Mecinus	janthinus	Coleoptera	Curculionidae	INSECT	toadflax	Limited distribution, priority E OR; hot, dry forest and grassland, large stemmed plants; overwinter survival best in s BC or snow-cover.	Light sweep net in May to July, earlier better; release 200.	Sig plant density reduction in BC, OR and WA.
Metzneria	paucipunctella	Lepidoptera	Gelichiidae	INSECT	knapweeds (spotted preferred, also diffuse and meadow)	Widespread; does not tolerate severe winters; bulk storage attracts predatory mites.	Clip larvae-infested seed heads late summer, early fall, early spring. Seed heads often infested with straw itch mites which attack biocontrols and cause severe human itching.	Although larvae destroy other agents in seed heads, greatest reduction in seed production occurs when moth and gall flies are all present. Deer mice cause heavy overwinter mortality.
Microlarinus	lareynii	Coleoptera	Curculionidae	INSECT	Puncturevine, also attacks Tribulus cistoides and some Kallstroemia spp.	Isolated sites, limited by cold winter temps., can use inundative in other areas.	Collect adults from soil litter with vacuum or aspirator or put plants and litter in bag in sun and collect crawling adults.	Very effective in warm climates.

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Microlarinus	lypriformis	Coleoptera	Curculionidae	INSECT	Puncturevine, also T. cistoides and some Kallstroemia spp.	Same as above.	Collect adults from soil litter, same as above.	Very effective in warm climates.
Nanophyes	marmoratus	Coleoptera	Curculionidae	INSECT	purple loosestrife	Sites without prolonged flooding; tolerates wide range of conditions incl. high tidal exchange, low host density; excellent host-finding ability.	Adults with beating tray and beat stick; release 100-200 adults per site.	Widespread, effective, 1000's per plant;
Oberea	erythrocephala	Coleoptera	Cerambycidae	INSECT	leafy spurge	Limited distribution; larvae bore down stem with large pith >3mm; warm, well-drained sites.	Sweep and hand pick adults at peak flowering, release 100+, may need to cage to establish.	Ineffective in western Canada prob due to small pith; In OR it changed the population from old, large roots to smaller, thinner, less competitive plants; attacks only specific biotypes of spurge.

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Pelochrista	medullana	Lepidoptera	Tortricidae	INSECT	knapweeds (spotted and diffuse)	Just released, difficult to establish, not yet available; prefers dry; damage identical to Agapeta.	Collect infested roots in fall, winter or early spring.	Reduces plant biomass.
Phrydiuchus	tau	Coleoptera	Curculionidae	INSECT	Mediterranean sage, also clary	Widespread, may want to move within few miles if Med sage becomes est around John Day; best on warm, dry sites. Attacks clary sage as well but prefers Med sage.	Sweep adults in late spring and early summer when flowers in 25% bloom; aspirate adults in Oct-Nov when mating and ovipositing.	Effective on sites with strong perennial component and little grazing, little effect on salt-desert scrub or annual dominated.
Prokelisia	marginata	Homoptera	Delphacidae	INSECT	Spartina anglica, S. alterniflora, S. foliosa	approved, not nec on FS lands yet; intertidal areas	Vacuum or sweep adults and nymphs June-Oct	early results promising for S. alterniflora in Willapa Bay
Psylliodes	chalcomera	Coleoptera	Chrysomelidae	INSECT	Musk thistle, also Italian, plumeless, and Illyrian.	Approved, but still unavailable, establishment unknown; found in cold and hot areas of Italy.	Sweep adults.	Unknown.

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Pterolonche	inspersa	Lepidoptera	Pterolonchidae	INSECT	knapweeds (Diffuse, spotted, and squarrose)	Recovered in Mosier, OR in 2005, rare and hard to work with; Mediterranean climate best.	Transfer adults, eggs, larvae, or pupae.	Once infested 20% of plants but now infrequent due to knapweed reduction from seed head weevils (Larinus spp.).
Puccinia	chondrillina	Uredinales	Pucciniaceae	FUNGUS	Rush skeletonweed	Widespread; most effective in mesic sites, less damaging in hot and dry sites.	During summer move infected stems and place in cool evening and when dew period anticipated; misting uninfected plants aids infection rate.	Pathotype available has little effect on SW OR late-flwr or NE WA, N ID early-flwr biotypes. In some CA areas considered more effective than mite or midge.
Sphenoptera	jugoslavica	Coleoptera	Buprestidae	INSECT	knapweeds (diffuse preferred, also spotted and squarrose)	Very widespread; warm, dry areas; females need 5 days > 86F to lay eggs.	Collect adults with sweep net in mid-July early evening.	Reduces biomass, seed production, and density.

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Spurgia	esula	Diptera	Cecidomyiidae	INSECT	leafy spurge	Dense spurge, south-facing slopes in cool climates, some shade okay.	Clip galls late May to October, release 100+ in dense, well-watered, sheltered spurge sites.	Ineffective, attacked by native species, not likely for USFS; galls on leafy spurge too sparse for much impact.
Subanguina	picridis	Nematoda	Tylenchidae	NEMAT ODE	Russian knapweed, diffuse knapweed	nematode, Isolated sites, need better dissemination; difficult to establish; does not do well in dry areas, best in moist areas.	Collect galls in fall and place on soil. Nematodes will emerge from disintegrating galls and move to shoots in wet spring.	Disperses very slowly; some sites now have native grasses but if area too small, weed will reinvade from edges.
Terellia	virens	Diptera	Tephritidae	INSECT	knapweeds (spotted preferred, also diffuse)	Prefers spotted knap.; isolated sites, igher elev. than weevils; does not survive well in seedheads with L. minutus, prefers cooler and wetter than weevils.	Collect infested seedheads in fall or early spring; must be kept moist; best to separate out parasitoids.	Reduces seed production; limited availability so effect still not determined.

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Tetranychus	lintearius	Acarina	Tetranychidae	MITE	gorse	Widespread W OR & WA, favors unshaded gorse patches away from the ocean.	Not needed	Now attacked near Bandon, OR by accid pred mite from greenhouse industry; at many other sites attacked by ladybird beetle and rendered ineffective.
Trichosirocalus[2]	horridus	Coleoptera	Curculionidae	INSECT	Subtribe Carduinae: musk, plumeless, Italian thistles accepted in US; in other areas Canada, and bull thistles are accepted.	Intro everywhere, recovered Klamath R only, not likely for USFS, poss on natives; surveys in Klamath Co have shown no nontarget impacts.	Sweep in July or pick in spring prior to bolt.	Seldom effective by itself. Prohib in CA due to concern for artichokes. Requires 3-5 years to build population. Disperses quite well.

[2]Not approved in CA

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Tyta [3]	luctuosa	Lepidoptera	Noctuidae	INSECT	Field bindweed (also may attack Calystegia spp.)	Recent releases, not established, although moths recovered; unlikely on FS; difficult to establish; recorded to feed on native Calystegia spp.	Transfer larvae and adults, can black light; not approved in CA	Does not significantly damage hedge bindweed (Calystegia sepium), effect on field bindweed unk.
Urophora	stylata	Diptera	Tephritidae	INSECT	bull thistle	Widespread in W OR with gaps, cold-adapted population now est on Umatilla Wildlife Refuge; while most seeds in an area can be killed, not effective due to recolonization by far-flying seeds; similar initial seed reduction as mowing but mowing allows later flowering when flies not available for seed predation.	Collect 20-50 galled seed heads in late fall, keep cool and dry through winter and release newly emerged adults in spring to avoid transferring associated parasites; sweep adults between May and July, transfer 130+ (half female) per release.	Because Bull thistle is transient, it is difficult to maintain fly populations for more than a few years in any location. Flies disperse rapidly.

[3] Not approved in CA

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Urophora	cardui	Diptera	Tephritidae	INSECT	Canada thistle	Widespread, may want to move within few miles; does best in scattered, semi-shaded, moist C. thistle stands.	Locally may transfer 50-100 galls in spring; otherwise collect galls in fall, winter, early spring, rear adults, separate other insects and release onto misted plants. Collect galls from similar habitats as cold-adapted strains have been developed.	Limited effectiveness; provides metabolic sink that reduces vigor.
Urophora	quadrifasciata	Diptera	Tephritidae	INSECT	knapweeds (black, brown, diffuse, meadow, short-fringed, spotted, squarrose, and cornflower)	Widespread; Larvae do not tolerate severe winters	Clip larvae-infested seed heads early spring and fall, sweep adults June to July.	Where both Urophora species are present, seed production is reduced at least 50%. Urophora species freq destroyed by seed head moth and weevils.

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
Urophora	affinis	Diptera	Tephritidae	INSECT	knapweeds (spotted, diffuse, squarrose)	Widespread; Does best in mesic or wetter years; check for presence prior to redistribution.	Clip larvae-infested seed heads early spring and fall, sweep adults in June.	Where both Urophora species are present, seed production is reduced at least 50%. Urophora species freq destroyed by seed head moth and weevils.
Urophora	solstitialis	Diptera	Tephritidae	INSECT	Musk thistle and plumeless thistle; In Europe assoc with Carduus spp.	Recent release in MD,MT, and OR, not established yet in US, difficult to establish.	Collect thistle heads after galls harden in August-September.	Unknown.
Urophora	sirunaseva	Diptera	Tephritidae	INSECT	yellow starthistle	Widespread in western US, SW OR; does not do well in windy areas, not in NE OR; excellent disperser.	Sweep adults late May and July.	Rarely exceeds 25% attack rate, effectiveness limited.
Zeuxidiplosis	giardi	Diptera	Cecidomyiidae	INSECT	St. Johnswort	Damp, mod to high humidity, high elevations; not suitable for dry summers or continuous wind.	Best to establish plants from new population in pots, infest with midges, and then transplant.	many intro in OR failed, est in So CA but para; high RH, does poorly in dry, windy; best in

Biocontrol Agents Meeting Standard 14 of the R6 2005 Invasive Plant ROD								
Agent Genus	**Agent Species**	**Order**	**Family**	**Type**	**Weed Targeted**	**Sites/ Recommended**	**Collection Notes**	**Effective**
								HI.

Table 2 - Attachment Table from White Paper - Biocontrol Agents Not Meeting Standard 14 of the R6 2005 Invasive Plant ROD

Agent Genus	Agent Species	Weed targeted	Aphis Status	Reason Not to Use	Effectiveness
Aceria	*centaureae*	Diffuse knapweed	Not approved	Not approved	
Aceria	*malherbae*	Field bindweed (may attack Calystegia spp.)	approved, not approved in CA	Spotty,isolated sites, Unlikely on USFS,doesn't do well in R6 climate,poss on Admin or Grasslands; warm sites;Not approved in CA due to presence of closely related natives (may infest *Calystegia* spp.).	Stunts plants, reduces flowering, reduces plant density in Texas.
Agonopterix	*nervosa*	gorse	Not approved	Not approved, Accidental Release	
Agonopterix	*alstroemeriana*	poison hemlock	Not approved	Not approved, Accidental Release	
Altica	*carduorum*	Canada thistle	Not approved	Not approved, may attack natives	
Cassida	*rubiginosa*	Canada thistle	Not approved	Not approved, Accidental Release	
Chaetorellia	*succinia*	yellow starthistle	Not approved	Not approved, Accidental, spreads well on own.	Appears more effective than C. australis. Will feed on Centaurea americana, a native.
Chrysolina	*variens*	St. Johnswort	Not approved	failed 50 yrs ago, will not be rereleased	unknown.
Gymnetron	*tetrum*	common mullein	Not approved	Not approved, Accidental	
Larinus	*planus*	Canada thistle	Not approved	Not approved, Accidental, known on Cirsium calolepsis on Wside	
Nanophyes	*brevis*	purple loosestrife	?	Not introduced in US, all females contaminated with parasitic nematode, no current plans for introduction in US	
Phrydiuchis	*spilmani*	Mediterranean sage	Requires reapproval	Introduction into U.S. failed, unlikely to be reintroduced.	

Agent Genus	Agent Species	Weed targeted	Aphis Status	Reason Not to Use	Effectiveness
Puccinia	*canaliculata*	yellow nutsedge	Not approved	not released in US, considered for bioherbicide use	Unknown.
Pythium	*rostratum*	knapweed	Not approved	Not approved	
Rhinocyllus	*conicus*	Canada thistle, Italian thistle	approved	No longer approved, widespread, no longer used, attacks natives	
Selenophoma	*juncea*	Scotch broom	Not approved	Not approved, widespread, no longer used, non-target effects	Suspected of killing plants in late spring.
Trichosirocalus	*horridus*	Subtribe Carduinae: musk, plumeless, Italian, Canada, and bull thistles are accepted.	approved, not approved in CA	Introduced everywhere, recovered Klamath R only, not likely for USFS.	Seldom effective by itself. Prohib in CA due to concern for artichokes. Requires 3-5 years to build population. Disperses well.
Tyria	*jacobaeae*	tansy ragwort	approved	Widespread, attacks natives (Packara sedaris,S. triangularis) but no population effect known, do not use east of Cascades	Works best in conjunction with L. jacobaeae.
Tyta	*luctuosa*	Field bindweed (also may attack Calystegia spp.)	approved, not approved in CA	Recent releases, not established, although moths recovered; unlikely on FS; difficult to establish; recorded to feed on native *Calystegia* spp.	Does not significantly damage hedge bindweed (*Calystegia sepium*), effect on field bindweed unk.

Source: Lia Spiegel, Entomologist
Blue Mountains Pest Management Service Center
401 Gekeler Lane
La Grande, Oregon 97850 - ph. 541.962.6574 FAX 541.962.6504

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Implementation Planning

This section outlines the process that would be used to ensure the selected alternative is properly implemented. The method follows Integrated Weed Management principles (R6 2005 FEIS, 3-3) and satisfies pesticide planning requirements at FSH 2109.14. It applies to currently known and new sites found during ongoing inventory.

1. Characterize the invasive plant infestation to be treated. This includes:

- Map and describe the target species, density, extent, treatment strategy, and site type.
- List any resource of concerns and determine if additional surveys are needed. Coordinate with resource specialists to get additional information or new information about specific locations. Identify and perform pre-treatment surveys for species of local interest and/or their habitats.

2. Develop site prescriptions

- Use Integrated Weed Management principles to identify possible effective methods of treatment using the Treatment Decision Tree described in section 2.2.6 above. Non-herbicide treatments should be considered when sites are small or target plant densities are low, particularly after several years of herbicide treatments. Prescribe herbicides as needed based on the biology of the target species and size of the infestation (for instance, manual treatment alone cannot effectively eradicate rhizomatous species). Determine that the prescribed treatment is within the scope of those analyzed in the EIS. If treatments would not be effective once Project Design Features are applied, further NEPA would also be required to authorize the effective treatment.
- Apply appropriate Project Design Features from Table 7 of the EIS.
- Determine that the prescribed treatment is consistent with the ESA consultation.
- Review compliance criteria for the Forest Plan and any other environmental standards indicated by the label or state regulations. Develop an Invasive Plant Prevention Plan, a public notification plan, and coordinate with local Tribes.
- Complete Form FS-2100-2, Pesticide Use Proposal. This form lists treatment objectives, specific herbicide(s) that would be used, the rate and method of application, and Project Design Features that apply. Apply for any herbicide application permits when needed for treatments in Riparian Areas.
- Confirm that acceptable plant or mulch materials are available for passive restoration. If the prescription includes extensive site preparation, additional NEPA is required.
- Coordinate with adjacent landowners, water users, agencies, and partners.

3. Accomplishment and Compliance Monitoring

- Develop a project work plan for herbicide use as described in FSH 2109.14.3. This plan presents organizational and operational details including treatment objectives, the equipment, materials, and supplies needed; the herbicide application method and rate; field crew organization and lines of responsibility, and a description of interagency coordination. The plan will also include a job hazard analysis to assure applicator safety.
- Ensure contracts and agreements include appropriate prescriptions and that herbicide ingredients and application rates meet label requirements, Standards 16 and 18, and site specific Project Design Features.
- Document and report herbicide use and certify applicator information in the National Pesticide Use Database, via the Forest Service Activity Tracking System (FACTS).
- Document the implementation of the public notification plan.

4. Post Treatment Monitoring

- Post-treatment reviews would occur on a sample basis or when required by a Project Design Feature to determine whether treatments were effective, if damage to non-target species occurred, or whether or not passive restoration occurred as expected.

Post-treatment monitoring would also be used to detect whether Project Design Features were appropriately applied and effective. Contract administration and other existing mechanisms would be used to correct deficiencies.

Revegetation Guidelines Document

United States
Department
Agriculture

Forest Service

**Pacific
Northwest
Region**

2003

Guidelines for Revegetation of Invasive Weed Sites and Other Disturbed Areas on National Forests and Grasslands in the Pacific Northwest

Vicky J. Erickson
Jean Wood
Scott A. Riley

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)

<u>The current extent and patterns of spread of invasive species</u>: 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.

<u>Grazing and hydrologic issues in riparian systems</u>: 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.

<u>Historical range of variability (HRV) and degree of departure:</u> 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 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:

[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.

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).

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.

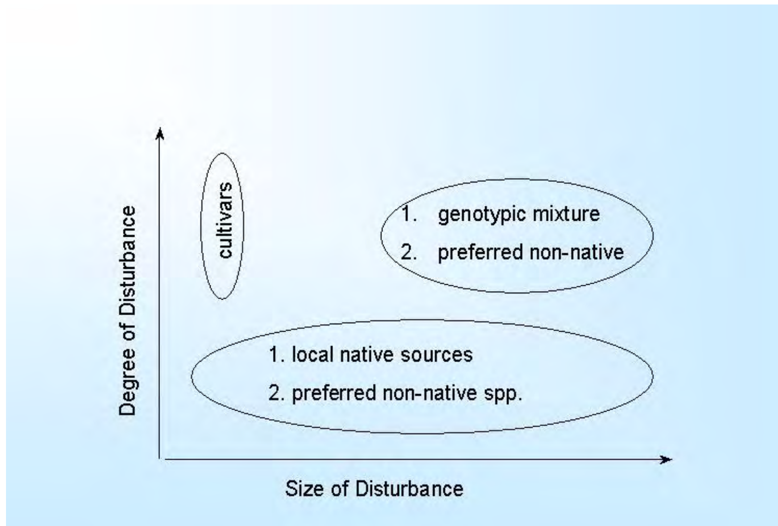

Fig. 1. Relationship between size and degree of disturbance and primary and secondary preferences for plant material for revegetation on National Forests and Grasslands in Region 6. (Adapted from Lesica and Allendorf 1999).

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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:

total number of seeds per pound

percentage of each pound that is pure, live seed (PLS)

number of acres to be treated

target PLS /ft^2 after considering site conditions and seeding method

Example calculations for a single species seed mix: 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.

Example calculations for a multi-species seed mixture: 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.

Plant Material Establishment

Site Preparation: to be written

SAVE TOPSOIL (if weed-free) by stockpiling for later use (see Appendix _, for topsoil guidelines).

Prepare seed bed by "roughing up" or terracing exposed soil surfaces so that broadcasted seed is caught and held on the slope.

Where transplanting is a viable option, prepare a capillary bed for storage of transplants. Capillary beds are used to maintain the moisture of the salvaged plants for extended periods of time, minimizing labor and water usage. (See Appendix _, for more information of construction and use).

Seed Treatments : to be written
e.g,. seed priming; germinator enhancers (GERMINATE)

Seeding Techniques: to be written

Bareroot and Containerized Planting Stock: to be written

Planting Techniques: to be written

Mulching [1]

A mulch is a non-living material placed on the soil surface primarily to protect the soil from wind and water erosion, facilitate infiltration, reduce evaporation and moderate soil temperatures. Mulching generally can improve overall germination and seedling establishment and protect the soil resource. Specific site conditions need to be examined to determine the potential effectiveness of a mulch. On shallow sites where soils are not highly erodible, soil moisture and organic matter are present, high winds are not a problem and no soil crusting is expected to occur, then mulching may not be necessary. Mulch, especially if applied at too high a rate, may inhibit germination and establishment of at least some native species by reducing temperature and light at the soil surface.

Straw mulches consisting of wheat, barley and/or oats are the most common mulches. Application rates can vary, but average 2 tons per acre. Care must be taken to use certified (if available) weed free straw to prevent the introduction of noxious weeds onto the site. Stems need to be as long as possible to increase its life expectancy as a mulch. Straw can be placed on the site by hand or with a blower for large areas. Straw mulch often needs to be anchored to prevent being blown away or washed away by overland water flow. The use of tackifiers, plastic, or biodegradable netting is an effective way to retain the straw on the site. Mechanical crimpers have also been used to push the straw into the soil surface on sites where the use of heavy equipment is feasible.

Native hay mulches have also been used but often contain high levels of noxious weed seed or other non-desirable plant species. Great care must be exercised when using native hay; if the introduced species are desirable, then native hay can result in increased diversity of the resulting plant community.

[1] Taken in part from National Park Service, USDI, Revegetation and reclamation training workshop, April 1993, and from the R1 and R4 Native Plant Handbooks.

Hydromulching with wood fiber or paper in a water slurry is another form of mulching. This requires the use of a machine called a hydromulcher or hydroseeder, and equipment access to the site. Wood fiber mulches are usually more effective than paper mulches because the longer wood fibers adhere to the soil and are more resistant to wind and water erosion. Hydromulch is often applied at average rates of 1500 lbs to the acre and a tackifier can be used to help it stay on the slope. Incorporation of seed and fertilizer in the mix is not a good idea because much of the seed will not be in contact with the soil and can be lost to desiccation. Fertilizer in the slurry can create a high salt concentration that can reduce water adsorption and kill the seed.

Woodchips, sawdust and bark can also be used as a mulch. These can be quite inexpensive if local sources are present. Wood residues are very long lasting compared to other mulches. However nutrients like nitrogen can get tied up and immobilized in the wood during the decay process. The addition of fertilizer can help offset nitrogen deficiencies during decomposition.

The use of pre-made erosion control mats are also effective for revegetation and rehabilitation projects. These mats come in a variety of types, sizes, strengths and can be expensive. Mats made from straw and/or coconut fiber with biodegradable netting are rolled onto the site and secured with metal staples. Stronger mats, either pure coconut fiber or synthetic fibers, need to be used on sites with high erosion hazards, high velocity overland flow rates, or steep slopes.

Mulching after seeding can improve the success of the revegetation by keeping the seed in contact with soil, moderating temperatures, and reducing water loss necessary for the seed to germinate. Mulching around planted seedlings can also improve water availability and provide protection from the environment.

Fertilizing: to be written

Fertilizer should be used only in exceptional circumstances. Generally, exotic species respond more vigorously to added nutrients. Where fertilizer is used, its composition may favor particular groups of species (Panetta and Groves 1990).

Fertilizer application is not recommended when:

Soil does not show evidence of nutrient deficiency

Seed or seedlings of locally native species, especially nitrogen-fixers (e.g. legumes), are introduced onto the site

Seeding with sterile hybrids such as REGREEN

Site is adjacent to a non-native or noxious weed seed source

Site is adjacent to a waterway (e.g. culvert removal projects)

Fertilizer application may be appropriate on sites in which biological indicators (e.g. chlorotic plants) and soil tests show a nutrient deficiency. Fertilizer has been found to increase growth of weedy annuals, which in turn inhibits the growth of slower growing perennial species (McLendon and Redente 1991, 1992, 1994; Redente *et al.* 1992)

Monitoring and Evaluation

This section is not complete

Monitoring is necessary to assess if proposed treatments were properly implemented, if actual treatments were effective and if additional treatments or maintenance are needed to make the revegetation project successful in the long-term.

The following information should be recorded as part of revegetation monitoring and evaluation:

Species seeded, planted, or transplanted onto the project site; source and cost of species used (if applicable).

Seed application rates; method of application (e.g. hydroseeding).

Type of mulch and/or erosion control blanket used (if any), mulch application rate (percent cover).

Fertilizer application rate (if applicable).

Other site treatments used, including terracing and irrigation.

Environmental conditions at the time of implementation.

Results - what worked and what did not work.

A Basic Monitoring Form has been included in Appendix _ as a starting point for recording and sharing information about the success (or failure) of treatments.

Decision Matrix

The Decision Matrix and associated Revegetation Prescriptions are being revamped

The following decision matrix recommends revegetation options based on site characteristics, erosion potential, and presence/absence of noxious weeds.

Site Characteristics

Riparian Group I

Upland

Erosion potential high (see guidelines, item 2A) Group II

Erosion potential low (see guidelines, item 2A) Group III

Wilderness, RNA or Botanical Special Interest Area Group IV

Group I: Riparian

Erosion potential high

Surface area of disturbance >0.25 acre; site forested (relatively cool and moist; receives some shading from adjacent stands) and has seed source of locally native woody species (e.g. red alder) available, or **non-forested** (open and relatively dry due to lack of shading; includes large forest openings, road projects (e.g. culvert removal), areas adjacent to clear-cuts, wet and dry meadows, and wetlands). **Noxious weeds present or absent**. Prescription A, pg. __

Surface area of disturbance (project area) <0.25 acre; site forested or non-forested

Noxious weeds present Prescription A, pg. __

Noxious weeds absent Prescription B, pg. __

Erosion Potential low

Noxious weeds present; site forested or non-forested; surface area of disturbance (project area) variable
Prescription C, pg. __

Noxious weeds absent; site forested or non-forested; surface area of disturbance (project area) variable
Prescription D, pg. __

Group II: Upland, high erosion potential

Noxious weeds present; site forested or non-forested; surface area of disturbance (project area) variable
Prescription A, pg. __

Noxious weeds absent; site forested or non-forested; surface area of disturbance (project area) variable
Prescription B, pg. __

Group III: Upland, low erosion potential

Noxious weeds present; site forested or non-forested; surface area of disturbance (project area) variable
Prescription C, pg. __

Noxious weeds absent

Surface area of disturbance (project area) >0.25 acre; site forested or non-forested
Prescription D, pg. __

Surface area of disturbance (project area) <0.25 acre

Site non-forested Prescription D, pg. __

Site forested Prescription E, pg. __

Group IV: Wilderness, RNAs and Special Interest Areas

All types of sites, from forested to non-forested, low to high elevation, noxious weeds may be present, good native seed source in the area. Prescription F, pg __

Revegetation Prescriptions

Prescription A

Conditions: Forested and non-forested riparian and upland sites with steep slopes and high erosion potential. Noxious weeds present or absent. Surface area of disturbance variable.

Objectives: Minimize surface erosion; stabilize slopes; minimize invasion by noxious weeds; maintain integrity of native plant communities.

Prescription:

Consult with Forest/District Soil Scientist on soil erosiveness and erosion control.

Seed with local native grasses if available or nonpersistent annual grass or sterile wheat.

Apply erosion control materials (see Appendix _). In very critical areas, consider salvaging and replanting displaced woody species onto project site. Consult with Forest Ecologist, Botanist, or Range Conservationist.

Do not fertilize.

Plan for future planting of native species on the site; i.e., for each project area, outline (a) acreage and approximate dimensions requiring further revegetation with native stock, (b) dominant native species present, and (c) provide a map of project locations. Submit native revegetation needs to Forest Ecologist, Botanist, or Range Conservationist.

Alternatives:

Prescription B (erosion control materials only)

Erosion control materials and transplants

Woody Species:

Forested Sites. On forested sites where seed source of locally native woody species is abundant, site should fill in naturally with trees and shrubs. Given that establishment of woody species may be delayed on these sites, especially if the project area is large, seedlings of woody species occurring within the vicinity of the project area may be collected and transplanted.

Non-forested Sites. On non-forested sites where seed source of locally native woody species may be lacking, seedlings of woody species occurring within the vicinity of the project area may be collected and transplanted. Seed of locally native grasses and herbs may be collected and sent to a nursery to be increased for use on the site in the following years.

Rationale:

Seeding with non-persistent annuals or sterile wheat. Seeding of project area with a nonpersistent annual or sterile wheat is recommended to (a) provide short-term erosion control, and (b) discourage invasion by noxious weeds and other aggressive non-native species until native species can become reestablished.

Seeding/transplanting native species: Seeding and transplanting of locally native herbaceous and woody species is recommended as needed in the future in order to provide native cover as quickly as possible, to discourage invasion by exotic species, and to maintain the integrity of native plant communities, structural and biological diversity, and wildlife values.

Fertilizer is not recommended because application may facilitate invasion by noxious weeds and/and undesirable, persistent non-natives. Additionally, fertilizer can change the soil (microbiotic) ecosystem

Advantages/Disadvantages:

Advantages. Erosion control blankets are shown to be highly effective; seeding with non-persistent, non-native grass (Regreen) provides quick vegetative cover & soil binding mechanism; Prescription A offers the greatest degree of erosion control.

Disadvantages. High cost of erosion control blanket; possible inhibition of natural colonization created by presence of annuals or hybrids.

Prescription B

Conditions: Forested riparian and upland sites with steep slopes and high erosion potential. Sites are small (disturbed area <0.25 acre), relatively moist, and have a good locally native, woody species seed source nearby. Noxious weeds are absent.

Objectives: Minimize surface erosion; stabilize slopes; maintain integrity of native plant communities.

Prescription:

- Consult Forest/District Soil Scientist for soil erodibility/hazard analysis
- Determine seeding needs
- Do not fertilize.
- Plan for future revegetation needs; see Prescription A.

Alternatives:

Prescription A: (erosion control materials & seed).

Bioengineered erosion control structures (e.g. using hardwood cuttings).

Erosion control materials plus transplants.

Woody Species:

Forested sites- on forested sites where seed source of locally native woody species is available, site should fill in naturally with trees and shrubs. Given that establishment of woody species may be delayed on these sites, especially if the project area is large, seedlings of woody species occurring within the vicinity of the project area may be collected and transplanted as funding becomes available.

Rationale:

Erosion control blanket: Erosion control materials alone should suffice in small, forested areas where a native seed source is readily available. Site may be sown with a nonpersistent annual or hybrid grass (see Appendix C) in critical areas.

Fertilizer is not recommended because application may facilitate invasion by noxious weeds and/and undesirable, persistent non-natives. Additionally, fertilizer can change the soil (microbiotic) ecosystem

Advantages/Disadvantages:

Advantages- Less expensive than Prescription A due to elimination of seeding; absence of non-persistent annual grass or REGREEN on site may facilitate colonization by native species.

Disadvantages- Less effective erosion control than Prescription A, lower aesthetic value for 1-3 years (depending on moisture), especially in visible areas (e.g. roadcuts), than Prescription A.

Prescription C

Conditions: Forested and non-forested riparian and upland sites with low erosion potential. Size of disturbed area variable. Noxious weeds present.

Objectives: Minimize surface erosion; minimize invasion by noxious weeds; maintain integrity of native plant communities

Prescription:

- Seed with nonpersistent annual or sterile wheatgrass (see Appendix A) as soon as possible after ground disturbance.
- Do not fertilize.
- Mulch with clean, weed-free wheat, oat, or barley straw/**local native hay**; crimp in mulch, if desired.
- Consult with Forest Noxious Weed Coordinator regarding site-specific control of noxious weeds.
- Plan for future revegetation needs; see Prescription A.

Alternatives: n/a

Woody Species:

Forested sites. On forested sites, seeding and outplanting of locally native herbaceous and woody species should be accomplished as soon as possible to discourage invasion by noxious weed species..

Non-forested sites. On non-forested sites, seed of locally native grasses and forbs may be sown as early as possible, contingent on seed availability. Seedlings of locally native woody species adapted to drier sites should be collected and outplanted as soon as bare rootstock becomes available (see Prescription A).

NOTE: Sites with low erosion potential should be given lower priority in revegetation projects than sites with high erosion potential; seedlings should not be allocated for low priority project sites until all high priority sites have been planted. Consult with Forest Noxious Weed Coordinator, Oregon or Washington State Weed Programs, or Forest Weed Strategy for site-specific control of noxious weeds.

Rationale:

Seeding with annual or REGREEN: Seeding of project area with a nonpersistent, annual or wheatgrass hybrid grass is recommended to (a) provide immediate erosion control in the short-term, and (b) discourage invasion by noxious weeds and other aggressive non-aggressive species until native species can become reestablished.

Seeding/outplanting native species: Seeding and outplanting of locally native herbaceous and woody species is recommended as needed in order to provide native cover as quickly as possible, to discourage invasion by exotic species, and to maintain the integrity of native plant communities.

Weed-free wheat, oat, or barley straw or weed-free local native hay: Any of these should effectively control surface erosion on relatively flat surfaces, and will be significantly less expensive than erosion control blanket/matting.

Fertilizer is not recommended because application may facilitate invasion by noxious weeds and/or undesirable non-natives.

Advantages/Disadvantages:

Advantages. Non-native, non-persistent annuals or sterile wheat grass (see Appendix C,) provide quick, effective erosion control, less expensive than erosion control blanket.

Disadvantages. Weed-free wheat, oat, or barley straw or weed-free local native hay plus non-persistent annuals or sterile wheat grass (see Appendix C) may inhibit colonization of site by native species; straw/hay and/or annuals and REGREEN may have mild allelopathic properties.

Prescription D

Conditions: Forested and non-forested upland, and riparian sites with low erosion potential. Size of disturbed area variable. Noxious weeds absent.

Objectives: Minimize surface erosion; maintain integrity of native plant communities

Prescription:

- If site <0.25 acres, **rake in or collect plant materials from edges** or mulch with weed-free wheat, oat, or barley straw or local native hay. Crimp in mulch, if desired. Let site revegetate on its own. Early seral plant species will recolonize these sites.
- Do not seed with introduced species.
- Plan for future revegetation needs; see Prescription A.

Alternatives:

Prescription C

Prescription E

Wheat, barley, or oat straw plus transplants

Woody Species:

Forested sites. On forested sites where seed source of locally native woody species is available, site should fill in naturally with trees and shrubs. Given that establishment of woody species may be delayed on these sites, especially if the project area is large, seedlings of woody species occurring within the vicinity of the project area may be collected and transplanted if possible.

Non-forested sites. On non-forested sites where seed source of locally native woody species may be lacking, seedlings of woody species occurring within the vicinity of the project area may be transplanted as soon as bare rootstock and/or plugs are available. Seed of locally native grasses and herbs may be sown, contingent on seed availability.

NOTE: Sites with low erosion potential should be given lower priority in revegetation projects than sites with high erosion potential; seedlings should not be allocated for these low priority sites until all high priority sites have been planted.

Rationale:

Wheat or oat straw mulch: Wheat or oat straw mulch should effectively control surface erosion on relatively flat surfaces, and will be significantly less expensive than erosion control blanket or matting.

Fertilizer: Fertilizer application is not recommended.

Advantages/Disadvantages:

Advantages. Least expensive erosion control treatment; facilitates colonization of site by native species to a greater extent than does Prescription C.

Disadvantages. Lower aesthetic value than Prescription C- may be a concern in highly visible areas. Potentially less effective erosion control measure than Prescription C.

Prescription E

Conditions: Forested upland sites on relatively flat ground and with low erosion potential. Sites are small in area (less than 0.25 acre), relatively moist, and have a good native seed source nearby. Noxious weeds are absent**.**

Objectives: Allow for natural recolonization of project site by native species; maintain integrity of native plant communities; determine natural, unimpeded rate of recovery of the site.

Prescription:

No treatment (control)

Alternatives:

Prescription D

No mulch, plus transplant

No treatment (control):

Monitor site recovery; i.e., record species present; percent cover by species or canopy class; and mean stem height of tree seedlings/saplings by species (if applicable).

Rationale:

A no treatment control is required to determine the relative effectiveness of other treatments. In small, upland areas with low erosion potential, the "*no treatment alternative*" should not have significant adverse impacts on the surrounding environment. The no treatment alternative should be applied carefully, however, and only after all potential effects are considered.

Advantages/Disadvantages:

Advantages. Least expensive alternative. Under appropriate conditions, presents the least impact to the surrounding environment and permits unimpeded, natural recovery of the native community to proceed.

Disadvantages. May be difficult to justify politically. May demand that public be educated about restoration alternatives. If not utilized under appropriate conditions, presents risk of surface erosion, and invasion by non-native species and noxious weeds.

Prescription F

Wilderness, RNA's, and Special Interest Areas

Conditions: All types of sites ranging from forested to non-forested, low elevation to high elevation, and steep to flat. Sites have a good native seed source in the area. Noxious weeds may be present**.**

Objectives: Allow for natural recolonization of project site by native species; maintain integrity of native plant communities and native plant gene pools; determine natural, unimpeded rate of recovery of the site (see *Authorities and Agreements*, Appendix A).

Prescription:

- If low potential for erosion, no treatment or rake in/collect native plant materials from the edges of the disturbance to spread on the bare soil.
- If high potential for erosion, work with Forest/District Soil Scientist to stabilize soils with erosion control materials.

- Check area for noxious weeds and contact Weed Coordinator if present.
- Last option – "avoid persistent or invasive exotic plants" and "choose a short-lived ground cover that will not hybridize with local species, displace native species permanently, or offer serious long-term competition to recovery of local plants". See Appendix B, R6 Revegetation Policy.

Alternatives:

Prescription D or E

No erosion control materials, plus local transplants from surrounding area

No treatment:

Monitor site recovery; i.e., record species present; percent cover by species or canopy class; and mean stem height of tree seedlings/saplings by species (if applicable).

Rationale:

A no treatment control is required to determine the relative effectiveness of other treatments. In small, upland areas with low erosion potential the "*no treatment alternative*" should not have significant adverse impacts on the surrounding environment. The no treatment alternative should be applied carefully, however, and only after all potential effects are considered.

Advantages/Disadvantages:

Advantages. Least expensive alternative. Under appropriate conditions, presents the least impact to the surrounding environment and permits unimpeded, natural recovery of the native community to proceed.

Disadvantages. May be difficult to justify politically. May demand that public be educated about restoration alternatives. If not utilized under appropriate conditions, presents risk of surface erosion, and invasion by non-native species and noxious weeds.

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Internet Resources for the Revegetation Guidelines

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 FICMNEW	http://bluegoose.arw.r9.fws.gov/FICMNEWFiles/FICMNEWHomePage.html
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/

Appendices for the Revegetation Guidelines Document

Appendix A for the Revegetation Guidelines Document
Authorities, Policy, and Agreements Guiding Use of Native Species in Revegetation

1. **National Environmental Policy Act of 1969**: "Prevent or eliminate damage to the environment and bioshpere…enrich…understanding of the ecological systems and natural resources important tot the Nation…".
2. **Endangered Species Act of 1973 as Amended:** "…Encouraging the states and other(s) …to maintain conservation programs…to better safeguard the Nation's heritage in fish, wildlife, and plants".
3. **Federal Land Policy Management Act of 1976:** "protect the quality of scientific…ecological, environmental…values, (and) where appropriate will preserve and protect certain public lands in their natural condition…"
4. **FEMAT (July, 1993)**: "Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands…"; "Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian –dependent species".
5. **NFP ROD SEIS (April 1994)**: "Another goal of forest management on federal lands is to maintain the biological diversity associated with native species and ecosystems in accordance with laws and regulation."; ACS Objective 9 "Maintain and restore habitat to support well-distributed populations of native plant, invetebrate, and vertebrate riparian-dependent species.
6. **NFP ROD SEIS Standards and Guidelines (April 1994)**: "In general, non-native species (Plant and animal) should not be introduced into LSR's."; "Evaluate the impacts of non-native species (plant and animal) currently existing within the reserves, and develop plans for eliminating or controlling non-native species that are inconsistent with LSR objectives."
7. **ICBEMP – Eastside Draft Environmental Impact Statement (May 1997)**: For Alternatives 3-7, Terrestrial Strategies TS-01 Objective: "Maintain and promote healthy, productive and diverse native plant communities as appropriate to soil type, climate, and land form."; Terrestrial Strategies TS-03 Objective:" Rehabilitate disturbed areas to restore native species, maintain productivity, and prevent soil loss"; Tribal Rights and Interests TI-03 Objective: "Recognize native plant communities as traditional resources that are important to tribes…".
8. **Executive Order 11990 Protection of Wetlands (May 24, 1997)**: "Maintenance of natural systems, including conservation and long-term productivity of existing flora and fauna, species, and habitat diversity and stability…".
9. **Executive Order 13112: Invasive Species (February 3, 1999)**: Directs actions to prevent introduction and spread of invasive species and restore native species. Revokes Executive Order 11987.
10. **Emergency Fire Rehabilitation Manual FSM2523 (May, 2000)**: "…Natural recovery by native species is preferred….(When action is required) include native plant materials when possible to meet the objectives of the burned-area emergency rehabilitation. When practicable, use seeds and plants in burned-area emergency rehabilitation projects that originate from genetically local sources of native species. When native materials are not available or suitable, give preference to non-native species that meet the treatment objectives, are nonpersistent, and are not likely to spread beyond the treatment area."

11. **Native Plant Conservation Initiative National Strategy (1995):** Ensure conservation and restoration of native plants and natural plant communities through ecosystem-based management. Educate the public, policymakers, and land managers about native plant conservation.
12. **36 CFR 219.27; 42 U.S.C. 4321; 36 CFR 219.1, 5; 16 U.S.C. 1601 – 1614; 36 CFR 219.26, Part 219**: Preserve, maintain, and enhance the diversity [including genetic diversity] of plant communities.
13. **7 CFR 650.23, Part 650**:.Preserve examples of land and water ecosystems [in RNA's] with their full range of genetic diversity of native plants.
14. **FSM 2323.52**: "[In wilderness] permit ecological processes to operate naturally. Allow wherever possible, the natural process of healing in handling disturbed communities. Consider structural or vegetative assistance only as last resort".
15. **FSH 2509.13-95-3, 26.6**:. "[In wilderness] design treatments as temporary, short-lived actions that provide immediate protection but maintain wilderness integrity. Protect the genetics of endemic [*confined geographically to a certain area*, (Hitchcock, et al., 1969)] plants in wilderness. Choose a short-lived ground cover that will not hybridize with local species, displace native species permanently, or offer serious long-term competition to recovery of local plants"
16. **7 CFR 650.23, Part 650, Subpart B, Sec. 650.23:** "[Research] natural areas are established and maintained for…serving as a genetic base for native plants and animals. Natural areas may be established to preserve examples of land and water ecosystems with their full range of genetic diversity of native plants and animals including threatened and endangered species"
17. **Region 6 Policy on Use of Native and Nonnative Plants on National Forests and Grasslands, (April 12, 1994)**: Use local native plants as feasible; avoid persistent or invasive exotic plants (see Appendix B, this document).

Appendix B for the Revegetation Guidelines Document

Regional and Forest Policy on Use of Native and Nonnative Plants on National Forests and Grasslands

Reply to: 2600 **Date:**April14, 1994

Subject: Use of Native and Nonnative Plants on National Forests and Grasslands

To: Directors and Forest Supervisors

Sound vegetation management is the key to achieving many important objectives of ecosystem management, which include maintaining and enhancing biological diversity, sustaining long-term site productivity, and having healthy ecosystems. Successful vegetation management is dependent on: (1) Clearly defined objectives, (2) availability of adapted plant materials to achieve the objectives, and (3) knowledge of the soil and other environmental conditions where the plant material is to be used. Revegetation objectives must also be guided by law. For example, it would not be appropriate to respond to natural disturbance processes in wilderness with revegetation projects unless life or property outside of wilderness is jeopardized.

The following direction is intended to guide the use of native and nonnative plant species to meet stated objectives of revegetation prescriptions and projects. Native plant vegetation has an intrinsic value as a component of forest and rangeland ecosystems. Nonnative plant species, although useful at times, have the potential to displace natural plant and animal communities, either through aggressive competition or through disease or insect introductions.

POLICY: Use local native plant species to meet management objectives. Follow appropriate seed and plant movement guidelines. Nonnative plant species may be used when: (1) Needed to protect basic resource values (site productivity), (2) as an interim, nonpersistent measure designed to aid in the re-establishment of native plants, or (3) local native plant species are not available. For example, massive soil loss can change sites so that native plant species cannot become established without interim ameliorating measures. As costs, availability, and technical knowledge permit, use of local native plant materials should become a more standard practice. Undesirable plants will not be used.

INTENT: The long-term goal is to use local native plant species as much as possible to meet management objectives. Areas that have the highest priority for using native plant species are those sites in and adjacent to wilderness (but only for restoration of unnatural disturbances), Research Natural Areas, National Parks, streams, wetlands, around documented sightings of sensitive plants, and in Native American cultural use areas. In areas that are in a permanently disturbed condition such as landing strips, powerline corridors, seed orchards, base areas in ski areas, or road cut and fill slopes, use of native plant species is a long-term goal but a lower priority.

Enclosed are DEFINITIONS as further clarification of intent.

/s/Robert Jacobs (for)

JOHN E. LOWE
Regional Forester

Enclosure

I CONCUR:R.SHAFFER:04/05/94

cc:
Dean Longrie, F&W
Gene Silovsky, F&W
Bob Meurisse, ERW
Fred Hall, ERW
Bernie Smith, Rec
Susan Sater, Rec
Margaret Peterson, Rec
Jerry Beatty, FPM
Fay Shon, FPM
Sheila Martinson, TM
Fred Zensen, TM
Richard Shaffer, TM

Native: Plant species present in Oregon and Washington prior to European arrival, circa 1800.

Example: fireweed (Epilobium angustifolium).

Local Native: A population of a native plant species which originated, i. e., grew from seeds or cuttings, from genetically local sources. The geographic and elevational boundaries that define a species' genetically local source are determined by plant movement guidelines.

Example: Douglas-fir (Pseudotsuga menziesii) seedlings grown from seed collected from the local seed zone.

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 (2) plant materials of a native species that does not originate from genetically local sources.

Examples: (1) black cottonwood (Populus trichocarpa) planted on an alpine ridge. (2) Douglas-fir (Pseudotsuga menziesii) seedlings originating from east of the Cascades planted in western Oregon or Washington.

Non-local native should NOT be used because planting them can affect existing plant communities, plant-animal relationships, and the local gene pool.

Acceptable Non-Native: Annual or short-lived perennial that is not persistent or competitive with native vegetation. These species are useful for erosion control or as noxious weed competitors.

Example: Sterile wheat.

Naturalized species: Nonnative species that were introduced by humans to Oregon and Washington and have "gone wild" or become a part of natural communities.

Example: Foxglove (Digitalis purpurea)

Exotic species: Nonnative species that are not known to occur in Oregon or Washington except possibly in landscape plantings or botanical gardens.

Example: Southern magnolia (Magnolia grandiflora

Undesirable Plant Species: Either one of the following:
Plant species on the Oregon or Washington Department of Agriculture noxious weed list.

Example: Hairy cats-ear (Hypochaeris radicata)

*Horticultural varieties of native plant species.

Appendix C for the Revegetation Guidelines Document

Native Species Production and Revegetation Information

Table C-1. Number of pounds of wild-collected seed needed to establish a 1-acre production field for select native grass and forb species, estimated first and second year yields, and anticipated seed costs.

SPECIES	RECOMMENDED GOVT.-FURNISHED LBS/ACRE [a]	AVERAGE GERM/PURITY	AVG YIELD YEAR 1 [b]	AVG YIELD YEAR 2	AVG SEED/POUND	COST PER POUND [c]
Bluebunch Wheatgrass (*Pseudoroegneria spicata*)	10	80/90	300	300	140,000	$10.00-$12.00
Blue Wildrye (*Elymus glaucus*)	8	80/95	450	200	110,000	$7.00-$9.00
Bottlebrush Squirreltail (*Elymus elymoides*) or Big Squirreltial (*Elymus* multisetus)	8	80/90	0	125	110,000	$25.00-$30.00
California Oatgrass (*Danthonia californica*)	10	80/90	24	246	125,000	$15.00-$17.00
Great Basin Wildrye (*Leymes cinereus)*	8	80/95	27	160	130,000	$10.00-$12.00
Idaho Fescue (*Festuca idahoensis*)	5	80/95	300	350	450,000	$11.00-$13.00
Lemmon's *Needlegrass (Achnatherum* lemmonii)	8	50/95	150	750	150,000	$15.00-$18.00
Mountain Brome (*Bromus carinatus*)	10	80/95	800	800	70,000	$7.00-$9.00
Needle and Thread Grass *(Hesperostipa* comata)	8	50/95	0	150	115,000	$25.00-$30.00
Pinegrass (*Calamagrostis rubescens*)	2	80/95	0	132	2,500,000	$27.00-$30.00
Prairie junegrass (*Koelaria macrantha*)	2	80/95	150	500	2,315,000	$12.00-$14.00
Sandberg's Bluegrass (*Poa secunda*)	2	75/95	700	900	1,314,000	$8.00-$10.00
Slender Wheatgrass (*Elymus trachycaulus*)	8	80/90	50	350	130,000	$6.00-$8.00
Thurber's Needlegrass (*Achnatherum thurberiana*)	7	50/95	0	150	225,000	$12.00-$14.00
Tufted Hairgrass (*Deschampsia cespitosa*)	2	80/90	109	509	2,500,000	$14.00-$16.00
Western Needlegrass (*Achnatherum occidentalis*)	8-10	50/95	103	189	275,000	$6.00-$8.00
Common Yarrow (*Achillea millefolium*)	2	85/95	165	165	3,000,000	$7.00-$9.00
Pearly-everlasting (*Anaphalis margaritacae*)	1	60/85	No Data	No Data	8,000,000	$20.00-$25.00

[a] Quantity of Government furnished seed will need to be increased if germination and/or purity of seed are lower than recommended values.
[b] Yield figures assume a late summer or fall sowing in year 0.
[C] Estimated range of prices expected for task orders issued against R6 2003 grass and forb seed production contract (R6-14-03-14)

Table C-2. Oregon and Washington State seed standards for Source Identified (SIA) class of seed. Where no standard exists, Kentucky bluegrass standards are frequently used for native grass seed, except *Achnatherum* and *Hesperostipa* species for which a minimum reasonable germination standard is 50.0%.

	Oregon State Standards			Washington State Standards				
Factor	**Kentucky bluegrass**	**ELGL**	**BRCA5**	**Kentucky bluegrass**	**ELGL**	**BRCA5**	**FEID**	**PSSPS**
Pure Seed, Min.	92.0%	96.0%	90.0%	97%	90%	95%	97%	95%
Other Crop, Max.	0.25%	0.50%	0.50%	0.5%	0.5%	1.0%	0.5%	0.5%b
Inert, Max.	8.0%	4.0%	10.0%	3%	10%	5%	3%	5%
Weed Seed*, Max.	0.30%	0.50%	0.30%	0.3%	0.3%a	0.3%a	0.3%a	0.3%a
Weed Seed Max.**, Group A	45/LB	27/LB	27/LB					
Germination, Min.	75%	65%	85%	80%	80%	85%	90%	85%
Max. seeds of other crop grass species				0.25	0.25	0.25	0.25	0.25

* None of prohibited weeds in Section V, General standards, nor St. Johnswort, is allowed (Oregon).
** Group A: Buckthorn plantain, docks, sheep sorrel, bedstraw (Oregon).
[a] A tolerance of 0.5% may be allowed for samples containing weedy Bromus spp. provided the total of all other weed seeds does not exceed 0.3%.
[b] A tolerance of 0.8% may be allowed in certified wheatgrass containing small grain seed provided the total of all other crop seed does not exceed 0.5%.

AOSCA Approved State Seed Testing Laboratories:

Oregon State University Seed Testing Laboratory
Oregon State University
Campus Way
Corvallis, OR 97331
Telephone: 541-737-4464
Fax: 541-737-2126
Email: Seedlab@orst.edu
Website: www.css.orst.edu/seedlab

Washington State Department of Agriculture
21 N. 1st Ave. #201
Yakima, WA
Telephone: 509-225-2630
Fax: 509-454-4395

Table C-3. Examples of some native grass and forb species useful for revegetation of disturbed sites on National Forests and Grasslands in the Pacific Northwest.

Species	Preferred Soil Type	Minimum Precipitation	Pure Stand PLS Rate Per Acre	Time of Seeding	Comments
Bluebunch wheatgrass Pseudoroegneria spicata	Silt loam to clay	10 inches	6-12 lbs.	Fall/Spring	Medium tall, tufted, cool season, long-lived perennial bunchgrass with deep roots and late phenology. Moderate establishment, adapted to droughty and harsh sites with poor soils..
Blue Wildrye Elymus glaucus	Sand to silt loam	12 inches	10 lbs.	Fall/Spring	Cool season, tall, perennial bunchgrass. Adapted to a wide range of sites, moderately drought tolerant; productive on poor sites. Rapid establishment; excellent for erosion control.
Bottlebrush squirreltail Elymus elymoides	Rocky/ sandy	6 inches	8-10 lbs.	Fall	Medium tall, early to mid-seral, short-lived cool season perennial bunchgrass. Very drought tolerant; good establishment on highly disturbed sites
California oatgrass Danthonia californica					
Great Basin Wildrye Leymus cinereus	Silt loam to clay	8 inches	9-11 lbs.	Fall/Spring	Very tall and robust, long-lived cool season bunchgrass; often spreads by short rhizomes. Adapted to a wide range of sites; moderate-to-very drought tolerant, but can also withstand periodic flooding. Slow to establish.
Idaho Fescue Festuca idahoensis	Silt loam to clay	10 inches	8 lbs.	Fall/Spring	Short-medium, long-lived cool season bunchgrass. Moderately drought tolerant. Slow to establish, but mature stands are strongly competitive.
Lemmon's needlegrass Achnatherum lemmonii					
Western needlegrass Achnatherum occidentale		8-14 inches			Strongly tufted, long-lived, cool season perennial bunchgrass. Deep and extensive fibrous root system. Strong seedling vigor; does well in harsh and arid environments. Very good for erosion control.
Thurber's needlegrass Achnatherum thurberiana		6 inches	6-8 lbs.	Fall/Spring	Short, cool season bunchgrass. Drought tolerant.
Mountain brome	Silt loam to	16 inches	19 lbs.	Fall/Spring	Tall, cool season, short-lived perennial bunchgrass adapted to a wide

Species	Preferred Soil Type	Minimum Precipitation	Pure Stand PLS Rate Per Acre	Time of Seeding	Comments
Bromus carinatus	claay				range of sites. Rapid establishment; productive on poor sites. Very good for erosion control..
Needle and Thread Grass Hesperostipa comata	Sand to silt loam	10 inches	8-14 lbs.	Fall/Spring	Tall, long-lived (?) cool season bunchgrass. Very drought tolerant.
Pinegrass Calamagrostis rubescens					
Prairie junegrass Koelaria macrantha	Sandy	12 inches	1-2 lbs.	Fall/Spring	Medium tall, cool season perennial bunchgrass. Drought tolerant and easy to establish; starts growth in very early spring..
Sandberg's Bluegrass Poa secunda	Sand to clay	8 inches	2-4 lbs.	Fall/Spring	Short, cool season perennial bunchgrass with shallow roots and early phenology. Drought tolerant and productive on poor sites. Slow to establish, but mature stands are strongly competitive.
Slender Wheatgrass Elymus trachycaulus	Sand to clay	16 inches, or wetland/riparian habitats	12 lbs.		Tall, cool season, short-lived perennial bunchgrass with very short rhizomes. Adapted to a wide range of sites; moderate drought tolerance; saline tolerant. Establishes easily and quickly. Very good for erosion control.
Tufted Hairgrass Deschampsia cespitosa	Silt loam to clay	20 inches, or wetland/riparian habitats	1-2 lbs.	Fall	Medium tall, densely tufted cool season perennial bunchgrass adapted to moist or riparian sites, but occurs on drier sites at higher elevations. Performs well in standing water or periodic flooding.
Slender hairgrass Deschampsia elongata	Silt loam to clay	20 inches, or wetland/riparian habitats	1-2 lbs.	Fall	Medium tall, cool season perennial bunchgrass.
Mannagrass Glyceria spp.	Clay	18 inches, or wetland/riparian habitats.	12 lbs.	Fall/Spring	Medium tall, cool season, rhizomatous. Perennial. Good for streambank stabilization.
Purple three-awn Aristida purpurea	Sandy	10 inches	6 lbs.	Fall/Spring	Short-medium, warm season perennial bunchgrass. Drought tolerant. Rapid establishment.
Sand dropseed Sporobolus cryptandrus	Sand to sandy	10 inches	1-2 lbs.	Late summer	Medium tall warm season perennial bunchgrass. Drought tolerant and easy to establish. Very good for erosion control and in a mix with slow establishing species.
Western Yarrow Achillea millefolium	Sand to sandy	8 inches	1 lbs.	Fall/Spring	Mid-to-late seral, rhizomatous perennial forb. Drought tolerant, aggressive. Shade intolerant.
Pearly -everlasting Anaphalis margartiacae		20	0.5	Fall/Spring	Requires full sun/shade intolerant

Species	Preferred Soil Type	Minimum Precipitation	Pure Stand PLS Rate Per Acre	Time of Seeding	Comments
Lupine spp. Lupinus spp.	Silt loam to clay	>10 inches	8-24 lbs.	Fall/Winter	Adapted to dry, open and shaded areas. Nitrogen fixer.

Appendix D for the Revegetation Guidelines Document

Non-native Species for Use in Revegetation

Table D-1. Information on non-persistent non-native annuals and sterile hybrids that may be useful in revegetation/restoration in certain ecological settings. The level of persistence of these plant materials may vary depending on local climate and site conditions, and seedings may slow or impede natural recovery to some degree. Check with your Forest Botanist, Geneticist, Soil Scientist, Ecologist, Range Conservationist, or seed supplier for their appropriateness, and for the variety that will perform best given the elevation, climate, and moisture conditions of the planting site. Some species and varieties are best planted in the fall, while others do better when seeded in the spring/summer.

Common or Trade Name	Scientific Name	***Comments***
Regreen	*Agropyron* X *Triticum* wheatgrass x wheat hybrid	• Synthetic inter-species hybrid, 1/4 wheatgrass and 3/4 wheat, male sterile, but can set seed if pollinated from a source of wheat pollen, annual, under good growing conditions can persist 3 seasons (Kratz 1995). • Recommended seeding rate pure live seed (PLS) pounds per acre is 10 - 40 pounds (Granite Seed 1996). • cheap and available in commercial quantities, use for reveg of disturbed logging sites in western Washington has not been very promising, seeds are large, difficult to stabilize on slopes, germination so-so, erosion cover not very dense (Crowder 1995). • Due to the large size and weight of this seed, the recommended lbs/acre (usually 12 lbs/ac) appears not to be adequate, due to low germination, or predation (Sandoval 1997). • All I can say is that we didn't get very good results [from Regreen] at all in tractor cut fire lines, we're not using anymore (Yates 1997). • High predation, the Regreen distributor told us to not put the seed out until the rains came to cut down on this problem. Apparently, when the seed gets wet it is less palatable (Grenier 1997). • Revisited test plots last summer (1 season after seeding); ZERO Regreen in the plots. (Segotta 1997). • Not impressed, tough to compare because we used the Regreen on firelines mostly and the wheat in burned areas; typically poor results on firelines (Lillybridge 1997). • Seeded in spring and fall, germination >85% for both seasons, worked well on road prisms and skid trails for reducing surface erosion/runoff, (grades not exceeding 10%...usually 4-5%). Regreen dying out in 2

Common or Trade Name	Scientific Name	Comments
		years with native veg established (Lewis 1997). • Regreen used on lime pit mine restoration project seeded heavy (30-50 lbs/ac), germination low (10-30%), but at high elevation substrate was lime, where soil was mixed with the lime by the cat, germination and cover was good, uniform (Finch 1997). • Not much success with Regreen, one problem was seeding too late in the fall so it sprouted, then frost killed; high bird predation, all our seeding more successful w/a thin layer of mulch is used (Potash 1997). • Poor germination (3-5%) with REGREEN under hydromulch on gentle to steep slopes in timber sale above 9,600' in elevation. Rocky poor soils on upper end of sale may have been part of the problem (Austin, 2000). • Fremont NF (Paisley/Silver Lake RD?) seeded with REGREEN after 2002 wildfires. Results pending. • Willamette NF has not had good results with REGREEN, and no longer recommends its use (Lippert 2003).
Pioneer	***Sterile triticale***	• May be used in plantings for short term erosion control by itself, or with slower to establish native species. Adapted to a wide range of soil and moisture conditions; advertised to perform better than wheat on dry and sandy soils, infertilse soils, acid and alkaline soils (Landmark Seed Co.). ,
White oats, domestic oats, cultivated oats, white horse feed oats	**Avena sativa**	• The Federal Highway Administration seeded 20-seeds/square foot [100#'s/acre] of Cayuse oats [variety of oats] and mulched with rice straw and tackifier along the edge of over a mile of Forest Highway 7 last fall, and it provided a good ground cover (Isle 1996). • On the 83,000 acre Fork Fire, found the oats that were sowed on steep chaparral slopes were growing well and uniformly, native seed sowed was much smaller and sparser, best erosion control where rice straw mulch, oats were sowed, and straw check dams and wattles in drainages (Isle 1997). • Oats germinate in fall but, if timed for a nurse crop for dormant natives it does not have an opportunity to obtain much growth before winter killed, not providing the best protection cover during the winter, advantage is no worry about competition from the oats the next spring; oat cover crop should be planted at 1 to 1 1/2 bushels per acre (Hodges 1996). • Cool season, moderately drought tolerant annual, low competition to establishing perennials. Fall planted varieties not suitable for the northern temperate zones with long winters. In areas with long winters, oats should be planted in spring and in fall or spring in more temperate climates (Granite Seed 1996). • Quick, one year cover. Good for cool wet sites, but does well on dry sites too once it is established. Wayne Hamilton has be using it extensively on roadsides on MBRD and DRD [Mount Baker-Snoqualmie

Common or Trade Name	Scientific Name	Comments
		NF] with great results if sowed in spring, fair in summer, poor in fall.
Barley or cereal barley	*Hordeum vulgare*	• Disappeared the 2nd year except where salvage logging had occurred (Arch Rock Fire 1990). Barley plots had less erosion than unseeded plots in half the monitored areas, barley provided significant cover in many areas after 1st year on wildfire site (Cleveland Fire 1991), does not seem to persist beyond 1st year w/out disturbance (Beyers 1997). • Observations (Crystal Burn, Toiyabe NF, 1994) seeding with cereal barley inhibited the return of native plant species in some areas in the short term, was still in evidence in areas that were disturbed by logging and areas that were not disturbed, in 1995-1996. In 1997, the amount of barley that was present on the site considered minimal. Those transects did not show native vegetation was inhibited. (Van Zuuk 1997). • (The Eldorado NF) used [cereal] barley on a burn on 10/92. Where tractor logging has disturbed the seed heads, a 2nd crop of barley is coming up. Elsewhere, 2nd year germination is poor, in some moist sites, annual flora took a hit, In 1995 the 1992 seeding of barley is now barely evident. Less than 0.1% of the ground cover is from barley and despite earlier concerns about the annuals; there was little long-term impact on the flora, not sure barley was cost-effective, not sure it really accomplished much other than providing forage, barley may have some value on a very small scale on a case-by-case basis, but otherwise would be reluctant to use it on future fires (Foster 1995). • Sow winter barley or winter wheat, since it germinates in the cooler fall and gets better growth prior to spring (Isle 1999). • Barley worked very well for us seeded in June/July along roadsides with no noxious weeds present. Native plants such as fireweed began recolonizing the sites the same year we planted the barley. Some barleys have deeper root systems than others and some are better planted in the spring/summer than fall. Also, some barleys are treated with a fungicide. Check with your local supplier before purchasing (Austin 2000). • The Willamette commonly uses fall barley as a non-persistent annual with good results. They often mix with 1-2 local native species (Lippert 2003). • Used on 2002 Bisquit fire, Umpqua NF (Wayne.Rolle). Results pending.
Cereal rye, common rye, or winter rye	*Secale cereale*	• Seeding rate is 55 lbs per acre, introduced, annual, but may occasionally act as biennial, widely grown as a crop, can contaminate wheat fields. Rye can be found throughout eastern CO in wheat fields and disturbed areas, major problem in the wheat fields in Colorado (CWMA 1997). Used for reveg, often along roads, and Dr. Weber says it is expanding its range in CO (Kratz 1995). • 9,000-acre fire from 1992 seeded with cereal rye, competed with the natives as well as conifers planted the

Common or Trade Name	Scientific Name	Comments
		2 years after the fire and STILL persists [1997] (Stubbs 1997). • Have used on our district for 10+ years. The Sandhills soil tends to blow, especially in the winter, permittees hand sow around windmills, seeding rate high (55 lbs of seed/acre) we do NOT have a problem with any invasion of the rye into the native population of grasses, greens up really early in spring and pronghorn seem to appreciate it (Emly 1995). • Rye should **not** be used as temporary cover crop unless it can be mown prior to seed maturity- plants reseed themselves and inhibit the germination of native perennials (Colorado Natural Areas Program et al. 1998). • For the Mount Baker-Snoqualmie NF, the jury is still out on this species. Persists longer than wheat or barley. • Can be highly persistent in certain settings. Cures out early and is a high fire hazard.in late summer in drier regions.
Triticale	*Triticum aestivum* X *Secale cereale*	• Use as cover crop in certain recreation and wildlife areas to provide temporary soil protection, add organics to soil, and improve infiltration and aeration, use 25 - 40 pounds per acre (NRCS 1988). • Cool season, drought tolerant, annual grass. Hybrid cross between common wheat and cereal rye. Both spring and winter varieties available. Seeding rate 60 - 100 pure live seed (PLS) pounds per acre recommended (Granite Seed 2000).
Winter wheat, soft white winter wheat, sterile wheat, common commercial wheat	**Triticum aestivum**	• Triticum aestivum strain 'madsen' used here with success, comes in thick the first year, making for great pheasant and chukar food. Make sure it is sterile wheat (Brooks 1996). • Winter wheat continues to grow throughout the winter during any warm-ups, provides good cover but can also compete against the natives in spring, and later shade out seedlings, the secret is to plant a lower rate than you would for a commercial crop. 40 to 60 lbs/acre is recommended; helpful tool is to mow at or before the boot stage. This helps open the canopy, and stops volunteers (Hodges 1996). • Spring and winter varieties suitable for different climates. Seeding rate 60 - 100 (PLS) lbs/acre recommended (Granite Seed 2000). • Recommended in certain recreation and wildlife areas for soil protection and erosion control if seeded at 20 -25 pounds per acre (NRCS 1988). • UMA seeded after Tower and Wheeler fire, but at much reduced rates (20-30lb/acre)

Common or Trade Name	Scientific Name	*Comments*
Lolium perenne		• Can be persistent in mesic environments.

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Appendix E for the Revegetation Guidelines Document

Invasive Plant Species to Avoid or Minimize in in Revegetation and Landscaping Plantings

Table E-1 contains a listing of non-native plant species that have commonly been used for decades in revegetation, landscaping, and wildflower/grass seed mixes. These species are no longer recommended for general use, however, because they are now known to be highly persistent and aggressive when introduced into native plant communities. In general, exotic species that have high reproductive output and are mid-to-late successional are among the most threatening and difficult to remove or control.

Table E-1 was developed based on recommendations and findings from a variety of sources. On-line resources, including the Natural Resource Conservation Service's PLANTS database and the USDA Agricultural Research Service's INVADERS database, were searched for information on the invasiveness on each plant species (see Legend for web sites). Plant species marked with "CD" were chosen by 13 USFS botanists and range ecologists from 5 western states in the "Top 10 Intentionally-sown Persistent Exotics" survey (Craig Dremann, 1998). They were noted for being especially aggressive in displacing native plant species and native plant communities throughout the western states. Species marked with "RMNP" were identified as "species of concern" (have the greatest potential for ecological impact) by researchers studying non-native vegetation the Rocky Mountain National Park. The Colorado Native Plant Society also developed a list of plants NOT recommended for use in revegetation, restoration, or gardening.

On sites dominated by large populations of one or more of these aggressive exotics, plant materials of more desireable species may be extremely difficult to establish unless efforts are first taken to reduce or eliminate the unwanted species. In addition, some of the species listed in Table E-1 may continue to play an appropriate but limited role in revegetation of noxious weed sites in settings where more desirable species (native and non-native) are not anticipated to establish or compete well against the target weed species. These aggressive exotics should be used only after their risk to TES plant species and other components of biological diversity has been carefully evaluated.

Table E-1. Grass and forb species to avoid or minimize in revegetation/restoration projects.

COMMON NAME	SCIENTIFIC NAME	NRCS	INV	RMNP	NE & GP	WISC	C A	CoNPS	C D	PCA	R6	COMMENTS
Canada bluegrass	*Poa compressa*	X				X			X		X	
Crested wheatgrass	*Agropyron cristatum* *A. desertorum*							X	X		X	
Hard fescue or sheep fescue	*Festuca ovina var. ovina*								X	X	X	Becoming naturalized in the Willamette Valley and very difficult to distinguish from native fescues; not recommended for use (B.Wilson) .Used in SW OR on weed sites in disturbed forest settings – not expected to persist once trees become established and shade it out (S. Bulkin)
Intermediate wheatgrass	Agropyron intermedium								X		X	
Kentucky bluegrass	Poa pratensis	X		X	X	X			X	X	X	
Red fescue	Festuca rubra										X	
Meadow fescue	*Festuca pratensis*								X	X	X	
Meadow foxtail	*Alopecurus pratensis*								X		X	
Orchardgrass	*Dactylis glomerata*	X		X	X			X	X	X	X	
Quackgrass	*Agropyron repens (Elytrigia repens or Elymus repens)*	X	X	X	X	X				X	X	
Reed canarygrass	*Phalaris arundinacea (Phalarioides arundinacea)*	X		X	X	X			X	X	X	
Smooth brome or Hungarian brome grass	*Bromopsis inermis (Bromus inermis)*			X	X	X		X	X	X	X	

COMMON NAME	SCIENTIFIC NAME	NRCS	INV	RMN P	NE & GP	WISC	C A	CoNPS	C D	PCA	R6	COMMENTS
Timothy	*Phleum pratense*	X						X	X	X	X	
Tall fescue	*Festuca arundinacea (Lolium arundinaceum)*	X					X				X	
Italian ryegrass common rye or annual ryegrass	*Lolium perenne* ssp. *Multiflorum*	X					X				X	May be persistent in mesic environments or maritime climates
Crab grass	*Digitaria sanguinalis*										X	
Dogtail grass	*Cynosurus echinatus*										X	
Alfalfa	*Medicago sativa*										X	
Sanfoin											X	Persistent
Burnet											X	
Birdsfoot trefoil	*Lotus corniculatus*										X	
Downy brome or cheatgrass	Bromus tectorum	X		X	X		X				X	Common contaminant in commercial seed and hay/straw
Rattail fescue											X	Common contaminant in commercial seed and hay/straw
Wild oats	Avena fatua										X	Common contaminant in commercial seed and hay/straw
Tumbleweed mustard	Sisymbrium loesellii										X	Common contaminant in commercial seed and hay/straw
	Conyza Canadensis										X	
Babysbreath	Gypsophila paniculata	X	X	X						X	X	Sold in nurseries and/or wildflower seed mixes
Bouncing bet or soapwort	*Saponaria officinalis (Lychnis saponaria)*	X			X		X	X			X	Sold in nurseries and/or wildflower seed mixes
Common yarrow (European variety)	Achillea millefolium *(European variety)*	X			X						X	Note: there is a European and a native variety of this – if in doubt, avoid this species.
Corn chamomile	*Anthemis arvensis*	X									X	Sold in nurseries and/or wildflower seed mixes
Dalmation	*Linaria dalmatica ssp.*	X	X	X						X	X	Sold in nurseries and/or wildflower seed

COMMON NAME	SCIENTIFIC NAME	NRCS	INV	RMN P	NE & GP	WISC	C A	CoNPS	C D	PCA	R6	COMMENTS
toadflax	*Dalmatica*											mixes
Dame's rocket	Hesperis matronalis	X			X	X		X		X	X	Sold in nurseries and/or wildflower seed mixes
European wand loosestrife or Purple loosestrife	*Lythrum virgatum (see Lythrum salicaria)*	X	X					X			X	Sold in nurseries and/or wildflower seed mixes
Klamath weed or St. John's wort	Hypericum perforatum	X	X	X	X	X	X			X	X	Sold in nurseries and/or wildflower seed mixes
Mayweed chamomile	*Anthemis cotula*	X			X						X	Sold in nurseries and/or wildflower seed mixes
Oxe-eye daisy	*Leucanthemum vulgare (Chrysanthemum leucanthemum)*	X	X			X	X	X		X	X	Sold in nurseries and/or wildflower seed mixes
Perennial sweetpea or perennial peavine	Lathyrus latifolius	X						X			X	Sold in nurseries and/or wildflower seed mixes
Purple loosestrife	*Lythrum salicaria*	X	X		X	X	X	X		X	X	Sold in nurseries and/or wildflower seed mixes
Scentless chamomile, wild chamomile, or scentless mayweed	*Matricaria perforata (Matricaria inodora, Matricaria maritima, Tripleurospermum inodorum)*	X	X					X			X	Sold in nurseries and/or wildflower seed mixes
Toadflax or butter & eggs	*Linaria vulgaris*	X	X	X	X			X			X	Sold in nurseries and/or wildflower seed mixes
Sweet clover, white	Melilotus alba	X		X		X		X	X	X	X	Sold in nurseries and/or wildflower seed mixes
Sweet clover, yellow	*Melilotus officianalis*			X	X	X		X	X	X	X	Sold in nurseries and/or wildflower seed mixes
Bachelor button	*Centurea cyanus*										X	Sold in nurseries and/or wildflower seed mixes
Forage kochia	*Kochia*										X	Sold in nurseries and/or wildflower seed mixes
Wild carrot	*Caucus carota*										X	

COMMON NAME	SCIENTIFIC NAME	NRCS	INV	RMN P	NE & GP	WISC	C A	CoNPS	C D	PCA	R6	COMMENTS
Foxglove	*Digitalis purpurea*										X	
Wild radish	*Raphanus sativus*										X	
Red sorrel	*Rumex acetosella*										X	
Curly dock	*Rumex crispus*										X	
Dandelion	*Taraxacum officinale*										X	
Salsify	*Tragopogon spp.*										X	
Red clover	*Trifolium pratense*										X	
Veronica	*Veronica serphyllifolia*										X	

Legend for Table E-1:
NRCS --- Natural Resource Conservation Service's PLANTS database, Invasive and/or noxious weed list, http://plants.usda.gov/plants/
INV --- USDA Agricultural Research Service's INVADERS database for ID, MT, OR, WA, and WY, http://invader.dbs.umt.edu/Noxious_Weeds
RMNP --- Rutledge, *et al*., "An assessment of exotic plant species of Rocky Mtn National Park".
NE & GP - PLANTS database, "Invasive weeds of Nebraska and the Great Plains", http://plants.usda.gov/plants/cgi_bin/invasive_all.cgi
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Table E-2. Grass cultivars historically used on USDA National Forest Lands in Oregon and Washington [1]

Release Name	Scientific Name	Common Name	Release Year	Plant Type	Origin	Genetic Background and Selection Methods
Bromar	*Bromus marginatus* Nees ex. Steud	mountain bromegrass	1946	Short-lived perennial bunchgrass	Pullman, WA	Mass selection from seed, tested over 10 years.
Canbar	*Poa secunda*J. Presl	Canby bluegrass	1979	Perennial bunchgrass	Blue Mts, WA	
Covar	*Festuca ovina* L.	sheep fescue	1977	Perennial bunchgrass	Konya, Turkey	
Critana	*Elymus lanceolatus* (Scribn. & J.G. Sm.) Gould ssp. *lanceolatus*	streambank wheatgrass	1971	Perennial sod-former	Havre, Montana	
Durar	*Festuca trachyphylla*(Hack.) Krajina	hard fescue	1949	Long-lived perennial bunchgrass	Introduced plants from Ashkhabad, Turkmenistan grown near Union, Oregon	
Elkton	*Elymus glaucus* ssp. *Jepsonii*	blue wildrye	1997	Short-lived perennial bunchgrass	Elkton, Oregon	1 population from 400 ft.elev
Goldar	*Pseudoroegneria spicata* (Pursh) A. Love ssp*. Spicata*	bluebunch wheatgrass	1989	Long-lived perennial bunchgrass	Malley Ridge, Umatilla National Forest, Asotin, WA	Diploid (2n = 14)

[1] This table is part of an internal white paper and journal article being prepared by Forest Service geneticists and researchers to describe the geographic origins and genetic constitution of cultivar releases that have been used on federal lines in the Pacific Northwest.

Greenar	*Thinopyrum intermedium*	intermediate wheatgrass	1945	Sod-former	USSR	
Joseph	*Festuca idahoensis*	Idaho fescue	1983	Perennial bunchgrass	Idaho	20 clones from plants interpollinated in greenhouses for 3 one-year cycles
Latar	*Dactylis glomerata*	orchardgrass	1957	Long-lived perennial sod-former	USSR	
Luna	*Thinopyrum intermedium*	intermediate wheatgrass	1963	Perennial wheatgrass	Ashkhabad, Turkmenistan	
Magnar	*Leymus cinereus*	basin wildrye	1979	Perennial bunchgrass	Saskatchewan, Canada	
Manchar	*Bromus inermis*	smooth brome	1943	Long-lived sod-former	Manchuria, China	
Oahe	*Thinopyrum intermedium*	intermediate wheatgrass	1961	Perennial sod-former	Russia	4 clones from self- and open-pollinated plants
Primar	*Elymus trachycaulus* (Link) Gould ex Shinners ssp. *trachycaulus*	slender wheatgrass	1946	long-lived perennial	Beebe, MT	Selected from original collection.
Schwendimar	*Elymus lanceolatus (*Scribn. & J.G. Sm.) Gould ssp. *lanceolatus*	thickspike wheatgrass	1994	Long-lived perennial sod-former	The Dalles, OR	
Secar *	*Pseudoroegneria spicata* (Pursh) A. Love ssp. *spicata*	bluebunch wheatgrass	1980	perennial bunchgrass	Lewiston, ID	Tetraploid (2n = 4x = 28)

Sherman	*Poa secunda* J. Presl	big bluegrass	1945	Long-lived perennial bunchgrass	Moro, OR	
Sodar	*Elymus lanceolatus* (Scribn. & J.G. Sm.) Gould ssp. *lanceolatus*	streambank wheatgrass	1954	Long-lived perennial sod-former	Canyon City, OR	
Whitmar	*Pseudoroegneria spicata* (Pursh) A. Love ssp. *Inermis* (Scribn. & J.G. Sm.) A. Love	bluebunch wheatgrass	1946	Long-lived perennial bunchgrass	Whitman County, WA	Mass selection from wild seed Diploid (2n = 14)

APPENDIX F for the Revegetation Guidelines Document

MULCH TYPES

TYPE	DESCRIPTION	REQUIRED EQUIPMENT	APPLICATION RATE	CONSIDERATIONS	COST (in 1995)	USEFUL LIFE
Straw	Certified Weed-free Straw	Hand application; blown on or applied by helicopter	4000 lbs/ac (4") on north slopes; 5000 lbs/ac (5") on south slopes	Tough to put on extremely steep slopes except by helicopter. Inexpensive; effective	$1000/ac by hand; $3000/ac by helicopter	2 years
Hydroseed Wood Cellulose Mulch	Hydro mulch with wood cellulose mulch	Applied with hydroseeding machine	$2000 lbs/ac	Hydroseeders are expensive to move in and are in short supply in the fall. Seeding cannot be kept current with construction. Very effective	$1000/ac by hand; $3000/ac by helicopter	1 year
Hydroseed Paper Mulch	Hydro mulch with paper mulch	Applied with hydroseeding machine	$2000 lbs/ac	Same as above	$1000/ac plus mobilization	1 year
Blankets (some come impregnated)	Various types of premade erosion control blankets	Rolled out and staked or pinned down	By the square foot	Netting decomposes at a different rate than mulch. Effective; expensive	$.49-3.50/sq yd for material only; add labor	2 years
Netting	Various types of biodegradable & non degradable netting	Rolled out and staked or pinned down	By the square foot	Can trap animals; decomposes slowly; used over mulch; bio-degradable types available	$.20-.50/sq yd for material only; add labor	2 years
Channel Liners	Various width heavy-duty blankets	Rolled out and staked or pinned down	By the square foot	Usually left in place. Effective; very expensive	$3.00-3.50/sq yd for material only; add labor	1 year
Tackifiers	Sprayed on material used to hold soil in place	Sprayed on, usually with a truck mounted sprayer	By the square foot	Short term	$800/ac plus mobilization	3 years
Sodding	Grass sod	Rolled out and pinned down	By the square foot	Used when instant plant establishment is important	$.17/sq ft; add delivery and labor	indefinite

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Appendix C – Wildlife

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Forest Service Sensitive Species Suspected to be on the Umatilla National Forest

Affected Environment

Terrestrial wildlife species found or suspected to be found in the Umatilla National Forest that are included in the Regional Forester's Sensitive Species List are listed in Table 1. The Regional Forester's Sensitive Species List is a proactive approach 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. This section contains the Affected Environment and Environmental Consequences for the sensitive species' that are **suspected** to occur on the Umatilla National Forest. Sensitive Species that are **documented** to occur on the Forest are discussed in Section 3.3.5 of Chapter 3 in the EIS. This section also demonstrates exposure groups and exposure scenarios, as well as the effects of invasive plants treatments for those exposure groups found on the Umatilla National Forest.

Table 1 - Suspected (S) or Documented (D) Wildlife of the Umatilla NF on the Regional Forester's Sensitive Species List (July 2004)

Common Name	Scientific Name	Occurrence
Mammals		
California wolverine	*Gulo gulo*	D
Rocky Mountain Bighorn Sheep	*Ovis canadensis canadensis*	D
Birds		
American peregrine falcon	*Falco peregrinus anatum*	S
Green-tailed Towhee (WA only)	*Pipilo chlorurus*	D
Upland sandpiper	*Bartramia longicauda*	S
Gray flycatcher	*Empidonax wrightii*	S
Amphibians		
Northern Leopard frog	*Rana pipiens*	S
Columbia spotted frog	*Rana luteiventris*	D
Reptiles		
Painted Turtle	*Chrysemys picta*	S
Striped Whipsnake, (WA only)	*Masticophis taeniatus*	S
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.*		

American peregrine falcon

Life History and Habitat Description

Peregrine falcons are crow/raven-sized raptors that inhabit cliffs located within approximately 0.5 miles 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). Preferred peregrine falcon habitat includes various open habitats from grassland to forest in association with suitable nesting cliffs. The falcon often nests on ledges or holes on the face of rocky cliffs or crags. Ideal locations include undisturbed areas with a wide view, near water, and close to plentiful prey. Foraging habitats of woodlands, open grasslands, and bodies of water are generally associated with the nesting territory. Falcons are known to forage over large areas, often ten to fifteen miles from the eyrie.

Peregrines lay 2-4 eggs in March-May, and commence incubation after the clutch is complete. Eggshell thinning induced by the metabolite of the pesticide known as 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 all peregrine nests has been chronic in northern CA and OR 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).

Project Area Information

There are no known peregrine falcon nests on the Umatilla National Forest, however the species has limited potential nesting habitat on the Forest and it is suspected it may occur. Flyovers have been observed in the past, although no flyovers have been recorded in the last few years. Peregrine nest site surveys were conducted in potential nesting habitat during the 1990's and are occasionally informally conducted now, however no nest has been found. No invasive plants have been located in potential peregrine falcon nesting habitat. Upland Sandpiper

Upland sandpipers generally nest in extensive, open tracts of short grassland habitat, including native prairie, dry meadows, pastures, domestic hayfields, and short-grass savanna, plowed fields along highway rights-of-ways 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 Explorer 2006).

In Oregon, the upland sandpiper nests in partly flooded meadows and grasslands, usually with a fringe of trees, and often in the middle of higher-elevation sagebrush communities. Meadows favored by this sandpiper are little grazed and have some growth of forbs. It may perch in coniferous trees or snags surrounding the nesting site. They forage in open meadows for its favorite foods, grasshoppers and crickets. They also eat ants, berries, and seeds of grasses and forbs (Csuti et al 2001).

Upland sandpipers are not known to occur on the Umatilla NF but are suspected to occur. They have been documented in the area, but not on National Forest system lands. Potential upland sandpiper habitat was queried by using all dry herbland (grassland) and dry shrubland that had less than 10 percent slope and was greater than 5,000 feet in elevation. Using this broad scale analysis, there is approximately 20,025 potential acres of upland sandpiper habitat within the Project Area. Approximately 617 acres or 3 percent of the 20,025 acres has known invasive species infestations. This analysis includes a much higher number of acres of potential habitat since it does not specifically identify partly flooded meadows or grasslands or short grass.

Upland Sandpiper

Life History and Habitat Description

Upland sandpipers generally nest in extensive, open tracts of short grassland habitat, including native prairie, dry meadows, pastures, domestic hayfields, and short-grass savanna, plowed fields along highway rights-of-ways 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 Explorer 2006).

In Oregon, the upland sandpiper nests in partly flooded meadows and grasslands, usually with a fringe of trees, and often in the middle of higher-elevation sagebrush communities. Meadows favored by this sandpiper are little grazed and have some growth of forbs. It may perch in coniferous trees or snags surrounding the nesting site. They forage in open meadows for its favorite foods, grasshoppers and crickets. They also eat ants, berries, and seeds of grasses and forbs (Csuti et al 2001).

Project Area Information

Upland sandpipers are not known to occur on the Umatilla NF but are suspected to occur. They have been documented in the area, but not on National Forest system lands. Potential upland sandpiper habitat was queried by using all dry herbland (grassland) and dry shrubland that had less than 10 percent slope and was greater than 5,000 feet in elevation. Using this broad scale analysis, there is approximately 20,025 potential acres of upland sandpiper habitat within the Project Area. Approximately 617 acres or 3 percent of the 20,025 acres has known invasive species infestations. This analysis includes a much higher number of acres of potential habitat since it does not specifically identify partly flooded meadows or grasslands or short grass.

Gray flycatcher

Life History and Habitat Description

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 the habitat used by gray flycatchers is fairly specific. Dry open ponderosa pine stands with extensive bitterbrush and bunchgrasses understory. Tree size ranges from small (6" diameter breast height) to large (40 inches 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. Their diet includes a variety of species ranging from small beetles to butterflies.

Project Area Information

One gray flycatcher was documented on the Pomeroy District on the north end of the Clearwater, near the guard station several years back. Since gray flycatchers are difficult to distinguish from the dusky flycatcher they may be more widespread than is currently recognized. Their territory has been reported to vary from three to nine acres, and the home range seems to be about 10 acres (Csuti et al. 2001). Broad scale mapping of potential breeding gray flycatcher habitat included: all dry shrublands and ponderosa stands with less than 30 percent canopy closure or juniper woodlands with less than or equal to 40 percent canopy closure.

Using these broad parameters, a total of approximately 78,288 acres of potential gray flycatcher breeding habitat exist. A total of approximately 1,560 acres or two percent of potential gray flycatcher habitat contains known infestations of invasive plant species. Approximately 42 percent of those acres are adjacent to roads (591 acres) or trails (64 acres).

Northern Leopard Frog

Life History and Habitat Description

The most cold-adapted of all the leopard frogs, northern leopard frogs are found in a variety of habitats from grassland, woodland and forest that ranges high into the mountains (Stebbins 1985). This leopard frog ranges in a wide variety of habitats (springs, marshes, wet meadows, riparian areas, vegetated irrigation canals, ponds, and reservoirs) and requires a high degree of vegetative cover for concealment (NatureServe Explore 2006, McAllister et al. 1999, Corkran and Thoms 2006). They prefer quiet or slowly flowing waters and avoid areas without cover (McAllister et al. 1999, Csuti et al. 2001). Typically, they are found between 500 and 3,000 feet in elevation (Corkran and Thoms 2006). They breed in ponds or lake edges with fairly, dense aquatic emergent vegetation in mid spring, and attach their eggs to submerged vegetation well below the surface (NatureServe Explore 2006, Corkran and Thoms 2006). Hatchlings cling to the egg mass or nearby vegetation (Corkran and Thoms 2006). Tadpoles live in dense aquatic vegetation (Corkran and Thoms 2006). Juveniles and adults live in aquatic vegetation in ponds, and in adjacent grass, sedge, weeds or brush (Corkran and Thoms 2006). Over-wintering habitats are larger lakes and streams that do not freeze completely during winter (NatureServe Explore 2006, McAllister et al. 1999).

Larvae eat algae, plant tissue, and other organic debris (Csuti et al. 2001). Carnivorous adults eat both invertebrates (spiders, insects, snails, and leeches) and vertebrates (tadpoles, small frogs, small snakes, and fish (McAllister et al. 1999, Csuti et al. 2001).

Project Area Information

This frog is known in Oregon mostly from older records and recent surveys have failed to find it in Oregon (Csuti et al. 2001). Corkran and Thoms (2006) stated “we were lucky enough to find the only northern leopard frog egg mass seen in Oregon or Washington for quite a few years.” Leopard frogs have not been found during any of the Forest amphibian surveys that have taken place. Their occurrence in the Project Area is unknown but unlikely. The Umatilla National Forest does not have GIS coverage for manmade and natural ponds, reservoirs, wet meadows, and stockponds; however it does have GIS coverage for lakeshores and springs. Although lakeshores and springs contain only a portion of the potential leopard frog habitat available in the Project Area, it does show some of the potential habitat available, and the portion of the potential habitat that contains invasive plants. This gives a sense of what proportion of the other waterbodies mentioned above may contain invasive plants. There are eight waterbodies and 397 springs defined in the Umatilla GIS coverages. In the model used for leopard frog potential habitat, the springs were buffered 300 feet, and lakeshores 300 feet to the outside and 25 feet to the inside. Using these parameters there are approximately 2,775 acres of northern leopard frog habitat, of which 133 acres are known to contain invasive plant species.

Painted Turtle

Life History and Habitat Description

Painted turtles are usually found below 3,500 feet in elevation (St. John 2002). This turtle occurs in slow moving, shallow, quiet waters, with muddy or sandy substrates with aquatic vegetation and basking sites (NatureServe Explore 2006, St. John 2002, Csuti et al. 2001, and Johnson 1995). Painted turtles are found in lakes, ponds, marshes, and slow moving streams located in a variety of surrounding vegetation types (St. Johns 2002). The turtle is active diurnally, April through October and hibernates in water in bottom mud (NatureServe Explore 2006 and Csuti et al. 2001). They nest in soft soil in open areas up to 500 feet from water (NatureServe Explore 2006, St. John 2002, and Csuti et al. 2001).

The turtle eats both plants; including algae, duckweed, bulrush, and animal matter including spiders, beetles, insect larvae, earthworms, crayfish, fish, frogs, and tadpoles (NatureServe Explore 2006, St. John 2002, and Csuti et al 2001). The young are more carnivorous, while the adults are more herbivorous.

Project Area Information

The painted turtle appears to be declining in Oregon due to lack of recruitment. Predation on young by introduced bullfrogs may be responsible for the decline (Csuti et al. 2001). This may be true for other parts of Oregon; however the Project Area currently does not have any known bullfrog populations. Surveys for painted turtles have been sporadically conducted. Although potential habitat does exist for this species, there are currently no known painted turtle locations on the Umatilla NF (A.Scot personal communication, 2006).

The same habitat model for mapping potential Columbia spotted frog habitat was used for painted turtle habitat. Although springs and lakeshores do not precisely fit the habitat painted turtles would use, it was the best data available and gives a general sense of the portion of potential habitat that may be impacted by invasive plants. Other potential painted turtle habitat not included in the model includes natural and manmade ponds (such as mining), marshes and slow moving streams. Using just the springs and lakeshore parameters, there are approximately 2,775 acres of painted turtle habitat on the Forest, of which 133 acres contain invasive plant species.

Striped Whipsnake

Life History and Habitat Description

The striped whipsnake is a R6 sensitive species for only the Washington portion of the Umatilla National Forest. This snake occurs from central Washington south to central Mexico. It is an arid area species, inhabiting grasslands, shrublands, sagebrush flats, rocky stream courses, and canyon bottoms (NatureServe Explorer 2006, St. John 2002, Csuti, et al 2001, Johnson 1995 and Parker and Brown 1980) and frequents juniper and pine-oak woodlands habitats (St. John 2002 and Csuti et al 2001). In Washington it occurs in the Columbia Plateau Ecoregion. Striped whipsnakes eat lizards, insects, other snakes, small mammals, and young birds. Young feed primarily on lizards and insects. Adults also take snakes, small mammals, young birds, and insects (St John 2002 and Csuti et al. 2001). The female will lay three to ten eggs in June or July and young hatch out in August or September. They use abandoned rodent burrows for communal nest sites. This snake is diurnal during warm months and hibernates in the winter. The whipsnake can also be found in underground dens or deep crevices in cold weather. It is active mainly from April through October (St John. 2002 and Csuti et al. 2001). Whipsnakes are known for their very rapid locomotion. Striped whipsnakes have been documented in Washington only 26 times. In the last decade, only three observations have been reported (Washington Herp Atlas 2005).

Project Area Information

The striped whipsnake may occur on the Forest though none have been found. It is unlikely they occur because the overall population is so low. The striped whipsnake is considered a sensitive species for only the Washington arid area species. Broad-scale potential habitat for the stripped whipsnake was determined by querying all hot-dry grasslands and shrublands as well as warm-hot riparian grasslands and shrublands. Using those parameters, the potential striped whipsnake habitat within the Project Area amounted to 211,105 acres, of which 3,825 acres or approximately two percent have known invasive plant infestations. Fifty-five percent of the invasive plant infestations in potential striped whipsnake habitat are adjacent to roads (2020 acres) and trails (80 acres).

Environmental Consequences

Effects to American peregrine falcon

Effects Common to All Alternatives

Currently peregrine falcons are not thought to inhabit the Project Area so there will be no effect regardless of alternative chosen. If in the future peregrine occupy sites in the Project Area, the mandatory PDF will avoid disturbance. No herbicide or NPE dose exceeded the toxicity indices for fish-eating birds even in a “worst case” scenario, so the likelihood of adverse impacts to peregrine falcons from herbicide dose is unlikely.

Treatment and Restoration

Currently peregrine falcons are not known to reside on the Umatilla National Forest; however as their populations continue to increase there is the possibility they may someday. Potential effects of invasive plant treatment methods on peregrine falcon are mainly associated with disturbance caused by noise, people and vehicles that may occur during the nesting season. However, peregrine falcons nest on cliffs, and no invasive plants have been located in potential nesting habitat, so it is improbable that disturbance would occur. In addition the PDF designed specifically for peregrine falcon would help to eliminate disturbance caused by treatments.

Manual and Mechanical Methods

Methods used to treat invasive plants or restore prey habitat will not likely adversely impact peregrine falcon. The general effects of each non-herbicidal method to wildlife are discussed previously in this chapter, and PDF for peregrine falcon was developed specifically to limit disturbance. All treatment methods that result in improved habitat for potential peregrine falcon prey species will provide a long-term benefit.

Biological Control

There is no indication that any biological controls would adversely affect the forage of prey for the peregrine falcon. Biological controls cannot affect peregrine falcon directly, because they only act on invasive plants.

Herbicides

If in the future peregrine occupy sites in the Project Area, no herbicide or NPE dose exceeded the toxicity indices for fish-eating birds even in a “worst case” scenario, so there will be no adverse impact to peregrine falcons regardless of the alternative chosen. There is no quantitative scenario for a predatory bird that eats primarily other birds, like 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 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 unfeasible 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. 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 because the herbicides proposed in this EIS are rapidly excreted from animals and do not bioaccumulate

The dose from NPE-based surfactant exceeded the level of concern, but only at the highest application rate. PDF F4 limits NPE to typical application rate only so this dose will not occur.

Currently no nest sites for peregrine falcon occur within 1.5 miles of any proposed treatment area, the mandatory PDF 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.

Early Detection Rapid Response

The analysis is the same for the EDRR. It is not expected that there would be any nest sites affected by the EDRR.

Differences between Alternatives

Alternative A – No Action

There is no nesting habitat or known locations in the areas of existing treatment areas or areas where existing NEPA is in place. Migrating or foraging may take place here but there is little to no effect anticipated from activities associated with this alternative.

Alternatives B, C & D– Proposed Action & Restricted Herbicide Use Alternatives

These alternatives have the same potential minor impact to peregrine falcons. The effect of having a potential disturbance to nesting peregrines would occur in all action alternatives, although currently there are no impacts since there are no known nests. The PDF is in place to minimize any disturbance should a nest be discovered in the future. No aerial spraying would occur in close proximity under any action alternative and broadcast spraying in riparian habitat would not impact peregrine falcon nests since the PDF would be mandatory.

Summary of Effects to Peregrine Falcon and Determination of Effects

There are no known peregrine falcon nests on or in close proximity to the Forest. There is no effect to peregrine falcon habitat from treatments. No alternative would alter cliff habitat. Herbicide, manual, and mechanical treatments have potential of disturbing nesting and foraging falcons. Based on the herbicide effect analysis there is very little risk of direct effects to peregrine falcons from the use of herbicides. The only possible direct effect is the possible ingestion of chemicals by eating birds that had been exposed to herbicides. The analysis shows no toxic effect from this exposure at levels that are probably higher than the actual exposures. The indirect effect to these birds would be from disturbance from workers doing herbicide, manual, and mechanical treatments.

Falcons are fairly sensitive to disturbance and will occasionally abandon nest sites when they are disturbed. The disturbance factor is less when they choose nest locations where they have a regularly reoccurring amount of human activity as evidenced by their use of bridges and buildings in a downtown location. Therefore the effect of disturbance would be minor to peregrine falcons.

Since currently there are no known peregrine falcon nests on the Forest there would be "no impact" to individuals or their habitat. However, if in the future peregrine do nest on the Forest the PDFs are in place to minimize impacts. If peregrine falcons do nest on the Forest in the future, there would be **"no impact"** to individuals or habitat of peregrine falcon.

Cumulative Effects

Since the herbicides selected do not pose a risk from bioaccumulation or a long residual effect there are no anticipated cumulative effects from either projects on or off of the Forest.

Effects to Upland Sandpiper

Effects Common to All Alternatives

Upland sandpipers nest in open, short-grass habitat. They are suspected to occur on the Umatilla National Forest but have not been documented. The cryptic nests of upland sandpipers are susceptible to crushing or trampling by people or vehicles. If they were nesting in areas where invasive plant treatments occurred, eggs or nestlings could be trampled, regardless of the treatment technique used, except for aerial spraying. Data is not sufficient to distinguish in a meaningful way the magnitude or duration of disturbance or trampling between alternatives. Due to the low likelihood of this sandpiper being present in the treatment sites, actual risk to the birds is very low.

Using broad-scale analysis approximately 3 percent (617 acres) of potentially 20,025 acres contain invasive plants. Upland sandpipers eat insects so the risk from herbicide and NPE-based surfactants is as discussed above for green-tailed towhee. Adverse effects cannot be ruled out for NPE at typical and high rates. Data is insufficient to distinguish between alternatives the likelihood or magnitude of this potential effect. Due to the low likelihood of this sandpiper being present in the treatment sites, actual risk to the birds is very low.

Treatment and Restoration

Potential effects of invasive plant treatment methods on upland sandpipers are limited and mainly associated with disturbance that may occur during the nesting season. Direct effects from invasive plant treatment include disturbance caused by noise, people and vehicles (trampling). If an upland sandpiper were to be nesting or foraging in the immediate vicinity of a treatment, they would likely be temporarily displaced and their nest could be crushed or trampled.

Manual and Mechanical Methods

Methods used to treat invasive plants could impact upland sandpipers, however at this time they are only suspected on the Forest. The general effects of each non-herbicidal method to wildlife are discussed previously in this chapter and PDFs were developed specifically to minimize impacts of these treatments. The potential effects from herbicides are discussed later in this appendix. All treatment methods that result in improved habitat for potential upland sandpiper habitat and their prey species will provide a long-term benefit.

Biological Control

There is no indication that any biological controls would adversely affect the cover or forage of prey for the upland sandpipers. Biological controls that reduce invasive plant populations, increase native plant populations, and provide a supplemental food source are indirectly beneficial to upland sandpipers. However, any biological control agents that affected native plant species could adversely affect insects that upland sandpipers feed on.

Herbicides

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. Contamination from NPE-based surfactants of an entire day's diet of invertebrates seems unlikely for the following reasons: 1) upland sandpiper are not known to forage within areas dominated by invasive plants, and, 2) the presence and movement of applicators is likely to scare off some invertebrates.

NPE-based surfactants exceeded the dose of concern for insectivorous birds at both typical and highest application rates.

Early Detection Rapid Response

The analysis is the same for the EDRR. It is not expected that there would be any additional impacts other than more sites treated. The herbicides do not bioaccummulate. The No Action Alternative (Alternative A), does not include EDRR. The short-term impacts of the treatments would largely be offset by the long-term benefit of retaining habitat for upland sandpipers and their prey species. Effects, if any, are expected to be negligible.

Differences between Alternatives

There is very little difference between alternatives for the upland sandpiper. Alternative A would treat less acres and does not include EDRR so would be less effective than any of the action alternatives considered. Alternative B, the Proposed Action, is the least restrictive alternative although it has standards and PDFs in place that minimize impacts to wildlife. It treats the same number of acres as Alternatives C and D, however does it more efficiently because it offers a wider choice of treatment methods, which translates into being less expensive to complete. None of the alternatives would aerial spray in the modeled potential upland sandpiper habitat. Alternative C currently has only approximately 57 acres in riparian habitat that would be chemically treated so whatever way it was treated either broadcast or manually it wouldn't have a large impact in relation to the other alternatives and their impacts to upland sandpiper habitat or forage species.

Summary of Effects to Upland Sandpiper and Determination of Effects

Upland sandpipers nest in open, short-grass habitat. They are suspected to occur on the Umatilla National Forest. The cryptic nests of upland sandpipers are susceptible to crushing or trampling by people or vehicles. If they 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. Due to the low likelihood of this sandpiper being present in the treatment sites, actual risk to the birds is very low.

Using broad-scale analysis approximately 3 percent (617 acres) of the potential 20,025 acres cof upland sandpiper habitat contain invasive plants. Upland sandpipers eat insects so the risk from herbicide and NPE-based surfactants has potential impacts. Adverse effects cannot be ruled out for glyphosate at high application rates or NPE at typical and high rates. Data is insufficient to distinguish between alternatives the likelihood or magnitude of this potential effect. Due to the low likelihood of this sandpiper being present in the treatment sites, actual risk to the birds is very low.

Currently there are no known upland sandpipers on the Forest, so there would be "no impact" to the species due to invasive plant treatments under any of the alternatives considered. However, if upland sandpipers are detected in the future, the analysis shows that under any of the alternatives, though the chances are very low, invasive plant treatment methods **"may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species"** to upland sandpipers.

Cumulative Effects

Since the herbicides selected do not pose a risk from bioaccumulation or a long residual effect there are not anticipated cumulative effects from either projects on or off of the Forest. The cumulative effects described within the bald eagle portion of this document would also apply to the upland sandpiper.

Effects to Gray Flycatcher

Effects Common to All Alternatives

Gray flycatchers are insectivorous birds and could be exposed to herbicides by consuming contaminated insects. It does not nest in close proximity to the ground and is not sensitive to the short-term disturbance that most invasive plant treatments would create. 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 upland sandpiper. Only glyphosate applied at high application rate and NPE-based surfactant applied at high and typical rates resulted in a dose that exceeded the NOAEL. Glyphosate is unlikely to be sprayed at high application rates

The exposure scenarios for insectivorous birds indicate that only NPE doses would exceed a threshold of concern. In order to receive this dose, the birds would have to feed exclusively on contaminated insects for an entire day's feeding. Gray flycatchers catch their flying insect prey high in the air, launching from a high perch in a snag or tree. Proposed broadcast spraying is along infested roadsides and the infestations occur in patches rather than long solid infestations. The patchy nature of proposed invasive plant treatments would make it unlikely for a single flycatcher to feed exclusively on insects from treated patches. While some of their insect prey may become contaminated by broadcast spraying, it seems unlikely that they would forage exclusively on contaminated insects. Therefore, adverse effects to gray flycatchers are unlikely.

Treatment and Restoration

Methods used to treat invasive plants and restore habitat could impact gray flycatchers. The general effects of each non-herbicidal method to wildlife are discussed previously in this chapter and PDFs were developed specifically to minimize impacts. The potential effects from herbicides are discussed later in this appendix. All treatment methods that result in improved habitat for potential gray flycatcher habitat and their prey species will provide a long-term benefit.

Manual and Mechanical Methods

Potential effects of invasive plant treatment methods on gray flycatcher are limited and mainly associated with disturbance and the affects of eating contaminated insects. Direct effects from invasive plant treatments include disturbance caused by noise, people and vehicles. Although it is unlikely, if a gray flycatcher were to be nesting or foraging in the immediate vicinity of a treatment, they would likely be temporarily displaced.

Biological Control

There is no indication that any biological controls would adversely affect the cover or forage of prey for the gray flycatcher. Biological controls that reduce invasive plant populations, increase native plant populations, and provide a supplemental food source are indirectly beneficial to gray flycatcher. However, any biological control agents that affected native plant species could adversely affect insects that gray flycatchers feed on.

Herbicides

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. However, NPE-based surfactants exceeded the dose of concern for insectivorous birds at typical application rates. Contamination from NPE-based surfactants of an entire day's diet of invertebrates seems unlikely for the following reasons: 1) gray flycatchers are not known to forage within areas dominated by invasive plants, and, 2) the presence and movement of applicators is likely to scare off some invertebrates. 3) NPE-based surfactants exceeded the dose of concern for insectivorous birds at both typical and highest application rates. Gray flycatchers do not nest or generally feed in close proximity to the ground, which is where invasive plants are found.

Some treatment areas may overlap nesting habitat. These treatment areas propose possible use of hand pulling and use of glyphosate, triclopyr, clopyralid imazapic, chlorsulfuron, and metsulfuron methyl applied by spot spray only. Available data suggests that adverse effects to insectivorous birds are not plausible for imazapic, chlorsulfuron, and metsulfuron methyl. The worst cast scenario analysis indicates that insectivorous birds could be at risk of adverse effects from NPE surfactant for acute exposures at typical application rates. Data is insufficient to assess risk from clopyralid and NPE for chronic exposures. At highest application rates, insectivorous birds are at risk of adverse effects from glyphosate, triclopyr, and NPE in acute exposures. Data are insufficient to assess risk from clopyralid, glyphosate, triclopyr, and NPE for chronic exposures at high application rates. However, the worst case scenario is based on consuming nothing but contaminated insects for an entire day. This scenario is more likely for a large broadcast spray operation that would encompass the nesting bird's territory. Given the directed spot spray application proposed on these sites for all alternatives, it is much less likely that gray flycatchers would consume only insects that had been contaminated by spot spray of targeted invasive plants. These flycatchers often eat flying insects, which are less likely to be inadvertently sprayed by a person conducting a spot spray application. Exposure to some herbicide or NPE cannot be ruled out; however, it is unlikely that gray flycatchers would be exposed to enough herbicide or NPE to cause an adverse effect. Any exposure that did occur would be limited to the individual birds whose territory included the specific patches of treated plants. Therefore, for all action alternatives, the proposed treatments may impact individuals but would not lead to a trend toward federal listing.

Early Detection Rapid Response

The analysis is the same for the EDRR. It is not expected that there would be any additional impacts other than more sites treated. The herbicides do not bioaccummulate. The No Action alternative (Alternative A), does not include EDRR. The short-term impacts of the treatments would not outweigh the long-term benefit of retaining habitat for gray flycatcher and their prey species. Effects, if any, are expected to be negligible.

Differences between Alternatives

There is very little difference between alternatives for the gray flycatcher. Alternative A would treat less acres and does not include EDRR so would be less effective than any of the action alternatives considered. Alternative B, the Proposed Action, is the least restrictive alternative although it has standards and PDFs in places that minimize impacts to wildlife. It treats the same number of acres as Alternatives C and D, however does it more efficiently because it offers a wider selection of treatment methods, which translates into cost making Alternative B less expensive to complete. Alternatives B and C propose aerial spraying approximately 60 acres in potential gray flycatcher habitat. The impacts from aerial spraying are minimized by the herbicides which can be used, as well as the standards and PDFs incorporated in this document. Impacts would be the same as discussed above. If further acres added through EDRR, the impacts would remain the same. Alternative C currently has only approximately 404 acres in riparian habitat. These acres would not be broadcast sprayed but would still be treated by hand spraying or stem injection for example. Potential disturbance may be for a longer period of time since plants would be treated individually but the long-term benefits from treatment would still benefit habitat over time. Gray flycatchers are not associated with riparian areas, so the differences in alternatives will not produce any notable differences in potential effects to the gray flycatcher.

Summary of Effects to Gray Flycatcher and Determination of Effects

There have been a couple of sightings of gray flycatchers on the Pomeroy Ranger District though no nests have been documented. Since gray flycatchers are difficult to distinguish from the dusky flycatcher they may be more widespread than is currently recognized. Broad-scale mapping shows approximately two percent of their potential habitat infested with invasive plant species. The analysis shows that the alternatives, though the probability is low, could impact gray flycatchers. Therefore, the invasive plant treatments **"may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species"** for gray flycatchers.

Cumulative Effects

Since the herbicides selected do not pose a risk from bioaccumulation or a long residual effect there are not anticipated cumulative effects from either projects on or off of the Forest. The cumulative effects described within the bald eagle portion of this document would also apply to the gray flycatcher.

Effects to Northern Leopard Frog

Effects Common to All Alternatives

The northern leopard frog is only suspected to occur on the Umatilla National Forest. The PDF would avoid broadcast spraying of herbicides, and avoid spot spraying of glyphosate with POEA surfactant, sulfometuron methyl, and NPE-based surfactants, within 100 feet of occupied or suitable leopard frog habitat. The PDF also requires the coordination of the treatment methods, timing, and location with the local Biologist. Sites may require surveys prior to application.

Treatment and Restoration

Potential effects of invasive plant treatment and restoration methods leopard frogs are mainly associated with disturbance, effects to their skin and absorption through the skin, and the potential affects of specific herbicides on their prey. Direct effects from invasive plant treatment include disturbance caused by noise, people and vehicles. Since no emergent vegetation is proposed for treatment under this plan, it is unlikely these species will be in the immediate vicinity of treatment; however they could be temporarily displaced by workers in the area.

Manual and Mechanical Methods

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 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 and they tend to jump back into the water whenever they detect disturbance close by. Disturbance in close proximity to amphibians would likely be for a longer duration with Alternative C since the plants would be treated individually rather than by broadcast treatment in the riparian areas. However, potential disturbance would occur with all alternatives. All treatment methods that result in improved habitat for amphibians and their prey will provide a long-term benefit.

Biological Control

There is no indication that any biological controls would adversely affect the cover or forage for this frog species. Biological controls cannot affect amphibians directly, because they only act on invasive plants.

Herbicides

Data on herbicide effects to amphibians is limited. Appendix P of the R6 2005 FEIS summarized available data on the effects of herbicides to amphibians and this discussion is incorporated by reference. Several studies have found that amphibians are less sensitive, or about as sensitive, as fish to some herbicides (Berrill et al. 1994; Berrill et al. 1997; Perkins et al. 2000). As stated previously, 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®.

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 LC50 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).

At 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 lethal doses.

Sufficient data are available for toxicity of sulfometuron methyl to allow quantitative estimates of exposure and risk. Data is limited to that generated by studies on *Xenopus*, 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.

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 the restriction is a standard in the LRMP. 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 higher application rates, tadpole responsiveness could be reduced. These concentrations 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.

In summary, adverse effects to amphibians are only likely from glyphosate with POEA and triclopyr applied at high rates, which will not happen because treatments will occur according to the PDFs that prohibit high application rates.

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).

This is well below the levels reported to cause concerns dicussed above. 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 (Bakke 2003). However, overspray or accidental spills could produce concentrations of NP9E that could adversely affect amphibians, particularly in small stagnant ponds.

Early Detection Rapid Response

The impacts of EDRR for this frog would be the same as those discussed above. The No Action alternative (Alternative A), does not include EDRR. The short-term impacts of the treatments would be outweighed by the long-term benefit of retaining habitat for leopard frogs.

Differences between Alternatives

Alternative A (No Action): Invasive plants sites are not delineated in leopard frog habitat under this alternative. The existing infestations in leopard frog habitat are not part of the current projects included in the No Action Alternative. Existing leopard frog populations would not be affected by manual, mechanical, or herbicide treatments. Alternative A is the least effective for improving habitat for this frog species since it does not treat in frog habitat does not incorporate EDRR.

Alternative B (Proposed Action): No emergent vegetation would be treated under any of the action alternatives considered in this EIS, which reduces the amount of herbicide that could come in contact with water. Glyphosate isopropylamine (IPA), RoundUp and POEA surfactant used in RoundUp have been specifically tested for ability to cause malformations in the frog embryo teratogenesis assay using Xenopus (Perkins et al. 2000). Xenopus is a highly sensitive assay species for determining the teratogenicity of chemicals (Mann and Bidwell 2000, Perkins et al. 2000). No increases in malformations were noted at levels that were not also lethal to the embryos. The 96-hour LC50 for glyphosate IPA was 7297 mg a.e./L. Formulations containing surfactant are known to have much higher toxicity to amphibians than glyphosate. RoundUp formulation containing POEA surfactant was 700 times mores toxic than glyphosate IPA (See Appendix D – Herbicide Effects to Wildlife, for glyphosate). The Forest Service does not use the formulation used in the Smith study; however, potential effects to spotted frogs from glyphosate cannot be ruled out. To further minimize frog exposure a PDF was developed that prohibits broadcast spraying of herbicides, as well as spot spraying of glyphosate with POEA surfactant, sulfometuron methyl, and NPE-based surfactants within 100 feet of occupied or suitable spotted or leopard frog habitat. In addition, treatment methods, timing, and location would be coordinated with local Biologists. With all of this protection in place, it is very unlikely that glyphosate will enter the water adjacent to treatment areas.

Adults could also be dermally exposed to glyphosate if they were to move through treated vegetation; however invasive plants have not been identified at any of the known spotted frog sites. It is, therefore, unlikely that frogs would be exposed to herbicides in this way.

Buffers established for use of triclopyr (see Aquatic Species section) would be effective at avoiding adverse effects from exposure to triclopyr BEE. The restriction on broadcast spray of any triclopyr would also greatly reduce potential adverse effects from triclopyr TEA and TCP. Some exposure could occur with spot and selective applications; these exposures are likely to be much less than that modeled in the “worst case scenario.” There would be no aerial spraying within amphibian habitat.

Alternative C: The use of triclopyr is prohibited within 300XX feet of perennial streams, lakes, and ponds. No adverse effects to leopard frogs would occur from triclopyr or TCP exposure. No herbicide at all is permitted within intermittent stream channels or within 10 feet of perennial streams, lakes, or ponds. This would reduce, but may not eliminate, exposure to glyphosate or other herbicides. Because glyphosate is strongly adsorbed to soil, runoff or percolation of glyphosate through the buffer and into water is unlikely. Eggs and tadpoles are unlikely to be exposed to glyphosate. Leopard frogs may be exposed to other herbicides, but available data suggests that adverse effects are unlikely.

Adults could still be dermally exposed to glyphosate as they move outside the buffers through treated vegetation. There is insufficient data to quantify dose received from dermal exposure to contaminated vegetation. It is assumed there is the potential that this type of exposure could result in adverse effects.

Alternative D: There would be no aerial spraying within close proximity to amphibian habitat under any of the alternatives since PDFs would be adhered to under all alternatives so Alternative D would have the same effects as Alternative B for leopard frogs.

Summary of Effects to Leopard Frog and the Determination of Effects

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 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 more likely in Alternative C due to increased use of manual and mechanical techniques. All treatment methods that result in improved habitat for frogs and their prey will provide a long-term benefit.

No emergent vegetation would be treated under any of the action alternatives considered in this EIS, which reduces the amount of herbicide that could come in contact with water. Glyphosate isopropylamine (IPA), RoundUp and POEA surfactant used in RoundUp have been specifically tested for ability to cause malformations in the frog embryo teratogenesis assay using Xenopus (Perkins et al. 2000). Xenopus is a highly sensitive assay species for determining the teratogenicity of chemicals (Mann and Bidwell 2000, Perkins et al. 2000). No increases in malformations were noted at levels that were not also lethal to the embryos. The 96-hour LC50 for glyphosate IPA was 7297 mg a.e./L. Formulations containing surfactant are known to have much higher toxicity to amphibians than glyphosate. RoundUp formulation containing POEA surfactant was 700 times mores toxic than glyphosate IPA (See Appendix D – Herbicide Effects to Wildlife, for glyphosate). The Forest Service does not use the formulation used in the Smith study; however, potential effects to spotted frogs from glyphosate cannot be ruled out. To further minimize frog exposure a PDF was developed that prohibits broadcast spraying of herbicides, as well as spot spraying of glyphosate with POEA surfactant, sulfometuron methyl, and NPE-based surfactants within 100 feet of occupied or suitable spotted or leopard frog habitat. In addition, treatment methods, timing, and location would be coordinated with local Biologists. With all of this protection in place, it is very unlikely that glyphosate will enter the water adjacent to treatment areas.

Adults could also be dermally exposed to glyphosate if they were to move through treated vegetation; however invasive plants have not been identified at any of the known spotted frog sites. It is, therefore, unlikely that frogs would be exposed to herbicides in this way.

Buffers established for use of triclopyr (see Aquatic Species section) would be effective at avoiding adverse effects from exposure to triclopyr BEE. The restriction on broadcast spray of any triclopyr would also greatly reduce potential adverse effects from triclopyr TEA and TCP. Some exposure could occur with spot and selective applications; these exposures are likely to be much less than that modeled in the “worst case scenario.”

No herbicide is permitted within intermittent stream channels or within 10 feet of perennial streams, lakes, or ponds. This would reduce, but may not eliminate, exposure to glyphosate or other herbicides. Because glyphosate is strongly adsorbed to soil, runoff or percolation of glyphosate through the buffer and into water is unlikely. Eggs and tadpoles are unlikely to be exposed to glyphosate. Leopard frogs may be exposed to other herbicides, but available data suggests that adverse effects are unlikely.

Currently no population of leopard frogs are known to exist on the Forest so there would be no impact to leopard frogs from any of the treatments described above. However, the analysis shows that under any of the alternatives, though the probability is low, treatments could impact spotted frogs. Therefore, the invasive plant treatments **“may impact individuals or habitat, but will not**

likely contribute to a trend towards federal listing or cause a loss of viability to the population or species" for spotted frogs and if leopard frogs become established on the Forest in the future, they could be impacted as well.

Cumulative Effects

Since the herbicides selected do not pose a risk from bioaccumulation or a long residual effect there are not anticipated cumulative effects from either projects on or off of the Forest. The cumulative effects described within the bald eagle portion of this document would also apply to the leopard frog.

Effects to Painted Turtle

Effects Common to All Alternatives

Very little research has been done on the effects of herbicides to reptiles. It is assumed therefore that the effects would be similar to other aquatic organisms such as fish (See Aquatic Organisms and Habitat in the EIS).

Painted turtles have not been documented on the Umatilla National Forest. Invasive plants impact a small percentage of potential painted turtle habitat within the Project Area. The objectives of the proposed treatments will restore and maintain turtle habitat. The PDF requires coordination with either the Oregon or Washington Department of Fish and Wildlife on the timing, methods, and locations of proposed treatments, if a population of painted turtles is found. Because any located painted turtle site would be monitored prior to treatment, the PDF is expected to be very effective at minimizing adverse impacts from herbicide exposure, manual, and mechanical treatment methods to painted turtles.

Since currently painted turtles are not known to occupy the Project Area, none of the alternatives will impact individuals. If in the future painted turtles occupy the Project Area, due to the effectiveness of the PDF, painted turtles and their habitat should be protected and their habitat enhanced where invasive plants occupy the site and are treated.

Treatment and Restoration

Methods used to treat invasive plants or restore prey habitat may have an affect on painted turtle. Potential effects of invasive plant treatment methods on painted turtle habitat are mainly associated with disturbance. Direct effects from invasive plant treatment include disturbance caused by noise, people and vehicles. There is the possibility turtles could be trampled or crushed or directly sprayed or exposed to herbicide. However, this is very unlikely because they haven't been detected on the Forest and also because if the turtles weren't in the water, sunning themselves adjacent to the water, they would likely be burrowed in somewhere or hidden. Restoration work could cause similar temporary disturbance as well. Due to standards and PDFs no potential painted turtle habitat would be aerial sprayed. Any invasive plant sites in potential turtle habitat would likely be spot sprayed or manually treated.

Manual and Mechanical Methods

The general effects of each non-herbicidal method to wildlife are discussed previously in this chapter and PDFs were developed to limit impacts. The potential effects from herbicides are discussed later in this Appendix. Treatment methods that result in improved habitat for painted turtle, even if there are short-term negative impacts, will provide a long-term benefit.

Biological Control

There is no indication that any biological controls would adversely affect the potential cover or forage for the painted turtle. Biological controls cannot affect painted turtle directly, because they only act on invasive plants.

Herbicides

There is almost no data available regarding the toxicity of herbicides to reptiles. In a review of pesticide effects to reptiles, Pauli and Money (2000) found very few studies, despite publications stating the need for such research dating back to Hall (1980). The only information available for herbicides included in the appendix of this EIS is from two reports concerning 2,4-D. One study investigated the effects of 2,4-D on alligators (Crain et al. 1997, as cited by SERA 1998), and Willemsen and Hailey (1989, cited by Pauli and Money 2000) noted adverse effects to tortoises in Greece after application of 2,4,5-T and 2,4-D. Pauli and Money (2000) concluded, "it is remarkable that no data appear to exist concerning the effects on reptiles of field applications of… modern herbicides (e.g., glyphosate, sulfonylureas)…" Hall and Henry (1992) stated, "Susceptibility of reptiles to selective pesticides is virtually unknown."

Hall and Clark (1982) found that the green anole lizard *(Anolis carolinenesis*) had a similar sensitivity as mallards and rats to organophosphates. Conversely, reptiles were reported to be more sensitive to some pesticides than birds or mammals (Rudd and Genelly 1956, as cited in Hall 1980). Hall (1980) stated that reptiles are apparently less sensitive than fish. The FS/SERA risk assessments use amphibians and/or fish as surrogates for reptiles. An assumption is made that exposures and doses that are protective of amphibians and fish would also be protective of reptiles. Amphibians and fish have very permeable skin, more so than reptiles, so they are more likely to absorb contaminants from their environment. And their complicated life cycle that includes metamorphosis makes amphibians sensitive indicators for environmental effects (Cowman and Mazanti 2000). However, the lack of data from reptiles leads to substantial uncertainty in the risk assessment for reptiles, since the response of these animals to doses of herbicide is not known.

Many reptile species would likely be under some cover during the day, when herbicides may be applied. But diurnal reptiles, like lizards, could conceivably be sprayed during applications. Nocturnal and diurnal reptiles could be exposed through contact with contaminated vegetation and soil or ingestion of contaminated prey. Contaminated water or prey could expose aquatic reptiles, but direct spray is not likely. The actual likelihood of exposing painted turtles depends on the application method, size of treatment area, habitat treated, and season of application. At this time no painted turtles would be affected since they do not inhabit the Forest, very limited habitat would be treated under the action alternatives.

Early Detection Rapid Response

The impacts of EDRR for these painted turtle would be the same as those discussed above. The No Action alternative (Alternative A), does not include EDRR. The short-term potential adverse impacts of the treatments would be largely offset by the long-term benefit of protecting painted turtle habitat from loss due to invasive plants.

Differences between Alternatives

Currently painted turtles are not known to inhabit the Forest so there would be no impact to painted turtles. The discussion below is only if they were to be found on the Forest in the future, which is doubtful.

Alternative A (No Action) would have no direct impacts to the painted turtle. There are no known turtle locations or habitat where the previously approved invasive treatment sites occur. This alternative is the least effective in its ability to retain potential painted turtle habitat since it does not incorporate EDRR measures into the approved plan, it also has the ability to use only two approved herbicides. Alternative A, would not be responsive to new invasive species infestations and would the least effective in restoring or enhancing painted turtle habitat.

The action alternatives have no treatment sites adjacent to known locations for the painted turtle. There are no known locations and no anticipated impacts to turtles on the Forest. If there were, PDF F-3 that restricts treatments near water systems and PDF J-5a would effectively eliminate the risk to the turtles.

Alternative C would utilize either spot spraying or manual and mechanical techniques within riparian areas (no broadcast spray), so there is potentially a slight increased risk of crushing or disturbance from spot spraying, manual or mechanical techniques relative to Alternatives B or D. The PDFs are expected to be very effective at minimizing adverse impacts from manual and mechanical techniques to pond turtles if they are discovered on the Forest. Alternative D and B would have the same impacts to the painted turtle since there would be no aerial spraying within turtle habitat in either alternative. The action alternatives may adversely impact individuals, but is not likely to lead to a trend toward federal listing.

Summary of Effects to Painted Turtle and Determination of Effects

See the “Differences between Alternatives” section directly above. Currently there are no painted turtles on the Forest so there would be no impact to turtles. If painted turtle are located on the Forest, there is a negligible potential for impacts to turtles, their populations or their habitat. By restricting herbicide use within 100 feet of a body of water, there should be very little chance of exposure to the turtles. The run-off that occurs should not raise concentrations to a level that would have toxic effects on the turtles. Currently, there are no planned treatments adjacent to ponds occupied by turtles. The EDRR would take into account the turtle locations and would take measures to avoid impacts to the turtles. The PDFs are expected to be very effective at minimizing adverse impacts from manual and mechanical techniques to pond turtles if they are discovered on the Forest. If pond turtles are eventually discovered on the Forest, the each or the alternatives analyzed “**may adversely impact individuals, but is not likely to lead to a trend toward federal listing.”**

Cumulative Effects

There are no known painted turtles on the Forest so there can not be any cumulative effects to the turtle. Currently, there are no past, present, or foreseeable future actions within the area where potential turtle habitat occurs that is predicted to noticeably impact their habitat.

Effects to Striped Whipsnake

Effects Common to All Alternatives

The striped whipsnake has not been documented on the Forest. The broad-scale habitat model developed for this snake showed about 3,825 acres of potential habitat or about 2 percent of its potential habitat containing invasive plant species. Striped whipsnake may be adversely affected by machinery, but are mobile and may escape in some cases. There is no data available on effects of herbicides to reptiles, but since they are often under shrubs, leaf litter, rocks or other objects, it appears that they are not likely to be exposed to direct sprays. Some indirect exposure to contaminated soil or vegetation could occur. The differences between the alternatives do not reduce herbicide exposure or risk of injury from mechanical equipment, so there is no difference in potential effects regardless of alternative chosen.

Treatment and Restoration

Potential effects of invasive plant treatment methods on striped whipsnake are associated with disturbance, possible crushing by machinery, herbicide exposure and the effects of eating contaminated prey. Direct effects from invasive plant treatment include disturbance caused by noise, people and vehicles. There is the possibility striped whipsnakes could be trampled or crushed or being directly sprayed or exposed to herbicide. However, this is very unlikely because they haven't been detected on the Forest and also because if the turtles weren't in the water, sunning themselves adjacent to the water, they would likely be burrowed in somewhere or hidden. Restoration work could cause similar temporary disturbance as well.

Manual and Mechanical Methods

Methods used to treat invasive plants or restore prey habitat may have an affect on painted turtle. The general effects of each non-herbicidal method to wildlife are discussed previously in this chapter and PDFs were developed to limit impacts. The potential effects from herbicides are discussed later in this appendix. All treatment methods that result in improved habitat for potential stiped whipsnakes, even if there are short-term negative impacts, will provide a long-term benefit.

Biological Control

There is no indication that any biological controls would adversely affect the potential cover or forage for the striped whipsnake. Biological controls cannot affect striped whipsnake directly, because they only act on invasive plants.

Herbicides

There is almost no data available regarding the toxicity of herbicides to reptiles. There is no specific data available for any of the herbicides approved for use under the 2005 Pacific Northwest Region Invasive Plant Program decision. However of the habitat modeled for potential striped whipsnake habitat only 2 percent of it contained invasive plants. The likelihood of negative impacts to striped whipsnakes or their habitat is extremely low. Striped whipsnakes could conceivably be sprayed during applications. They could be exposed through contact with contaminated vegetation and soil or ingestion of contaminated prey. Contaminated water or prey could expose the striped whipsnake to herbicides, but direct spray is not likely. The actual likelihood of expose depends on the application method, size of treatment area, habitat treated, and season of application.

Early Detection Rapid Response

EDRR would be utilized with any of the action alternatives. The impacts of EDRR for these striped whipsnake would be the same as those discussed above. The No Action Alternative (Alternative A), does not include EDRR.. The short-term impacts of the EDRR treatments would be outweighed by the long-term benefit of retaining habitat for striped whipsnake.

Differences between Alternative

Currently striped whipsnake are not known to inhabit the Forest so there would be no impact to them. The discussion is only if they were to be found on the Forest in the future, which is doubtful. The differences between the alternatives do not reduce herbicide exposure or risk of injury from mechanical equipment, so there is no difference in potential effects regardless of alternative chosen.

Alternative A is the least effective in its ability to retain potential striped whipsnake habitat since it does not incorporate EDRR measures into the approved plan, it also has the ability to use only two approved herbicides. Alternative A, no action, would not be responsive to new invasive. Alternatives B and C propose to serial spray approximately 20 acres of potential striped whipsnake habitat. The potential that aerial spraying would actually directly spray a striped whipsnake is extremely low.

Summary of Effects to Stripped Whipsnake and Determination of Effects

The striped whipsnake has not been documented on the Forest. The broad-scale habitat model developed for this snake showed about 3,825 acres of potential habitat or about 2 percent of its potential habitat containing invasive plant species. Striped whipsnake may be adversely affected by machinery, but are mobile and may escape in some cases. There is no data available on effects of herbicides to reptiles, but since they are often under shrubs, leaf litter, rocks or other objects, it appears that they are not likely to be exposed to direct sprays. Some indirect exposure to contaminated soil or vegetation could occur. The differences between the alternatives do not reduce herbicide exposure or risk of injury from mechanical equipment, so there is no difference in potential effects regardless of alternative chosen.

There will be “no impact” to striped whipsnake since they currently do not inhabit the Forest. If the striped whipsnake were discovered on the Forest, and treatment sites were within occupied whipsnake habitat, the alternatives may adversely impact individuals, but is not likely to lead to a trend toward federal listing.

Cumulative Effects

There are no known striped whipsnakes on the Forest so there are no cumulative effects.

Exposure Groups for Forest Service Sensitive Wildlife

Since exposure data do not exist for most individual wildlife species in the Region, the Forest Service Sensitive wildlife species evaluated in this EIS were placed into exposure groups of similar relationship, body size, and food habits. Table 2 lists the exposure groups, the exposure scenarios and the members of each group used for this analysis. Exposure scenarios are described in Chapter 3.3.4 of the EIS - Invasive Plants Treatment Methods Effects to Wildlife.

Table 2 - Exposure groups, exposure scenarios, and species included in each group. Grouping various wildlife species facilitates calculation of estimated exposures to herbicides.

Exposure Group	Exposure Scenarios	Species Included**
Large Herbivore – Mammal	Consumption of 100% contaminated grass	Rocky Mountain bighorn sheep
Small Herbivore – Mammal	Consumption of 100% contaminated leaves and leafy vegetables Direct spray on 50% of body, complete absorption Consumption of water contaminated by an accidental spill.	(Western gray squirrel, pygmy rabbit, Western (Mazama) pocket gopher)*
Carnivore – Mammal	Consumption of an entire days diet of prey that has been directly sprayed on 50% of body surface	California wolverine, (Pacific fisher)
Sm. Insectivore – Mammal	Consumption of an entire day's diet of contaminated insects	(Pacific pallid bat, Townsend's big-eared bat, spotted bat, Pacific fringe-tailed bat, bats, Baird's shrews, Pacific shrews)
Herbivore – Bird	Consumption of 100% contaminated grass	(Western sage grouse1, sharp-tailed grouse, Columbian sharp-tailed grouse)
Insectivore – Bird	Consumption of an entire days diet of contaminated small insects using empirical relationships for residues in vegetation (no data available on concentrations of pesticides in insects)	gray flycatcher, green-tailed towhee, upland sandpiper,(black swift, ash-throated flycatcher, yellow-billed cuckoo, tricolored blackbird, bobolink, greater yellowlegs, yellow rail, bufflehead, harlequin duck)
Predatory Bird	Consumption of an entire day's diet of small mammal prey that has been directly sprayed	American peregrine falcon2, (northern goshawk, ferruginous hawk, great gray owl, greater sandhill crane)
Piscivorous Bird	Consumption of fish contaminated by an accidental spill	(common loon, Clark's grebe, eared grebe, red-necked grebe, horned grebe, least bittern)
Reptiles	None available. Information from literature is used.	striped whipsnake, painted turtle, (Sharptailed snake, California mountain kingsnake, common kingsnake, Northwestern pond turtle)
Amphibians	For sulfometuron methyl, used water concentrations from runoff and percolation estimates. For other herbicides, information from literature is used.	Columbia spotted frog, northern leopard frog, (California slender salamander, Oregon slender salamander, black salamander, Cope's giant salamander, Del Norte salamander, Larch Mountain salamander, Siskiyou Mountain salamander, Van Dyke's salamander, Cascade torrent salamander, Columbia torrent salamander, Olympic torrent salamander, southern torrent (seep) salamander, foothill yellow-legged frog, Oregon spotted frog)

* Sensitive wildlife species within parenthesis are not Umatilla National Forest sensitive species but are included as examples.
**Bolded sensitive species have either been documented or are suspected to occur on the Umatilla National Forest.
1 Most animals will eat more than one type of food. Species were placed in groups that represented the majority of their diet, or the type of diet that would pose the most risk.
2 No scenario is yet available for animals that feed primarily on birds, so exposures from mammal prey are used.

The general effects to wildlife from invasive plant treatments, and treatment and restoration standards are discussed above. For sensitive species, dose estimates for each exposure group were obtained from Forest Service/ SERA risk assessments or calculated in project file worksheets using the Forest Service/SERA exposure scenarios. The exposure estimates were then compared to wildlife toxicity indices. Results of exposure scenarios for birds and mammals are found below in Table 4 and Table 5.

When data is insufficient to estimate doses, information from literature is used to evaluate toxic effects. These doses and information from the literature are subsequently used to evaluate effects to the members of each exposure group in conjunction with diet, plausibility of exposure scenario, behavior, etc.

Scientific uncertainty exists in extrapolating laboratory data to specific species and wild conditions. Laboratory species, and soil/air conditions may not accurately reflect in situation scenarios. Herbicides considered in this EIS have had comparatively little testing and analysis for amphibians and virtually no data exists for reptiles found in the Region. Also, data is insufficient to evaluate effects to predatory birds that eat primarily birds (i.e. American peregrine falcon), and ducks feeding primarily on aquatic insects (i.e. Harlequin ducks and bufflehead which are not present on the Forest). All these species need to be evaluated at the site-specific scale to determine the likelihood of exposure.

Effects of the Alternatives on Sensitive Wildlife

The invasive plant treatments and restoration projects were designed to reduce or eliminate adverse effects to sensitive species, as required in Treatment and Restoration Standard 22 for all alternatives. However, short-term, minor adverse effects (See individual species discussions) could occur under any alternative from the herbicide treatment methods. And, there may be some instances where it is most prudent to conduct a project that has a short-term adverse effect in order to provide a long-term beneficial effect to the habitat

Table 4 and Table 5 display the different herbicides that may be used, with restrictions, in the action alternatives. The No Action Alternative, which continues treatment under the existing 1995 EA, is limited to, Glyphosate or Picloram. Dicamba was originally included in the list of approved herbicides for the 1995 EA, but was removed from use by the R6 ROD 2005. The exposure scenarios were compiled from the FS and SERA risk assessment in the *R6 Invasive Plant Species Program EIS* (USDA, 2005a and b).

Symbol meanings are as follows for Tables 3 and 4:

- -- Exposure scenario results in a dose below the toxicity index
- × •Exposure scenario results in a dose that exceeds the toxicity index

Table 3 - Exposure scenario results from FS/SERA risk assessments for mammals, birds, and honeybees using the typical application rate and upper residue rates

Animal/Scenario	Chlorsulfuron	Clopyralid	Glyphosate	Imazapic	Imazapyr	Metsulfuron methyl	Picloram	Sethoxydim	Sulfometuron methyl	Triclopyr	NPE Surfactant
ACUTE EXPOSURES											
Direct spray, bee	--	--	--	--	--	--	--	--	--	--	
Direct spray, sm. mammal	--	--	--	--	--	--	--	--	--	--	*
Consume Contaminated Vegetation											
small mammal	--	--	--	--	--	--	--	--	--	--	--
large mammal	--	--	--	--	--	--	--	--	--	--	*
large bird	--	--	--	--	--	--	--	--	--	*	*
Consume Contaminated Water											
Spill, sm. mammal	--	--	--	--	--	--	--	--	--	--	--
Consume Contaminated Insects											
small mammal	--	--	--	--	--	--	--	--	--	--	*
small bird	--	--	--	--	--	--	--	--	--	*	*
Consume Contaminated Prey											
carnivore (sm. mammal)	--	--	--	--	--	--	--	--	--	--	--
predatory bird (sm. mammal)	--	--	--	--	--	--	--	--	--	--	--
predatory bird (fish)	--	--	--	--	--	--	--	--	--	--	--
CHRONIC EXPOSURES											
Consume Contaminated Vegetation											
small mammal, on site	--	--	--	--	--	--	--	--	--	--	--
lg. mammal, on site	--	--	--	--	--	--	--	--	--	*	--
lg. bird, on site	--	--	--	--	--	--	--	--	--	*	--
Consume Contaminated Water											
small mammal	--	--	--	--	--	--	--	--	--	--	--
Consume Contaminated Insects#											
small mammal	--	**unk**	**--**	**--**	**--**	**--**	**unk**	**unk**	**unk**	**unk**	**unk**
small bird	--	**unk**	**unk**	**--**	**--**	**--**	**unk**	**unk**	**unk**	**unk**	**unk**
Consume Contaminated Prey											
carnivore (sm. mammal)#	--	--	--	--	--	--	--	--	--	*	--
predatory bird (sm. mammal)#	--	--	--	--	--	--	--	--	--	--	--
predatory bird (fish)	--	--	--	--	--	--	--	--	--	--	--

*****Includes scenario for direct spray of a rabbit-sized mammal.

Data is lacking regarding chronic exposures, so effects are assumed by comparing acute dose vs. chronic NOAEL, and will likely over-estimate actual risk.

unk – unknown; insufficient data to assess risk

Table 4 - Exposure scenario results from FS/SERA risk assessments for mammals, birds, and honeybees using the highest application rate and upper residue rates

Animal/Scenario	Chlorsulfuron	Clopyralid	Glyphosate	Imazapic	Imazapyr	Metsulfuron methyl	Picloram	Sethoxydim	Sulfometuron methyl	Triclopyr	NPE Surfactant
ACUTE EXPOSURES											
Direct spray, bee	--	--	♦	--	--	--	--	--	--	♦	
Direct spray, sm. mammal	--	--	--	--	--	--	--	--	--	--	♦
Consume Contaminated Vegetation											
small mammal	--	--	--	--	--	--	--	--	--	--	♦
large mammal	--	--	♦	--	--	--	--	--	--	♦	♦
large bird	--	--	--	--	--	--	--	--	--	♦	♦
Consume Contaminated Water											
Spill, sm. mammal	--	--	--	--	--	--	--	--	--	--	--
Consume Contaminated Insects											
small mammal	--	--	♦	--	--	--	♦	--	--	♦	♦
small bird	--	--	♦	--	--	--	--	--	--	♦	♦
Consume Contaminated Prey											
carnivore (sm. mammal)	--	--	--	--	--	--	--	--	--	--	--
predatory bird (sm. mammal)	--	--	--	--	--	--	--	--	--	--	♦
predatory bird (fish)	--	--	--	--	--	--	--	--	--	--	--
CHRONIC EXPOSURES											
Consume Contaminated Vegetation											
small mammal, on site	--	--	--	--	--	--	--	--	--	--	--
lg. mammal, on site	--	--	--	--	--	--	--	--	♦	♦	--
lg. bird, on site	--	♦	♦	--	--	--	--	♦	♦	♦	--
Consume Contaminated Water											
small mammal	--	--	--	--	--	--	--	--	--	--	--
Consume Contaminated Insects#											
small mammal	--	**unk**	**unk**	**--**	**--**	**--**	**unk**	**unk**	**unk**	**unk**	**unk**
small bird	--	**unk**	**unk**	**--**	**--**	**--**	**unk**	**unk**	**unk**	**unk**	**unk**
Consume Contaminated Prey											
carnivore (sm. mammal)#	--	--	--	--	--	--	--	--	--	♦	♦
predatory bird (sm. mammal)#	--	--	--	--	--	--	--	♦	--	♦	♦
predatory bird (fish)	--	--	--	--	--	--	--	--	--	--	--

•Includes scenario for direct spray of a rabbit-sized mammal
Data is lacking regarding chronic exposures, so effects are assumed by comparing acute dose vs. chronic NOAEL, which will likely over-estimate actual risk.
unk – unknown; insufficient data to assess risk

In terms of effects to sensitive species, there are no substantial differences between the different standards and PDFs in the alternatives or the alternatives as a whole. Therefore, the following table, Table 5, summarizes the potential effects to each sensitive species group.

Table 5 - Potential effects from invasive plant treatment methods to groups of sensitive species

Sensitive Species Group	Potential Effects	Determination
Large herbivorous mammal	Worst-case exposure exceeds toxicity index from ingesting forage that has glyphosate, picloram, sulfometuron methyl, triclopyr, or NPE surfactants if broadcast sprayed. Worst-case herbicide exposure is highly unlikely for non-selective herbicides; more likely for selective herbicides.	MINL* Bighorns utilize cheatgrass. Worst-case exposure can be reduced by project design (Standard 22).
Small herbivorous mammals	Mechanical treatments may reduce cover and increase incidence of cheatgrass in certain habitat. Worst-case exposure exceeds toxicity index from ingesting forage that has been sprayed with triclopyr, or NPE surfactants if broadcast sprayed. Worst-case herbicide exposure is highly unlikely for non-selective herbicides; much more likely for selective herbicides.	MINL. Invasive plants threaten habitat. Short-term adverse effects provide long-term benefit. Worst-case exposure can be reduced by project design (Standard 22).
Carnivorous mammals	Infrequent and short-term disturbance from treatment projects could affect wolverines during breeding season. Worst-case exposure exceeds toxicity index from ingesting prey that has been sprayed with triclopyr. Worst-case herbicide exposure is highly unlikely.	MINL. Invasive plants may degrade habitat for some prey. Short-term adverse effects provide long-term benefit. Worst-case exposure highly unlikely.
Insectivorous mammals	Mechanical treatments may reduce foraging areas over the short-term. Worst-case exposure exceeds toxicity index from ingesting prey that has been sprayed with clopyralid, glyphosate, picloram, sethoxydim, sulfometuron methyl, and triclopyr if broadcast sprayed. Worst-case herbicide exposure is highly unlikely for bats, somewhat more likely for shrews.	MINL. Little overlap between invasive plants and shrew habitat. Bats may forage over large areas, reducing exposure. Worst-case exposure can be reduced by project design (Standard 22).
Herbivorous birds	Mechanical treatments may reduce cover and increase incidence of cheatgrass within grouse habitat. Worst-case exposure exceeds toxicity index from ingesting forage that has been sprayed with clopyralid, glyphosate, picloram, sethoxydim, sulfometuron methyl, and triclopyr if broadcast sprayed. Worst-case herbicide exposure is highly unlikely for non-selective herbicides; much more likely for selective herbicides.	MINL. Invasive plants threaten habitat. Short-term adverse effects provide long-term benefit. Worst-case exposure can be reduced by project design (Standard 22).
Insectivorous birds	Manual and mechanical treatments could trample or harm eggs or young of ground or low-nesting species during the breeding season. Worst-case exposure exceeds toxicity index from ingesting prey that has been sprayed with clopyralid, glyphosate, picloram, sethoxydim, sulfometuron methyl, and triclopyr if broadcast sprayed. Worst-case herbicide exposure is likely for grassland species on large projects.	MINL. Invasive plants threaten habitat for some species. Short-term adverse effects provide long-term benefit. Worst-case exposure can be reduced by project design (Standard 22).
Predatory birds	Manual and mechanical treatments could disturb species during the nesting season or affect their prey base. Worst-case exposure exceeds toxicity index from ingesting prey that has been sprayed with sethoxydim, and triclopyr if broadcast sprayed. Worst-case herbicide exposure is unlikely except aerial spray of grasslands.	MINL. Invasive plants may alter habitat for prey. Short-term adverse effects provide long-term benefit. Worst-case exposure can be reduced by project design (Standard 22).

Sensitive Species Group	Potential Effects	Determination
Piscivorous birds	Manual and mechanical treatments could disturb species during the nesting season. Worst-case exposure does not exceed toxicity index for any herbicide.	MINL. Invasive plants can reduce or eliminate preferred nesting habitat. Short-term adverse effects provide long-term benefit.
Reptiles	Mechanical treatments could trample or harm individuals. Insufficient data to determine potential effects from herbicides.	MINL. Species have extensive distributions. Most adverse effects can be reduced by project design (Standard 22).
Amphibians	Applications or accidental spills of glyphosate or triclopyr, could harm or kill amphibians.	MINL. Little overlap between invasive plants and amphibian habitat, except for riparian weeds. Herbicide exposure can be reduced by project design (Standard 22).

* May Impact, Not likely to adversely impact

Tables 6 – 13 Herbicides

Table 6 – Herbicides Analyzed in the Region 6 Invasive Plants EIS

Chemical Name	Selectivity	Sample Trade Name
Chlorsulfuron	broad-leaf	Telar, Glean, Corsair
Clopyralid	broad-leaf	Transline, Stinger
Dicamba*	broad-leaf & woody	Vanquish, Banvel
Glyphosate	No	RoundUp, Rodeo, Accord, Aquamaster
Imazapic	some broad-leaf & some grasses	Plateau
Imazapyr	No	Arsenal, Chopper, Stalker, Habitat
Metsulfuron methyl	broad-leaf & woody	Escort
Picloram	broad-leaf & woody	Tordon
Sethoxydim	grasses	Poast
Sulfometuron methyl	No	Oust
Triclopyr	broad-leaf & woody	Garlon, Pathfinder, Remedy
2,4-D*	broad-leaf	Weedone, Weedar, Savage, “Weed ‘n Feed”
* Not selected in the 2005 Record of Decision. Not currently available for use on forests in R6.		

Table 7 – Application Rates

Table 7 - Herbicide and nonylphenol polyethoxylate application rates to be used to treat invasive plants, including the incidental rates of application of the impurity hexachlorobenzene

Herbicide	Typical Application Rate lb ai/ac*	Lowest Application Rate lb ai/ac	Highest Application Rate lb ai/ac
Chlorsulfuron	0.056	0.0059	0.25
Clopyralid	0.35	0.1	0.5
Dicamba	0.3	0.25	2
Glyphosate	2	0.5	7
Imazapic	0.13	0.031	0.19
Imazapyr	0.45	0.03	1.25
Metsulfuron Methyl	0.03	0.013	0.15
Picloram	0.35	0.1	1.0
Sethoxydim	0.3	0.094	0.38
Sulfometuron Methyl	0.045	0.03	0.38
Triclopyr	1.0	0.1	10
2,4-D	1.0	0.5	2.0
Nonylphenol Polyethoxylate	1.67	0.167	6.68
Hexachlorobenzene#	0.000004	0.0000024	0.000012

* pounds of active ingredient per acre

#These application rates reflect the incidental rates of application of the impurity hexachlorobenzene.

Source: USDA Forest Service 2003, SERA 1998, 2001, 2003

Umatilla National Forest Herbicide Spray Buffers

Aerial spraying will not be used in municipal watersheds or wilderness. There are no chemical emergent treatments proposed as part of this project.

Table 8 - Herbicide Use Buffers – Perennial and Wet Intermittent Streams - Proposed Action

Herbicide	Perennial and Wet Intermittent Stream			
	Aerial	Broadcast	Spot	Hand/ Select
Aquatic Labeled Herbicides				
Aquatic Glyphosate	300	100	Water's edge	Water's edge
Aquatic Triclopyr-TEA	None Allowed	None Allowed	15	Water's edge
Aquatic Imazapyr*	300	100	Water's edge	Water's edge
Low Risk to Aquatic Organisms				
Imazapic	200	100	15	Bankfull
Clopyralid	200	100	15	Bankfull
Metsulfuron Methyl	None Allowed	100	15	Bankfull
Moderate Risk to Aquatic Organisms				
Imazapyr	300	100	50	Bankfull
Sulfometuron Methyl	None Allowed	100	50	5
Chlorsulfuron	None Allowed	100	50	Bankfull
High Risk to Aquatic Organisms				
Triclopyr-BEE	None Allowed	None Allowed	150	150
Picloram	300	100	50	50
Sethoxydim	300	100	50	50
Glyphosate	300	100	50	50

Table 9 - Herbicide Use Buffers – Dry Intermittent Streams - Proposed Action (Alternative B)

Herbicide	Dry Intermittent Stream			
	Aerial	Broadcast	Spot	Hand/ Select
Aquatic Labeled Herbicides				
Aquatic Glyphosate	100	50	0	0
Aquatic Triclopyr-TEA	None Allowed	None Allowed	0	0
Aquatic Imazapyr*	100	50	0	0
Low Risk to Aquatic Organisms				
Imazapic	100	50	0	0
Clopyralid	100	50	0	0
Metsulfuron Methyl	None Allowed	50	0	0
Moderate Risk to Aquatic Organisms				

Herbicide	Dry Intermittent Stream			
	Aerial	Broadcast	Spot	Hand/ Select
Imazapyr	200	50	15	Bankfull
Sulfometuron Methyl	None Allowed	50	15	Bankfull
Chlorsulfuron	None Allowed	50	15	Bankfull
High Risk to Aquatic Organisms				
Triclopyr-BEE	None Allowed	None Allowed	150	150
Picloram	200	100	50	50
Sethoxydim	200	100	50	50
Glyphosate	200	100	50	50

Table 10 - Herbicide Use Buffers – Wetlands - Proposed Action (Alternative B)

Herbicide	Wetlands			
	Aerial	Broadcast	Spot	Hand/ Select
Aquatic Labeled Herbicides				
Aquatic Glyphosate	300	100**	Water's edge	Water's edge
Aquatic Triclopyr-TEA	None Allowed	None Allowed	15	Water's edge
Aquatic Imazapyr*	300	100**	Water's edge	Water's edge
Low Aquatic Hazard Rating				
Imazapic	200	100	15	Water's Edge
Clopyralid	200	100	15	Water's Edge
Metsulfuron Methyl	200	100	15	Water's Edge
Moderate Aquatic Hazard Rating				
Imazapyr	300	100	50	Water's Edge
Sulfometuron Methyl	None Allowed	100	50	Water's Edge
Chlorsulfuron	None Allowed	100	50	Water's Edge
Greater Aquatic Hazard Rating				
Triclopyr-BEE	None Allowed	None Allowed	150	150
Picloram	300	100	50	50
Sethoxydim	300	100	50	50
Glyphosate	300	100	50	50

*Aquatic Imazapyr (Habitat) may not be used until the risk assessment (currently underway) is completed for inert ingredients and additives.
** If wetland, pond or lake is dry, there is no buffer.

Table 11 – Toxicity Indices for Mammals

Table 11 - 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/kg1	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	NOAEL2	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	NOAEL3	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/kg4
Sethoxydim	Acute	NOAEL	160 mg/kg5	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
Triclopyr6	Acute	NOAEL	100 mg/kg	Rat	Malformed fetuses at 300 mg/kg
	Chronic7	NOAEL	0.5 mg/kg/day	Dog	Effect on kidney at 2.5 mg/kg/day
2,4-D	Acute	“non-lethal”	10 mg/kg	Rat & Dog	Effects on kidney, blood, and liver
	Chronic	NOAEL	1 mg/kg/day	Rat & Dog	Effects on kidney, blood, and liver at 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 Acute values are based on chronic values; if the dose does not cause an effect over a period of 21 weeks, it is reasonable to assume that it will not cause effects after one day of exposure (SERA 2004 Dicamba).

2 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.

3 The acute NOAEL of 24 mg/kg is very close to the chronic NOAEL, so chronic value is used for acute exposures as well.

4 USEPA/OPP 1998

5 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.

6 Triclopyr BEE and TEA have equal toxicities to mammals (SERA 2003a).

7 Value taken from Quast et al. 1976 as cited in SERA Triclopyr 2003. This represents an extremely conservative

approach, explained in more detail in the write up on triclopyr later in this document.

Source: SERA 1998, 2001, 2003, 2004 and USDA FS 2003.

Table 12 – Comparison Summary of Herbicides and NPE Surfactant

For Table 12, categories of the herbicides are simply relative to each other; all 10 of these herbicides are low risk compared to other herbicides, and especially when compared to other pesticides. The categories are based on various criteria. This is general information only and background data should be reviewed before making any conclusions or conducting any analysis regarding these herbicides or NPE-based surfactants.

Table 12 - Relative Comparison Summary of the 10 Herbicides and NPE Surfactant

Risk Rating	Aquatic[6]	Wildlife[7]	Worker Health[8]	Public Health[9]
LOWEST	clopyralid, imazapic, metsulfuron methyl, NPE-based surfactants	chlorsulfuron, clopyralid imazapic, imazapyr, metsulfuron methyl, sethoxydim	chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, sethoxydim, sulfometuron methyl	chlorsulfuron, metsulfuron methyl, sulfometuron methyl

[6] R6 2005 FEIS, Fisheries Biological Assessment
[7] R6 2005 FEIS, Appendix P, Summary of Herbicide Effects to Wildlife
[8] R6 2005 FEIS, Appendix Q, Human Health Risk Assessment
[9] ibid

Risk Rating	Aquatic[6]	Wildlife[7]	Worker Health[8]	Public Health[9]
MODERATE	chlorsulfuron, imazapyr, sulfometuron methyl	glyphosate, picloram	picloram, triclopyr	clopyralid, glyphosate, imazapic, imazapyr, picloram, sethoxydim, triclopyr
HIGHER	sethoxydim, glyphosate, picloram, triclopyr	triclopyr, NPE-based surfactants	NPE-based surfactants	NPE-based surfactants

Aquatics

LOWEST = Under GLEAMS parameters, the concentrations of herbicides in water did NOT exceed level of concern for fish.

MODERATE and HIGHER = some effect to plants, algae, or aquatic insects plausible.

Wildlife

LOWEST = Exposure scenarios result in doses below the toxicity indices for all acute exposures, even at highest application rates.

MODERATE = Exposure scenarios result in doses that exceed the toxicity indices for some acute exposures, but only at highest application rates.

HIGHER = Exposure scenarios result in doses that exceed the toxicity indices for some acute exposures at typical application rates. (Risk of chronic exposure is variable and depends on many factors, including life history of wildlife, and persistence and selectivity of herbicide. Most chronic exposure scenarios are highly unlikely.)

Worker Health: Based on backpack spray applications.

LOWEST = HQ less than 0.1

MODERATE = HQ less than 1.0 but greater than 0.

HIGHER = HQ > 1.0

Public Health:

Based on scenario of public drinking water from a small pond contaminated by an accidental spill of 200 gallons - HQ thresholds same as for WORKER Health

Table 13 – Exposure Scenarios

For Table 13 symbol meanings are as follows:

-- Exposure scenarios result in a dose below the toxicity index at both the typical and highest application rates.
★ Exposure scenarios result in a dose that exceeds the toxicity index at the typical and highest application rates.
♦ Exposure scenarios result in a dose that exceeds the toxicity index at the highest application rate only.

Table 13 - Summary of exposure scenario results for listed species

SPECIES	Chlorsulfuron	Clopyralid	Dicamba	Glyphosate	Imazapic	Imazapyr	Metsulfuron methyl	Picloram	Sethoxydim	Sulfometuron methyl	Triclopyr	2,4-D	NPE Surfactant
Grizzly Bear	--	--	♦	♦	--	--	--	--	--	♦	★	★	★
Gray Wolf	--	--	--	--	--	--	--	--	--	--	★1	★	♦
Canada Lynx	--	--	--	--	--	--	--	--	--	--	★1	★	♦
Woodland Caribou	--	--	♦	♦	--	--	--	--	--	♦	★	★	★
American Brown Pelican	--	--	--	--	--	--	--	--	--	--	--	--	--
Bald Eagle	--	--	--	--	--	--	--	--	--	--	--	--	--
No. Spotted Owl	--	--	--	--	--	--	--	--	♦1	--	♦1	★1	♦1
Marbled Murrelet	--	--	--	--	--	--	--	--	--	--	--	--	--
Snowy Plover	--	--	--	--	--	--	--	--	--	--	--	--	--
OSS butterfly2	--	--	--	♦	--	--	--	--	--	--	♦	★	?
Bliss R snail3	--	--	--	--	--	--	--	--	--	--	--	--	--

1 These scenarios exceed the toxicity index only for assumed chronic exposures, risks are actually unknown, but the chronic exposure scenarios are not plausible.

2 Based on exposure scenario calculations for honeybee

3 Based on water concentrations used to calculate exposure to fish, and information on toxicity to federally listed aquatic invertebrates from analysis used for the EIS.

Source: SERA 1998, 2001, 2003, 2004 and USDA FS 2003.

Summary of Herbicide Effects to Wildlife – Shawna Bautista

Summary of Herbicide Effects to Wildlife

DRAFT

Prepared by: Shawna L. Bautista, Wildlife Biologist, Invasive Plant EIS

US Forest Service, Region 6 Regional Office, Portland, OR

February 2005

U.S. Fish and Wildlife Servic

Summary of Herbicide Effects to Wildlife

This document is a summary of toxicity information presented in Forest Service Risk Assessments (SERA 1998, 2001, 2003) and some public literature. I summarized information found in the human health and ecological risk assessment sections of the risk assessments, and obtained literature published in peer-reviewed journals, from authors, and on the internet. I conducted the literature search primarily to verify figures in the risk assessments, or to find specific values - it was not a comprehensive search. Syracuse Environmental Research Associates (SERA) conducted very comprehensive searches of the literature when preparing the risk assessments, and also evaluated the research papers for quality of methods and analysis used.

Citation Method Used in This Document

Because a large number of risk assessments produced by SERA are the basis for this document, many of them were produced in the same year, and the inherent difficulty in accurately tracking citations designated by year and lower case letter (e.g. 2003a, 2003b, etc.), I have resorted to a different citation convention. For risk assessments produced by SERA, the author and year is followed by the chemical name analyzed in the cited risk assessment. For example, information taken from the glyphosate risk assessment produced by SERA in 2003 is cited as: (SERA 2003 Glyphosate). Hopefully, this will avoid confusion when the inevitable rearranging of information takes place during editing. Information in this report is taken from risk assessments produced by SERA unless otherwise noted.

Herbicides Analyzed

The herbicides included in this summary are those being analyzed in the Region 6 Invasive Plant Environmental Impact Statement (EIS) (Table 1). These herbicides or formulations are registered for use in forestry applications, right-of-ways, or rangelands and are appropriate for use against invasive plant species in Region 6 of the USDA Forest Service. The mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Table 1. Herbicides analyzed and some representative formulation names.

Chemical Name	Trade Name
Chlorsulfuron	Telar, Glean, Corsair
Clopyralid	Transline, Stinger
Dicamba	Banvel, Vanquish
Glyphosate	RoundUp, Rodeo, Accord
Imazapic	Plateau
Imazapyr	Arsenal, Chopper, Stalker
Metsulfuron methyl	Escort
Picloram	Tordon
Sethoxydim	Poast
Sulfometuron methyl	Oust
Triclopyr	Garlon, Pathfinder, Remedy
2,4-D	Weedone, Weedar, Savage

It is not feasible to evaluate specific effects to specific wildlife species at a regional scale. The effects of herbicide use must be evaluated at the site-specific scale before any projects involving herbicide use are authorized. However, it is useful to understand the general and relative risks that proposed herbicides pose to wildlife in the planning area.

The following discussion will provide information on all herbicides considered in the USDA Forest Service, Pacific Northwest Region, Invasive Plant EIS. Refer to the following text box for terms and concepts about potential effects of herbicides.

Terms and acronyms used in this document.

Allometric = pertaining to allometry, the study and measure of growth. In toxicology, the study of the relationship of body size to various processes that may impact how chemicals affect the organism or how the chemicals are transported within the organism.

bioconcentration = the net accumulation of a substance by an aquatic organism as a result of uptake directly from aqueous solution (i.e. water with other stuff mixed in).

bioaccumulation = the net accumulation of a substance by an organism as a result of uptake directly from all environmental sources and from all routes of exposure (primarily from food or water that is ingested).

dose = the actual quantity of a chemical administered to, or absorbed by, an organism.

gavage = a method of dose administration; the substance is placed directly in the stomach..

exposure = the amount of chemical in contact with an animal.

LD_{50} (lethal dose50) - The dose of a chemical calculated to cause death in 50% of a defined experimental animal population over a specified observation period. The observation period is typically 14 days.

LOAEL = Lowest-observed-adverse-effect level; lowest exposure associated with an adverse effect.

NOEL = No-observed-effect level; no effects attributable to treatment.

NOAEL =No-observed-adverse-effect level: An exposure level at which there are no statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control; some effects may be produced at this level, but they are not considered as adverse, or as precursors to adverse effects. In an experiment with several NOAELs, the regulatory focus is primarily on the highest one, leading to the common usage of the term NOAEL as the highest exposure without adverse effects.

NOEC = No-observed-effect concentration; synonymous with NOEL.

Surfactant = surface acting agent; any substance that when dissolved in water or an aqueous solution reduces its surface tension or the interfacial tension between it and another liquid.

Surrogate = a substitute; lab animals are substituted for humans or other wildlife in toxicity testing.

Toxicity index = in this document, it is the dose of herbicide used to determine the potential for an adverse effect to wildlife. It is the lowest dose reported to cause the most sensitive effect in the most sensitive species tested, and is usually a reported NOAEL for a sub-lethal effect, but may be an LD_{50} (or a portion thereof) when data is lacking.

a.e. = acid equivalent

a.i. = active ingredient

kg = kilogram, equivalent to 1000 grams or 2.2 pounds

g = gram, equivalent to 1000 milligrams or about 0.035 ounce (28 g = 1 ounce)

mg = milligram; 0.001 gram.

mg/L = milligrams per liter; equivalent to ppm.

mg/kg = milligrams per kilogram; equivalent to ppm.

ppm = part(s) per million; equivalent to mg/L and mg/kg.

ppb = part(s) per billion

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 Forest Service contracts with 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 EIS relies on these risk assessments. All toxicity data, exposure scenarios, and assessments of risk are based upon information in the SERA risk assessments unless otherwise noted. Typical application rates of herbicides and nonylphenol polyethoxylate (NPE) surfactant used in this analysis can be found in Table 2.

Table 2. Herbicide and nonylphenol polyethoxylate application rates used to treat invasive plants. Included are the incidental rates of application of the impurity hexachlorobenzene.

Herbicide	Typical Application Rate lb ai/ac*	Lowest Application Rate lb ai/ac	Highest Application Rate lb ai/ac
Chlorsulfuron	0.056	0.0059	0.25
Clopyralid	0.35	0.1	0.5
Dicamba	0.3	0.25	2
Glyphosate	2	0.5	7
Imazapic	0.13	0.031	0.19
Imazapyr	0.45	0.03	1.25
Metsulfuron Methyl	0.03	0.013	0.15
Picloram	0.35	0.13	1.0
Sethoxydim	0.3	0.094	0.38
Sulfometuron Methyl	0.045	0.03	0.38
Triclopyr	1.0	0.1	10
2,4-D	1.0	0.5	2.0
Nonylphenol Polyethoxylate	1.67	0.167	6.68

Hexachlorobenzene#	0.000004	0.0000024	0.000012

* pounds of active ingredient per acre

#These application rates reflect the incidental rates of application of the impurity hexachlorobenzene.

Source: USDA Forest Service 2003, SERA 1998, 2001, 2003

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. List 1 contains "inerts of toxicological concern"; List 2 contains "potentially toxic inerts, high priority for testing"; List 3 contains "inerts of unknown toxicity"; and List 4 contains "minimal risk inerts" or "inerts for which EPA has sufficient information to conclude that their current use patterns will not adversely affect public health or the environment." 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, compared to active ingredients.

Inert Ingredient Effects

There is very little data regarding the effects to most wildlife species from inert ingredients contained in the 12 herbicides considered in this EIS. 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/

Many of the inert ingredients are proprietary in nature and have not been tested on laboratory or wildlife species. 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. However, toxicity data to support any assessment of hazard or risk are usually very poor, even when the identity of the inert is known.

Chlorsulfuron – The identity of inerts used in chlorsulfuron are confidential, but SERA reviewed them for preparation of the risk assessment (SERA 2003 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 5

Dicamba – The identity of inerts used in Banvel® and Vanquish® are confidential, but SERA reviewed them for preparation of the risk assessment (SERA, 2003-Dicamba). EPA has not classified any of the inerts as toxic. A comparison of toxicity data on Banvel® with corresponding data on dicamba indicates that there are no substantial differences in terms of acute lethal potency (see SERA, 2003-Dicamba, p. 3-12). However, Banvel® causes severe skin irritation while the DMA salt of dicamba (the active ingredient in Banvel®) does not

(Budai et al., 1997; Kuhn, 1997, 1998 as cited in SERA, 2003-Dicamba). No similar studies are available for Vanquish®. But a formulation containing the active ingredient in Vanquish (IPA salt of dicamba) was found to have a lower acute lethal potency to bobwhite quail than other forms of dicamba (SERA, 2003-Dicamba citing Beavers 1986 and Campbell et al. 1993).

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, 2003-Imazapic). EPA has not classified any of the inerts as toxic.

Imazapyr – The identity of inerts used in imazapic formulations are confidential, but SERA reviewed them for preparation of the risk assessment (SERA, 2003-Imazapyr). No apparently hazardous materials were identified in the review of inerts. The NCAP website (http://www.pesticide.org/FOIA/picloram.html) identifies only glacial acetic acid, an approved food additive, 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 metsulfuron methyl formulations are confidential, but SERA reviewed them for preparation of the risk assessment (SERA, 2003-Metsulfuron methyl). EPA has not classified any of the inerts as toxic.

Picloram – The 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; 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. 6

Sulfometuron methyl - The identity of inerts used in Oust are confidential, but SERA reviewed them for preparation of the risk assessment (SERA, 2003-Sulfometuron). EPA has not classified any of the inerts 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.

2,4-D – There is no discussion of inert ingredients in the SERA risk assessment for 2,4-D. Identities of inerts contained in many formulations are available at the NCAP website (www.pesticide.org/FOIA/24d.html). Most inert ingredients identified are on EPA's List 3 or List 4 for inert ingredients and not identified as toxic. However, several formulations contain inerts that are on EPA's List 2; Potentially Toxic Inerts, High Priority for Testing. List 2 inerts in some 2,4-D formulations include:

- Antifoam 1400 (CAS # 1330-20-7)
- Xylene (CAS # 1330-20-7)
- Diethanolamine (CAS # 111-42-2)
- Petroleum solvent (CAS # 64742-94-5)
- Hydrogenated aliphatic solvent (CAS # 64742-47-8)
- Butoxyethanol (CAS # 11-76-2)

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.

Surfactant Effects

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, 2002) 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, p. 4-14). 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, p. 4-14).

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. The properties of the particular NPE depend upon the number of ethoxylate groups that are attached to the NP. The most common NPE used in surfactants with pesticides is a mixture that has, as a majority, 8-10 ethoxylate groups attached, and can be abbreviated NP9E. NP 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.

Potential effects of NPE were analyzed using exposure scenarios to quantitatively estimate the dose of NPE that birds and mammals may receive if they consumed contaminated vegetation or prey, or if a small mammal was directly sprayed. Each estimated dose was compared to toxicity levels reported from laboratory data and summarized in USDA FS 2003. Data is lacking on the toxic effects of NP or NPE to birds, with only the median lethal dose (LD_{50}) identified in the literature. Risk to birds is therefore evaluated using the toxicity values from mammals, which introduces additional uncertainty into the conclusions regarding birds. Data for terrestrial invertebrates is lacking or insufficient, so risks cannot be adequately characterized.

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 and birds at typical and high application rates (project file worksheets; USDA, FS 2003). The exposure scenarios and calculated doses used in the analysis represent worst-case scenarios and are not entirely plausible. At the typical application rate, adverse effects could occur to small mammals that may be directly sprayed, large mammals and large birds consuming contaminated vegetation, and small mammals and small birds consuming contaminated insects. At the highest application rate, adverse effects could occur to small mammals that may be directly sprayed, large or small mammals and large birds consuming contaminated vegetation, small mammals and small birds consuming contaminated insects, and a predatory bird consuming a small mammal that has been directly sprayed. No chronic exposures result in plausible risk to mammals or birds.

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 LC_{50} of 3.9 ppm (3.9 mg/L). Similar to studies with herbicides, the LC_{50} 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 EC_{50} values as low as 2.3 ppm, and reduced dissolved oxygen content in the water lowered the EC_{50} values by about half as compared to normal oxygen levels. The tadpoles recovered from the narcosis. Malformations in Xenopus occurred at EC_{50} 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.

Effects of Impurities

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, pp. 3-25). The use of picloram and clopyralid in remote forest locations could constitute the primary source of localized contamination however. 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). EGBE has been classified as moderately toxic by EPA. Borrecco and Neisess (1991) found that potential doses of EGBE to mammals were less than 0.001 of the lowest LD_{50} 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.

Metabolites

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. 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.

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.” 10

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, masculization), 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, and they are bioaccumulatory and present 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, masculization and feminization, undescended testicles, increased cancer rates, altered bone density and structure, and malformed fallopian female reproductive tract (Kubiak et al., 1989; Colborn and Clement, 1992; 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, 1981, 1991 (a, b); Fry and Toone, 1981; Fry et al., 1987; Giesyet et al., 1994; Gilbertson et al., 1991; Guillette et al., 1994, 1995; Kubiak et al., 1989; Mac and Edsall, 1991, 1993; Leatherland, 1993; Peakall and Fox, 1987; White and Hoffman, 1995; and Wren, 1991).

Of the chemicals analyzed in this DEIS, 2,4-D and 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). One study on glyphosate, Yousef et al. (1995), indicated that there may be some concerns with glyphosate, but the study was poorly conducted and results are not reliable.

Sulfometuron methyl can cause malformations in amphibians (SERA, 2003-Sulfometuron), but whether the malformations are caused by endocrine disruption, cellular toxicity, or other pathway has not been reported.

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. 11

Some of the herbicides analyzed in this document (e.g. 2,4-D and picloram) have been investigated for possible synergistic effects but the study designs were insufficient for the assessment of toxicologic interactions (SERA, 2003-Picloram; p. 3-35) However, data on this potential effect is incomplete and not likely to be obtained in the foreseeable future: the sheer number of potential combinations of contaminants, environmental stressors, and wildlife species make it unfeasible to investigate thoroughly.

USEPA (2000) 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. But statistically significant interactions (both syntergistic and antagonistic) have been noted in some studies. Unfortunately, even with excellent data, the uncertainties and complexities of chemical interactions create substantial uncertainty in the risk characterization for chemical mixtures (ATSDR, 2004; USEPA, 2000).

Effects of Active Ingredients and Surrogate Species

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. This leads to uncertainty in the risk assessment analysis. Environmental stressors can increase the adverse effects of contaminants, but the degree to which these effects may occur for various herbicides is largely unknown. 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 lethal doses, to determine the potential for doses to cause an "adverse effect" to wildlife.

FS/SERA risk assessments and published literature are the primary sources of information used to evaluate effects of herbicides to wildlife. First, we discuss field studies found in the published literature regarding potential effects of herbicide use to wildlife. Then, qualitative and quantitative information from the FS/SERA risk assessments and published literature regarding effects of active ingredients are discussed.

Toxicity Data and Exposure Analysis

The FS/SERA risk assessments present the toxicity data from studies conducted to meet EPA registration requirements and from published literature. In addition, exposure of various animals to herbicide is quantitatively estimated to characterize risk from the use of each herbicide.

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. Rare species are not tested and the physiological requirements for some organisms prohibit their use in toxicity testing because these requirements cannot be met within the test system. 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, unpublished. proposal, 2003).

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 terrestrial wildlife. This does not alleviate concerns over interspecies variations in response, however.

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 toxicity of the chemical is measured by laboratory tests required by EPA. The amount of chemical to which an animal may be exposed is influenced by several factors, discussed below. 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 some scenarios use the same value for exposure and dose. Also, different species have different susceptibilities to various chemicals. This is discussed more in the section on surrogates.

Factors that Influence Exposure and Dose

The exposure of an animal to an herbicide is greatly influenced by relationships between body size and several physiological, metabolic, and pharmacological processes (allometry). For example, allometric relationship dictates that animals of smaller size have a larger amount of surface area for their mass than larger animals. This relationship greatly influences basic physiological properties, such as food consumption and thermoregulation. Some of the allometric factors that influence exposure to herbicides are detailed below.

Body Weight

Several parameters used to estimate herbicide contact are reported on a “per body weight” basis, expressed in grams (g) or kilograms (kg). For example, both food and water ingestion rates are reported on a per body weight basis (such as gram of fresh food or water per gram of fresh body weight per day). Body weights, in units of mass, are reported as fresh weight that might be obtained by weighing a live animal in the field. Also, body weight data are used in empirical models to calculate some parameters, such as surface area, when there no specific measurements are available. Calculations of “potential dose to animal” use body weight of animals.

Metabolic Rate

Metabolic rate is not directly calculated in this document, or in the FS/SERA risk assessments, but reported values for various species are used to calculate food consumption requirements. It is reported on the basis of kilocalories per day for units of body weight (kcal/kg/day). Metabolic rate is closely related to body size, with smaller animals generally having higher metabolic rates than larger animals.

Contact Rate

Exposure involves direct contact with the herbicide, and wildlife may be exposed to herbicides by ingesting the chemical (oral) or by external contact (dermal). Oral exposures may occur from eating contaminated vegetation or prey, drinking contaminated water, or by grooming activities. Dermal exposures may occur from direct spray, or contact with contaminated vegetation or water. These contact routes are influenced by allometric relationships, as well as habitat preferences and feeding behaviors.

Oral Routes

Food ingestion: Small animals generally have higher caloric requirements than large animals, so a small animal ingests a greater amount of food per unit body weight compared to large animals. A

20g mouse, for example, will generally consume an amount of food equal to about 15 percent of its body weight every day, depending on calorie content of the diet. A value of 3.6 g of food consumed per day for a 20g mouse is used in the FS/SERA risk assessments for calculating exposure from contaminated food. This is equivalent to 18 percent of the body weight and is generated from general allometric relationships for food consumption in rodents (US EPA/ORD, 1993, p. 3-6, as cited in SERA, 2003-Glyphosate). This value may underestimate exposure to small mammals that consume primarily vegetation, rather than seeds (SERA, 2003a). Food consumption is calculated from caloric requirements for different sized animals for the various exposure scenarios in the FS/SERA risk assessments.

Dietary composition: Dietary composition is an important consideration in exposure assessments because different foods have varying herbicide residues. Grasses may have substantially higher residues than fruits or other vegetation (Kenaga, 1973; Fletcher et al. 1994; Pfleeger et al., 1996). The FS/SERA risk assessments use data from Siltanen et al. (1981) for concentrations on fruit. Also, small insects may contain higher residues than large insects, based on empirical relationships (Pfleeger et al., 1996). Some herbicides have the potential to bioaccumulate in fish; therefore fish-eating birds may be exposed. Caloric content of various foods, with caloric requirements of animals, is used to estimate daily amount of food consumed based on data from US EPA/ORD 1993 (as cited in SERA, 2003-Glyphosate). In the FS/SERA risk assessments, exposure scenarios use a large herbivore consuming 100 percent grass diet, a large bird consuming grass, a small bird consuming small insects, and a predatory bird consuming contaminated fish (SERA, 2003-Glyphosate, p. 4-14 to 4-15).

Water ingestion: There are well-established relationships between body weight and water consumption across a wide range of mammalian species. Mice, weighing about 20 g (0.02 kg) consume about 0.005 L of water/day (i.e. 0.25 L/kg/day). These values are used in the exposure scenarios for small mammals. Since the body size to volume relationship dictates that smaller animals will receive larger doses for a given exposure, consumption of contaminated water is not calculated for larger animals. Water ingestion is obviously influenced by environmental factors, such as heat and availability. But estimates for the variability in water consumption are not available for wildlife.

Grooming: Birds and mammals may spend a great deal of time grooming fur or feathers. If the animal has been exposed to herbicide, some chemical may be absorbed through the grooming process. However, a study by Gaines (1969, as cited in SERA, 2001) suggests that grooming is not significant in the toxic response of small mammals. At any rate, the doses received from grooming would be less than those received through contaminated food or direct spray, given the assumptions in the exposure scenarios. See dermal exposure route information below.

Dermal Route

Dermal contact can occur from direct spray or contact with contaminated vegetation or water. Since only a small portion of an applied herbicide would be available as dislodgeable residue on vegetation, or in a water body where it was diluted, dermal exposure is modeled only for direct spray scenarios in FS/SERA risk assessments. The extent of dermal contact for an animal depends on the application rate of the herbicide, the surface area of the animal, and the rate of absorption. Since a larger proportion of a small animal's body would be involved, relative to larger animals, direct spray scenarios are only conducted for a small mammal and a honeybee in FS/SERA risk assessment (SERA, 2001). Skin, fur and feathers provide some protection from chemicals, and not all of the chemical on an animal will be absorbed. Amphibians may be an exception, since their skin may be much more permeable than the skin of a mammal or bird. In this document, we assume that the skin affords no protection at all (e.g., 100 percent absorption). Scenarios with a different assumption regarding absorption may be found in the various FS/SERA risk assessments. The approach taken here (100 percent absorption) may account for multiple absorption pathways, such as dermal absorption plus that from grooming or preening. However, there is no quantitative data available regarding this assumption. The actual dose received after dermal exposure is also influenced by the specific herbicide considered since different herbicides have different dermal absorption rates and properties (SERA, 2001, section 3.9).

Summary of Exposure Scenarios

An exposure scenario was developed, and a quantitative estimate of dose received by the animal type in the scenario was calculated when enough data was available (SERA, 2001). While it is possible to model exposure in a very large number of non-target animals, highly species-specific exposure assessments are of little use in the absence of species specific dose-response data (SERA, 2001). The exposure assessment should not be more complicated than the dose-response assessment. Therefore, exposure scenarios used in this document are calculated when dose-response data for specific herbicides indicate that one group and/or size of animal may be more sensitive than others. For example, if data indicates that larger mammals may be more sensitive than smaller mammals, separate exposure scenarios have been developed for each. In the absence of such data, only exposures for small mammals may be calculated because they would receive the highest dose per kg body weight.

The exposure scenarios that are used in the Ecological Risk Assessments (SERA, 2001) and/or for this EIS (project file worksheets) are as follows:

Acute Exposures

20 g mammal: A mouse-sized mammal is directly sprayed over 50 percent of body surface area and 100 percent absorption occurs over one day. A “mouse” consumes contaminated vegetation, daily food consumption equal to 18 percent of body weight (a value between seed diet and vegetation diet needs), and one day’s diet is 100 percent contaminated. A “mouse” consumes contaminated insects, daily food consumption equals 50 percent of body weight, and one day’s diet is 100 percent contaminated. A “mouse” consumes contaminated water (volume water consumed is based on allometric relationship) after spill of 200 gallons into a small pond (with no dissipation or degradation of the herbicide).

5 kg mammal: A fox-sized animal consumes small mammal prey that has been contaminated by direct spray. Daily food consumption equals 8 percent of body weight.

70 kg mammal: A deer-sized animal consumes contaminated grass (grass has higher herbicide residues), daily food consumption is 14.16 kg/day (equal to 20 percent of body weight), and one day’s diet is 100 percent contaminated.

4 kg bird: A goose-sized bird consumes contaminated grass and one day’s diet is 100 percent contaminated.

10 g bird: A small, passerine-sized bird consumes contaminated small insects and one day’s diet is 100 percent contaminated.

Predatory bird: A bird-of-prey consumes fish that has been contaminated by an accidental spill of 200 gal into a small pond. Assumptions used include no dissipation of herbicide, bioconcentration is equilibrium with water, contaminant level in whole fish is used, and upper estimate assumes 15 percent of body weight eaten/day. A spotted-owl sized bird consumes small mammal prey that has been contaminated by direct spray.

Terrestrial invertebrate: A honeybee (0.093g) is directly sprayed and 100 percent absorption occurs over one day.

Chronic Exposures

20 g mammal: A mouse-sized mammal consumes contaminated vegetation for 90 days (upper estimate assumes 20 percent of diet is contaminated), and the herbicide dissipates over time. A "mouse" consumes contaminated ambient water for an extended period.

70 kg mammal: A deer-sized mammal consumes contaminated grass for 90 days (upper estimate assumes 100 percent of diet is contaminated), and the herbicide dissipates over time.

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4kg bird: A goose-sized bird consumes contaminated grass for 90 days (upper estimate assumes 100 percent of diet is contaminated), and herbicide dissipates over time.

Predatory bird: A bird-of-prey consumes fish from contaminated water over a lifetime. Assumptions used include dissipation and degradation of herbicide is considered, bioconcentration is equilibrium with water, contaminant level in whole fish is used, and upper estimate assumes 15 percent of body weight eaten/day.

No data are available to estimate chronic exposures from contaminated insects or mammal prey, so risk from chronic exposure is estimated using the acute dose compared to the chronic toxicity index.

In this document, only the highest ranges of exposure assumptions are included, although a more complete range of possible values is included in the SERA risk assessments. 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 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.

Estimated doses from the above exposure scenarios are compared to toxicity levels from laboratory research. The lowest reported dose that caused the most sensitive effect in the most sensitive species is used in this analysis to indicate the potential for an adverse effect when that dose is exceeded. These doses are referred to as "toxicity indices" in this document, and NOAEL's are used whenever possible. If available data have not identified a NOAEL, then an LD_{50} or other level may be used. Table 3 lists the toxicity indices for mammals and Table 4 lists the toxicity indices for birds.

Following the tables are summaries of herbicide effects to birds and mammals, reptiles, amphibians, and terrestrial invertebrates based on the results of the analysis and information in the literature. The likelihood that potential adverse effects would occur is then discussed followed by a brief summary of some of the available field studies. The document concludes with detailed descriptions of the exposure scenario results for each scenario and herbicide.

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Table 3. Toxicity indices <u>for mammals</u> 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 – larger mammal	NOAEL	3 mg/kg	Rabbit	Weight loss, increased post-implant losses, decreased number of live young at 10 mg/kg
Acute – smaller mammal	NOAEL[1]	30 mg/kg	Rat	Neurotoxic effects (e.g. impaired gait) at 300 mg/kg	
Chronic – all sizes	NOAEL	3 mg/kg/day	Rabbit	Weight loss, increased post-implant losses, decreased number of live young at 10 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[2]	45 mg/kg	Dog	Microscopic muscle	

Table 3. Toxicity indices <u>for mammals</u> 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
					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[3]	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[4] liver weight at 35 mg/kg
Sethoxydim	Acute	NOAEL	160 mg/kg[5]	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[6]	Acute	NOAEL	100 mg/kg	Rat	Malformed fetuses at 300 mg/kg
	Chronic[7]	NOAEL	0.5 mg/kg/day	Dog	Effect on kidney at 2.5 mg/kg/day
2,4-D	Acute	"non-lethal"	10 mg/kg	Rat & Dog	Effects on kidney, blood, and liver

	Chronic	NOAEL	1 mg/kg/day	Rat & Dog	Effects on kidney, blood, and liver at 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 Small animals are less susceptible than larger animals. NOAEL estimated from LOAEL of 300 mg/kg/day for neurotoxic effects, using safety factor of 10 to extrapolate from a LOAEL to a NOAEL. Identical to observed NOAEL for neurotoxicity in rabbits (Hoberman 1992).

2 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.

3 The acute NOAEL of 24 mg/kg is very close to the chronic NOAEL, so chronic value is used for acute exposures as well.

4 USEPA/OPP 1998

5 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 (BASF 1980, MRID 00045864 cited in SERA, 2003-Triclopyr).

6 Triclopyr BEE and TEA have equal toxicities to mammals (SERA, 2003a).

7 Value taken from Quast et al. 1976 as cited in SERA Triclopyr 2003. This represents an extremely conservative approach, explained in more detail in the write up on triclopyr later in this document.

Source: SERA 1998, 2001, 2003, 2004 and USDA FS 2003.

Table 4. 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

Table 4. 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
	Chronic[1]	NOAEL	15 mg/kg/day	Rat	Thickening of gastric epithelium at 150 mg/kg/day
Dicamba	Acute	NOAEL	13.6 mg/kg	Quail	Neurotoxic effects at 27 mg/kg/day
	Chronic	NOAEL	13.6 mg/kg/day[2]	Quail	Neurotoxic effects at 27 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[3]	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.

Table 4. 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
	Chronic	LOAEL[4]	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[5]	NOAEL	2 mg/kg/day	Rat	Effects on blood and bile ducts at 20 mg/kg/day
Triclopyr BEE[6]	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 mg/kg/day	Mallard & Quail	Decreased survival of offspring, reduced eggshell thickness at 20 mg/kg/day
2,4-D	Acute	LD_{50}	562 mg/kg[7]	Mallard & Quail	50% mortality at 562 mg/kg
	Chronic[7]	NOAEL	1 mg/kg/day	Rat & dog	Effects on kidney, blood, and liver at 5 mg/kg/day
NPE Surfactants[9]	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 Higher reported NOAEL for chronic dietary exposure is 92 mg/kg/day, with no signs of neurotoxicity. The lower value from acute exposures is used in FS/SERA risk assessment for chronic exposures as a more protective toxicity index.

3 Chronic toxicity studies in birds are not available, so the value from mammal studies is used.

4 Based on one study in which a NOAEL was not determined, so the LOAEL is used.

5 Birds may be somewhat less sensitive than mammals, but data are limited, so the lower value from mammal studies is used.

6 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 Weed Science Society of America 2002.

8 No chronic toxicity data for birds is available; so the mammal chronic value is used. Acute toxicity of 2,4-D to mammals is somewhat lower than it is for birds.

9 Data on birds is not available in published literature. This information from an unpublished study referred to in USDA FS 2003. Since information is lacking, this value is used for illustrative purposes only and no attempt is made to quantify risk to birds from NPE surfactants.

Source: SERA 1998, 2001, 2003, 2004; USDA FS 2003; and Weed Science Society of America 2002.

<u>Summary of Herbicide Effects to Birds and Mammals</u>

The data available for mammals are derived from numerous studies conducted to meet registration requirements, and primarily on laboratory animals that serve as surrogates. Data for mammals are available for more types of toxicity tests and often on a wider variety of species than are available for birds.

Availability of information on the direct toxicological effects of the 12 herbicides on wild mammals varies by herbicide. Glyphosate and 2,4-D have been widely studied, including field applications. Little or no data on wildlife may exist for other herbicides. Herbicides have been tested on only a limited number of species under conditions that may not well-represent populations of free-ranging animals (SERA 1998, 2001, 2003).

Toxicity data available for birds are derived from studies conducted to meet registration requirements, and primarily on domestic birds that serve as surrogates. There are typically fewer types of toxicity studies conducted on birds using a more restricted variety of species than are conducted for mammals. Almost all laboratory data is collected on mallards and northern bobwhite. How the sensitivities of different bird species to herbicides may vary from that reported for mallard and bobwhite is not known.

Tables 5 and 6 summarize the results of exposure scenarios for the 12 herbicides and NPE surfactants considered in this analysis. Chlorsulfuron, imazapic, imazapyr, and metsulfuron methyl do not appear to pose any plausible risk to terrestrial wildlife or bees at either the typical or highest application rates. When an herbicide does pose plausible risk, it is consistently insectivorous and grass-eating animals that are most likely to receive doses above the toxicity index. Direct spray of mammals is a concern only for 2,4-D, and NPE surfactants at the typical application rate, and additionally, dicamba at the highest application rate.

Fish-eating birds do not receive a dose above the toxicity index for any herbicide or application rate. Consumption of contaminated water, even as the result of an accidental spill, results in doses well below the toxicity index for all herbicides. For the herbicides considered in this analysis, birds are less sensitive than mammals to acute exposures. Chronic toxicity data on birds is often limited.

Dicamba, triclopyr, and 2,4-D have the highest potential to adversely affect wildlife. Dicamba has a relatively low acute toxicity to adult animals, in terms of direct lethal doses, but adverse effects on reproduction and nervous systems occur at much lower doses. Dicamba shows a consistent pattern of increased toxicity to larger sized animals, across several species and animal types (i.e. birds and mammals). Dicamba exposures exceed the toxicity indices for five scenarios at the typical application rate, and nine scenarios at the highest application rate. 22

Triclopyr TEA and BEE are somewhat more toxic to birds than triclopyr acid. The toxicities of these compounds to mammals show no remarkable differences. Triclopyr can be acutely lethal only at very high doses. However, indications of adverse effects to the kidney can occur at very low doses, at least in dogs. These adverse effects are indicated by increases in blood urea nitrogen and creatinine in dogs, but no histopathological changes to the kidneys were found. Triclopyr exposures exceed the toxicity indices for eight scenarios at the typical application rate, and 12 scenarios at the highest application rate.

2,4-D also has a relatively low acute toxicity to mammals in terms of direct lethal doses, but signs of adverse effects to the nervous system or internal organs may occur at very low doses. 2,4-D shows a consistent pattern of increased toxicity to larger sized animals. Birds appear somewhat less sensitive than mammals to acute toxic effects. The toxicity indices for 2,4-D in the risk assessment (SERA, 1998) are inconsistent with the most sensitive effects reported for mammals (SERA, 1998, p. 3-52). Relying on the most sensitive effects reported, 2,4-D use may produce exposures that can have adverse effects to terrestrial wildlife in 15 scenarios at the typical application rate, and 16 scenarios at the highest application rate.

Glyphosate, applied at the typical application rate has little potential to adversely affect birds or mammals. An exception might be insectivorous birds that experience chronic exposures. There are no data available on the persistence or degradation of glyphosate residue on insects, so the acute dose is compared to the chronic toxicity index. This is an extremely protective approach and may greatly overestimate risk. However, it is worth noting so that appropriate protective measures may be taken when using glyphosate in the habitat of insectivorous birds. At the highest application rate, glyphosate has the potential to adversely affect large grass-eating mammals, and insectivorous birds and mammals in acute and chronic exposures. Additionally, grass-eating birds may be adversely affected in a chronic exposure. In total, glyphosate exposures exceed the toxicity indices for one scenario at the typical application rate, and eight exposures at the highest application rate.

Clopyralid, applied at the typical application rate has little potential to adversely affect birds or mammals, except for insectivorous birds and mammals. There are no data available on the persistence or degradation of clopyralid residue on insects, so the acute dose is compared to the chronic toxicity index. This is an extremely protective approach and may greatly overestimate risk. However, it is worth noting so that appropriate protective measures may be taken when using clopyralid in the habitat of insectivorous birds and mammals. At the highest application rate, clopyralid may adversely affect grass-eating birds, insectivorous birds and mammals and predatory birds eating small mammal prey for chronic exposures.

The same qualification for chronic exposure to insectivorous animals applies to predatory birds, in that the acute dose is compared to the chronic toxicity index. No acute exposures exceed the toxicity indices. In total, clopyralid exposures exceed the toxicity indices for one exposure at the typical application rate, and four at the highest application rate.

Table 5. Exposure scenario results from FS/SERA risk assessments for mammals, birds, and honeybees using the typical application rate

The actual likelihood of exposing specific bird or mammal species depends on the application method, size of treatment area, habitat treated, and season of application, and must be analyzed at the site-specific levelTable 5. Exposure scenario results from FS/SERA risk assessments for mammals, birds, and honeybees using the typical application rate and upper residue rates.
Symbol meanings are as follows:
-- Exposure scenario results in a dose below the toxicity index.
Exposure scenario results in a dose that exceeds the toxicity index.

Animal/ Scenario	Chlorsulfuron	Clopyralid	Dicamba	Glyphosate	Imazapic	Imazapyr	Metsulfuron methyl	Picloram	Sethoxydim	Sulfometuron methyl	Tirclopyr	2,4-D	NPE Surfactant
ACUTE EXPOSURES													
Direct spray, bee	--	--	--	--	--	--	--	--	--	--	--		
Direct spray, sm. mammal	--	--	--*	--	--	--	--	--	--	--	--		
Consume contaminated vegetation													
small mammal	--	--	--	--	--	--	--	--	--	--	--		--
large mammal	--	--		--	--	--	--	--	--	--	--		
large bird	--	--		--	--	--	--	--	--	--			
Consume contam. water													
Spill, sm. mammal	--	--	--	--	--	--	--	--	--	--	--		--
Consume contam. insects													
small mammal	--	--	--	--	--	--	--	--	--	--	--		
small bird	--	--		--	--	--	--	--	--	--			
Consume contam. prey													
carnivore (sm. mammal)	--	--	--	--	--	--	--	--	--	--	--		--
predatory bird (sm. mammal)	--	--	--	--	--	--	--	--	--	--	--	--	--
predatory bird (fish)	--	--	--	--	--	--	--	--	--	--	--	--	--
CHRONIC EXPOSURES													

Consume contam. veg.													
small mammal, on site	--	--	--	--	--	--	--	--	--	--	--		--
lg. mammal, on site	--	--	--	--	--	--	--	--	--	--			--
lg. bird, on site	--	--	--	--	--	--	--	--	--	--			
Consume contam. water													
small mammal	--	--	--	--	--	--	--	--	--	--	--	--	--
Consume contam. insects#													
small mammal	--			--	--	--	--						
small bird	--				--	--	--						
Consume contam. prey													
carnivore (sm. mammal)#	--	--	--	--	--	--	--	--	--	--			--
predatory bird (sm. mammal)#	--	--	--	--	--	--	--	--	--	--	--		--
predatory bird (fish)	--	--	--	--	--	--	--	--	--	--	--	--	--

*Includes scenario for direct spray of a rabbit-sized mammal.

Data is lacking regarding chronic exposures, so effects are assumed by comparing acute dose vs. chronic NOAEL, which will likely over-estimate actual risk.

Table 6. Exposure scenario results from FS/SERA risk assessments for mammals, birds, and honeybees using the highest application rate and upper residue rates.
Symbol meanings are as follows:
-- Exposure scenario results in a dose below the toxicity index.
♦ Exposure scenario results in a dose that exceeds the toxicity index.

Animal/Scenario	Chlorsulfuron	Clopyralid	Dicamba	Glyphosate	Imazapic	Imazapyr	Metsulfuron methyl	Picloram	Sethoxydim	Sulfometuron methyl	Triclopyr	2,4-D	NPE Surfactant
ACUTE EXPOSURES													
Direct spray, bee	--	--	--	♦	--	--	--		--	--	--	♦	♦
Direct spray, sm. mammal	--	--	♦*	--	--	--	--	--	--	--	--	♦	♦
Consume contaminated vegetation													
small mammal	--	--	--	--	--	--	--	--	--	--	--	♦	♦
large mammal	--	--	♦	♦	--	--	--	--	--	--	♦	♦	♦
large bird	--	--	♦	--	--	--	--	--	--	--	♦	♦	♦
Consume contam. water													
Spill, sm. mammal	--	--	--	--	--	--	--	--	--	--	--	♦	--
Consume contam. insects													
small mammal	--	--	♦	♦	--	--	--	♦	--	--	♦	♦	♦
small bird	--	--	♦	♦	--	--	--	--	--	--	♦	♦	♦
Consume contam. prey													

Table 6. Exposure scenario results from FS/SERA risk assessments for mammals, birds, and honeybees using the highest application rate and upper residue rates.
Symbol meanings are as follows:
-- Exposure scenario results in a dose below the toxicity index.
♦ Exposure scenario results in a dose that exceeds the toxicity index.

Animal/Scenario	Chlorsulfuron	Clopyralid	Dicamba	Glyphosate	Imazapic	Imazapyr	Metsulfuron methyl	Picloram	Sethoxydim	Sulfometuron methyl	Triclopyr	2,4-D	NPE Surfactant
carnivore (sm. mammal)	--	--	--	--	--	--	--	--	--	--	--	♦	--
predatory bird (sm. mammal)	--	--	--	--	--	--	--	--	--	--	--	--	♦
predatory bird (fish)	--	--	--	--	--	--	--	--	--	--	--	--	--
CHRONIC EXPOSURES													
Consume contam. veg.													
small mammal, on site	--	--	--	--	--	--	--	--	--	--	--	♦	--
lg. mammal, on site	--	--	♦	--	--	--	--	--	--	♦			
lg. bird, on site	--	♦	♦	♦	--	--	--	--	♦	♦			
Consume contam. water													
small mammal	--	--	--	--	--	--	--	--	--	--			
Consume contam. insects#													
small mammal	--	♦	♦	♦	--	--	--	♦	♦	♦			

Table 6. Exposure scenario results from FS/SERA risk assessments for mammals, birds, and honeybees using the highest application rate and upper residue rates.
Symbol meanings are as follows:
-- Exposure scenario results in a dose below the toxicity index.
♦ Exposure scenario results in a dose that exceeds the toxicity index.

Animal/Scenario	Chlorsulfuron	Clopyralid	Dicamba	Glyphosate	Imazapic	Imazapyr	Metsulfuron methyl	Picloram	Sethoxydim	Sulfometuron methyl	Triclopyr	2,4-D	NPE Surfactant
small bird	--	♦	♦	♦	--	--	--	♦	♦	♦			
Consume contam. prey													
carnivore (sm. mammal)#	--	--	--	--	--	--	--	--	--	--			
predatory bird (sm. mammal)#	--	--	--	--	--	--	--	--	♦	--			

* Includes scenario for direct spray of a rabbit-sized mammal.

Data is lacking regarding chronic exposures, so effects are assumed by comparing acute dose vs. chronic NOAEL, which will likely over-estimate actual risk.

Herbicide Effects on Reptiles

There is almost no data available regarding the toxicity of herbicides to reptiles. In a review of pesticide effects to reptiles, Pauli and Money (2000) found very few studies, despite publications stating the need for such research dating back to Hall (1980). The only information available for herbicides included in this EIS is from two reports concerning 2,4-D. One study investigated the effects of 2,4-D on alligators (Crain et al. 1997, as cited by SERA 1998), and Willemsen and Hailey (1989, cited by Pauli and Money 2000) noted adverse effects to tortoises in Greece after application of 2,4,5-T and 2,4-D. Pauli and Money (2000) concluded, “it is remarkable that no data appear to exist concerning the effects on reptiles of field applications of… modern herbicides (e.g., glyphosate, sulfonylureas)…”

Hall and Henry (1992) stated, “Susceptibility of reptiles to selective pesticides is virtually unknown.”

Hall and Clark (1982) found that the green anole lizard (Anolis carolinenesis) had a similar sensitivity as mallards and rats to organophosphates. Conversely, reptiles were reported to be more sensitive to some pesticides than birds or mammals (Rudd and Genelly 1956, as cited in Hall 1980). Hall (1980) stated that reptiles are apparently less sensitive than fish. The FS/SERA risk assessments use amphibians and/or fish as surrogates for reptiles. An assumption is made that exposures and doses that are protective of amphibians and fish would also be protective of reptiles. Amphibians and fish have very permeable skin, more so than reptiles, so they are more likely to absorb contaminants from their environment. And their complicated life cycle that includes metamorphosis makes amphibians sensitive indicators for environmental effects (Cowman and Mazanti, 2000). However, the lack of data from reptiles leads to substantial uncertainty in the risk assessment for reptiles, since the response of these animals to doses of herbicide is not known.

Many reptile species would likely be under some cover during the day, when herbicides may be applied. But diurnal reptiles, like lizards, could conceivably be sprayed during applications. Nocturnal and diurnal reptiles could be exposed through contact with contaminated vegetation and soil or ingestion of contaminated prey. Contaminated water or prey could expose aquatic reptiles, but direct spray is not likely. The actual likelihood of exposing reptiles depends on the application method, size of treatment area, habitat treated, and season of application, and must be analyzed at the site-specific level.

Herbicide Effects on Amphibians

Data on toxicity of herbicides to amphibians are limited. Several studies have found that amphibians are less sensitive, or about as sensitive, as fish to some herbicides (Berrill et al. 1994; Berrill et al. 1997; Johnson 1976; Mayer and Ellersieck 1986; Perkins et al. 2000). Consequently, separate dose-response assessments from exposure scenarios have not been created for amphibians in the FS/SERA risk assessments. Available information on toxicity of herbicides to amphibians is summarized below.

Neither the published literature nor the EPA files include data regarding the toxicity of chlorsulfuron, clopyralid, imazapic, imazapyr, metsulfuron methyl, picloram, or sethoxydim to amphibian species. However, data for other aquatic species indicate that chlorsufuron, clopyralid, imazapic, imazapyr, metsulfuron methyl, and picloram have a very low potential to cause any adverse effect in aquatic animals (SERA 2003 Chlorsulfuron; SERA, 2003-Clopyralid; SERA, 2003-Imazapic; SERA, 2003-Imazapyr; SERA, 2003-Metsulfuron methyl; SERA, 2003-Picloram). The formulation Poast is much more toxic to aquatic organisms than sethoxydim.

However, even considering the higher toxicity of Poast, there is no indication that aquatic animals are likely to be exposed to concentrations that would result in toxic effects. There is a substantial limitation to this risk characterization in that no chronic toxicity studies on aquatic animals are available for either sethoxydim or Poast (SERA, 2001 Sethoxydim).

Dicamba 28

Johnson (1976) tested the tadpoles of two Australian frog species (Adelotus brevis and Limnodynastes peroni) for their responses to dicamba exposure. The 96-hour LC_{50} was 106 mg/L for L. peroni, and 185 mg/L for A. brevis. The 24-hour LC_{50} for the two species were 205 and 220 mg/L, respectively. These values are in the range of those reported for tolerant fish species for dicamba exposure (SERA, 2000-Dicamba). Estimated water concentrations for dicamba indicate that there is no basis for asserting or predicting that adverse effects to aquatic animals are plausible (SERA, 2003-Dicamba). Even the highest water contamination rate for an accidental spill is below the LC_{50} of the most sensitive aquatic animal by a factor of 2.5 (SERA, 2003-Dicamba, p. 4-37).

Glyphosate

Glyphosate isopropylamine (IPA), RoundUp and POEA surfactant used in RoundUp have been specifically tested for ability to cause malformations in the frog embryo teratogenesis assay using Xenopus (Perkins et al. 2000). Xenopus is a highly sensitive assay species for determining the teratogenicity of chemicals (Mann and Bidwell 2000, Perkins et al. 2000). No increases in malformations were noted at levels that were not also lethal to the embryos. The RoundUp formulation containing POEA surfactant was 700 times mores toxic than glyphosate IPA. POEA surfactant alone was more toxic than the RoundUp formulation. No statistically significant increases in abnormalities were seen in any groups exposed to POEA at levels that were not also lethal. The 96-hour LC_{50} for glyphosate IPA was 7297 mg a.e./L, and that for RoundUp was 9.3 mg a.e./L. Perkins et al. (2000) calculated that if RoundUp was applied at the highest application rate directly to water 15 cm deep (volumn not specified), the expected environmental contamination was less than the LC_{50} and the LC_5 by a factor of about three.

A study by Smith (2001) looked at effects to western chorus frog (Pseudacris tiseriata) and Plains leopard frog (Rana blairi) from a formulation of glyphosate that contains glyphosate IPA and ethoxylated tallowamine surfactant (Kleeraway Grass and Weed Killer RTU (Monsanto)). Smith exposed 1-week old tadpoles for 24-hours to the following concentrations of Kleeraway: 0.1 (1 part Kleeraway to 9 parts deionized water), 0.1, 0.001, and 0.0001. These concentrations are equivalent to 560 mg a.e./L, 56 mg a.e./L, 5.6 mg a.e./L, and 0.56 mg a.e./L (SERA, 2003-Glyphosate, p. 4-20). Smith reported some mortality at concentrations as low as 0.56 mg a.e./L for both species. Acute exposure to Kleeraway had no effect on growth or development of surviving tadpoles. Results found by Smith are not consistent with other information on the effects of glyphosate or other formulations to amphibians. However, other studies have found that different formulations can have different toxicities to frogs (Mann and Bidwell, 1999). Formulations containing surfactant are known to have much higher toxicity to amphibians than glyphosate. The Forest Service does not use the formulation used in the Smith study.

Bidwell and Gorrie (1995; cited in SERA 2003 Glyphosate) reported 48-hour LC_{50} values of 11.6 mg a.e./L for the Roundup 360 formulation and 121 mg/L for technical grade glyphosate using four species of frogs from western Australia.

At the typical application rate, expected water concentrations for acute and longer-term exposures are well below any reported LC_{50} for amphibians, with the exception of the study by Smith (2001)

(SERA, 2003-Glyphosate, Worksheet G03). At the highest application rate, lethal doses could occur from formulations containing surfactant.

Sulfometuron methyl

The effect of sulfometuron methyl to amphibians was investigated in one study using Xenopus (Fort 1998; cited in SERA 2003 Sulfometuron methyl). Results of the study found that sulfometuron methyl exposure can cause moderately severe malformations in these frogs, including miscoiling of the gut, incomplete eye lens formation, abnormal craniofacial development, and decreased tail resorption. The concentration that produced these effects depended upon the length of exposure, with shorter exposures showing no effect at higher concentrations than longer exposures. The author did not sate whether data were reported in terms of mg of sulfometuron methyl or mg of Oust. The FS/SERA risk assessment assumes that data refer to mg of Oust, to provide the most protection. The NOAEC for malformations for 4-hour exposure is 0.38 mg a.i./L, and that for 30-day exposure is 0.0075. However, exposure to 0.0075 mg a.i./L for 14 days was identified as the LOAEC for tail resorption rate effects. No mortality was observed at concentrations up to 7.5 mg a.i./L.

Unlike the other FS/SERA risk assessments, a quantitative evaluation of exposure and risk from sulfometuron methyl was conducted for amphibians. SERA (2003 Sulfometuron methyl) compared estimated water concentrations for acute and chronic exposures to acute and chronic NOEC values for frogs, from Fort (1998). The estimated exposure is 0.002 of the acute NOEC, and 0.00075 of the chronic NOEC. Therefore, at the typical and highest application rates, there is no basis for asserting or predicting that adverse effects to amphibians are plausible. There is a substantial reservation in that this conclusion is based on data from one species, but other studies have indicated that Xenopus are a sensitive indicator for effects to amphibians (Mann and Bidwell 2000, Perkins et al. 2000).

Triclopyr

Triclopyr BEE is much more toxic to aquatic species that triclopyr TEA or triclopyr acid (SERA 2003 Triclopyr). Triclopyr was specifically tested for ability to cause malformations in the frog embryo teratogenesis assay using Xenopus laevis (Perkins et al. 2000). Xenopus is a highly sensitive assay species for determining the teratogenicity of chemicals (Mann and Bidwell 2000, Perkins et al. 2000). No statistically significant increase in abnormalities were seen in any groups exposed to Garlon 3A or Garlon 4 at levels that were not also lethal to the embryos. Consistent with results for other aquatic species, Garlon 3A, containing triclopyr TEA, was 15 times less toxic than Garlon 4, containing triclopyr BEE. Garlon 4 reduced embryo growth at a concentration below the LC_{50}. Perkins et al. (2000) found that the 96-hour LC_{50} for Garlon 4 was 10 mg a.e./L, and that for Garlon 3A was 159 mg a.e./L. Perkins et al. (2000) calculated that if Garlon 4 was applied at the highest application rate directly to water 15 cm deep (volume not specified), the expected environmental contamination was less than the LC_{50} and the LC_5 by a factor of about four and three, respectively. 30

Berrill et al. (1994) conducted toxicity studies on eggs and tadpoles of leopard frog (Rana pepiens), green frog (Rana clamitans), and bullfrog (Rana catesbeiana) exposed to technical grade triclopyr BEE. The study was conducted in darkness to prevent hydrolysis of triclopyr BEE to tricolopyr acid. Exposure of eggs to concentrations up to 4.6 ppm triclopyr a.e. for 48 hours caused no effect on hatching success, timing, malformations or subsequent avoidance behavior of tadpoles hatched from exposed eggs (Berrill et al. 1994). Tadpoles were more sensitive; all bullfrog and green frog tadpoles exposed to 2.3 and 4.6 ppm triclopyr a.e. died. Leopard frogs were more tolerant and few died, but all were unresponsive to prodding at 2.3 and 4.6 ppm a.e.

About half the bullfrog and most green frog tadpoles became unresponsive to prodding when exposed to 1.1 ppm a.e. Surviving tadpoles recovered after exposure was terminated.

Water concentrations from application of triclopyr acid at the typical application rate are below 1 mg/L (1 ppm), so acute and chronic risks to aquatic animals are low (SERA, 2003-Triclopyr, Worksheet G03). At the highest application rate, acute exposure from runoff could adversely affect responsiveness of some tadpoles, increasing the risk of predation. Despite the difference in toxicity, the conclusion is the same for triclopyr BEE, due to the difference in estimated water concentration.

2,4-D

Unlike other herbicides in this analysis, 2,4-D may be more toxic to some species of amphibians than to fish. The effects of 2,4-D on amphibians have been studied for African clawed frog, toads (Bufo melanostictus), and crested newts (Triturus cristatus carnifex) (SERA, 1998). Malformations in Xenopus occur a concentration greater than 200 mg/L, but this concentration may also be a lethal dose (SERA, 1998). At this concentration, all adult crested newts were dead after three hours exposure to the isoctyl ester of 2,4-D in water (Zaffaroni et al. 1986, cited in SERA, 1998). All male newts died after 31 days exposure to 50 mg/L, while none of the females died. One newt died after 21 days exposure to 25 mg/L. The 96-hour LC50 for toads was 8.05 mg/L and mortality began to appear at 6.1 mg/L (Vardia et al., 1984, cited in SERA, 1998). Concentrations of 2,4-D in ambient water are estimated to be 0.002 mg/L in a runoff scenario and 6 mg/L after an accidental spill. Water concentration from runoff is well below any dose reported to cause mortality in amphibians. However, mortality to amphibians could result from an accidental spill of a large volumn of 2,4-D (SERA, 1998).

The actual likelihood of exposing amphibians depends on the application method, habitat treated, and season of application, and must be analyzed at the site-specific level.

Herbicide Effects on Invertebrates

Manufacturers are required to conduct toxicity tests on honeybees as part of the registration process. The estimated doses and toxicity values of the herbicides to honey bees are listed in Table 7. The inclusion of other terrestrial invertebrates in toxicity studies varies for each herbicide. However, even the most well-studied will include effects on only a small fraction of terrestrial invertebrate species potentially found in any diverse ecosystem. Risk to invertebrates can only be inferred based on the few test species for which data are available.

Effects of chlorsulfuron to terrestrial invertebrates have been studied using a leaf beetle (Gastrophysa polygoni), large whitebutterfly (Pieris brassicae), and nemotodes (SERA, 2003-Chlorsulfuron). Direct spray of first-instar larva and feeding of larva on treated plants did not produce significant changes in mortality, but did delay development of those feeding on treated plants. Placing eggs of the leaf beetle on treated plants significantly decreased survival (Kjaer and Elmegaard, 1996; cited in SERA, 2003-Chlorsulfuron). In another study (Kjaer and Heimbach, 2001), newly hatched larvae of the leaf beetle and whitebutterfly were placed on treated plants and no significant effects on survival or relative growth rates were found. Two species of nematodes (Steinernema carpocapsae and S. feltiae) were exposed to chlorsulfuron in soil and no effect was observed on reproduction, viability or movement (Rovesti and Desco, 1990; cited in SERA 2003-Chlorsulfuron). A British publication (Tomlin, 2000) reports an LD_{50} > 25mg/kg for honey bees, but it is not clear what research provides the basis for this value.

Clopyralid has been tested on a variety of terrestrial invertebrates. Standard bioassays on honeybees (LD_{50} >90 mg/kg) have been conducted as well as exposure of earthworms to clopyralid in soil (LC_{50} >1000 ppm). Also, Hassan et al. (1994) provided a summary of several bioassays and field trials using a variety of terrestrial invertebrates. Clopyralid produced some mortality in insect parasites, predatory mites, Semiadalia 11-notata (Coccinellidae), Anthocoris nemoralis (Anthocoridae), and Chrysoperla carnea (Chrysopidae). Pekar et al. (2002; cited in SERA 2003 Clopyralid) reported that clopyralid was “harmless” to wild immature spiders (Theridion impressum).

Table 7. Potential herbicide doses for bees in a direct spray scenario, assuming 100% absorption.

Herbicide	Typical Application Rate	Dose for Bee	Toxicity Index for Bee
Chlorsulfuon	0.056 lb/ac	8.98 mg/kg	>25 mg/kg (LD_{50})
Clopyralid	0.35 lb/ac	56.1 mg/kg	909 mg/kg (no mortality)
Dicamba	0.3 lb/ac	48.1 mg/kg	1000 mg/kg (no mortality)
Glyphosate	2.0 lb/ac	321 mg/kg	540 mg/kg (NOAEC)
Imazapic	0.13 lb/ac	16 mg/kg	387 mg/kg (no mortality)
Imazapyr	0.45 lb/ac	72.1 mg/kg	1000 mg/kg (no mortality)
Metsulfuron Methyl	0.03 lb/ac	4.81 mg/kg	270 mg/kg (NOEC)
Picloram	0.35 lb/ac	56.1 mg/kg	1,000 mg/kg (no mortality)
Sethoxydim	0.3 lb/ac	60.1 mg/kg	107 mg/kg (NOAEL)
Sulfometuron Methyl	0.045 lb/ac	7.21 mg/kg	1,075 mg/kg (NOEC)
Triclopyr BEE	1.0 lb/ac	160 mg/kg	>1,075 mg/kg (LD_{50})
Triclopyr TEA	1.0 lb/ac	160 mg/kg	>1,075 mg/kg (LD_{50})
2,4-D	1.0 lb/ac	163 mg/kg	124 mg/kg (LD_{50})
NP9E	1.67 lbs/ac	268.00 mg/kg	unknown

Source: SERA 1996-2003 and USDA FS 2003.

1 Standard acute toxicity studies using bees were not identified in a complete search of studies submitted to EPA. Tomlin (2000) reports bee LD50 > 25 mg/kg in a British pesticide manual. Another study found no mortality to a leaf-eating beetle directly sprayed at a rate corresponding to 107 lb/ac (SERA 2003 Chlorsulfuron).

Dicamba is not particularly toxic to honeybees (LD_{50} >1000mg/kg). Hassan et al. (1998; cited in SERA 2003 Dicamba) classified the formualation Banvel as harmless to the beneficial parasite, Trichogramma cacoeciae. Potter et al. (1990; cited in SERA 2003 Dicamba) observed no toxic effects to earthworms in a field study after an application of about 0.1 lb/acre. This rate is below the typical application rate however.

There is a low potential for glyphosate to adversely affect terrestrial invertebrates. The honeybee LD_{50} for glyphosate is greater than 1075 mg/kg and the NOEC is 540 mg/kg. Mortality at 134 mg/kg in one study was attributed to equipment failure (SERA, 2003-Glyphosate). Direct foliar spray had no effect on the spider mite (Tetranchys urticae). One-hundred percent mortality to spider mites was reported after application of RoundUp ULTRA at 3.6 kg a.i./ha, but it was attributed to the solution causing the mites to stick to the glass plates. Studies of the effects of glyphosate on the spider Lepthyphantes tenuis resulted in no effects that could be attributed to glyphosate toxicity. No significant effects were noted in studies on rove beetles, butterflies, or terrestrial snail (Helix aspersa). The soil LC_{50} for a worm common in Libya, Aporrectodea caliginosa, is 177-246 mg glyphosate/kg soil (Mohamed et al., 1995; cited in SERA, 2003-Glyphosate).

The standard acute toxicity study to honeybees is the only study found on the effects of imazapic to terrestrial invertebrates. At 387 mg/kg, mortality was not statistically significant (SERA, 2003-Imazapic).

Imazapyr has a low acute toxicity to bees with an LD_{50} >1000 mg/kg. No information on effects to other terrestrial invertebrates is available.

Standard bioassays on effects of metsulfuron methyl to honeybees reported LD_{50} > 1075 mg/kg and a NOAEL of at least 270 mg/kg. Very high application rates (almost five times higher than the highest labeled application rate) resulted in a 15 percent reduction in eff hatching for rove beetle (Samsoe-Petersen 1995; cited in SERA 2003 Metsulfuron methyl).

Data on the toxicity of picloram to terrestrial invertebrates is available only for the honeybee and the brown garden snail (Helix aspersa). The honeybee LD50 is greater than 1000 mg/kg and dietary concentration of 5000 mg/kg over a 14-day period did not increase mortality for the snail.

For sethoxydim, the honeybee NOAEL is 107 mg/kg. The only other study on invertebrates investigated effects to Mexican bean beetle (Epilachna varivestis) feeding on soybean and lima bean plants treated with the equivalent of 5-6 lbs/acre (15 times higher than the highest labeled application rate). There was a slight increase in days to pupation for larvae, but also significant increases in both the number of egg masses as well as total number of eggs produced by beetles feeding on sethoxydim treated plants (Agnello et al. 1986; cited in SERA 2001 Sethoxydim).

Only two studies are available on the toxicity of sulfometuron methyl to terrestrial invertebrates and they both looked at effects to the honeybee. Sulfometuron methyl has a very low potential to adversely affect bees, with an acute NOAEL of 1075 mg/kg (SERA, 2001-Sulfometuron methyl). No mortality was reported at the highest doses tested.

Honeybee assays provide the only information on the effects of triclopyr acid and triclopyr TEA to terrestrial invertebrates. In both bioassays, the LD_{50} is greater than 1075 mg/kg (SERA, 2003-Triclopyr). 33

The effects of 2,4-D have been studied for a limited variety of terrestrial invertebrates. Reported LD_{50} for honeybees range from 124 mg/kg to 1129 mg/kg (SERA, 1998-2,4-D).

Mortality may occur 5-7 days after exposure to toxic levels. 2,4-D is reported to cause mortality or other adverse effects to southern armyworm (Spodoptera eridania), wheat sawfly larvae, millipedes (Scytonotus simplex), coccinellid larvae, various beetle species, parasitic wasps, and earthworms (Hassan et al., 1991; and Roberts and Dorough 1984 – both cited in SERA, 1998-2,4-D; see also Table 4 in Norris and Kogan 2000). Response of earthworms is variable with no measurable effect in the field or in a microcosm for some studies (SERA, 1998-2,4-D). Other soil invertebrates were not affected by application of the sodium salt of 2,4-D at rates of 1.34 and 2.68 lbs/acre (Prasse, 1979; cited in SERA, 1998-2,4-D). Terrestrial slugs (Deroceras reticulatum) may absorb 2,4-D through contact with contaminated soil (Haqu and Ebing, 1983; cited in SERA, 1998-2,4-D).

The actual likelihood of exposing invertebrates depends on the application method, size of treatment area, habitat treated, and season of application, and must be analyzed at the site-specific level.

Likelihood these exposures and effects will actually occur

While the above exposure scenarios consider animal sizes, feeding habits, herbicide application rates, and toxicity data, they cannot account for all the variables found in the field during actual applications. Such factors as foliar interception, animal behavior (e.g. nocturnal versus diurnal activity), season of use, and selective application methods can significantly reduce or eliminate actual exposure to herbicides in field conditions. For example, while toxicity of some herbicides could pose a concern for the early stages of amphibian development, an actual application of herbicide occurring after mid-summer, well after this stage of development might be present at a specific location, could significantly reduce risk (Perkins et al., 2000).

Direct spray of small mammals is very unlikely to occur, since they are typically nocturnal and spend the day in burrows, nests, or underneath dense vegetation. Diurnal small mammals, like ground squirrels, may be active in treatment areas, but would likely seek shelter or move away from the treatment activity. Aerial application could directly spray some diurnal small mammals. The likelihood that a predatory bird or mammal would prey on the same small mammal that had been directly sprayed is remote, and an entire day’s diet of contaminated small mammals is very remote. 34

Direct spray of insects could occur, as they are present in vegetation and would not necessarily flee during treatment operations. However, foliar interception would reduce the actual amount sprayed on almost all insects present. Insectivorous birds may establish territories during the breeding season. If the treatment area involved most of one or several territories, it could be feasible for an insectivorous bird to consume all or most of its daily diet within the treatment area. The young of even herbivorous bird species are highly dependant upon insects for their growth and development. Therefore, while the actual doses received by insectivorous birds may be lower than the exposure scenarios predict, due to foliar interception, application method and other variables, the consumption of contaminated insects by young birds may offset this advantage. Consumption of contaminated insects remains a concern for some herbicides, and likelihood of exposure must be evaluated at the site-specific level. Insectivorous mammals may be less likely to consume a large amount of contaminated invertebrates, because they either forage over very large areas, like bats, or may forage on fossorial invertebrates, like shrews.

Consumption of contaminated grass by large birds or mammals would depend on the habitat-type in the treatment area and whether these animals are likely to forage there. The application method would be very important in determining the amount of exposure. Selective foliar applications to target invasive plants are not likely to lead to exposure. But broadcast foliar applications of large areas, particularly aerial applications, could contaminate forage. Consumption of contaminated vegetation is a substantial concern for some herbicides, but the specific application methods and timing may easily avoid exposure to these animals.

In order to evaluate how actual implementation can influence effects to wildlife, field studies for many of the above herbicides have been conducted.

Field Studies

Field studies can help evaluate the likelihood of population effects to wildlife from herbicides as applied. Some herbicides have been tested in many field studies on several groups of species with results published in open literature, while other herbicides have few or no field studies reported.

Most field studies could only detect changes in population numbers and are not sensitive enough to detect sublethal effects to wildlife. Some studies have investigated sub-lethal effects (e.g. Sullivan et al., 1998). However, sublethal effects that resulted in indirect mortality or other population changes would produce effects that could be detected by most longer-term field studies.

Chlorsulfuron

No field studies are available.

Clopyralid

Rice et al. (1997) published results from an 8-year field study that found no significant effects on plant species diversity from the use of clopyralid, clopyralid plus 2,4-D, or picloram. Hassan et al. (1994) reported summary of effects to terrestrial invertebrates in field trials.

Dicamba

Potter et al. (1990; cited in SERA, 2003-Dicamba) observed no toxic effects to earthworms in a field study after an application of about 0.1 lb/acre. This rate is below the typical application rate however.

Glyphosate

Sullivan et al. (1998) looked at long-term influence of glyphosate treatment in a spruce forest on reproduction, survival, and growth attributes of deer mouse (Peromyscus maniculatus) and southern red-backed vole (Clethrionomys gapperi) populations. For all statistically significant differences in their study (e.g. successful pregnancies, survival), the differences between treated and untreated populations were within the range of natural fluctuations for these small mammal populations over a 5-year period.

Sullivan et al. (1997) investigated the influence of aerial herbicide treatments on small mammal populations 9 and 11 years post-treatment. They found that glyphosate did not adversely affect reproduction, survival, or growth of deer mice or Oregon voles (Microtus oregoni) in coastal forest a decade after application. Species richness and diversity changed little over the decade after treatment and concluded that post-harvest successional change had more impact than that induced by herbicide treatment.

A field study on effects to the spider Lepthyphantes tenuis attributed population decrease to the secondary effects from changes in vegetation (Haughton et al., 2001; cited in SERA, 2003-Glyphosate). Bramble et al. (1997) investigated butterfly diversity and abundance on electric transmission right-of-ways treated with herbicides versus those treated with only mechanical methods. Herbicides used in the right-of-way treatments included a mixture of picloram and triclopyr, a mixture of triclopyr and metsulfuron methyl, a mixture of glyphosate and fosamine, a mixture of triclopyr and imazapyr, and glyphosate alone. They found no significant differences in diversity or abundance of butterflies between herbicide and no-herbicide units.

Cole et al. (1998) found that small mammal capture rates in Oregon forests that were logged, burned and then sprayed with glyphosate did not differ from those that were just logged and burned. Other studies have found that numbers of some species appear to increase or remain the same after treatment with herbicides, while other species decrease (Anthony and Morrison 1985; Lautenschlager, 1993; Ritchie et al., 1987; Sullivan, 1990a). The same species might show all three responses in different studies with the same herbicide (see Sullivan, 1990a). In these studies, effects to small mammals occurred from habitat changes created by herbicide treatment, rather than from direct effects of herbicides (Santillo et al., 1989; Sullivan 1990a; Sullivan 1990b; Sullivan and Sullivan, 1981).

Santillo et al. (1989) found a substantial decrease in herbivorous insects on glyphosate treated sites, while there was clearcut verses untreated, but no trend between treated and untreated sites for predatory insects. The overall decrease in insect numbers decreased available food for shrews. Cole et al. (1997) sampled amphibians in Oregon clearcuts with and without glyphosate applications. Capture rates did not differ between treated and untreated plots for rough-skinned newt, ensatina, Pacific giant salamander, Dunn’s salamander, western redback salamander, and red-legged frog.

Imazapic, Sethoxydim, Sulfometuron methyl

No field studies available.

Imazapyr

Imazapyr was used on a low volume retreatment in the Bramble et al. (1997) study mentioned above (see glyphosate) without apparent adverse effects to butterfly diversity and abundance on electric transmission right-of-ways.

Metsulfuron methyl

Metsulfuron methyl was in one of the mixtures used to treat electric transmission right-of-ways in the Bramble et al. (1997) study mentioned above (see glyphosate), which found no apparent adverse effects to butterfly diversity and abundance.

Picloram

Rice et al. (1997) published results from an 8-year field study that found no significant effects on plant species diversity from the use of clopyralid, clopyralid plus 2,4-D, or picloram. Brooks et al. 1995 studied effects of picloram, imazapyr, and triclopyr mixtures on small mammals and found reduced numbers on sites after herbicide treatments. However, no control site (i.e. non-treated) was used so it is not possible to discern herbicide effects from normal population fluctuations that are common with small mammals. Nolte and Fulbright (1997) studied effects of an aerial application of picloram/triclopyr mixture on small mammals, birds, and rare plants. Effects to animal diversity or plant species richness or evenness were not found.

Picloram was in some of the mixtures used to treat electric transmission right-of-ways in studies by Bramble et al. (1997, 1999). The 1997 study found no significant differences to butterfly diversity and abundance, while the 1999 study found significantly higher diversity and abundance of butterflies on herbicide-treated units than on handcutting units.

Triclopyr

There are a number of field studies reported in the open literature, most of which indicate no or beneficial effects (SERA 2003 Triclopyr). Refer also to the study by Brooks et al. (1995) mentioned above. In contrast, Leslie et al. 1996 found that white-tailed deer avoid areas that used a “brown and burn” technique, where the site is treated with herbicide followed by a prescribed burn. McMurray et al. (1993a; 1993b; 1994) reported no adverse effects to reproductivity in mammals.

Triclopyr was in some of the mixtures used to treat electric transmission right-of-ways in studies by Bramble et al. (1997, 1999). The 1997 study found no significant differences to butterfly diversity and abundance, while the 1999 study found significantly higher diversity and abundance of butterflies on herbicide-treated units than on handcutting units.

2,4-D

Rice et al. (1997) published results from an 8-year field study that found no significant effects on plant species diversity from the use of clopyralid, clopyralid plus 2,4-D, or picloram. Response of earthworms is variable with no measurable effect in the field or in a microcosm for some studies (Potter et al., 1990; and Gile, 1983; cited in SERA, 1998).

2,4-D was one of the herbicides used in a study by Bramble et al. (1999), which found significantly higher diversity and abundance of butterflies on herbicide-treated units than on handcutting units in electric transmission right-of-ways.

Johnson and Hansen (1969) found no significant difference in density or litter size of deer mouse populations between areas treated with 2,4-D and untreated areas. They also found that treatment with 2,4-D reduced density of northern pocket gophers (Thomomys talpoides) and least chipmunks (Eutamias minimus) and increased abundance of Montane vole (Microtus montanus). Changes in density and abundance were attributed to changes in food and cover produced by the herbicide treatment.

Results of Exposure Analysis for Each Herbicide

Calculated doses for each herbicide at typical and highest application rates for each scenario are included in Appendix 1.

<u>CHLORSULFURON</u>

Small Mammal Directly Sprayed

The acute NOAEL for mammals in laboratory toxicity tests is 75 mg/kg. For exposure scenarios that use the typical application rate of 0.056 lb/acre, if a small mammal is directly sprayed, and 100 percent absorption is assumed, the animal would receive an acute dose of 1.36 mg/kg (SERA, 2003-Chlorsulfuron, Worksheet F02a). This dose is 0.018 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to small herbivorous mammals are plausible (SERA 2003 Chlorsulfuron, p. 4-27).

At the highest application rate of 0.25 lb/acre, the animal would receive an acute dose of 6.06 mg/kg (project file). This dose is 0.08 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible at any application rate.

Small Mammal Drinking Contaminated Water

The acute NOAEL for mammals in laboratory toxicity tests is 75 mg/kg. The estimated dose to a small mammal from drinking water contaminated by an accidental spill, assuming the highest levels of contamination, is 0.11 mg/kg for acute exposure (SERA, 2003-Chlorsulfuron, Worksheet F05). If a small mammal consumes contaminated water over time, accounting for dissipation, degradation, and other processes, the animal would receive a chronic dose of 0.0000074 mg/kg/day (SERA, 2003-Chlorsulfuron, Worksheet F07). Doses to a large mammal would be even lower on a per kg body weight basis. These doses are 0.0015 of the acute NOAEL, and 0.000001 of the chronic NOAEL, respectively, so there is no basis for asserting or predicting that adverse effects to mammals are plausible (SERA, 2003-Chlorsulfuron, p. 4-27).

At the highest application rate of 0.25 lb/acre, the acute dose from drinking water contaminated by a spill is 0.495 mg/kg (project file). This dose is 0.007 of the acute NOAEL. The chronic dose is also below the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible, even in a worst-case scenario.

Large Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 75 mg/kg. For exposure scenarios that use the typical application rate of 0.056 lb/acre, if a 70 kg mammal consumed contaminated vegetation on site shortly after application, assuming the highest residue rates and 100 percents of the diet contaminated, it would receive an acute dose of 2.72 mg/kg (SERA 2003 Chlorsulfuron, Worksheet F10). This dose is 0.036 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large herbivorous mammals are plausible (SERA, 2003-Chlorsulfuron, p. 4-27). The chronic NOAEL for mammals in laboratory toxicity tests is 5 mg/kg/day. Chronic exposure from the consumption of contaminated vegetation for 90 days at the treatment site, assuming the highest residue rates, results in a dose of 1.14 mg/kg (SERA, 2003-Chlorsulfuron, Worksheet F11a). This dose is 0.228 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to large herbivorous mammals are plausible (SERA, 2003-Chlorsulfuron, p. 4-27).

Estimated doses using the highest application rate (0.25 lb/acre) are less than the acute NOAEL and equal to the chronic NOAEL for mammals. No exposure exceeds the NOAEL, so no adverse effects are plausible from acute or chronic dietary exposures. The assumptions in the chronic exposure scenario are very unlikely to occur in field conditions, so the weight of evidence suggests that no adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Chlorsulfuron, p. 4-28).

Medium Carnivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 75 mg/kg. For exposure scenarios that use the typical application rate of 0.056 lb/acre, if a 5 kg mammal consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 0.118 mg/kg (SERA, 2003-Chlorsulfuron, Worksheet F16a). This dose is 0.0016 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to carnivorous mammals are plausible (SERA, 2003-Chlorsulfuron, p. 4-27). Doses to larger mammals would be even lower on a per kg body weight basis.

Chlorsulfuron does not appear to accumulate or persist in animals following either single or multiple doses. The elimination of chlorsulfuron has been studied in rats, goats, cows, and hens (SERA, 2003-Chlorsulfuron). A combination of elimination and metabolism extensively and rapidly eliminated chlorsulfuron and its metabolites from the bodies of all mammalian species studied. The half-life for elimination in rats is less than six hours (Shrivastava, 1979 cited in SERA, 2003-Chlorsulfuron). Therefore, chronic exposures from contaminated mammal prey due to a single application of chlorsulfuron are unlikely to cause any adverse effect. In addition, the acute dose is much less than the chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of chlorsulfuron over time are plausible.

Estimated doses using the highest application rate (0.25 lb/acre) are less than the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Chlorsulfuron, p. 4-28).

Small Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 75 mg/kg. If a small mammal consumes contaminated vegetation shortly after application, assuming the highest residue rates, the acute dose received is 0.15 mg/kg (SERA, 2003-Chlorsulfuron, Worksheet F03). This estimated dose is 0.002 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to small herbivorous mammals are plausible (SERA, 2003-Chlorsulfuron, p. 4-27).

The chronic NOAEL for mammals in laboratory toxicity tests is 5 mg/kg/day. If a small mammal consumes contaminated vegetation at the treatment site for 90-days, assuming the highest residue rates, the animal would receive a chronic dose of 0.013 mg/kg/day (SERA, 2003-Chlorsulfuron, Worksheet F04a). This dose is 0.0026 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to small herbivorous mammals are plausible (SERA, 2003-Chlorsulfuron, p. 4-27).

Estimated doses using the highest application rate (0.25 lb/acre) are less than the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA 2003 Chlorsulfuron, p. 4-28).

Small Insectivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 75 mg/kg. For exposure scenarios that use the typical application rate of 0.056 lb/acre, if a small mammal consumes contaminated insects shortly after application, assuming the highest residue rates, the acute dose received is 3.89 mg/kg (SERA, 2003-Chlorsulfuron, Worksheet 14a). This dose is 0.052

of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous mammals are plausible (SERA, 2003-Chlorsulfuron, p. 4-27).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. However, the acute dose is much less than the chronic NOAEL as well, and chronic doses are much lower than acute doses. Therefore, there is no basis for asserting or predicting that adverse effects to insectivorous mammals from chronic exposures are plausible (SERA, 2003-Chlorsulfuron, p. 4-27).

The estimated dose (17.3 mg/kg) using the highest application rate (0.25 lb/acre) is less than the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Chlorsulfuron, p. 4-28).

Large Herbivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 1686 mg/kg. For exposure scenarios that use the typical application rate of 0.056 lb/acre, if a 4 kg bird consumed contaminated grass on site shortly after application, assuming the highest residue rates and 100 percent of diet is contaminated, it would receive an acute dose of 4.26 mg/kg (SERA, 2003-Chlorsulfuron, Worksheet F12). This dose is 0.0025 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Chlorsulfuron, p. 4-27).

The chronic NOAEL for birds in laboratory toxicity tests is 140 mg/kg/day. Chronic exposure from the consumption of contaminated grass for 90 days at the treatment site, assuming the highest residue rates and 100 percent of diet is contaminated, results in a dose of 1.79 mg/kg/day (SERA, 2003-Chlorsulfuron, Worksheet F13a). This dose is 0.013 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Chlorsulfuron, p. 4-27).

Estimated doses using the highest application rate (0.25 lb/acre) are less than the acute and chronic NOAELs for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Chlorsulfuron, p.4-28).

Large Fish-eating Bird

Many chemicals may be concentrated or partitioned from water into the tissues of animals in the water. This process is referred to as bioconcentration. The potential for bioconcentration of chlorsulfuron in fish was studied in bluegill and channel catfish exposed to ^{14}C-chlorsulfuron for 28 days (Han 1981 and Priester et al., 1991, cited in SERA, 2003 Chlorsulfuron). In the SERA risk assessments, concentrations in viscera are considered to reflect concentration in whole fish. Bioconcentration factors (BCF) for bluegill were <1 L/kg in muscle and 4-6 L/kg in viscera and liver (SERA, 2003-Chlorsulfuron, Appendix 9). BCF for channel catfish were 1.5 L/kg in muscle and < 12 L/kg in viscera and liver (SERA, 2003-Chlorsulfuron, Appendix 9). In both studies, residue levels in live fish dropped 70-90 percent during a two-week cleansing period. No adverse effects on fish were observed during the studies. The exposure scenarios in the SERA risk assessment use a whole-fish BCF of 2.6 L/kg for acute exposure and 12 L/kg for chronic exposure.

The acute NOAEL for birds in laboratory toxicity tests is 1686 mg/kg. For exposure scenarios that use the typical application rate of 0.056 lb/acre, if a predatory bird consumed fish from a pond contaminated by an accidental spill, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive an acute dose of 0.295 mg/kg (SERA 2003 Chlorsulfuron, Worksheet F08). This dose is 0.00017 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible (SERA 2003 Chlorsulfuron, p. 4-27).

The chronic NOAEL for birds in laboratory toxicity tests is 140 mg/kg/day. If a predatory bird consumed fish contaminated by runoff for a lifetime, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive a chronic dose of 0.00009 mg/kg/day (SERA, 2003-Chlorsulfuron, Worksheet F09). This dose is 0.00000064 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible (SERA, 2003-Chlorsulfuron, p. 4-27).

Estimated doses using the highest application rate (0.25 lb/acre) are much less than the acute and chronic NOAELs for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-hlorsulfuron, p.4-28).

Large Predatory Bird

The acute NOAEL for birds in laboratory toxicity tests is 1686 mg/kg. For exposure scenarios that use the typical application rate of 0.056 lb/acre, if a 0.6 kg bird consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 0.181 mg/kg (SERA, 2003-Chlorsulfuron, Worksheet F16b). This dose is 0.0001 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to predatory birds are plausible (SERA, 2003-Chlorsulfuron, p. 4-27).

Chlorsulfuron does not appear to bioconcentrate or persist in animals following either single or multiple doses. The elimination of chlorsulfuron has been studied in rats, goats, cows, and hens (SERA, 2003-Chlorsulfuron). A combination of elimination and metabolism extensively and rapidly eliminated chlorsulfuron and its metabolites from the bodies of all mammalian species studied. The half-life for elimination in rats is less than six hours (Shrivastava 1979 cited in SERA, 2003-Chlorsulfuron). Therefore, chronic exposures from contaminated mammal prey due to a single application of chlrosulfuron are unlikely to cause any adverse effect. In addition, the acute dose is much less than the chronic NOAEL for birds, so there is no basis for asserting or predicting that adverse effects are plausible (SERA, 2003-Chlorsulfuron, p. 4-27).

Estimated doses using the highest application rate (0.25 lb/acre) are much less than the acute and chronic NOAELs for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Chlorsulfuron, p.4-28).

Small Insectivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 1686 mg/kg. For exposure scenarios that use the typical application rate of 0.056 lb/acre, if a 10 g bird consumed contaminated insects on site shortly after application, assuming the highest residue rates, it would receive an acute dose of 6.32 mg/kg (SERA, 2003-Chlorsulfuron, Worksheet F14b). This dose is 0.004 of the acute

NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous birds are plausible (SERA, 2003-Chlorsulfuron, p. 4-27).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. However, the acute dose is much less than the chronic NOAEL as well, and chronic doses are much lower than acute doses. Therefore, there is no basis for asserting or predicting that adverse effects are plausible (SERA, 2003-Chlorsulfuron, p. 4-27).

Estimated doses using the highest application rate (0.25 lb/acre) are much less than the acute and chronic NOAELs for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Chlorsulfuron, p.4-28).

CLOPYRALID

Small Mammal Directly Sprayed

The acute NOAEL for mammals in laboratory toxicity tests is 75 mg/kg. For, exposure scenarios that use the typical application rate of 0.35 lb/acre, if a small mammal is directly sprayed, and 100 percent absorption is assumed, the animal would receive an acute dose of 8.49 mg/kg (SERA, 2003-Clopyralid, Worksheet F02a). This estimated dose is 0.10 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible (SERA, 2003-Clopyralid, p. 4-23).

At the highest application rate of 0.5 lb/acre, the animal would receive an acute dose of 12.1 mg/kg (project file). This dose is 0.2 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible at any application rate.

Small Mammal Drinking Contaminated Water

The estimated doses to a small mammal from drinking water contaminated by an accidental spill, assuming the highest levels of contamination, are 2.33 mg/kg for acute exposure (SERA, 2003-Clopryalid, Worksheet F05). If a small mammal consumes contaminated water over time, accounting for dissipation, degradation, and other processes, the animal would receive a chronic dose of 0.00067 mg/kg/day (SERA, 2003-Clopyralid, Worksheet F07). Doses to a large mammal would be even lower on a per kg body weight basis. These doses are 0.03 of the acute NOAEL, and 0.00004 of the chronic NOAEL, respectively, so there is no basis for asserting or predicting that adverse effects to mammals are plausible (SERA, 2003-Clopyralid, p. 4-23).

At the highest application rate of 0.5 lb/acre, the acute dose from drinking water contaminated by a spill is 3.32 mg/kg (project file). This dose is 0.04 of the acute NOAEL. The chronic dose is also below the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible, even in a worst-case scenario.

Large Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 75 mg/kg. For exposure scenarios that use the typical application rate of 0.35 lb/acre, if a 70 kg mammal consumed contaminated vegetation on site shortly after application, assuming the highest residue rates and 100 percents of the diet contaminated, it would receive an acute dose of 17.0 mg/kg (SERA, 2003-Clopyralid, Worksheet F10). This dose is 0.2 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large herbivorous mammals are plausible (SERA, 2003-Clopyralid, p. 4-23).

The chronic NOAEL for mammals in laboratory toxicity tests is 15 mg/kg/day. Chronic exposure from the consumption of contaminated vegetation for 90 days at the treatment site, assuming the highest residue rates, results in a dose of 8.95 mg/kg/day (SERA, 2003-Clopyralid, Worksheet F11a). This dose is 0.6 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to large herbivorous mammals are plausible (SERA, 2003-Clopyralid, p. 4-23).

Estimated doses using the highest application rate (0.50 lb/acre) are less than the acute and chronic NOAELs for mammals, although only marginally so for the chronic NOAEL. Since both doses are still below the NOAEL, there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Clopyralid, p. 4-23).

Medium Carnivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 75 mg/kg. For exposure scenarios that use the typical application rate of 0.35 lb/acre, if a 5 kg mammal consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 0.734 mg/kg (SERA, 2003-Clopyralid, Worksheet F16a). Doses to a large mammal would be even lower on a per kg body weight basis. This dose is 0.02 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to carnivorous mammals are plausible (SERA, 2003-Clopyralid, p. 4-23).

Clopyralid does not appear to accumulate in animal tissues. The elimination and metabolism of clopyralid has been studied in rats, hens, lambs, and goats (SERA, 2003-Clopyralid). These animals rapidly excreted largely unmetabolized clopyralid. The half-life for elimination in rats is three hours (Dow AgroSciences 1998 cited in SERA, 2003-Clopyralid). Therefore, chronic exposures from contaminated mammal prey due to a single application of clopyralid are unlikely to cause any adverse effect. In addition, the acute dose is less than the chronic NOAEL of 15 mg/kg/day for mammals, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of clopyralid over time are plausible. 44

Estimated doses using the highest application rate (0.50 lb/acre) are less than the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Clopyralid, p. 4-23).

Small Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 75 mg/kg. If a small mammal consumes contaminated vegetation shortly after application, assuming the highest residue rates, the acute dose received is 0.938 mg/kg (SERA 2003 Clopyralid, Worksheet F03). This estimated dose is 0.01 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to small herbivorous mammals are plausible (SERA 2003 Clopyralid, p. 4-23).

The chronic NOAEL for mammals in laboratory toxicity tests is 15 mg/kg/day. If a small mammal consumes contaminated vegetation at the treatment site for 90-days, assuming highest residue rates, the animal would receive a chronic dose of 0.0987 mg/kg/day (SERA 2003 Clopyralid, Worksheet F04a). This estimated dose is 0.007 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to small herbivorous mammals are plausible (SERA 2003 Clopyralid, p. 4-23).

Estimated doses using the highest application rate (0.50 lb/acre) are than the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA 2003 Clopyralid, p. 4-23).

Small Insectivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 75 mg/kg. For exposure scenarios that use the typical application rate of 0.35 lb/acre, if a small mammal consumes contaminated insects shortly after application, assuming the highest residue rates, the acute dose received is 24.3 mg/kg (SERA 2003 Clopyralid, Worksheet 14a). This dose is 0.30 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous mammals are plausible (SERA 2003 Clopyralid, p. 4-23).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. The acute dose is greater than the chronic NOAEL (15 mg/kg/day), so adverse effects to insectivorous mammals appear plausible from chronic dietary exposures. The dose is less than the chronic LOAEL of 150 mg/kg/day, however. The exposure scenario uses residue rates from small insects, which are substantially higher than those for large insects, and assumes that 100 percent of the daily diet is composed of insects that have been directly sprayed. For bats, in particular, the scenario is unlikely to occur in the field. It seems more plausible for shrews and small fossorial insectivores, however

The estimated dose (34.7 mg/kg) using the highest application rate (0.50 lb/acre) is less than the acute NOAEL, but greater than the chronic NOAEL for mammals. The dose is less than the chronic LOAEL of 150 mg/kg/day, however. No adverse effects are plausible from acute exposures, but adverse effects to insectivorous mammals are plausible from chronic dietary exposures.

Large Herbivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 670 mg/kg. For exposure scenarios that use the typical application rate of 0.35 lb/acre, if a 4 kg bird consumed contaminated grass on site shortly after application, assuming the highest residue rates and 100 percent of diet is contaminated, it would receive an acute dose of 26.6 mg/kg (SERA, 2003-Clopyralid, Worksheet F12). This dose is 0.04 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Clopyralid, p. 4-23).

There is no chronic toxicity index available for effects of clopyralid to birds, so the mammal chronic NOAEL will be used. In acute dietary exposures, the bird NOAEL is about a factor of nine above the mammal NOAEL, suggesting that birds are less sensitive than mammals to clopyralid. The chronic NOAEL for mammals in laboratory toxicity tests is 15 mg/kg/day. Chronic exposure from the consumption of contaminated grass for 90 days at the treatment site, assuming the highest residue rates and 100 percent of diet is contaminated, results in a dose of 14.0 mg/kg/day (SERA, 2003-Clopyralid, Worksheet F13a). This estimated dose is 0.90 of the chronic NOAEL for mammals, and birds appear to be less sensitive to clopyralid than mammals, so there is no basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Clopyralid, p. 4-23).

Estimated doses using the highest application rate (0.50 lb/acre) are less than the acute NOAEL for birds, but greater than the chronic NOAEL for mammals. The chronic dose is less than the chronic LOAEL of 150 mg/kg/day, however. No adverse effects are plausible from acute exposures, but adverse effects to large herbivorous birds appear plausible from chronic dietary exposures. However, the assumptions in the chronic exposure scenario are very unlikely to occur in field conditions, so the weight of evidence suggests that no adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Clopyralid, p. 4-23).

Large Fish-eating Bird

Many chemicals may be concentrated or partitioned from water into the tissues of animals in the water. This process is referred to as bioconcentration. Clopyralid does not appear to bioconcentrate, based on one study in sunfish (Bidlack 1982 as cited in SERA, 2003-Clopyralid). The exposure scenarios in the SERA risk assessment use a whole-fish BCF of 1 L/kg for acute and chronic exposures.

The acute NOAEL for birds in laboratory toxicity tests is 670 mg/kg. For exposure scenarios that use the typical application rate of 0.35 lb/acre, if a predatory bird consumed fish from a pond contaminated by an accidental spill, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive an acute dose of 2.38 mg/kg (SERA, 2003-Clopyralid, Worksheet F08).

This dose is 0.004 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible (SERA, 2003-Clopyralid, p. 4-23).

There is no chronic toxicity index available for effects of clopyralid to birds, so the mammal chronic NOAEL will be used. In acute dietary exposures, the bird NOAEL is about a factor of nine above the mammal NOAEL, suggesting that birds are less sensitive than mammals to clopyralid. The chronic NOAEL for mammals in laboratory toxicity tests is 15 mg/kg/day. If a predatory bird consumed fish contaminated by runoff for a lifetime, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive a chronic dose of 0.000683 mg/kg/day (SERA 2003 Clopyralid, Worksheet F09). This estimated dose is 0.00005 of the chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible (SERA, 2003-Clopyralid, p. 4-23).

Estimated doses using the highest application rate (0.50 lb/acre) are less than the acute NOAEL for birds and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Large Predatory Bird

The acute NOAEL for birds in laboratory toxicity tests is 670 mg/kg. For exposure scenarios that use the typical application rate of 0.35 lb/acre, if a 0.6 kg bird consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 1.13 mg/kg (SERA 2003 Clopyralid, Worksheet F16b). This is 0.002 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to predatory birds are plausible.

Clopyralid does not appear to bioconcentrate, based on one study in sunfish (Bidlack 1982 as cited in SERA 2003 Clopyralid). The elimination and metabolism of clopyralid has been studied in rats, hens, lambs, and goats ((SERA, 2003-Clopyralid). These animals rapidly excreted largely unmetabolized clopyralid. The half-life for elimination in rats is three hours (Dow AgroSciences, 1998 cited in SERA, 2003). Therefore, chronic exposures from contaminated mammal prey due to a single application of clopyralid are unlikely to cause any adverse effect. In addition, the acute dose is less than the chronic NOAEL for birds, so there is no basis for asserting/predicting that adverse effects from repeated acute exposures from multiple applications of clopyralid over time are plausible.

Estimated doses using the highest application rate (0.50 lb/acre) are less than the acute NOAEL for birds, and the chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects to predatory birds are plausible.

Small Insectivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 670 mg/kg. For exposure scenarios that use the typical application rate of 0.35 lb/acre, if a 10 g bird consumed contaminated insects on site shortly after application, assuming the highest residue rates, it would receive an acute dose of 39.5 mg/kg (SERA, 2003-Clopyralid, Worksheet F14b). This dose is 0.06 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous birds are plausible (SERA, 2003-Clopyralid, p. 4-23).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. The acute dose is greater than the chronic NOAEL (15 mg/kg/day) for mammals, so adverse effects to insectivorous birds appear plausible from chronic dietary exposures. The dose is less than the chronic LOAEL of 150 mg/kg/day, however.

The estimated dose (56.4 mg/kg) using the highest application rate (0.50 lb/acre) is less than the acute NOAEL for birds but greater than the chronic NOAEL for mammals. The dose is less than the chronic LOAEL of 150 mg/kg/day, however. No adverse effects are plausible from acute exposures, but adverse effects to insectivorous birds appear plausible from chronic dietary exposures.

DICAMBA

Dicamba has a relatively low acute toxicity to adult animals, in terms of direct lethal doses, but adverse effects on reproduction and nervous systems occur at much lower doses. Dicamba shows a consistent pattern of increased toxicity to larger sized animals, across several species and animal types (i.e. birds and mammals).

The following results are based on a very protective reference dose from EPA that is disputed by more recent information from EPA's Office of Pesticide Programs (OPP) (Durkin, pers. com.). The appropriateness of the toxicity index is currently being peer reviewed, and may change with the final risk assessment for dicamba. If the value used by OPP becomes the toxicity index used for the FS/SERA risk assessment, the analysis will show a lower potential for adverse effects to mammals (Durkin, pers. com).

Small Mammal Directly Sprayed

The acute NOAEL for small mammals in laboratory toxicity tests is 30 mg/kg, and it is 3 mg/kg for larger mammals. For, exposure scenarios that use the typical application rate of 0.3 lb/acre, if a small mammal is directly sprayed, and 100 percent absorption is assumed, the animal would receive an acute dose of 7.27 mg/kg (SERA, 2003-Dicamba, Worksheet F02a). If a mammal the size of a rabbit is directly sprayed, it would receive an acute dose of 1.69 mg/kg (SERA, 2003-Dicamba, Worksheet F02c). These estimated doses are 0.2 and 0.6 of their respective NOAELs, so there is no basis for predicting or asserting that adverse effects to smaller herbivorous mammals are plausible (SERA, 2003-Dicamba, p. 4-32). 48

At the highest application rate of 2.0 lb/acre, the acute dose is 48.5 mg/kg for a small mammal, and 11.2 for a rabbit-sized mammal (project file). These doses are 1.6 times greater than the acute NOAEL for small mammals, and 3.7 times greater than the acute NOAEL for larger mammals. The dose in the rabbit-sized mammal (about 12 mg/kg) exceeds the LOAEL for adverse reproductive effects in larger mammals. The dose for the mouse-sized mammal (60 mg/kg) is less than the LOAEL for neurotoxic effects in smaller mammals. Therefore, adverse effects to reproduction of rabbit-sized mammals are plausible and adverse effects to nervous system responses in mouse-sized mammals may be plausible, from direct spray exposure at the highest application rate.

Small Mammal Drinking Contaminated Water

The estimated doses to a small mammal from drinking water contaminated by an accidental spill, assuming the highest levels of contamination, are 1.33 mg/kg for acute exposure (SERA, 2003-Dicamba, Worksheet F05). If a small mammal consumes contaminated water over time, accounting for dissipation, degradation, and other processes, the animal would receive a chronic dose of 0.00000132 mg/kg/day (SERA, 2003-Dicamba, Worksheet F07). Doses to a large mammal would be even lower on a per kg body weight basis, but dicamba is more toxic to larger animals. These doses are 0.44 of the acute NOAEL for large mammals, and 0.0000004 of the chronic NOAEL, respectively, so there is no basis for asserting or predicting that adverse effects to mammals are plausible (SERA, 2003-Dicamba, p. 4.32).

At the highest application rate of 2.0 lb/acre, the acute dose to a small mammal from drinking water contaminated by a spill is 8.87 mg/kg (project file). This dose is 0.3 of the acute NOAEL. The chronic dose is also below the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible, even in a worst-case scenario.

Large Herbivorous Mammal

The acute NOAEL for large mammals in laboratory toxicity tests is 3 mg/kg. For exposure scenarios that use the typical application rate of 0.3 lb/acre, if a 70 kg mammal consumed contaminated vegetation on site shortly after application, assuming the highest residue rates and 100 percents of the diet contaminated, it would receive an acute dose of 14.6 mg/kg

(SERA, 2003-Dicamba, Worksheet F10). This dose is greater than the acute NOAEL and also exceeds the acute LOAEL for large mammals (10 mg/kg). Since the toxicity index is based on reproductive effects, the interpretation of risk is made with respect to the toxicity studies on which the NOAEL is based (SERA, 2003-Dicamba, p. 4-33). Therefore, adverse effects to the reproductive ability of large grass-eating mammals are plausible at the typical application rate (SERA, 2003-Dicamba, p. 4-31).

The chronic NOAEL for both large and small mammals in laboratory toxicity tests is 3 mg/kg/day, based on the same studies used to determine the acute NOAEL for large mammals. Chronic exposure from the consumption of contaminated vegetation for 90 days at the treatment site, assuming the highest residue rates, results in a dose of 2.10 mg/kg/day (SERA 2003 Dicamba, Worksheet F11a). This dose is 0.7 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible (SERA, 2003-Dicamba, p. 4-32). 49

Estimated doses using the highest application rate (2.0 lb/acre) are greater than the acute NOAEL and greater than the chronic NOAEL for mammals. The acute dose (97.3 mg/kg) is intermediate between the NOAEL for neurotoxicity (30 mg/kg) and the LOAEL for neurotoxicity, so adverse effects to nervous systems are not expected, but are plausible (SERA 2003 Dicamba, p. 4-33). However, the acute dose is a factor of 10 above the LOAEL for reproductive effects, so adverse effects to reproduction would not only be plausible, they are expected at the highest application rate (SERA, 2003-Dicamba, p. 4-33). The chronic dose (14.0 mg/kg/day) is greater than the chronic LOAEL (10 mg/kg/day) for reproductive effects. Adverse effects to reproduction are plausible for the chronic exposure.

Medium Carnivorous Mammal

The acute NOAEL for small mammals in laboratory toxicity tests is 30 mg/kg. For exposure scenarios that use the typical application rate of 0.3 lb/acre, if a 5 kg mammal consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 0.629 mg/kg (SERA, 2003-Dicamba, Worksheet F16a). Doses to a large mammal would be even lower on a per kg body weight basis. This dose is 0.02 of the acute NOAEL for smaller mammals, so there is no basis for asserting or predicting that adverse effects to carnivorous mammals are plausible (SERA, 2003-Dicamba, p. 4-32).

Dicamba does not appear to accumulate or persist in animal tissues. The elimination of dicamba has been studied in rats, mice, rabbits, and dogs (SERA 2003 Dicamba). A combination of elimination and metabolism extensively and rapidly eliminated dicamba and its metabolites from the bodies of all mammalian species studied. With dietary exposure, urinary and fecal excretion approached 96 percent and 4 percent, respectively (SERA, 2003-Dicamba). Following a single oral dose of 100 mg/kg, 67-83 percent of the dose was excreted as parent compound within 48 hours in rats, mice, rabbits and dogs (SERA, 2003-Dicamba, citing Atallah et al., 1980). However, renal saturation can occur at doses above approximately 150 mg/kg, presumably increasing the time it takes for dicamba to be excreted. Therefore, chronic exposures from contaminated mammal prey due to a single application of dicamba are unlikely to cause any adverse effect. In addition, the acute dose is less than the chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of carnivorous mammals over time are plausible.

The estimated dose using the highest application rate (2 lb/acre) is less than the acute NOAEL for small mammals, and equal to the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Small Herbivorous Mammal

The acute NOAEL for small mammals in laboratory toxicity tests is 30 mg/kg, and it is 3 mg/kg for larger mammals. If a small mammal consumes contaminated vegetation shortly after application, assuming the highest residue rates, the acute dose received is 0.804 mg/kg (SERA, 2003-Dicamba, Worksheet F03). This estimated doses is 0.03 of the acute NOAEL, respectively, so there is no basis for asserting or predicting that adverse effects to small herbivorous mammals are plausible (SERA, 2003-Name, p. 4-32).

The chronic NOAEL for mammals in laboratory toxicity tests is 3 mg/kg/day. If a small mammal consumes contaminated vegetation at the treatment site for 90-days, assuming highest residue rates, the animal would receive a chronic dose of 0.0232 mg/kg/day (SERA, 2003-Dicamba, Worksheet F04a). This estimated dose is 0.008 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to small herbivorous mammals are plausible.

Estimated doses using the highest application rate (2 lb/acre) are less than the acute and chronic NOAEL for small mammals for the consumption of contaminated vegetation, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Small Insectivorous Mammal

The acute NOAEL for small mammals in laboratory toxicity tests is 30 mg/kg. For exposure scenarios that use the typical application rate of 0.3 lb/acre, if a small mammal consumes contaminated insects shortly after application, assuming the highest residue rates, the acute dose received is 20.8 mg/kg (SERA, 2003-Dicamba, Worksheet 14a). This dose is 0.7 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous mammals are plausible (SERA, 2003-Dicamba, p. 4-32).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. The acute dose is greater than the chronic NOAEL and also exceeds the chronic LOAEL for effects to reproductions, so adverse effects to insectivorous mammals appear plausible from chronic dietary exposures. The exposure scenario uses residue rates from small insects, which are substantially higher than those for large insects, and assumes that 100 percent of the daily diet is composed of insects that have been directly sprayed. For bats, in particular, the scenario is unlikely to occur in the field. It seems more plausible for shrews and small fossorial insectivores, however.

The estimated dose using the highest application rate (2 lb/acre) is greater than the acute NOAEL, and greater than the chronic NOAEL for mammals. The estimated dose (150 mg/kg) is equal to the LOAEL for neurotoxicity, but a factor of 15 greater than the LOAEL for reproductive effects (10 mg/kg). Therefore, adverse effects to nervous system responses are plausible and adverse effects to reproduction would not only be plausible, they are expected at the highest application rate.

Large Herbivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 13.6 mg/kg. For exposure scenarios that use the typical application rate of 0.3 lb/acre, if a 4 kg bird consumed contaminated grass on site shortly after application, assuming the highest residue rates and 100 percent of diet is contaminated, it would receive an acute dose of 22.8 mg/kg (SERA, 2003-Dicamba, Worksheet F12). This dose is greater than the acute NOAEL, and about equal to the LOAEL for neurotoxic effects (27 mg/kg). Therefore, adverse effects to grass-eating birds are plausible at the typical application rate (SERA, 2003-Dicamba, p. 4-34).

The chronic NOAEL for birds in laboratory toxicity tests is 13.6 mg/kg/day. Chronic exposure from the consumption of contaminated grass for 90 days at the treatment site, assuming the highest residue rates and 100 percent of diet is contaminated, results in a dose of 3.29 mg/kg/day (SERA 2003 Dicamba, Worksheet F13a). This estimated dose is 0.2 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to grass-eating birds are plausible (SERA, 2003-Dicamba, p. 4-32).

Estimated doses using the highest application rate (2 lb/acre) are greater than the acute NOAEL and greater than the chronic NOAEL for birds. The acute dose (150 mg/kg) is 5 times greater than the LOAEL for neurotoxic effects, so adverse effects to nervous system responses are expected. Adverse effects to reproductive ability are also plausible at this dose (LOAEL = 184 mg/kg) (SERA 2003 Dicamba, p.4-34).

The chronic dose is equal to the LOAEL for neurotoxic effects, so adverse effects to nervous system responses are plausible from chronic exposures.

Large Fish-eating Bird

Many chemicals may be concentrated or partitioned from water into the tissues of animals in the water. This process is referred to as bioconcentration. Because of its low octanol water partition coefficient, dicamba has a very low potential to bioconcentrate in fish (SERA, 2003-Dicamba, p. 3-23). Yu et al. (1975) and Francis et al. (1985), as cited in SERA 2004 Dicamba, conducted microcosm studies to measure the bioconcentration of dicamba in aquatic species. Both studies indicated that bioconcentration did not occur. The bioconcentration factor (BCF) of a substance can be estimated using a formula discussed in Calabrese and Baldwin (1993). This formula yields a BCF of 0.66 for dicamba in whole fish, which is higher than the values from the microcosm studies. The exposure scenarios in the SERA risk assessment use a whole-fish BCF of 0.66 L/kg for acute and chronic exposure.

The acute NOAEL for birds in laboratory toxicity tests is 13.6 mg/kg. For exposure scenarios that use the typical application rate of 0.3 lb/acre, if a predatory bird consumed fish from a pond contaminated by an accidental spill, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive an acute dose of 0.899 mg/kg (SERA, 2003-Dicamba, Worksheet F08). This dose is 0.07 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible (SERA, 2003-Dicamba, p. 4-32).

The chronic NOAEL for birds in laboratory toxicity tests is 13.6 mg/kg/day. If a predatory bird consumed fish contaminated by runoff for a lifetime, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive a chronic dose of 0.000000891 mg/kg/day (SERA 2003 Dicamba, Worksheet F09). This estimated dose is 0.00000007 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible (SERA 2003 Dicamba, p. 4-32).

Estimated doses using the highest application rate (2 lb/acre) are less than the acute and chronic NOAEL for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Large Predatory Bird

The acute NOAEL for birds in laboratory toxicity tests is 13.6 mg/kg. For exposure scenarios that use the typical application rate of 0.3 lb/acre, if a 0.6 kg bird consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 0.97 mg/kg (SERA 2003 Dicamba, Worksheet F16b). This is 0.07 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to predatory birds are plausible.

Dicamba does not appear to accumulate or persist in animal tissues. The elimination of dicamba has been studied in rats, mice, rabbits, and dogs (SERA 2003 Dicamba).

A combination of elimination and metabolism extensively and rapidly eliminated dicamba and its metabolites from the bodies of all mammalian species studied. With dietary exposure, urinary and fecal excretion approached 96 percent and 4 percent, respectively (SERA, 2003-Dicamba). Following a single oral dose of 100 mg/kg, 67-83 percent of the dose was excreted as parent compound within 48 hours in rats, mice, rabbits and dogs (SERA, 2003-Dicamba, citing Atallah et al. 1980). However, renal saturation can occur at doses above approximately 150 mg/kg, presumably increasing the time it takes for dicamba to be excreted. Therefore, chronic exposures from contaminated mammal prey due to a single application of dicamba are unlikely to cause any adverse effect. In addition, the acute dose is less than the chronic NOAEL for birds, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of predatory birds over time are plausible.

Estimated doses using the highest application rate (2 lb/acre) also result in an exposure less than the acute and chronic NOAEL for birds/mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Small Insectivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 13.6 mg/kg. For exposure scenarios that use the typical application rate of 0.3 lb/acre, if a 10 g bird consumed contaminated insects on site shortly after application, assuming the highest residue rates, it would receive an acute dose of 33.8 mg/kg (SERA, 2003-Dicamba, Worksheet F14b). This dose is greater than the acute NOAEL. This dose is equal to the LOAEL for neurotoxic effects, so adverse effects to nervous system responses in insectivorous birds are plausible (SERA, 2003-Dicamba, p. 4-34).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. The acute dose is greater than the chronic NOAEL for birds (13.6 mg/kg/day) and also greater than the chronic LOAEL for neurotoxic effects (27 mg/kg/day). So adverse effects to nervous system responses are plausible from chronic exposures.

The estimated dose (226 mg/kg) using the highest application rate (2 lb/acre) is greater than the acute and chronic NOAEL for birds. This dose is also almost 9 times greater than the LOAEL for neurotoxic effects, and greater than the LOAEL for reproductive effects (184 mg/kg/day), so adverse effects to insectivorous birds are expected at the highest application rate.

GLYPHOSATE

Small Mammal Directly Sprayed

The acute NOAEL for mammals in laboratory toxicity tests is 175 mg/kg. For, exposure scenarios that use the typical application rate of 2 lb/acre, if a small mammal is directly sprayed, and 100 percent absorption is assumed, the animal would receive an acute dose of 48.5 mg/kg (SERA, 2003-Glyphosate, Worksheet F02a). This estimated dose is 0.3 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible (SERA, 2003-Glyphosate, p. 4-43).

At the highest application rate of 7 lb/acre, the animal would receive an acute dose of 170 mg/kg (project file). This dose is 0.97 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible at any application rate.

Small Mammal Drinking Contaminated Water

The acute NOAEL for mammals in laboratory toxicity tests is 175 mg/kg. The estimated doses to a small mammal from drinking water contaminated by an accidental spill, assuming the highest levels of contamination, are 5.32 mg/kg for acute exposure (SERA, 2003-Glyphosate, Worksheet F05). If a small mammal consumes contaminated water over time, accounting for dissipation, degradation, and other processes, the animal would receive a chronic dose of 0.00234 mg/kg/day (SERA 2003 Glyphosate, Worksheet F07). Doses to a large mammal would be even lower on a per kg body weight basis. These doses are 0.03 of the acute NOAEL, and 0.00001 of the chronic NOAEL, respectively, so there is no basis for asserting or predicting that adverse effects to mammals are plausible (SERA, 2003-Glyphosate, p. 4-43).

At the highest application rate of 7 lb/acre, the acute dose from drinking water contaminated by a spill is 18.6 mg/kg (project file). This dose is 0.1 of the acute NOAEL. The chronic dose is also below the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible, even in a worst-case scenario.

Large Herbivorous Mammal 54

The acute NOAEL for mammals in laboratory toxicity tests is 175 mg/kg. For exposure scenarios that use the typical application rate of 2 lb/acre, if a 70 kg mammal consumed contaminated vegetation on site shortly after application, assuming the highest residue rates and 100 percents of the diet contaminated, it would receive an acute dose of 97.1 mg/kg (SERA, 2003-Glyphosate, Worksheet F10). This dose is 0.6 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible (SERA, 2003-Glyphosate, p. 4-43).

The chronic NOAEL for mammals in laboratory toxicity tests is 175 mg/kg/day. Chronic exposure from the consumption of contaminated vegetation for 90 days at the treatment site, assuming the highest residue rates, results in a dose of 53.2 mg/kg/day (SERA, 2003-Glyphosate, Worksheet F11a). This dose is 0.3 of the chronic NOAEL, so there is no/ basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible (SERA, 2003-Glyphosate, p. 4-43).

Estimated doses using the highest application rate (7 lb/acre) result in doses greater than the acute and equal to the chronic NOAEL for mammals. The acute dose is equal to a LOAEL that resulted in some mortality to pregnant rabbits. Thus, while the acute dose to herbivorous mammals at the highest application rate is well below the LD_{50} (2,000 mg/kg), mortality in some animals would be plausible (SERA, 2003-Glyphosate, p. 4-44).

Medium Carnivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 175 mg/kg. For exposure scenarios that use the typical application rate of 2 lb/acre, if a 5 kg mammal consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 4.2 mg/kg (SERA, 2003-Glyphosate, Worksheet F16a). Doses to a large mammal would be even lower on a per kg body weight basis. This dose is 0.024 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to carnivorous mammals are plausible (SERA, 2003-Glyphosate, p. 4-43).

Glyphosate does not appear to accumulate or persist in animal tissues. Only about 30 percent of ingested glyphosate is absorbed from the gastrointestinal tract (several studies by Davies 1996 cited in SERA, 2003-Glyphosate). The glyphosate that is absorbed is distributed widely throughout the body, and then efficiently excreted. More than 97 percent of the administered dose is excreted unchanged, and glyphosate does not substantially concentrate or persist in any tissue (SERA, 2003-Glyphosate, p. 3-5). These conclusions are consistent with data from a field study that measured glyphosate residues in several small mammal species after an aerial application in Oregon (Newton et al. 1984). Newton et al. (1984) found that residues in small mammals were below 1 mg/kg for deermice and shrews, and below 2 mg/kg for voles, three days after treatment. Therefore, chronic exposures from contaminated mammal prey due to a single application of glyphosate are unlikely to cause any adverse effect. In addition, the acute dose is much less than the chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of glyphosate over time are plausible.

The estimated dose using the highest application rate (7 lb/acre) is much less than the acute and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Small Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 175 mg/kg. If a small mammal consumes contaminated vegetation shortly after application, assuming the highest residue rates, the acute dose received is 2.11 mg/kg (SERA, 2003-Glyphosate, Worksheet

F03). This estimated dose is 0.01 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to small herbivorous mammals are plausible (SERA, 2003-Glyphosate, p. 4-43).

The chronic NOAEL for mammals in laboratory toxicity tests is 175 mg/kg/day. If a small mammal consumes contaminated vegetation at the treatment site for 90-days, assuming highest residue rates, the animal would receive a chronic dose of 0.231 mg/kg/day (SERA 2003-Glyphosate, Worksheet F04a). This estimated dose is 0.001 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to small herbivorous mammals are plausible (SERA, 2003-Glyphosate, p. 4-43).

Estimated doses using the highest application rate (7 lb/acre) are less than the acute and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Small Insectivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 175 mg/kg. For exposure scenarios that use the typical application rate of 2 lb/acre, if a small mammal consumes contaminated insects shortly after application, assuming the highest residue rates, the acute dose received is 139 mg/kg (SERA, 2003-Glyphosate, Worksheet 14a). This dose is 0.793 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to small insectivorous mammals are plausible (SERA, 2003-Glyphosate, p. 4-43).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. However, the acute dose is less than the chronic NOAEL as well, and chronic doses are much lower than acute doses. Therefore, there is no basis for asserting or predicting that adverse effects to insectivorous mammals from chronic exposures are plausible.

The estimated dose (486 mg/kg) using the highest application rate (7 lb/acre) is greater than the acute and chronic NOAELs for mammals, so adverse effects to insectivorous mammals are plausible. This dose also exceeds the acute and chronic LOAEL (350 mg/kg) for diarrhea in mammals. The exposure scenario uses residue rates from small insects, which are substantially higher than those for large insects, and assumes that 100 percent of the daily diet is composed of insects that have been directly sprayed. For bats, in particular, the scenario is unlikely to occur in the field. It seems more plausible for shrews and small fossorial insectivores, however. (Check Newton et al 1984 paper).

<u>Large Herbivorous Bird</u>

The acute NOAEL for birds in laboratory toxicity tests is 562 mg/kg. For exposure scenarios that use the typical application rate of 2 lb/acre, if a 4 kg bird consumed contaminated grass on site shortly after application, assuming the highest residue rates and 100 percent of diet is contaminated, it would receive an acute dose of 152 mg/kg (SERA, 2003-Glyphosate, Worksheet F12). This dose is 0.3 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Glyphosate, p. 4-43).

The chronic NOAEL for birds in laboratory toxicity tests is 100 mg/kg/day. Chronic exposure from the consumption of contaminated grass for 90 days at the treatment site, assuming the highest residue rates and 100 percent of diet is contaminated, results in a dose of 83.2 mg/kg/day (SERA, 200X-Name, Worksheet F13a). This estimated dose is 0.8 of the chronic NOAEL, so there is no/ basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Glyphosate, p. 4-43).

Estimated doses using the highest application rate (7 lb/acre) are less than the acute NOAEL, but greater than the chronic NOAEL for birds. LOAEL's are not reported for birds in the sources I reviewed, presumably because of a lack of toxic responses in laboratory tests. No adverse effects are plausible from acute exposures, but adverse effects to large herbivorous birds appear plausible from chronic dietary exposures, based on dose exceeding the NOAEL. The assumptions in the chronic exposure scenario are unlikely to occur in field conditions, particularly because glyphosate is a non-selective herbicide and would kill most forage species at this application rate, making the forage unavailable or unpalatable. However, some monitored values for glyphosate residues on vegetation (Newton et al. 1994) are higher than those used in the SERA risk assessments. Therefore, the higher residue rates may offset the lack of forage availability, and adverse effects to herbivorous birds are plausible.

<u>Large Fish-eating Bird</u>

Many chemicals may be concentrated or partitioned from water into the tissues of animals in the water. This process is referred to as bioconcentration. The EPA uses a BCF for whole fish of 0.52 L/kg based on a study by Forbis (1989 as cited in SERA, 2003-Glyphosate) and corroborated by Chamberlain et al. (1996, as cited in SERA, 2003). Therefore, exposure scenarios in the SERA risk assessment use a whole-fish BCF of 0.52 L/kg for acute and chronic exposures.

The acute NOAEL for birds in laboratory toxicity tests is 562 mg/kg. For exposure scenarios that use the typical application rate of 2 lb/acre, if a predatory bird consumed fish from a pond contaminated by an accidental spill, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive an acute dose of 2.83 mg/kg (SERA, 2003-Glyphosate, Worksheet F08). This dose is 0.005 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible (SERA, 2003-Glyphosate, p. 4-43).

The chronic NOAEL for birds in laboratory toxicity tests is 100 mg/kg/day. If a predatory bird consumed fish contaminated by runoff for a lifetime, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive a chronic dose of 0.00125 mg/kg/day (SERA, 2003-Glyphosate, Worksheet F09). This estimated dose is 0.00001 of the chronic NOAEL, so there is no basis for asserting/predicting that adverse effects to fish-eating birds are plausible.

Estimated doses using the highest application rate (7 lb/acre) are much less than the acute and chronic NOAELs for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Large Predatory Bird

The acute NOAEL for birds in laboratory toxicity tests is 562mg/kg. For exposure scenarios that use the typical application rate of 2 lb/acre, if a 0.6 kg bird consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 6.46 mg/kg (SERA, 2003-Glyphosate, Worksheet F16b). This is 0.0115 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to predatory birds are plausible.

Glyphosate does not appear to accumulate or persist in animals. Only about 30 percent of ingested glyphosate is absorbed from the gastrointestinal tract (several studies by Davies 1996 cited in SERA, 2003-Glyphosate). The glyphosate that is absorbed is distributed widely throughout the body, and then efficiently excreted. More than 97 percent of the administered dose is excreted unchanged, and glyphosate does not substantially concentrate or persist in any tissue (SERA 2003 Glyphosate, p. 3-5). These conclusions are consistent with data from a field study that measured glyphosate residues in several small mammal species after an aerial application in Oregon (Newton et al., 1984). Newton et al. (1984) found that residues in small mammals were below 1 mg/kg for deermice and shrews, and below 2 mg/kg for voles, three days after treatment. Therefore, chronic exposures from contaminated mammal prey due to a single application of glyphosate are unlikely to cause any adverse effect. In addition, the acute dose is much less than the chronic NOAEL for birds, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of glyphosate over time are plausible.

Estimated doses using the highest application rate (7 lb/acre) are less than the acute and chronic NOAELs for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Small Insectivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 562 mg/kg. For exposure scenarios that use the typical application rate of 2 lb/acre, if a 10 g bird consumed contaminated insects on site shortly after application, assuming the highest residue rates, it would receive an acute dose of 226 mg/kg (SERA, 2003-Glyphosate, Worksheet F14b). This dose is 0.4 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous birds are plausible (SERA, 2003-Glyphosate, p. 4-43).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. However, the acute dose is greater than the chronic NOAEL for birds. LOAEL's are not reported for birds in the sources I reviewed, presumably because of a lack of toxic responses in laboratory tests. Adverse effects to insectivorous birds appear plausible from chronic dietary exposures, based on dose exceeding the NOAEL.

The estimated dose using the highest application rate (7 lb/acre) is greater than the acute and chronic NOAELs for birds, so adverse effects to insectivorous birds appear plausible at the highest application rate.

IMAZAPIC

Small Mammal Directly Sprayed

For, exposure scenarios that use the typical application rate of 0.1 lb/acre, if a small mammal is directly sprayed, and 100 percent absorption is assumed, the animal would receive an acute dose of 2.42 mg/kg (SERA, 2003-Imazapic, Worksheet F02a). This estimated dose is 0.007 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible (SERA, 2003-Imazapic, p. 4-21).

At the highest application rate of 0.19 lb/acre, the animal would receive an acute dose of 4.36 mg/kg (project file). This dose is 0.01 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible at any application rate.

Small Mammal Drinking Contaminated Water

The acute NOAEL for mammals in laboratory toxicity tests is 350 mg/kg. The estimated doses to a small mammal from drinking water contaminated by an accidental spill, assuming the highest levels of contamination, are 0.665 mg/kg for acute exposure (SERA, 2003-Imazapic, Worksheet F05). If a small mammal consumes contaminated water over time, accounting for dissipation, degradation, and other processes, the animal would receive a chronic dose of 0.000000439 mg/kg/day (SERA, 2003-Imazapic, Worksheet F07). Doses to a large mammal would be even lower on a per kg body weight basis. These doses are 0.002 of the acute NOAEL, and 0.000000009 of the chronic NOAEL, respectively, so there is no basis for asserting or predicting that adverse effects to mammals are plausible (SERA, 2003-Imazapic, p. 4-21).

At the highest application rate of 0.19 lb/acre, the acute dose from drinking water contaminated by a spill is 1.26 mg/kg (project file). This dose is 0.004 of the acute NOAEL.

The chronic dose is also below the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible, even in a worst-case scenario.

Large Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 350 mg/kg. For exposure scenarios that use the typical application rate of 0.1 lb/acre, if a 70 kg mammal consumed contaminated vegetation on site shortly after application, assuming the highest residue rates and 100 percents of the diet contaminated, it would receive an acute dose of 4.86 mg/kg (SERA, 2003-Imazapic, Worksheet F10). This dose is 0.01 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible (SERA 2003 Imazapic, p. 4-21).

The chronic NOAEL for mammals in laboratory toxicity tests is 45 mg/kg/day. Chronic exposure from the consumption of contaminated vegetation for 90 days at the treatment site, assuming the highest residue rates, results in a dose of 0.929 mg/kg/day (SERA, 2003-Imazapic, Worksheet F11a). This dose is 0.02 of the chronic NOAEL, so there is no/ basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible (SERA, 2003-Imazapic, p. 4-21).

Estimated doses using the highest application rate (0.1875 lb/acre) are less than the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 20030-Imazapic, p. 4-21).

Medium Carnivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 350 mg/kg. For exposure scenarios that use the typical application rate of 0.1 lb/acre, if a 5 kg mammal consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 0.21 mg/kg (SERA, 2003-Imazapic, Worksheet F16a). Doses to a large mammal would be even lower on a per kg body weight basis. This dose is 0.0006 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to carnivorous mammals are plausible (SERA, 2003=-Imazapic, p. 4-21).

Imazapic does not appear to accumulate or persist in animals following either single or multiple doses. The elimination of imazapic has been studied in rats, hens, and goats (Afzal, 1994; Cheng, 1993; Gatterdam 1993a,b; Kao 1993a,b; Sharp and Thalacker, 1999; all as cited in SERA, 2003-Imazapic). A combination of elimination and metabolism extensively and rapidly eliminated imazapic and its metabolites from the bodies of all species studied.

Therefore, chronic exposures from contaminated mammal prey due to a single application of imazapic are unlikely to cause any adverse effect. In addition, the acute dose is much less than the chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of imazapic over time are plausible.

The estimated dose using the highest application rate (0.1875 lb/acre) is less than the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Imazapic, p. 4-21).

Small Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 350 mg/kg. If a small mammal consumes contaminated vegetation shortly after application, assuming the highest residue rates, the acute dose received is 0.268 mg/kg (SERA, 2003-Imazapic, Worksheet F03). This estimated dose is 0.0008 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible (SERA, 2003-Imazapic, p. 4-21).

The chronic NOAEL for mammals in laboratory toxicity tests is 45 mg/kg/day. If a small mammal consumes contaminated vegetation at the treatment site for 90-days, assuming highest residue rates, the animal would receive a chronic dose of 0.0102 mg/kg/day (SERA, 2003-Imazapic, Worksheet F04a). This estimated dose is 0.0002 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible (SERA, 2003-Imazapic, p. 4-21).

Estimated doses using the highest application rate (0.1875 lb/acre) are less than the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Imazapic, p. 4-21).

Small Insectivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 350 mg/kg. For exposure scenarios that use the typical application rate of 0.1 lb/acre, if a small mammal consumes contaminated insects shortly after application, assuming the highest residue rates, the acute dose received is 6.94 mg/kg (SERA, 2003-Imazapic, Worksheet 14a). This dose is 0.02 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous mammals are plausible (SERA, 2003-Imazapic, p. 4-21).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. However, the acute dose is less than the chronic NOAEL for mammals as well, and chronic doses are much lower than acute doses. Therefore, there is no basis for asserting or predicting that adverse effects to insectivorous mammals from chronic exposures are plausible.

The estimated dose using the highest application rate (0.1875 lb/acre) is less than the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Imazapic, p. 4-21).

Large Herbivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 1100 mg/kg. For exposure scenarios that use the typical application rate of 0.1 lb/acre, if a 4 kg bird consumed contaminated grass on site shortly after application, assuming the highest residue rates and 100 percent of diet is contaminated, it would receive an acute dose of 7.6 mg/kg (SERA, 2003-Imazapic, Worksheet F12). This dose is 0.007 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Imazapic, p. 4-21).

The chronic NOAEL for birds in laboratory toxicity tests is 113 mg/kg/day. Chronic exposure from the consumption of contaminated grass for 90 days at the treatment site, assuming the highest residue rates and 100 percent of diet is contaminated, results in a dose of 1.45 mg/kg/day (SERA, 2003-Imazapic, Worksheet F13a). This estimated dose is 0.01 of the chronic NOAEL, so there is no/ basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Imazapic, p. 4-21).

Estimated doses using the highest application rate (0.1875 lb/acre) are less than the acute and chronic NOAELs for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA 2003 Imazapic, p. 4-21).

Large Fish-eating Bird

Many chemicals may be concentrated or partitioned from water into the tissues of animals in the water. This process is referred to as bioconcentration. The potential for bioconcentration of imazapic in fish was studied in bluegill sunfish exposed to ^{14}C-labeled imazapic for 28 days (Robinson, 1994, cited in SERA, 2003-Imazapic). In the SERA risk assessments, concentrations in viscera are considered to reflect concentration in whole fish. Bioconcentration factors (BCF) for bluegill were 0.11 L/kg in whole fish, indicating that the concentration of imazapic in the fish was less than the concentration of imazapic in the water (SERA, 2003-Imazapic). The exposure scenarios in the SERA risk assessment use a whole-fish BCF of 0.11 L/kg for acute and chronic exposures because of the rapid time it takes to reach a steady state and the very low BCF.

The acute NOAEL for birds in laboratory toxicity tests is 1100 mg/kg. For exposure scenarios that use the typical application rate of 0.1 lb/acre, if a predatory bird consumed fish from a pond contaminated by an accidental spill, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive an acute dose of 0.0749 mg/kg (SERA, 2003-Imazapic, Worksheet F08). This dose is 0.00007 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible (SERA, 2003-Imazapic, p. 4-21).

The chronic NOAEL for birds in laboratory toxicity tests is 113 mg/kg/day. If a predatory bird consumed fish contaminated by runoff for a lifetime, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive a chronic dose of 0.0000000495 mg/kg/day (SERA, 200X-Worksheet F09). This estimated dose is 0.0000000004 of the chronic NOAEL, so there is no basis for asserting/predicting that adverse effects to fish-eating birds are plausible (SERA, 2003-Imazapic, p. 4-21).

Estimated doses using the highest application rate (0.1875 lb/acre) also result in exposures much less than the acute and chronic NOAELs for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Imazapic, p. 4-21).

Large Predatory Bird

The acute NOAEL for birds in laboratory toxicity tests is 1100 mg/kg. For exposure scenarios that use the typical application rate of 0.1 lb/acre, if a 0.6 kg bird consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 0.323 mg/kg (SERA, 2003-Imazapic, Worksheet F16b). This is 0.0003 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to predatory birds are plausible (SERA, 2003-Imazapic, p. 4-21).

Imazapic does not appear to accumulate or persist in animals following either single or multiple doses. The elimination of imazapic has been studied in rats (Cheng 1993), hens

(Afzal, 1994; Gatterdam, 1993a,b), and goats (Kao 1993a,b; Sharp and Thalacker, 1999; cited in SERA, 2003-Imazapic). A combination of elimination and metabolism extensively and rapidly eliminated imazapic and its metabolites from the bodies of all species studied. Therefore, chronic exposures from contaminated mammal prey due to a single application of imazapic are unlikely to cause any adverse effect. In addition, the acute dose is much less than the chronic NOAEL for birds, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of imazapic over time are plausible.

The estimated dose using the highest application rate (0.1875 lb/acre) is less than the acute and chronic NOAELs for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Imazapic, p. 4-21).

Small Insectivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 1100 mg/kg. For exposure scenarios that use the typical application rate of 0.1 lb/acre, if a 10 g bird consumed contaminated insects on site shortly after application, assuming the highest residue rates, it would receive an acute dose of 11.3 mg/kg (SERA, 2003-Imazapic, Worksheet F14b). This dose is 0.01 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous birds are plausible (SERA, 2003-Imazapic, p. 4-21).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. However, the acute dose is less than the chronic NOAEL for birds as well, and chronic doses are much lower than acute doses. Therefore, there is no basis for asserting or predicting that adverse effects to insectivorous birds from chronic exposures are plausible.

The estimated dose using the highest application rate (0.1875 lb/acre) is less than the acute and chronic NOAELs for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Imazapic, p. 4-21).

IMAZAPYR

Small Mammal Directly Sprayed

The acute NOAEL for mammals in laboratory toxicity tests is 250 mg/kg. For, exposure scenarios that use the typical application rate of 0.45 lb/acre, if a small mammal is directly sprayed, and 100 percent absorption is assumed, the animal would receive an acute dose of 10.9 mg/kg (SERA, 2003-Imazapyr, Worksheet F02a). This estimated dose is 0.04 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible (SERA, 2003-Imazapyr, p. 4-25).

At the highest application rate of 1.25 lb/acre, the animal would receive an acute dose of 30.3 mg/kg (project file). This dose is 0.1 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible at any application rate.

Small Mammal Drinking Contaminated Water

The estimated doses to a small mammal from drinking water contaminated by an accidental spill, assuming the highest levels of contamination, are 1.22 mg/kg for acute exposure (SERA, 2003-Imazapyr, Worksheet F05). If a small mammal consumes contaminated water over time, accounting for dissipation, degradation, and other processes, the animal would receive a chronic dose of 0.0000659 mg/kg/day (SERA 2003 Imazapyr, Worksheet F07). Doses to a large mammal would be even lower on a per kg body weight basis. These doses are 0.005 of the acute NOAEL, and 0.0000003 of the chronic NOAEL, respectively, so there is no basis for asserting or predicting that adverse effects to mammals are plausible (SERA, 2003-Imazapyr, p. 4-25).

At the highest application rate of 1.25 lb/acre, the acute dose from drinking water contaminated by a spill is 3.39 mg/kg (project file). This dose is 0.005 of the acute NOAEL. The chronic dose is also below the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible, even in a worst-case scenario. The acute NOAEL for mammals in laboratory toxicity tests is 250 mg/kg. For exposure scenarios that use the typical application rate of 0.45 lb/acre, if a 5 kg mammal consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 0.944 mg/kg (SERA, 2003-Imazapyr, Worksheet F16a). (Doses to a large mammal would be even lower on a per kg body weight basis). This dose is 0.004 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to carnivorous mammals are plausible (SERA, 2003-Imazapyr, p. 4-25).

Imazapyr does not appear to accumulate or persist in animals following either single or multiple doses (SERA, 2003-Imazapyr, p. 3-2). The elimination of imazapyr has been studied in rats and lactating goats and the studies reported that it is rapidly excreted, unchanged, in urine and feces (Mallipudi et al., 1983; and Zdybak, 1992 as cited in SERA, 2003-Imazapyr). No metabolites were identified. Therefore, chronic exposures from contaminated mammal prey due to a single application of imazapyr are unlikely to cause any adverse effect. In addition, the acute dose is much less than the chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of imazapyr over time are plausible.

Estimated doses using the highest application rate (1.25 lb/acre) are less than the acute and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-mazapyr, p. 4-25).

The acute NOAEL for mammals in laboratory toxicity tests is 250 mg/kg. For exposure scenarios that use the typical application rate of 0.45 lb/acre, if a 70 kg mammal consumed contaminated vegetation on site shortly after application, assuming the highest residue rates and 100 percents of the diet contaminated, it would receive an acute dose of 21.9 mg/kg (SERA, 2003-Imazapyr, Worksheet F10). This dose is 0.09 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible (SERA, 2003-Imazapyr, p. 4-25).

The chronic NOAEL for mammals in laboratory toxicity tests is 250 mg/kg/day. Chronic exposure from the consumption of contaminated vegetation for 90 days at the treatment site, assuming the highest residue rates, results in a dose of 10.6 mg/kg/day (SERA, 200X-Name, Worksheet F11a). This dose is 0.04 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible (SERA, 2003-Imazapyr, p. 4-25).

Estimated doses using the highest application rate (1.25 lb/acre) are less than the acute and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Imazapyr, p. 4.25).

<u>Medium Carnivorous Mammal</u>

<u>Large Herbivorous Mammal</u>

<u>Small Herbivorous Mammal</u>

The acute NOAEL for mammals in laboratory toxicity tests is 250 mg/kg. If a small mammal consumes contaminated vegetation shortly after application, assuming the highest residue rates, the acute dose received is 1.21 mg/kg (SERA, 2003-Imazapyr, Worksheet F03). This estimated dose is 0.005 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible (SERA, 2003-Imazapyr, p. 4-25).

The chronic NOAEL for mammals in laboratory toxicity tests is 250 mg/kg/day. If a small mammal consumes contaminated vegetation at the treatment site for 90-days, assuming highest residue rates, the animal would receive a chronic dose of 0.117 mg/kg/day (SERA, 2003-Imazapyr, Worksheet F04a). This estimated dose is 0.0005 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible.

Estimated doses using the highest application rate (1.25 lb/acre) are less than the acute and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Imazapyr, p. 4-25).

<u>Small Insectivorous Mammal</u>

The acute NOAEL for mammals in laboratory toxicity tests is 250 mg/kg. For exposure scenarios that use the typical application rate of 0.45 lb/acre, if a small mammal consumes contaminated insects shortly after application, assuming the highest residue rates, the acute dose received is 31.2 mg/kg (SERA, 2003-Imazapyr, Worksheet 14a). This dose is 0.1 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous mammals are plausible (SERA, 2003-Imazapyr, p. 4-25).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. However, the acute dose is less than the chronic NOAEL for mammals as well, and chronic doses are much lower than acute doses. Therefore, there is no basis for asserting or predicting that adverse effects to insectivorous mammals from chronic exposures are plausible.

The estimated dose using the highest application rate (1.25 lb/acre) is less than the acute and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Imazapyr, p. 4-25).

<u>Large Herbivorous Bird</u>

The acute NOAEL for birds in laboratory toxicity tests is 674 mg/kg. For exposure scenarios that use the typical application rate of 0.45 lb/acre, if a 4 kg bird consumed contaminated grass on site shortly after application, assuming the highest residue rates and 100 percent of diet is contaminated, it would receive an acute dose of 34.2 mg/kg (SERA, 2003-Imazapyr, Worksheet F12). This dose is 0.05 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Imazapyr, p. 4-25).

The chronic NOAEL for birds in laboratory toxicity tests is 200 mg/kg/day. Chronic exposure from the consumption of contaminated grass for 90 days at the treatment site, assuming the highest residue rates and 100 percent of diet is contaminated, results in a dose of 16.5 mg/kg/day (SERA, 2003-Imazapyr, Worksheet F13a). This estimated dose is 0.08 of the chronic NOAEL, so there is no/ basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Imazapyr, p. 4-25).

Estimated doses using the highest application rate (1.25 lb/acre) are less than the acute and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Imazapyr, p. 4-25).

Large Fish-eating Bird

Many chemicals may be concentrated or partitioned from water into the tissues of animals in the water. This process is referred to as bioconcentration. The potential for bioconcentration of imazapyr in fish was studied in bluegill sunfish exposed to ^{14}C-labeled imazapyr for 28 days (McAllister et al., 1985, cited in SERA, 2003-Imazapyr). In the SERA risk assessments, concentrations in viscera are considered to reflect concentration in whole fish. Bioconcentration factors (BCF) for bluegill were 0.5 L/kg, indicating that the concentration of imazapyr in the fish was less than the concentration of imazapyr in the water (SERA, 2003-Imazapyr, p. 3-20). The exposure scenarios in the SERA risk assessment use a whole-fish BCF of 0.5 L/kg for acute and chronic exposures.

The acute NOAEL for birds in laboratory toxicity tests is 674 mg/kg. For exposure scenarios that use the typical application rate of 0.45 lb/acre, if a predatory bird consumed fish from a pond contaminated by an accidental spill, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive an acute dose of 0.625 mg/kg (SERA, 2003-Imazapyr, Worksheet F08). This dose is 0.0009 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible (SERA, 2003-Imazapyr, p. 4-25).

The chronic NOAEL for birds in laboratory toxicity tests is 200 mg/kg/day. If a predatory bird consumed fish contaminated by runoff for a lifetime, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive a chronic dose of 0.0000338 mg/kg/day (SERA, 2003-Imazapyr, Worksheet F09). This estimated dose is 0.0000002 of the chronic NOAEL, so there is no basis for asserting/predicting that adverse effects to fish-eating birds are plausible.

Estimated doses using the highest application rate (1.25 lb/acre) are less than the acute and chronic NOAEL for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Imazapyr, p. 4-25).

Large Predatory Bird

The acute NOAEL for birds in laboratory toxicity tests is 674 mg/kg. For exposure scenarios that use the typical application rate of 0.45 lb/acre, if a 0.6 kg bird consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 1.45 mg/kg (SERA, 2003-Imazapyr, Worksheet F16b). This is 0.002 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to predatory birds are plausible.

Imazapyr does not appear to accumulate or persist in animals following either single or multiple doses (SERA, 2003-Imazapyr, p. 3-2). The elimination of imazapyr has been studied in rats and lactating goats and the studies reported that it is rapidly excreted, unchanged, in urine and feces (Mallipudi et al., 1983; and Zdybak, 1992 as cited in SERA, 2003-Imazapyr). No metabolites were identified. Therefore, chronic exposures from contaminated mammal prey due to a single application of imazapyr are unlikely to cause any adverse effect. In addition, the acute dose is much less than the chronic NOAEL for birds, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of imazapyr over time are plausible.

The estimated dose using the highest application rate (1.25 lb/acre) is less than the acute and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Imazapyr, p. 4-25).

Small Insectivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 674 mg/kg. For exposure scenarios that use the typical application rate of 0.45 lb/acre, if a 10 g bird consumed contaminated insects on site shortly after application, assuming the highest residue rates, it would receive an acute dose of 50.8 mg/kg (SERA, 2003-Imazapyr, Worksheet F14b). This dose is 0.08 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous birds are plausible (SERA, 2003-Imazapyr, p. 4-25).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. However, the acute dose is less than the chronic NOAEL for birds as well, and chronic doses are much lower than acute doses. Therefore, there is no basis for asserting or predicting that adverse effects to insectivorous birds from chronic exposures are plausible.

The estimated dose using the highest application rate (1.25 lb/acre) is less than the acute and chronic NOAEL for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Imazapyr, p. 4-25).

METSULFURON METHYL

Small Mammal Directly Sprayed

The acute NOAEL for mammals in laboratory toxicity tests is 25 mg/kg. For, exposure scenarios that use the typical application rate of 0.03 lb/acre, if a small mammal is directly sprayed, and 100 percent absorption is assumed, the animal would receive an acute dose of 0.727 mg/kg (SERA, 2003-Metsulfuron methyl, Worksheet F02a). This estimated dose is 0.03 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible (SERA, 2003-Metsulfuron methyl, p. 4-26).

At the highest application rate of 0.15 lb/acre, the animal would receive an acute dose of 3.64 mg/kg (project file). This dose is 0.1 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible at any application rate.

Small Mammal Drinking Contaminated Water

The estimated doses to a small mammal from drinking water contaminated by an accidental spill, assuming the highest levels of contamination, are 0.0443 mg/kg for acute exposure (SERA, 2003-Metsulfuron methyl, Worksheet F05). If a small mammal consumes contaminated water over time, accounting for dissipation, degradation, and other processes, the animal would receive a chronic dose of 0.00000176 mg/kg/day (SERA 2003 Metsulfuron methyl, Worksheet F07). Doses to a larger mammal would be even lower on a per kg body weight basis. These doses are 0.002 of the acute NOAEL, and 0.00000007 of the chronic NOAEL, respectively, so there is no basis for asserting or predicting that adverse effects to mammals are plausible (SERA, 2003-Metsulfuron methyl, p. 4-26, 4-27).

At the highest application rate of 0.15 lb/acre, the acute dose from drinking water contaminated by a spill is 0.222 mg/kg (project file). This dose is 0.009 of the acute NOAEL. The chronic dose is also below the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible, even in a worst-case scenario.

Large Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 25 mg/kg. For exposure scenarios that use the typical application rate of 0.03 lb/acre, if a 70 kg mammal consumed contaminated vegetation on site shortly after application, assuming the highest residue rates and 100 percents of the diet contaminated, it would receive an acute dose of 1.46 mg/kg (SERA, 2003-Metsulfuron methyl, Worksheet F10). This dose is 0.06 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible (SERA, 2003-Metsulfuron methyl, p. 4-26). The chronic NOAEL for mammals in laboratory toxicity tests is 25 mg/kg/day. Chronic exposure from the consumption of contaminated vegetation for 90 days at the treatment site, assuming the highest residue rates, results in a dose of 0.613 mg/kg/day (SERA, 2003-Metsulfuron methyl, Worksheet F11a). This dose is 0.02 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible (SERA, 2003-Metsulfuron methyl, p. 4-27).

Estimated doses using the highest application rate (0.15 lb/acre) are less than the acute and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA 2003 Metsulfuron methyl, p. 4-27).

Medium Carnivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 25 mg/kg. For exposure scenarios that use the typical application rate of 0.03 lb/acre, if a 5 kg mammal consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 0.0629 mg/kg (SERA, 2003-Metsulfuron methyl, Worksheet F16a). Doses to a large mammal would be even lower on a per kg body weight basis. This dose is 0.003 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to carnivorous mammals are plausible (SERA, 2003-Metsulfuron methyl, p. 4-26).

Metsulfuron methyl does not appear to accumulate or persist in animal tissues. The elimination of metsulfuron methyl has been studied in rats, hens cows, and goats (SERA 2003 Metsulfuron methyl, citing Charlton and Bookhart, 1996; USEPA, 1998; Hershberger and Moore, 1985; Hundley, 1985; Hunt, 1984). A combination of elimination of the unchanged compound and metabolism rapidly eliminated metsulfuron methyl from the bodies of all species studied. The half-life for elimination in all species is one day or less (SERA, 2003-Metsulfuron methyl, p. 3-3). Therefore, chronic exposures from contaminated mammal prey due to a single application of metsulfuron methyl are unlikely to cause any adverse effect. In addition, the acute dose is much less than the chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of metsulfuron methyl over time are plausible. The estimated dose using the highest application rate (0.15 lb/acre) is less than the acute and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-etsulfuron methyl, p. 4-27).

Small Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 25 mg/kg. If a small mammal consumes contaminated vegetation shortly after application, assuming the highest residue rates, the acute dose received is 0.0804 mg/kg (SERA, 200- Metsulfuron methyl, Worksheet F03). This estimated dose is 0.003 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible (SERA, 2003-Metsulfuron methyl, p. 4-26).

The chronic NOAEL for mammals in laboratory toxicity tests is 25 mg/kg/day. If a small mammal consumes contaminated vegetation at the treatment site for 90-days, assuming highest residue rates, the animal would receive a chronic dose of 0.00676 mg/kg/day (SERA, 2003-Metsulfuron methyl, Worksheet F04a). This estimated dose is 0.0003 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to small herbivorous mammals are plausible (SERA, 2003-Metsulfuron methyl, p. 4-27).

Estimated doses using the highest application rate (0.15 lb/acre) are less than the acute and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA 2003 Metsulfuron methyl, p. 4-27).

Small Insectivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 25 mg/kg. For exposure scenarios that use the typical application rate of 0.03 lb/acre, if a small mammal consumes contaminated insects shortly after application, assuming the highest residue rates, the acute dose received is 2.08 mg/kg (SERA, 2003-Metsulfuron methyl, Worksheet 14a). This dose is 0.08 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous mammals are plausible (SERA, 2003-Metsulfuron methyl, p. 4-26).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. However, the acute dose is less than the chronic NOAEL as well, and chronic doses are much lower than acute doses. Therefore, there is no basis for asserting or predicting that adverse effects to insectivorous mammals from chronic exposures are plausible.

Estimated doses using the highest application rate (0.15 lb/acre) also result in an exposure less than the acute and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Large Herbivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 1043 mg/kg. For exposure scenarios that use the typical application rate of 0.03 lb/acre, if a 4 kg bird consumed contaminated grass on site shortly after application, assuming the highest residue rates and 100 percent of diet is contaminated, it would receive an acute dose of 2.28 mg/kg (SERA, 2003-Metsulfuron methyl, Worksheet F12). This dose is 0.002 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Metsulfuron methyl, p. 4-26).

The chronic NOAEL for birds in laboratory toxicity tests is 120 mg/kg/day. Chronic exposure from the consumption of contaminated grass for 90 days at the treatment site, assuming the highest residue rates and 100 percent of diet is contaminated, results in a dose of 0.96 mg/kg/day (SERA, 2003-Metsulfuron methyl, Worksheet F13a). This estimated dose is 0.008 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Metsulfuron methyl, p. 4-27).

Estimated doses using the highest application rate (0.15 lb/acre) are less than the acute and chronic NOAELs for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Metsulfuron methyl, p. 4-27).

Large Fish-eating Bird

Many chemicals may be concentrated or partitioned from water into the tissues of animals in the water. This process is referred to as bioconcentration. The potential for bioconcentration of metsulfuron methyl in fish was studied in bluegill sunfish exposed to ^{14}C-metsulfuron methyl for 28 days (Han 1982, cited in SERA, 2003-Metsulfuron methyl). In the SERA risk assessments, concentrations in viscera are considered to reflect concentration in whole fish. Bioconcentration factors (BCF) reported for bluegill viscera were 0.21 L/kg after 24 hours and the highest BCF reported was 2.11 L/kg after 14 days (SERA, 2003-Metsulfuron methyl, Appendix 8). The exposure scenarios in the SERA risk assessment use a whole-fish BCF of 0.21 L/kg for acute exposure and 2.11 L/kg for chronic exposure.

The acute NOAEL for birds in laboratory toxicity tests is 1043 mg/kg. For exposure scenarios that use the typical application rate of 0.03 lb/acre, if a predatory bird consumed fish from a pond contaminated by an accidental spill, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive an acute dose of 0.00954 mg/kg (SERA, 2003-Metsulfuron methyl, Worksheet F08). This dose is 0.000009 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible (SERA, 2003-Metsulfuron methyl, p. 4-26).

The chronic NOAEL for birds in laboratory toxicity tests is 120 mg/kg/day. If a predatory bird consumed fish contaminated by runoff for a lifetime, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive a chronic dose of 0.0000038 mg/kg/day (SERA, 2003-Metsulfuron methyl, Worksheet F09). This estimated dose is 0.00000003 of the chronic NOAEL, so there is no basis for asserting/predicting that adverse effects to fish-eating birds are plausible (SERA 2003 Metsulfuron methyl, p. 4-27).

Estimated doses using the highest application rate (0.15 lb/acre) are much less than the acute and chronic NOAELs for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Large Predatory Bird

The acute NOAEL for birds in laboratory toxicity tests is 1043mg/kg. For exposure scenarios that use the typical application rate of 0.03 lb/acre, if a 0.6 kg bird consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 0.097 mg/kg (SERA, 2003-Metsulfuron methyl, Worksheet F16b). This is 0.00009 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to predatory birds are plausible (SERA, 2003-Metsulfuron methyl, p. 4-26).

Metsulfuron methyl does not appear to accumulate or persist in animal tissues. The elimination of metsulfuron methyl has been studied in rats, hens cows, and goats (SERA, 2003-Metsulfuron methyl, citing Charlton and Bookhart, 1996; USEPA, 1998; Hershberger and Moore, 1985; Hundley, 1985; Hunt, 1984). A combination of elimination of the unchanged compound and metabolism rapidly eliminated metsulfuron methyl from the bodies of all species studied. The half-life for elimination in all species is one day or less (SERA, 2003-Metsulfuron methyl, p. 3-3). Therefore, chronic exposures from contaminated mammal prey due to a single application of metsulfuron methyl are unlikely to cause any adverse effect. In addition, the acute dose is much less than the chronic NOAEL for birds, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of metsulfuron methyl over time are plausible.

The estimated dose using the highest application rate (0.15 lb/acre) is less than the acute and chronic NOAELs for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Small Insectivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 1043 mg/kg. For exposure scenarios that use the typical application rate of 0.03 lb/acre, if a 10 g bird consumed contaminated insects on site shortly after application, assuming the highest residue rates, it would receive an acute dose of 3.38 mg/kg (SERA, 2003-Metsulfuron methyl, Worksheet F14b). This dose is 0.003 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous birds are plausible (SERA, 2003-Metsulfuron methyl, p. 4-26).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. However, the acute dose is less than the chronic NOAEL for birds as well, and chronic doses are much less than acute doses. Therefore, there is no basis for asserting or predicting that adverse effects to insectivorous birds from chronic exposures are plausible.

The estimated doses using the highest application rate (0.15 lb/acre) is less than the acute and chronic NOAELs for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

PICLORAM

Small Mammal Directly Sprayed

The acute NOAEL for mammals in laboratory toxicity tests is 34 mg/kg. For, exposure scenarios that use the typical application rate of 0.35 lb/acre, if a small mammal is directly sprayed, and 100 percent absorption is assumed, the animal would receive an acute dose of 8.49 mg/kg (SERA, 2003-Picloram, Worksheet F02a). This estimated dose is 0.2 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible (SERA, 2003-Picloram, p. 4-29).

At the highest application rate of 1 lb/acre, the animal would receive an acute dose of 24.2 mg/kg (project file). This dose is 0.7 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible at any application rate.

Small Mammal Drinking Contaminated Water

The estimated doses to a small mammal from drinking water contaminated by an accidental spill, assuming the highest levels of contamination, are 0.887 mg/kg for acute exposure (SERA, 2003-Picloram, Worksheet F05). If a small mammal consumes contaminated water over time, accounting for dissipation, degradation, and other processes, the animal would receive a chronic dose of 0.000205 mg/kg/day (SERA, 2003-Picloram, Worksheet F07).

Doses to a large mammal would be even lower on a per kg body weight basis. These doses are 0.03 of the acute NOAEL, and 0.00003 of the chronic NOAEL, respectively, so there is no basis for asserting or predicting that adverse effects to mammals are plausible (SERA, 2003-Picloram, p. 4-29).

At the highest application rate of 1 lb/acre, the acute dose from drinking water contaminated by a spill is 2.53 mg/kg (project file). This dose is 0.07 of the acute NOAEL. The chronic dose is also below the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible, even in a worst-case scenario.

Large Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 34 mg/kg. For exposure scenarios that use the typical application rate of 0.35 lb/acre, if a 70 kg mammal consumed contaminated vegetation on site shortly after application, assuming the highest residue rates and 100 percents of the diet contaminated, it would receive an acute dose of 17.0 mg/kg (SERA, 2003-Picloram, Worksheet F10). This dose is 0.5 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible (SERA, 2003-Picloram, p. 4-29). The chronic NOAEL for mammals in laboratory toxicity tests is 7 mg/kg/day. Chronic exposure from the consumption of contaminated vegetation for 90 days at the treatment site, assuming the highest residue rates, results in a dose of 2.18 mg/kg/day (SERA 2003 Picloram, Worksheet F11a). This dose is 0.3 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible (SERA, 2003-Picloram, p. 4-29).

Estimated doses using the highest application rate (1 lb/acre) are greater than the acute NOAEL and about equal to the chronic NOAEL for mammals. The acute dose (48.6 mg/kg) is less than the acute LOAEL for decreased weight gain in rabbits (USEPA/OPP, 1998). No adverse effects are plausible from chronic exposures, but adverse effects to large herbivorous mammals may be plausible from acute dietary exposures.

Medium Carnivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 34 mg/kg. For exposure scenarios that use the typical application rate of 0.35 lb/acre, if a 5 kg mammal consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 0.734 mg/kg (SERA, 2003-Picloram, Worksheet F16a). Doses to a larger mammal would be even lower on a per kg body weight basis. This dose is 0.0216 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to carnivorous mammals are plausible (SERA, 2003-Picloram, p. 4-29).

Picloram does not appear to accumulate or persist in animals. The elimination of picloram has been studied in humans, rats, dogs, and cattle (SERA 2003 Picloram). In humans, over 75 percent of the administered picloram was eliminated after six hours and over 90 percent was eliminated after 72 hours (SERA, 2003-Picloram citing Nolan et al. 1984). Therefore, chronic exposures from contaminated mammal prey due to a single application of picloram are unlikely to cause any adverse effect. In addition, the acute dose is much less than the chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of carnivorous mammals over time are plausible.

The estimated dose using the highest application rate (1 lb/acre) is less than the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Small Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 34 mg/kg. If a small mammal consumes contaminated vegetation shortly after application, assuming the highest residue rates, the acute dose received is 0.938 mg/kg (SERA, 2003-Picloram, Worksheet F03). This estimated dose is 0.03 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible (SERA, 2003-Picloram, p. 4-29).

The chronic NOAEL for mammals in laboratory toxicity tests is 7 mg/kg/day. If a small mammal consumes contaminated vegetation at the treatment site for 90-days, assuming highest residue rates, the animal would receive a chronic dose of 0.024 mg/kg/day (SERA, 2003-Picloram, Worksheet F04a). This estimated dose is 0.003 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to small herbivorous mammals are plausible (SERA, 2003-Picloram, p. 4-29).

Estimated doses using the highest application rate (1 lb/acre) are less than the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Small Insectivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 34 mg/kg. For exposure scenarios that use the typical application rate of 0.35 lb/acre, if a small mammal consumes contaminated insects shortly after application, assuming the highest residue rates, the acute dose received is 24.3 mg/kg (SERA, 2003-Picloram, Worksheet 14a). This dose is 0.714 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous mammals are plausible (SERA, 2003-Picloram, p. 4-29).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. The acute dose is greater than the chronic NOAEL (7 mg/kg), and near the chronic LOAEL (35 mg/kg/day) for increased liver weight. So adverse effects to insectivorous mammals appear plausible from chronic dietary exposures. The exposure scenario uses residue rates from small insects, which are substantially higher than those for large insects, and assumes that 100 percent of the daily diet is composed of insects that have been directly sprayed. For bats, in particular, the scenario is unlikely to occur in the field. It seems more plausible for shrews and small fossorial insectivores, however.

The estimated dose (69.4 mg/kg) using the highest application rate (1 lb/acre) is greater than the acute and chronic NOAELs for mammals. It is less than the acute LOAEL for decreased weight gain, but is almost twice the chronic LOAEL for increased liver weight. So adverse effects to insectivorous mammals appear plausible from acute or chronic dietary exposures.

Large Herbivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 1500 mg/kg. For exposure scenarios that use the typical application rate of 0.35 lb/acre, if a 4 kg bird consumed contaminated grass on site shortly after application, assuming the highest residue rates and 100 percent of diet is contaminated, it would receive an acute dose of 26.6 mg/kg (SERA, 2003-Name, Worksheet F12). This dose is 0.02 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Picloram, p. 4-29).

There is no chronic toxicity index available for effects of picloram to birds, so the mammal chronic NOAEL will be used. Since the acute NOAEL for birds is greater than the acute NOAEL for mammals, the use of the chronic figure from mammals is likely to over-estimate risk to birds. The chronic NOAEL for mammals in laboratory toxicity tests is 7 mg/kg/day. Chronic exposure from the consumption of contaminated grass for 90 days at the treatment site, assuming the highest residue rates and 100 percent of diet is contaminated, results in a dose of 3.41 mg/kg/day (SERA, 2003-Picloram, Worksheet F13a). This estimated dose is 0.5 of the chronic NOAEL, so there is no/ basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Picloram, p. 4-29).

Estimated doses using the highest application rate (1 lb/acre) are less than the acute NOAEL for birds, but greater than the chronic NOAEL for mammals. The chronic dose is less than the chronic LOAEL for mammals. No adverse effects are plausible from acute exposures, but adverse effects to large herbivorous birds appear plausible from chronic dietary exposures, based on dose exceeding the NOAEL. Since picloram does not kill grass, herbicide residues on grass may be more available for chronic ingestion than non-selective herbicides.

Large Fish-eating Bird

Many chemicals may be concentrated or partitioned from water into the tissues of animals in the water. This process is referred to as bioconcentration. The potential for bioconcentration of picloram in fish was studied in bluegill and channel catfish exposed to ^{14}C-picloram for 28 days (Bidlack 1980a,b cited in SERA, 2003-Picloram). Only trace amounts of ^{14}C-picloram were recovered in the fish, so the BCF for picloram appears to be substantially less than one (SERA 2003 Picloram). The exposure scenarios in the SERA risk assessment use a whole-fish BCF of 1 L/kg for acute and chronic exposures, which will over-estimate exposure.

The acute NOAEL for birds in laboratory toxicity tests is 1500 mg/kg. For exposure scenarios that use the typical application rate of 0.35 lb/acre, if a predatory bird consumed fish from a pond contaminated by an accidental spill, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive an acute dose of 0.908 mg/kg (SERA, 2003-Picloram, Worksheet F08). This dose is 0.0006 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible (SERA, 2003-Picloram, p. 4-29).

There is no chronic toxicity index available for effects of picloram to birds, so the mammal chronic NOAEL will be used. Since the acute NOAEL for birds is greater than the acute NOAEL for mammals, the use of the chronic figure from mammals is likely to over-estimate risk to birds. The chronic NOAEL for mammals in laboratory toxicity tests is 7 mg/kg/day. If a predatory bird consumed fish contaminated by runoff for a lifetime, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive a chronic dose of 0.000214 mg/kg/day (SERA, 2003-Picloram, Worksheet F09). This estimated dose is 0.00003 of the chronic NOAEL, so there is no basis for asserting/predicting that adverse effects to fish-eating birds are plausible (SERA, 2003-Picloram, p. 4-29).

Estimated doses using the highest application rate (1 lb/acre) are less than the acute NOAEL for birds and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Large Predatory Bird

The acute NOAEL for birds in laboratory toxicity tests is 1500 mg/kg. For exposure scenarios that use the typical application rate of 0.35 lb/acre, if a 0.6 kg bird consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 1.13 mg/kg (SERA 2003 Picloram, Worksheet F16b). This is 0.000754 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to predatory birds are plausible (SERA, 2003-Picloram, p. 4-29).

Picloram does not appear to accumulate or persist in animals. The elimination of picloram has been studied in humans, rats, dogs, and cattle (SERA, 2003-Picloram). In humans, over 75 percent of the administered picloram was eliminated after six hours and over 90 percent was eliminated after 72 hours (SERA, 2003-Picloram citing Nolan et al. 1984). Therefore, chronic exposures from contaminated mammal prey due to a single application of picloram are unlikely to cause any adverse effect. In addition, the acute dose is less than the chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of picloram over time are plausible.

The estimated dose using the highest application rate (1 lb/acre) is less than the acute NOAEL for birds and chronic NOAEL mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Small Insectivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 1500 mg/kg. For exposure scenarios that use the typical application rate of 0.35 lb/acre, if a 10 g bird consumed contaminated insects on site shortly after application, assuming the highest residue rates, it would receive an acute dose of 39.5 mg/kg (SERA, 2003-Picloram, Worksheet F14b). This dose is 0.03 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous birds are plausible (SERA, 2003-Picloram, p. 4-29).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. However, the acute dose is greater than the chronic NOAEL for mammals, so adverse effects to insectivorous birds appear plausible from chronic dietary exposures.

The estimated dose using the highest application rate (1 lb/acre) is less than the acute NOAEL for birds, but greater than the chronic NOAEL for mammals. The acute dose (113 mg/kg) is also greater than the chronic LOAEL for mammals (35 mg/kg/day), so adverse effects to insectivorous birds appear plausible from chronic dietary exposures.

SETHOXYDIM

Small Mammal Directly Sprayed

The acute NOAEL for mammals in laboratory toxicity tests is 160 mg/kg. For, exposure scenarios that use the typical application rate of 0.30 lb/acre, if a small mammal is directly sprayed, and 100 percent absorption is assumed, the animal would receive an acute dose of

7.27 mg/kg (Project file, Sethoxdim Worksheet F02a). This estimated dose is 0.05 and 0.005 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible (SERA 2001 Sethoxydim, p. 4-19).

Small Mammal Drinking Contaminated Water

The estimated doses to a small mammal from drinking water contaminated by an accidental spill, assuming the highest levels of contamination, are 0.997 mg/kg for acute exposure (Project file, Sethoxdim Worksheet F05). If a small mammal consumes contaminated water over time, accounting for dissipation, degradation, and other processes, the animal would receive a chronic dose of 0.0000527 mg/kg/day (Project file, Sethoxdim Worksheet F07). Doses to a large mammal would be even lower on a per kg body weight basis. These doses are 0.006 of the acute NOAEL, and 0.000006 of the chronic NOAEL, respectively, so there is no basis for asserting or predicting that adverse effects to mammals are plausible (SERA 2001 Sethoxydim, p. 4-19).

At the highest application rate of 0.375 lb/acre, the acute dose from drinking water contaminated by a spill is 0.997 mg/kg (project file). This dose is 0.006 of the acute NOAEL. The chronic dose is also below the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible, even in a worst-case scenario.

Large Herbivorous Mammal 79

The acute NOAEL for mammals in laboratory toxicity tests is 160 mg/kg. For exposure scenarios that use the typical application rate of 0.30 lb/acre, if a 70 kg mammal consumed contaminated vegetation on site shortly after application, assuming the highest residue rates and 100 percent of the diet contaminated, it would receive an acute dose of 14.6 mg/kg (Project file, Sethoxdim Worksheet F10). This dose is 0.09 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible (SERA, 2001-Sethoxydim, p. 4-19).

The chronic NOAEL for mammals in laboratory toxicity tests is 9 mg/kg/day. Chronic exposure from the consumption of contaminated vegetation for 90 days at the treatment site, assuming the highest residue rates, results in a dose of 0.701 mg/kg/day (Project file, Sethoxdim Worksheet

F11a). This dose is 0.08 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible (SERA, 2001-Sethoxydim, p. 4-19).

Estimated doses using the highest application rate (0.375 lb/acre) are less the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA 2001 Sethoxydim, p. 4-19).

Medium Carnivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 160 mg/kg. For exposure scenarios that use the typical application rate of 0.30 lb/acre, if a 5 kg mammal consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 0.629 mg/kg (Project file,

Sethoxdim Worksheet F16a). Doses to a large mammal would be even lower on per kg body weight basis. This dose is 0.004 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to carnivorous mammals are plausible (SERA 2001 Sethoxydim, p. 4-19).

There is no information in the risk assessment (SERA 2001 Sethoxydim) on accumulation or elimination of sethoxydim in mammals. Therefore, the potential for chronic exposures from contaminated mammal prey due to a single application of sethoxydim cannot be deduced. However, the acute dose is less than the chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of sethoxydim over time are plausible.

Estimated doses using the highest application rate (0.375 lb/acre) are less than the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Small Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 160 mg/kg. If a small mammal consumes contaminated vegetation shortly after application, assuming the highest residue rates, the acute dose received is 0.804 mg/kg (Project file, Sethoxdim Worksheet F03). This estimated dose is 0.005 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible (SERA, 2001-Sethoxydim, p. 4-19).

The chronic NOAEL for mammals in laboratory toxicity tests is 9 mg/kg/day. If a small mammal consumes contaminated vegetation at the treatment site for 90-days, assuming highest residue rates, the animal would receive a chronic dose of 0.00773 mg/kg/day (Project file, Sethoxdim Worksheet F04a). This estimated dose is 0.0009 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible (SERA, 2001-Sethoxydim, p. 4-19).

Estimated doses using the highest application rate (0.375 lb/acre) are less than the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2001-Sethoxydim, p. 4-19).

Small Insectivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 160 mg/kg. For exposure scenarios that use the typical application rate of 0.30 lb/acre, if a small mammal consumes contaminated insects shortly after application, assuming the highest residue rates, the acute dose received is 20.8 mg/kg (Project file, Sethoxdim Worksheet 14a). This dose is 0.10 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous mammals are plausible.

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. However, the acute dose is greater than the chronic NOAEL and the chronic LOAEL (18 mg/kg/day) for mild anemia. So adverse effects to insectivorous mammals appear plausible from chronic dietary exposures. The exposure scenario uses residue rates from small insects, which are substantially higher than those for large insects, and assumes that 100 percent of the daily diet is composed of insects that have been directly sprayed. For bats, in particular, the scenario is unlikely to occur in the field. It seems more plausible for shrews and small fossorial insectivores, however.

The estimated dose using the highest application rate (0.375 lb/acre) is less than the acute NOAEL, but greater than the chronic NOAEL for mammals, so adverse effects to insectivorous mammals are plausible from chronic dietary exposures.

Large Herbivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 500 mg/kg. For exposure scenarios that use the typical application rate of 0.30 lb/acre, if a 4 kg bird consumed contaminated grass on site shortly after application, assuming the highest residue rates and 100 percent of diet is contaminated, it would receive an acute dose of 22.8 mg/kg (Project file, Sethoxdim Worksheet F12). This dose is 0.05 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2001-Sethoxydim, p. 4-19).

The chronic LOAEL for birds in laboratory toxicity tests is 10 mg/kg/day. Chronic exposure from the consumption of contaminated grass for 90 days at the treatment site, assuming the highest residue rates and 100 percent of diet is contaminated, results in a dose of 1.10 mg/kg/day (Project file, Sethoxdim Worksheet F13a). This estimated dose is 0.1 of the chronic LOAEL. If we apply the standard EPA conversion for extrapolating from a LOAEL to a NOAEL, the NOAEL becomes 1 mg/kg, and the dose is equal to the chronic NOAEL. At this dose, adverse reproductive effects to large grass-eating birds are not likely.

Estimated doses using the highest application rate (0.375 lb/acre) are less than the acute NOAEL and chronic LOAEL. But the estimated dose is greater than the extrapolated chronic NOAEL for birds, so adverse effects to grass-eating birds is plausible from chronic dietary exposures at the highest application rate.

Large Fish-eating Bird

Many chemicals may be concentrated or partitioned from water into the tissues of animals in the water. This process is referred to as bioconcentration. The potential for bioconcentration of sethoxydim in fish was studied in bluegill and catfish. Bioconcentration factors (BCF) for catfish were 0.71 L/kg in muscle and 0.75 L/kg in whole fish (SERA, 2001-Sethoxydim, Appendix 3). BCF for bluegill sunfish were substantially higher, measuring 7 L/kg in muscle and 21 L/kg in whole fish (SERA, 2001-Sethoxydim, Appendix 3). The BCF for acute exposure is calculated using the elimination half-life of sethoxydim residue in fish, to adjust for the expected bioconcentration after one day (SERA, 2001-Sethoxydim, p. 3-16). The exposure scenarios in the SERA risk assessment use a whole-fish BCF of 3.6 L/kg for acute exposure and 21 L/kg for chronic exposure.

The acute NOAEL for birds in laboratory toxicity tests is 500 mg/kg. For exposure scenarios that use the typical application rate of 0.30 lb/acre, if a predatory bird consumed fish from a pond contaminated by an accidental spill, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive an acute dose of 3.68 mg/kg (Project file, Sethoxdim Worksheet F08). This dose is 0.007 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible (SERA, 2001-Sethoxydim, p. 4-19).

The chronic LOAEL for birds in laboratory toxicity tests is 10 mg/kg/day. If a predatory bird consumed fish contaminated by runoff for a lifetime, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive a chronic dose of 0.00113 mg/kg/day (Project file, Sethoxdim Worksheet F09). This estimated dose is 0.0001 of the chronic LOAEL. If we apply the standard EPA safety factor for extrapolating from a LOAEL to a NOAEL, the NOAEL becomes 1 mg/kg. The dose is 0.001of the chronic NOAEL, so there is no basis for asserting/predicting that adverse effects to fish-eating birds are plausible (SERA, 2001-Sethoxydim, p. 4-19).

Estimated doses using the highest application rate (0.375 lb/acre) also result in exposures less than the acute and extrapolated chronic NOAELs for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

<u>Large Predatory Bird</u>

The acute NOAEL for birds in laboratory toxicity tests is 500 mg/kg. For exposure scenarios that use the typical application rate of 0.30 lb/acre, if a 0.6 kg bird consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 0.97 mg/kg (Project file, Sethoxdim Worksheet F16b). This is 0.002 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to predatory birds are plausible.

There is no information in the risk assessment (SERA, 2001-Sethoxydim) on accumulation or elimination of sethoxydim in mammals. Therefore, the potential for chronic exposures from contaminated mammal prey due to a single application of sethoxydim cannot be deduced. However, the acute dose is less than the chronic LOAEL, and the extrapolated NOAEL, for birds, so there is no basis for asserting/predicting that adverse effects from repeated acute exposures from multiple applications of sethoxydim over time are plausible.

The estimated dose using the highest application rate (0.375 lb/acre) is less than the acute NOAEL and less than the chronic LOAEL. The dose (1.21 mg/kg) is greater than the extrapolated chronic NOAEL for birds. Therefore, adverse effects to predatory birds appear plausible from chronic dietary exposures at the highest application rate, base on dose exceeding an extrapolated chronic NOAEL.

<u>Small Insectivorous Bird</u>

The acute NOAEL for birds in laboratory toxicity tests is 500 mg/kg. For exposure scenarios that use the typical application rate of 0.30 lb/acre, if a 10 g bird consumed contaminated insects on site shortly after application, assuming the highest residue rates, it would receive an acute dose of 33.8 mg/kg (Project file, Sethoxdim Worksheet F14b). This dose is 0.07 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous birds are plausible (SERA, 2001-Sethoxydim, p. 4-19).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. However, the acute dose is 3 times greater than the chronic LOAEL for birds, so adverse effects to reproduction of insectivorous birds are expected from chronic dietary exposures. The estimated dose using the highest application rate (0.375 lb/acre) is less than the acute NOAEL, but 4 times greater than the chronic LOAEL for birds. Therefore, adverse effects to reproduction of insectivorous birds are expected from chronic dietary exposures at the highest application rate.

SULFOMETURON METHYL

Small Mammal Directly Sprayed

The acute NOAEL for mammals in laboratory toxicity tests is 87 mg/kg. For, exposure scenarios that use the typical application rate of 0.045 lb/acre, if a small mammal is directly sprayed, and 100 percent absorption is assumed, the animal would receive an acute dose of 1.09 mg/kg (SERA 2003 Sulfometuron methyl, Worksheet F02a). This estimated dose is 0.01 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible (SERA, 2003-Sulfometuron methyl, p. 4-30).

At the highest application rate of 0.38 lb/acre, the animal would receive an acute dose of 9.21 mg/kg (project file). This dose is 0.1 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible at any application rate.

Small Mammal Drinking Contaminated Water

The estimated doses to a small mammal from drinking water contaminated by an accidental spill, assuming the highest levels of contamination, are 0.122 mg/kg for acute exposure (SERA 2003 Sulfometuron methyl, Worksheet F05). If a small mammal consumes contaminated water over time, accounting for dissipation, degradation, and other processes, the animal would receive a chronic dose of 0.461 mg/kg/day (SERA 2003 Sulfometuron methyl, Worksheet F07). Doses to a large mammal would be even lower on a per kg body weight basis. These doses are 0.001 of the acute NOAEL, and 0.0000002 of the chronic NOAEL, respectively, so there is no basis for asserting or predicting that adverse effects to mammals are plausible (SERA 2003 Sulfometuron methyl, p. 4-30 and 4-31).

At the highest application rate of 0.38 lb/acre, the acute dose from drinking water contaminated by a spill is 1.03 mg/kg (project file). This dose is 0.01 of the acute NOAEL. The chronic dose is also below the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible, even in a worst-case scenario.

Large Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 87 mg/kg. For exposure scenarios that use the typical application rate of 0.045 lb/acre, if a 70 kg mammal consumed contaminated vegetation on site shortly after application, assuming the highest residue rates and 100 percents of the diet contaminated, it would receive an acute dose of 2.19 mg/kg (SERA, 2003-Sulfometuron methyl, Worksheet F10). This dose is 0.03 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible (SERA, 2003-Sulfometuron methyl, p. 4-30).

The chronic NOAEL for mammals in laboratory toxicity tests is 2 mg/kg/day. Chronic exposure from the consumption of contaminated vegetation for 90 days at the treatment site, assuming the highest residue rates, results in a dose of 0.35 mg/kg/day (SERA, 2003-Sulfometuron methyl, Worksheet F11a). This dose is 0.2 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible (SERA, 2003-Sulfometuron methyl, p. 4-30).

Estimated doses using the highest application rate (0.38 lb/acre) are less than the acute NOAEL, but greater than the chronic NOAEL for mammals. The chronic dose (2.95 mg/kg) is less than the chronic LOAEL (20 mg/kg/day) for effects to blood and bile ducts. No adverse effects are plausible from acute exposures, but adverse effects to large herbivorous mammals appear plausible from chronic dietary exposures, based on dose exceeding the chronic NOAEL. However, the assumptions in the chronic exposure scenario are very unlikely to occur in field conditions, so the weight of evidence suggests that no adverse effects are plausible using typical or worst-case exposure assumptions (SERA 2003 Sulfometuron methyl, p. 4-31).

Medium Carnivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 87 mg/kg. For exposure scenarios that use the typical application rate of 0.045 lb/acre, if a 5 kg mammal consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 0.0944 mg/kg (SERA, 2003 Sulfometuron methyl, Worksheet F16a). Doses to a larger mammal would be even lower on a per kg body weight basis. This dose is 0.001 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to carnivorous mammals are plausible SERA, 2003 -ulfometuron methyl, p. 4-30.

Sulfometuron methyl is eliminated fairly rapidly and does not appear to accumulate in animal tissues (SERA, 2003-Sulfometuron methyl). The metabolism of sulfometuron methyl has been studied in lactating goats and rats. Goats eliminated 94-99 percent in the urine (Keoppe and Mucha, 1991 cited in SERA, 2003-Sulfometuron methyl). The half-life for metabolism in rats is 28 hours after a gavage dose of 16 mg/kg and 40 hours after a dose of 3000 mg/kg (DuPont, 1989 cited in SERA, 2003-Sulfometuron methyl). Therefore, chronic exposures from contaminated mammal prey due to a single application of sulfometuron methyl are unlikely to cause any adverse effect. In addition, the acute dose is much less than the chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of sulfometuron methyl over time are plausible.

The estimated dose using the highest application rate (0.38 lb/acre) is less than the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Small Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 87 mg/kg. If a small mammal consumes contaminated vegetation shortly after application, assuming the highest residue rates, the acute dose received is 0.121 mg/kg (SERA, 2003-Sulfometuron methyl, Worksheet F03). This estimated dose is 0.001 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible (SERA, 2003-Sulfometuron methyl, p. 4-30).

The chronic NOAEL for mammals in laboratory toxicity tests is 2 mg/kg/day. If a small mammal consumes contaminated vegetation at the treatment site for 90-days, assuming highest residue rates, the animal would receive a chronic dose of 0.00386 mg/kg/day (SERA, 2003-Sulfometuron methyl, Worksheet F04a). This estimated dose is 0.002 of the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible (SERA, 2003-Sulfometuron methyl, p. 4-31).

Estimated doses using the highest application rate (0.38 lb/acre) are less than the acute and chronic NOAELs for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Small Insectivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 87 mg/kg. For exposure scenarios that use the typical application rate of 0.045 lb/acre, if a small mammal consumes contaminated insects shortly after application, assuming the highest residue rates, the acute dose received is 3.12 mg/kg (SERA, 2003-Sulfometuron methyl, Worksheet 14a). This dose is 0.04 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to mammal insectivores are plausible (SERA, 2003-Sulfometuron methyl, p. 4-30).

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. The acute dose is greater than the chronic NOAEL (2 mg/kg/day), but less than the chronic LOAEL (20 mg/kg/day) for effects to blood and bile ducts. So adverse effects to insectivorous mammals appear plausible from chronic dietary exposures, based on dose exceeding the chronic NOAEL. The exposure scenario uses residue rates from small insects, which are substantially higher than those for large insects, and assumes that 100 percent of the daily diet is composed of insects that have been directly sprayed. For bats, in particular, the scenario is unlikely to occur in the field. It seems more plausible for shrews and small fossorial insectivores, however.

The estimated dose (26.4 mg/kg) using the highest application rate (0.38 lb/acre) is less than the acute NOAEL. But the acute dose is greater than the chronic NOAEL and the chronic LOAEL (20 mg/kg/day) for effects to blood and bile ducts. No adverse effects are plausible from acute exposures, but adverse effects to insectivorous mammals are plausible, and may be expected, from chronic dietary exposures at the maximum application rate.

Large Herbivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 312 mg/kg. For exposure scenarios that use the typical application rate of 0.045 lb/acre, if a 4 kg bird consumed contaminated grass on site shortly after application, assuming the highest residue rates and 100 percent of diet is contaminated, it would receive an acute dose of 3.42 mg/kg (SERA, 2003-Sulfometuron methyl, Worksheet F12). This dose is 0.01 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Sulfometuron methyl, p. 4-30).

There is no chronic toxicity index available for effects of sulfometuron methyl to birds, so the mammal chronic NOAEL will be used (acute toxicities of sulfometuron methyl to mammals and birds are of similar magnitude (SERA 2003 Sulfometuron methyl, p. 4-24)). The chronic NOAEL for mammals in laboratory toxicity tests is 2 mg/kg/day. Chronic exposure from the consumption of contaminated grass for 90 days at the treatment site, assuming the highest residue rates and 100 percent of diet is contaminated, results in a dose of 0.547 mg/kg/day (SERA, 2003-Sulfometuron methyl, Worksheet F13a). This estimated dose is 0.3 of the chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects to large grass-eating birds are plausible (SERA, 2003-Sulfometuron methyl, p. 4-31).

Estimated doses using the highest application rate (0.38 lb/acre) are less than the acute NOAEL for birds, but greater than the chronic NOAEL for mammals. The chronic dose (4.62 mg/kg/day) is less than the chronic LOAEL for mammals. No adverse effects are plausible from acute exposures, but adverse effects to large herbivorous birds appear plausible from chronic dietary exposures, based on dose exceeding a NOAEL. However, the assumptions in the chronic exposure scenario are very unlikely to occur in field conditions, so the weight of evidence suggests that no adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Sulfometuron methyl, p. 4-31).

Large Fish-eating Bird

Many chemicals may be concentrated or partitioned from water into the tissues of animals in the water. This process is referred to as bioconcentration. The potential for bioconcentration of sulfometuron methyl in fish was studied in bluegill sunfish and channel catfish exposed to ^{14}C-sulformeturon methyl for 28 days (Harvey, 1981, cited in SERA, 2003-Sulfometuron methyl, p. 3-21). In the SERA risk assessments, concentrations in viscera are considered to reflect concentration in whole fish. No bioaccumulation occurred in either muscle or viscera of bluegill. Bioconcentration Factors (BCF) for viscera of channel catfish after one day of exposure was 3.5 L/kg, and 6 L/kg after 28 days (SERA, 2003-Sulfometuron methyl, Appendix 2). Therefore, exposure scenarios in the SERA risk assessment use a whole-fish BCF of 3.5 L/kg for acute exposure and 6 L/kg for chronic exposure.

The acute NOAEL for birds in laboratory toxicity tests is 312 mg/kg. For exposure scenarios that use the typical application rate of 0.045 lb/acre, if a predatory bird consumed fish from a pond contaminated by an accidental spill, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive an acute dose of 0.437 mg/kg (SERA, 200X, Worksheet F08). This dose is 0.001 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible (SERA, 2003-Sulfometuron methyl, p. 4-30).

There is no chronic toxicity index available for effects of sulfometuron methyl to birds, so the mammal chronic NOAEL will be used (acute toxicities of sulfometuron methyl to mammals and birds are of similar magnitude (SERA, 2003-Sulfometuron methyl, p. 4-24)).

The chronic NOAEL for mammals in laboratory toxicity tests is 2 mg/kg/day. If a predatory bird consumed fish contaminated by runoff for a lifetime, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive a chronic dose of 0.000003 mg/kg/day (SERA, 200X-Worksheet F09). This estimated dose is 0.000001 of the chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible (SERA 2003 Sulfometuron methyl, p. 4-31).

Estimated doses using the highest application rate (0.38 lb/acre) also result in exposures much less than the acute NOAEL for bird and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Sulfometuron methyl, p. 4-31).

Large Predatory Bird

The acute NOAEL for birds in laboratory toxicity tests is 312 mg/kg. For exposure scenarios that use the typical application rate of 0.045 lb/acre, if a 0.6 kg bird consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 0.145 mg/kg (SERA, 2003-Sulfometuron methyl, Worksheet F16b). This is 0.0005 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to predatory birds are plausible.

Sulfometuron methyl does not appear to accumulate in animal tissues. The elimination of this herbicide has been studied in lactating goats and rats (SERA, 2003-Sulfometuron methyl). Goats eliminated 94-99 percent in the urine (Keoppe and Mucha 1991 cited in SERA, 2003-Sulfometuron methyl). The half-life for metabolism in rats is 28 hours after a gavage dose of 16 mg/kg and 40 hours after a dose of 3000 mg/kg (DuPont, 1989 cited in SERA, 2003-Sulfometuron methyl). Therefore, chronic exposures from contaminated mammal prey due to a single application of sulfometuron methyl are unlikely to cause any adverse effect. In addition, the acute dose is less than the chronic NOAEL for mammals, so there is no basis for asserting/predicting that adverse effects from repeated acute exposures from multiple applications of sulfometuron methyl over time are plausible.

Estimated doses using the highest application rate (0.38 lb/acre) are less than the acute NOAEL for birds and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions (SERA, 2003-Sulfometuron methyl, p. 4-30 and 4-31).

Small Insectivorous Bird

The acute NOAEL for birds in laboratory toxicity tests is 312 mg/kg. For exposure scenarios that use the typical application rate of 0.045 lb/acre, if a 10 g bird consumed contaminated insects on site shortly after application, assuming the highest residue rates, it would receive an acute dose of 5.08 mg/kg (SERA, 2003-Sulfometuron methyl, Worksheet F14b). This dose is 0.02 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous birds are plausible (SERA, 2003-Sulfometuron methyl, p. 4-30).

There is no chronic toxicity index available for effects of sulfometuron methyl to birds, so the mammal chronic NOAEL will be used (acute toxicities of sulfometuron methyl to mammals and birds are of similar magnitude (SERA, 2003-Sulfometuron methyl, p. 4-24)). Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. The acute dose is greater than the chronic NOAEL for mammals (2 mg/kg/day), but less than the chronic LOAEL (20 mg/kg/day) for mammals. So adverse effects to insectivorous birds appear plausible from chronic dietary exposures, based on an acute dose exceeding a chronic NOAEL.

The estimated dose using the highest application rate (0.38 lb/acre) is less than the acute NOAEL for birds, but greater than the chronic NOAEL for mammals. The acute dose (42.9 mg/kg/day) is also two times greater than the chronic mammal LOAEL for effects to blood and bile ducts. No adverse effects are plausible from acute exposures, but adverse effects to insectivorous birds are plausible, and may be expected, from chronic dietary exposures at the maximum application rate.

TRICLOPYR 89

Toxicity indices and doses are the same for triclopyr acid and triclopyr BEE for mammals, but they differ for birds. The EPA has used two different values for a reference dose on the effects of triclopyr to mammals. The FS/SERA risk assessment (2003 Triclopyr) relies on a chronic toxicity index (NOEL of 5 mg/kg/day) from a rat reproduction study. In this analysis, we will use a lower value from a 1-year feeding study of dogs (chronic NOEL of 0.5 mg/kg/day; Quast et al. 1976, cited in SERA, 2003-Triclopyr). Dogs were not considered by EPA to be a good model for human health effects, because they do not excrete weak acids as well as other animals (see Timchalk and Nolan 1997; Timchalk et al. 1997). Canids are, however, relevant for concerns about effects to wildlife. It may be argued that the use of the 0.5 mg/kg/day value for the toxicity index in this analysis is overly cautious, because it represents competition for excretion rather than a toxic effect (Timchalk et al. 1997), and because it is being applied to other animals besides canids. However, it meets the criteria for providing a data-based worst-case analysis for potential effects to wildlife, and is therefore consistent with the criteria for choice of other indices used in this analysis.

Small Mammal Directly Sprayed

The acute NOAEL for mammals in laboratory toxicity tests is 100 mg/kg. For, exposure scenarios that use the typical application rate of 1 lb/acre, if a small mammal is directly sprayed, and 100 percent absorption is assumed, the animal would receive an acute dose of 24.2 mg/kg (SERA, 2003-Triclopyr, Worksheet F02a). This estimated dose is 0.2 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible.

At the highest application rate of 10 lb/acre, the animal would receive an acute dose of 242 mg/kg (project file). This dose is greater than the acute NOAEL but less than the acute LOAEL for malformed fetuses, although not substantially. So adverse effects are plausible from direct spray at the highest application rate, based on dose exceeding the NOAEL.

Small Mammal Drinking Contaminated Water

The estimated doses to a small mammal from drinking water contaminated by an accidental spill, assuming the highest levels of contamination, are 2.66 mg/kg for acute exposure (SERA, 2003-Triclopyr, Worksheet F05). If a small mammal consumes contaminated water over time, accounting for dissipation, degradation, and other processes, the animal would receive a chronic dose of 0.00732 mg/kg/day (SERA, 2003-Triclopyr, Worksheet F07). Doses to a large mammal would be even lower on a per kg body weight basis. These doses are 0.03 of the acute NOAEL, and 0.01 of the chronic NOAEL, respectively, so there is no basis for asserting or predicting that adverse effects to mammals are plausible.

At the highest application rate of 10 lb/acre, the acute dose from drinking water contaminated by a spill is 26.6 mg/kg (project file). This dose is 0.3 of the acute NOAEL. The chronic dose is also below the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to mammals are plausible, even in a worst-case scenario.

Large Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 100 mg/kg. For exposure scenarios that use the typical application rate of 1 lb/acre, if a 70 kg mammal consumed contaminated vegetation on site shortly after application, assuming the highest residue rates and 100 percents of the diet contaminated, it would receive an acute dose of 48.6 mg/kg (SERA, 2003-Triclopyr, Worksheet F10). This dose is 0.5 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to large grass-eating mammals are plausible.

The chronic NOAEL for mammals in laboratory toxicity tests is 0.5 mg/kg/day. Chronic exposure from the consumption of contaminated vegetation for 90 days at the treatment site, assuming the highest residue rates, results in a dose of 32.0 mg/kg/day (SERA, 2003-Triclopyr, Worksheet F11a). This dose is greater than the chronic NOAEL and 13 times greater than the LOAEL of 2.5 mg/kg for effects to kidneys. Adverse effects to grass-eating mammals are plausible and of substantial concern with the use of triclopyr (SERA, 2003-Triclopyr, p. 4-28).

Estimated doses using the highest application rate (10 lb/acre) are greater than the acute and chronic NOAELs for mammals. The acute dose is 486 mg/kg; which also exceeds the acute LOAEL for malformed fetuses. The chronic dose is 320 mg/kg; which exceeds the chronic LOAEL for effects to kidneys. Adverse effects to reproduction and internal organs of grass-eating mammals are plausible with acute and chronic exposures at the highest application rate. The potential for adverse effects are of substantial concern with the use of triclopyr (SERA, 2003-Triclopyr, p. 4-28).

Medium Carnivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 100 mg/kg. For exposure scenarios that use the typical application rate of 1 lb/acre, if a 5 kg mammal consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 2.10 mg/kg (SERA 2003 Triclopyr, Worksheet F16a). Doses to a larger mammal would be even lower on a per kg body weight basis. This dose is 0.021 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to carnivorous mammals are plausible.

Triclopyr acid and triclopyr BEE do not appear to accumulate or persist in animals. The elimination of triclopyr has been studied in rats and cattle (SERA 2003 Triclopyr). A study by Timchalk et al. (1990) found that the half-life for elimination in rats is 3.6 hours and that virtually all the ingested dose of triclopyr is excreted unchanged in the urine, although four minor metabolites are formed. In cattle, over 86 percent of the ingested dose was eliminated unchanged in the urine and almost all the dose was eliminated after 24 hours (Eckerlin et al. 1987, cited in SERA 2003). Therefore, chronic exposures from contaminated mammal prey due to a single application of triclopyr are unlikely to cause any adverse effect. However, the acute dose is greater than the chronic NOAEL for mammals, but slightly less than the chronic LOAEL, so adverse effects to carnivorous mammals appear plausible from chronic dietary exposures.

The estimated dose using the highest application rate (10 lb/acre) is less than the acute NOAEL, but greater than the chronic LOAEL for effects to kidneys of mammals. No adverse effects are plausible from acute exposures, but adverse effects to carnivorous mammals appear plausible from chronic dietary exposures at the maximum application rate.

Small Herbivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 100 mg/kg. If a small mammal consumes contaminated vegetation shortly after application, assuming the highest residue rates, the acute dose received is 0.495 mg/kg (SERA, 2003-Triclopyr, Worksheet F03). This estimated dose is 0.005 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible.

The chronic NOAEL for mammals in laboratory toxicity tests is 0.5 mg/kg/day. If a small mammal consumes contaminated vegetation at the treatment site for 90-days, assuming highest residue rates, the animal would receive a chronic dose of 0.0652 mg/kg/day (SERA, 2003-Triclopyr, Worksheet F04a). This estimated dose is 0.1 the chronic NOAEL, so there is no basis for asserting or predicting that adverse effects to herbivorous mammals are plausible.

Estimated doses using the highest application rate (10 lb/acre) are less than the acute NOAEL, but slightly greater than the chronic NOAELs for mammals. The chronic dose (0.65 mg/kg/day) is less than the chronic LOAEL (2.5 mg/kg/day) for effects to kidneys. No adverse effects are plausible from acute exposures, but adverse effects to herbivorous mammals appear plausible from chronic dietary exposures at the maximum application rate, based on dose exceeding a NOAEL.

Small Insectivorous Mammal

The acute NOAEL for mammals in laboratory toxicity tests is 100 mg/kg. For exposure scenarios that use the typical application rate of 1 lb/acre, if a small mammal consumes contaminated insects shortly after application, assuming the highest residue rates, the acute dose received is 69.4 mg/kg (SERA, 2003-Triclopyr, Worksheet 14a). This dose is 0.694 of the acute NOAEL, so there is no basis for asserting or predicting that adverse effects to insectivorous mammals are plausible.

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. However, the acute dose is much greater than the chronic LOAEL for mammals, so adverse effects to insectivorous mammals appear plausible from chronic dietary exposures. The exposure scenario uses residue rates from small insects, which are substantially higher than those for large insects, and assumes that 100 percent of the daily diet is composed of insects that have been directly sprayed. For bats, in particular, the scenario is unlikely to occur in the field. It seems more plausible for shrews and small fossorial insectivores, however.

The estimated dose (694 mg/kg) using the highest application rate (10 lb/acre) is much greater than the acute and chronic NOAELs for mammals. The acute dose is more than two times greater than the acute LOAEL for malformed fetuses and more than 200 times greater than the chronic LOAEL for effects to kidneys. Therefore, adverse effects to insectivorous mammals may be expected if they feed on insects contaminated with triclopyr applied at the highest application rate.

Large Herbivorous Bird

Triclopyr BEE is slightly more toxic to birds in acute exposures than triclopyr acid. For triclopyr acid, the acute LD_{50} for birds in laboratory toxicity tests is 535 mg/kg and for triclopyr BEE the acute LD_{50} is 388 mg/kg. For exposure scenarios that use the typical application rate of 1 lb/acre, if a 4 kg bird consumed contaminated grass on site shortly after application, assuming the highest residue rates and 100 percent of diet is contaminated, it would receive an acute dose of 76.0 mg/kg (SERA 2003 Triclopyr, Worksheets F12). This dose is 0.1 of the acute LD_{50} for triclopyr acid and 0.2 of the acute LD_{50} for triclopyr BEE. Since the acute exposure scenario for bird is based on an LD_{50} rather than an acute NOAEL, the FS/SERA risk assessments base the level of concern on 0.1 of the LD_{50} (SERA, 2003-Triclopyr), a factor used by EPA as a result of data analysis and modeling conducted by their Office of Pesticide Programs (Urban and Cook, 1986). Therefore, acute exposure from triclopyr acid is equal to the level of concern and that from triclopyr BEE is greater than the

level of concern (SERA 2003 Triclopyr). Adverse effects to grass-eating birds are plausible and of substantial concern with the use of triclopyr (SERA, 2003-Triclopyr, p. 4-28).

The chronic NOAEL for birds in laboratory toxicity tests is 10 mg/kg/day for both triclopyr acid and triclopyr BEE. Chronic exposure from the consumption of contaminated grass for 90 days at the treatment site, assuming the highest residue rates and 100 percent of diet is contaminated, results in a dose of 50.1 mg/kg/day (SERA, 2003-Triclopyr, Worksheets F13a). This estimated dose is greater than the chronic NOAEL and more than two times greater than the chronic LOAEL for decreased survival of offspring. The assumptions in the chronic exposure scenario are unlikely to occur in field conditions, however, adverse effects reproduction of grass-eating birds are plausible and of substantial concern with the use of triclopyr (SERA, 2003-Triclopyr, p. 4-28).

At the highest application rate (10 lb/acre), the acute dose is 760 mg/kg, which is greater than the acute LD_{50} for birds, for both triclopyr acid and triclopyr BEE. Mortality could be expected for birds feeding on vegetation contaminated with triclopyr applied at the highest application rate. In the case of the chronic exposures, the estimated dose (501 mg/kg/day) is much greater than the chronic LOAEL for decreased survival of offspring. Adverse effects, including mortality and decreased reproduction, to grass-eating birds are plausible and of substantial concern with the use of triclopyr (SERA, 2003-Triclopyr, p. 4-28).

Large Fish-eating Bird

Many chemicals may be concentrated or partitioned from water into the tissues of animals in the water. This process is referred to as bioconcentration. The potential for bioconcentration of triclopyr in fish was studied in bluegill sunfish exposed to ^{14}C-triclopyr (Rick et al., 1996; and Lickly and Murphy, 1987; cited in SERA 2003 Triclopyr). Bioconcentration factors (BCF) of triclopyr and its metabolites (primarily TCP) for bluegill were 0.83 L/kg for whole fish, which is the figure used in the exposure scenarios in the SERA risk assessment for acute and chronic exposures.

Triclopyr BEE is slightly more toxic to birds in acute exposures than triclopyr acid. For triclopyr acid, the acute LD_{50} for birds in laboratory toxicity tests is 535 mg/kg and for triclopyr BEE the acute LD_{50} is 388 mg/kg. For exposure scenarios that use the typical application rate of 1 lb/acre, if a predatory bird consumed fish from a pond contaminated by an accidental spill, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive an acute dose of 2.26 mg/kg (SERA, 2003-Triclopyr, Worksheet F08). This dose is 0.004 of the acute LD_{50} for triclopyr acid, and 0.006 of the acute LD50 for triclopyr BEE. Since the acute exposure scenario for bird is based on an LD_{50} rather than an acute NOAEL, the FS/SERA risk assessments base the level of concern on 0.1 of the LD_{50} (SERA, 2003-Triclopyr), a factor used by EPA as a result of data analysis and modeling conducted by their Office of Pesticide Programs (Urban and Cook 1986). The resultant values are much less than the level of concern, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible.

The chronic NOAEL for birds in laboratory toxicity tests is 10 mg/kg/day for both triclopyr acid and triclopyr BEE. If a predatory bird consumed fish contaminated by runoff for a lifetime, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive a chronic dose of 0.00623 mg/kg/day (SERA, 2003-Triclopyr, Worksheet F09). This estimated dose is 0.0006 of the chronic NOAEL, so there is no basis for asserting/predicting that adverse effects to fish-eating birds are plausible.

Estimated doses using the highest application rate (10 lb/acre) are less than 0.1 of the acute LD_{50} and the chronic NOAEL for birds, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

<u>Large Predatory Bird</u>

Triclopyr BEE is slightly more toxic to birds in acute exposures than triclopyr acid. For triclopyr acid, the acute LD_{50} for birds in laboratory toxicity tests is 535 mg/kg and for triclopyr BEE the acute LD_{50} is 388 mg/kg. For exposure scenarios that use the typical application rate of 1 lb/acre, if a 0.6 kg bird consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 3.23 mg/kg (SERA, 2003-Triclopyr, Worksheet F16b). This is 0.00604 of the acute LD_{50} for triclopyr acid and 0.00833 of the acute LD_{50} for triclopyr BEE. Since the acute exposure scenario for bird is based on an LD_{50} rather than an acute NOAEL, the FS/SERA risk assessments base the level of concern on 0.1 of the LD_{50} (SERA, 2003-Triclopyr), a factor used by EPA as a result of data analysis and modeling conducted by their Office of Pesticide Programs (Urban and Cook, 1986). The resultant values are much less than the level of concern, so there is no basis for asserting or predicting that adverse effects to predatory birds are plausible.

Triclopyr acid and triclopyr BEE do not appear to accumulate or persist in animals. The elimination of triclopyr has been studied in rats and cattle (SERA, 2003-Triclopyr). A study by Timchalk et al. (1990) found that the half-life for elimination in rats is 3.6 hours and that virtually all of the ingested dose of triclopyr is excreted unchanged in the urine, although four minor metabolites are formed. In cattle, over 86 percent of the ingested dose was eliminated unchanged in the urine and almost all of the dose was eliminated after 24 hours (Eckerlin et al., 1990). Therefore, chronic exposures from contaminated mammal prey due to a single application of triclopyr are unlikely to cause any adverse effect. In addition, the acute dose is less than the chronic NOAEL for birds, so there is no basis for asserting or predicting that adverse effects from repeated acute exposures from multiple applications of predatory birds over time are plausible.

Estimated doses using the highest application rate (10 lb/acre) are less than 0.1 of the LD_{50} for both triclopyr acid and triclopyr BEE, although only marginally so for triclopyr BEE (acute dose of 32.3 vs. 38.8 for 0.1 of the LD_{50}). The acute dose (32.3 mg/kg) is greater than the bird chronic LOAEL (20 mg/kg) for decreased survival of offspring, so adverse affects to predatory birds are plausible from triclopyr at the highest application rate.

<u>Small Insectivorous Bird</u>

Triclopyr BEE is slightly more toxic to birds in acute exposures than triclopyr acid. For triclopyr acid, the acute LD_{50} for birds in laboratory toxicity tests is 535 mg/kg and for triclopyr BEE the acute LD_{50} is 388 mg/kg. For exposure scenarios that use the typical application rate of 1 lb/acre, if a 10 g bird consumed contaminated insects on site shortly after application, assuming the highest residue rates, it would receive an acute dose of 113 mg/kg (SERA 2003 Triclopyr, Worksheet F14b). This dose is 0.2 of the acute LD_{50} for triclopyr acid, and 0.3 of the LD_{50} for triclopyr BEE. Since the acute exposure scenario for bird is based on an LD_{50} rather than an acute NOAEL, the FS/SERA risk assessments base the level of concern on 0.1 of the LD_{50} (SERA 2003 Triclopyr), a factor used by EPA as a result of data analysis and modeling conducted by their Office of Pesticide Programs (Urban and Cook 1986). Therefore, the acute dose is two times greater than the level of concern for triclopyr acid, and three times greater than the level of concern for triclopyr BEE (but less than both LD_{50}s). Adverse effects to insectivorous birds are plausible, assuming the highest residue rates.

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. However, the acute dose is five times greater than the chronic LOAEL for decreased survival of offspring in birds, so adverse effects to insectivorous birds may be expected from chronic dietary exposures.

Estimated dose from contaminated insects, assuming the highest residue rates, at the highest application rate (10 lb/acre) is 1,130 mg/kg. This dose is two times greater than the LD_{50} for triclopyr acid and three times greater than the LD_{50} for triclopyr BEE. Mortality is expected if insectivorous birds feed exclusively within the treatment area on contaminated insects.

2,4-D

Note: whether the chronic dose of 1 mg/kg is an actual NOAEL is ambiguous and it could be argued that it is a LOAEL. There is conflicting interpretation between EPA (USEPA, 1997) and the authors of the study (Serota et al., 1983) upon which the value is based.

Small Mammal Directly Sprayed

The acute “non-lethal” dose for mammals in laboratory toxicity tests is 10 mg/kg. For, exposure scenarios that use the typical application rate of 1 lb/acre, if a small mammal is directly sprayed, and 100 percent absorption is assumed, the animal would receive an acute dose of 24.2 mg/kg (Project file, 2,4-D Worksheet F02a). This dose is within the range of doses in which mild signs of systemic toxicity are plausible, and sub-clinical signs of neurologic toxicity, increased thyroid weight, decreased testicular weight, decreased body weight gain, damage to several organs are expected (SERA, 1998, p. 3-52).

Small Mammal Drinking Contaminated Water

The estimated dose to a small mammal from drinking water contaminated by an accidental spill, assuming the highest levels of contamination, is 0.664 mg/kg for acute exposure (Project file, 2,4-D Worksheet F05). If a small mammal consumes contaminated water over time, accounting for dissipation, degradation, and other processes, the animal would receive a chronic dose of 0.000586 mg/kg/day (Project file, 2,4-D Worksheet F07). Doses to a larger mammal would be even lower on a per kg body weight basis. These doses are 0.07 of the acute “non-lethal” dose, and 0.0006 of the chronic NOAEL, respectively. The acute dose is within the range of doses in which increased thyroid weight, decreased testicular weight, and decreased body weight gain are plausible (SERA, 1998, p. 3-52).

At the highest application rate of 2 lb/acre, the acute dose from drinking water contaminated by a spill is 1.33 mg/kg (project file). This dose is 0.10 of the acute NOAEL. The acute dose is within the range of doses in which increased thyroid weight, decreased testicular weight, decreased body weight gain, sub-clinical pathology to kidney and liver, and sub-clinical signs of neurotoxicity are plausible (SERA, 1998, p. 3-52).

The chronic dose (0.0017 mg/kg) is below any dose level in which effects have been noted.

Large Herbivorous Mammal

The acute “non-lethal” dose for mammals in laboratory toxicity tests is 10 mg/kg. For exposure scenarios that use the typical application rate of 1 lb/acre, if a 70 kg mammal consumed contaminated vegetation on site shortly after application, assuming the highest residue rates and 100 percents of the diet contaminated, it would receive an acute dose of 48.6 mg/kg (Project file, 2,4-D Worksheet F10). This dose is greater than the acute “non-lethal” dose. This dose is within the range of doses in which mild signs of systemic toxicity are plausible, and sub-clinical signs of neurologic toxicity, increased thyroid weight, decreased testicular weight, decreased body weight gain, damage to several organs are expected (SERA, 1998, p. 3-52).

The chronic NOAEL for mammals in laboratory toxicity tests is 1 mg/kg/day. Chronic exposure from the consumption of contaminated vegetation for 90 days at the treatment site, assuming the highest residue rates, results in a dose of 10.8 mg/kg/day (Project file, 2,4-D Worksheet F11a). This dose is greater than the chronic NOAEL and the chronic LOAEL (5 mg/kg/day) for effects to kidney, blood, and liver. This dose is within the range of doses in which mild signs of systemic toxicity are plausible, and sub-clinical signs of neurologic toxicity, increased thyroid weight, decreased testicular weight, decreased body weight gain, damage to several organs are expected (SERA, 1998, p. 3-52).

Estimated doses using the highest application rate (2 lbs/acre) are 97.1 mg/kg for acute doses and 21.5 mg/kg/day for chronic doses. The acute dose is much greater than the acute “non-lethal” dose and chronic LOAEL (5 mg/kg) for mammals (Project file, 2,4-D High Rate Worksheet WL Ex1). The acute dose is within the range of doses in which mild signs of systemic toxicity are plausible; sub-clinical signs of neurologic toxicity, increased thyroid weight, decreased testicular weight, decreased body weight gain, damage to several organs are expected; and mortality may occur (SERA, 1998, p. 3-52). The chronic dose is four times greater than the chronic LOAEL for effects to kidney, blood and liver. Unlike the case with the chronic exposure scenario involving non-selective herbicides, the acute and chronic exposure scenario could occur in the field. 2,4-D is selective for broadleaved weeds, so if 2,4-D were broadcast sprayed in foraging habitat in attempt to control broadleaved weeds, the forage grasses with herbicide residue would remain available to large grass-eating mammals.

Medium Carnivorous Mammal

The acute “non-lethal” dose for mammals in laboratory toxicity tests is 10 mg/kg. For exposure scenarios that use the typical application rate of 1 lb/acre, if a 5 kg mammal consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 2.10 mg/kg (Project file, 2,4-D Worksheet F16a). Doses to a larger mammal would be even lower on a per kg body weight basis. This dose is 0.21 of the acute “non-lethal” dose, but is within the range of doses in which sub-clinical signs of neurologic toxicity are plausible, and increased thyroid weight, decreased testicular weight, decreased body weight gain, and subclinical pathology to kidney and liver are expected (SERA, 1998, p. 3-52).

2,4-D does not appear to accumulate or persist in animal tissues and is eliminated fairly rapidly. If adverse effects from 2,4-D are to develop, they will develop relatively fast and will not become more severe as the duration of exposure continues (SERA, 1998, p. 3-50, 3-51). Therefore, chronic exposures from contaminated mammal prey due to a single application of 2,4-D are unlikely to cause adverse effects beyond those reported above, for acute exposure.

The estimated dose (4.2 mg/kg) using the highest application rate (2 lbs/acre) is less than the acute “non-lethal” dose. This dose is greater than the chronic NOAEL for mammals, but slightly less than the chronic LOAEL (Project file, 2,4-D High Rate Worksheet WL Ex1). The acute dose is within the range of doses in which sub-clinical signs of neurologic toxicity are plausible, and increased thyroid weight, decreased testicular weight, decreased body weight gain, and subclinical pathology to kidney and liver are expected (SERA, 1998, p. 3-52).

Small Herbivorous Mammal

The acute “non-lethal” dose for mammals in laboratory toxicity tests is 10 mg/kg. If a small mammal consumes contaminated vegetation shortly after application, assuming the highest residue rates, the acute dose received is 2.68 mg/kg (Project file, 2,4-D Worksheet F03). This dose is 0.3 of the acute “non-lethal” dose. This dose is within the range of doses in which sub-clinical signs of neurologic toxicity are plausible, and increased thyroid weight, decreased testicular weight, decreased body weight gain, and subclinical pathology to kidney and liver are expected (SERA, 1998, p. 3-52).

The chronic NOAEL for mammals in laboratory toxicity tests is 1 mg/kg/day. If a small mammal consumes contaminated vegetation at the treatment site for 90-days, assuming highest residue rates, the animal would receive a chronic dose of 0.119 mg/kg/day (Project file, 2,4-D Worksheet F04a). This estimated dose is 0.1 of the chronic NOAEL. This dose is within the range of doses in which increased thyroid weight, decreased testicular weight, and decreased body weight gain are plausible (SERA, 1998, p. 3-52).

Estimated doses using the highest application rate (2 lbs/acre) are less than the acute “non-lethal” dose and chronic NOAEL for mammals (Project file, 2,4-D High Rate Worksheet WL Ex1). The acute dose (5.36 mg/kg) is within the range of doses in which sub-clinical signs of neurologic toxicity are plausible, and increased thyroid weight, decreased testicular weight, decreased body weight gain, and subclinical pathology to kidney and liver are expected (SERA, 1998, p. 3-52).

Small Insectivorous Mammal

The acute “non-lethal” dose for mammals in laboratory toxicity tests is 10 mg/kg. For exposure scenarios that use the typical application rate of 1 lb/acre, if a small mammal consumes contaminated insects shortly after application, assuming the highest residue rates, the acute dose received is 69.4 mg/kg (Project file, 2,4-D Worksheet 14a). This dose is seven times greater than the acute “non-lethal” dose. This dose is within the range of doses in which mild signs of systemic toxicity are plausible, and sub-clinical signs of neurologic toxicity, increased thyroid weight, decreased testicular weight, decreased body weight gain, damage to several organs are expected (SERA, 1998, p. 3-52). The exposure scenario uses residue rates from small insects, which are substantially higher than those for large insects, and assumes that 100 percent of the daily diet is composed of insects that have been directly sprayed. For bats, in particular, the scenario is unlikely to occur in the field. It seems more plausible for shrews and small fossorial insectivores, however.

Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. Residue on insects likely declines over time, but the extent of decline has not been quantified. However, the acute dose is 13 times greater than the chronic LOAEL for effects to kidney, blood, and liver. The adverse effects from chronic exposure are the same as those noted above for acute exposure. The exposure scenario uses residue rates from small insects, which are substantially higher than those for large insects, and assumes that 100 percent of the daily diet is composed of insects that have been directly sprayed. For bats, in particular, the scenario is unlikely to occur in the field. It seems more plausible for shrews and small fossorial insectivores, however.

The estimated dose using the highest application rate (2 lbs/acre) is 139 mg/kg. This dose is 13 times greater than the acute “non-lethal” dose, and 27 times greater than the chronic LOAEL for effects to kidney, blood, and liver in mammals (Project file, 2,4-D High Rate Worksheet WL Ex1). The dose is within the range of doses in which frank neurological and/or reproductive effects, including birth defects, are expected. While this dose is above the LD_{50} for cattle (100 mg/kg), it is well below the LD_{50} for small mammals (1800 mg/kg) (SERA, 1998 2,4-D).

Large Herbivorous Bird

Toxicity data for the effects of 2,4-D on birds is much more limited than for mammals. The FS/SERA risk assessment for 2,4-D contains very little information specific to birds, so the following discussion uses dietary LD50 for bobwhite quail and mallard (>5620 ppm) to calculate the toxicity index (Weed Science Society of America 2002, p. 115). Since the acute exposure scenario for bird is based on an LD_{50} rather than an acute NOAEL, 0.1 of the LD_{50} is used as the toxicity index. EPA uses this factor (0.1) as a result of data analysis and modeling conducted by their Office of Pesticide Programs (Urban and Cook, 1986). The acute dietary LD_{50} for birds in laboratory toxicity tests corresponds to 562 mg/kg. For exposure scenarios that use the typical application rate of 1 lb/acre, if a 4 kg bird consumed contaminated grass on site shortly after application, assuming the highest residue rates and 100 percent of diet is contaminated, it would receive an acute dose of 76.0 mg/kg (Project file, 2,4-D Worksheet F12). The toxicity index (0.1 of the LD_{50}) is 56.2 mg/kg. This dose is greater than the toxicity index, so adverse effects to grass-eating birds are plausible from acute dietary exposures. Unlike the case with the chronic exposure scenario involving non-selective herbicides, this acute exposure scenario very well could occur in the field. 2,4-D is selective for broadleaved weeds, so if 2,4-D were broadcast sprayed in foraging habitat in attempt to control broadleaved weeds, the forage grasses with herbicide residue would remain available to large grass-eating birds.

There is no chronic toxicity index cited in the 2,4-D risk assessment (SERA, 1998) for effects to birds, so the mammal chronic NOAEL will be used (birds appear to be less sensitive to 2,4-D than are mammals; SERA, 1998). The chronic NOAEL for mammals in laboratory toxicity tests is 1 mg/kg/day. Chronic exposure from the consumption of contaminated grass for 90 days at the treatment site, assuming the highest residue rates and 100 percent of diet is contaminated, results in a dose of 16.9 mg/kg/day (Project file, 2,4-D Worksheet F13a). This estimated dose is greater than the chronic NOAEL for mammals, and also exceeds the chronic LOAEL for mammals (5 mg/kg/day) for effects to kidney, liver and blood. So adverse effects to grass-eating birds are expected from chronic dietary exposures.

At the highest application rate (2 lb/acre), the acute dose (152 mg/kg) is greater than the acute toxicity index for birds. The dose is less than the LD_{50}, so is not likely to be lethal, but it is greater than 0.1 of the LD_{50}, so sub-lethal effects may be plausible. The chronic dose (33.7 mg/kg/day) exceeds the chronic NOAEL and the chronic LOAEL (5 mg/kg/day) for effects to mammal kidney, liver, and blood. Therefore, adverse effects to grass-eating birds appear expected from acute and chronic dietary exposures at the typical and highest application rates.

Large Fish-eating Bird

Many chemicals may be concentrated or partitioned from water into the tissues of animals in the water. This process is referred to as bioconcentration. The potential for bioconcentration of 2,4-D in fish was studied in carp and tilapia exposed to ^{14}C-labelled 2,4-D for 0.5 to 14 days (Wang et al., 1994, cited in SERA, 1998-2,4-D). The ranges of bioconcentration factors (BCF) reported in this study were 10-40 L/kg. Conversely, field studies indicate that the application of 2,4-D to a lake at very high application rates did not result in bioconcentration of the herbicide in game fish (Hoeppel and Westerdahl 1983). Due to the lack of a time-concentration relationship in the Wang et al. study, the SERA risk assessment (SERA, 1998-2,4-D) uses a whole-fish BCF of 25 L/kg for acute exposure chronic exposure scenarios.

Toxicity data for the effects of 2,4-D on birds is much more limited than for mammals. The FS/SERA risk assessment for 2,4-D contains very little information specific to birds, so the following discussion uses dietary LD_{50} for bobwhite quail and mallard (>5620 ppm) to calculate the toxicity index (Weed Science Society of America 2002, p.115). Since the acute exposure scenario for bird is based on an LD_{50} rather than an acute NOAEL, 0.1 of the LD_{50} is used as the toxicity index. EPA uses this safety factor (0.1) as a result of data analysis and modeling conducted by their Office of Pesticide Programs (Urban and Cook 1986). The acute dietary LD_{50} for birds in laboratory toxicity tests corresponds to 562 mg/kg. For exposure scenarios that use the typical application rate of 1 lb/acre, if a predatory bird consumed fish from a pond contaminated by an accidental spill, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive an acute dose of 6.8 mg/kg (Project file, 2,4-D Worksheet F08). The toxicity index (0.1 of the LD_{50}) is 56.2 mg/kg. This dose is 0.12 of the toxicity index, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible.

There is no chronic toxicity index cited in the 2,4-D risk assessment (SERA, 1998) for effects to birds, so the mammal chronic NOAEL will be used (acute toxicities of 2,4-D to mammals is somewhat less than birds). The chronic NOAEL for mammals in laboratory toxicity tests is 1 mg/kg/day. If a predatory bird consumed fish contaminated by runoff for a lifetime, assuming the highest concentrations in fish and highest intake on a body weight basis, it would receive a chronic dose of 0.006 mg/kg/day (Project file, 2,4-D Worksheet F09). This estimated dose is 0.006 of the chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects to fish-eating birds are plausible.

Estimated doses using the highest application rate (2 lb/acre) also result in exposures less than the acute toxicity index for birds and chronic NOAEL for mammals, so there is no basis for asserting or predicting that adverse effects are plausible using typical or worst-case exposure assumptions.

Large Predatory Bird

Toxicity data for the effects of 2,4-D on birds is much more limited than for mammals. The FS/SERA risk assessment for 2,4-D contains very little information specific to birds, so the following discussion uses dietary LD_{50} for bobwhite quail and mallard (>5620 ppm) to calculate the toxicity index (Weed Science Society of America, 2002, p.115). Since the acute exposure scenario for bird is based on an LD_{50} rather than an acute NOAEL, 0.1 of the LD_{50} is used as the toxicity index. EPA uses this safety factor (0.1) as a result of data analysis and modeling conducted by their Office of Pesticide Programs (Urban and Cook, 1986). The acute dietary LD_{50} for birds in laboratory toxicity tests corresponds to 562 mg/kg. For exposure scenarios that use the typical application rate of 1 lb/acre, if a 0.6 kg bird consumed small mammal prey that has been contaminated by direct spray, assuming 100 percent absorption for the prey, it would receive an acute dose of 3.23 mg/kg (Project file, 2,4-D Worksheet F16b). The toxicity index (0.1 of the LD_{50}) is 56.2 mg/kg. This dose 0.057of the acute toxicity index, so there is no basis for asserting or predicting that adverse effects to predatory birds are plausible.

2,4-D does not appear to accumulate or persist in animal tissues and is eliminated fairly rapidly. If adverse effects from 2,4-D are to develop, they will develop relatively fast and will not become more severe as the duration of exposure continues (SERA, 1998, p. 3-50, 3-51). Therefore, chronic exposures from contaminated mammal prey due to a single application of 2,4-D seem unlikely. However, the acute dose is greater than the chronic NOAEL, but less than the chronic LOAEL, for mammals, so adverse effects may be plausible.

At the highest application rate (2 lb/acre), the estimated dose (6.46 mg/kg) is less than the acute toxicity index for birds, but greater than the chronic NOAEL and LOAEL for mammals. Therefore, adverse effects from acute doses are unlikely, but may be plausible from chronic exposure.

Small Insectivorous Bird

Toxicity data for the effects of 2,4-D on birds is much more limited than for mammals. The FS/SERA risk assessment for 2,4-D contains very little information specific to birds, so the following discussion uses dietary LD_{50} for bobwhite quail and mallard (>5620 ppm) to calculate the toxicity index (Weed Science Society of America 2002, p.115). Since the acute exposure scenario for bird is based on an LD_{50} rather than an acute NOAEL, 0.1 of the LD_{50} is used as the toxicity index. EPA uses this safety factor (0.1) as a result of data analysis and modeling conducted by their Office of Pesticide Programs (Urban and Cook 1986). The acute dietary LD_{50} for birds in laboratory toxicity tests corresponds to 562 mg/kg. For exposure scenarios that use the typical application rate of 1 lb/acre, if a 10 g bird consumed contaminated insects on site shortly after application, assuming the highest residue rates, it would receive an acute dose of 113 mg/kg (Project file, 2,4-D Worksheet F14b). The toxicity index (0.1 of the LD_{50}) is 56.2 mg/kg. This dose is 2 times greater than the acute toxicity index, so adverse effects to insectivorous birds are plausible.

There is no chronic toxicity index cited in the 2,4-D risk assessment (SERA 1998) for effects to birds, so the mammal chronic NOAEL will be used (acute toxicities of 2,4-D to mammals is somewhat less than birds). The chronic NOAEL for mammals in laboratory toxicity tests is 1 mg/kg/day. Data on degradation of herbicide residues from insects is not available, so no chronic exposure scenario has been developed. However, the acute dose is much greater than the chronic LOAEL for effects to mammal kidney, liver, and blood, so adverse effects to insectivorous birds may be expected.

At the highest application rate (2 lb/acre), the estimated dose (226 mg/kg) is much greater than the acute toxicity index for birds and chronic LOAEL for effects to mammal kidney, liver, and blood. Therefore, adverse effects to insectivorous birds are expected from acute and chronic dietary exposures at the typical and highest application rates.

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APPENDIX 1 of Summary of Herbicide Effects to Wildlife

Estimated doses for each exposure scenario for 12 herbicides.

The upper estimate used for this analysis includes worst-case assumptions such as highest residue rates, highest food intake, etc.

Chlorsulfuron / Typical Application Rate
Only the Upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	1.36E+00	1.36E+00	1.36E+00	F02a
bee, 100% absorption	8.98E+00	8.98E+00	8.98E+00	F02b
Contaminated vegetation				
small mammal	7.00E-02	7.00E-02	1.50E-01	F03
large mammal	9.63E-01	9.63E-01	2.72E+00	F10
large bird	1.51E+00	1.51E+00	4.26E+00	F12
Contaminated water				
small mammal, spill	1.11E-02	2.22E-03	1.11E-01	F05
Contaminated insects				
small mammal	1.30E+00	1.30E+00	3.89E+00	F14a
small bird	2.11E+00	2.11E+00	6.32E+00	F14b
Contaminated prey				
predatory mammal (small mammal)	1.17E-01	1.17E-01	1.17E-01	F16a
predatory bird (small mammal)	1.81E-01	1.81E-01	1.81E-01	F16b
predatory bird (fish)	1.97E-02	1.97E-03	2.95E-01	F08

Chlorsulfuron / Typical Application Rate
Only the Upper exposure estimates are used in this document.

Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	2.95E-03	1.47E-03	1.26E-02	F04a
large mammal, on site	1.22E-01	4.05E-02	1.14E+00	F11a
large bird, on site	1.90E-01	6.34E-02	1.79E+00	F13a
Contaminated water				
small mammal	4.92E-06	8.20E-07	7.38E-06	F07
Contaminated fish				
predatory bird	4.03E-05	3.36E-06	9.07E-05	F09

Chlorsulfuron / Highest Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals.				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	6.06E+00	6.06E+00	6.06E+00	F02a
bee, 100% absorption	4.01E+01	4.01E+01	4.01E+01	F02b
Contaminated vegetation				
small mammal	3.13E-01	3.13E-01	6.70E-01	F03
large mammal	4.30E+00	4.30E+00	1.21E+01	F10
large bird	6.73E+00	6.73E+00	1.90E+01	F12
Contaminated water				
small mammal, spill	4.95E-02	9.89E-03	4.95E-01	F05
Contaminated insects				
small mammal	5.78E+00	5.78E+00	1.73E+01	F14a

Chlorsulfuron / Highest Application Rate
Only upper exposure estimates are used in this document.

small bird	9.40E+00	9.40E+00	2.82E+01	F14b
Contaminated prey				
predatory mammal (small mammal)	5.25E-01	5.25E-01	5.25E-01	F16a
predatory bird (small mammal)	8.08E-01	8.08E-01	8.08E-01	F16b
predatory bird (fish)	8.79E-02	8.79E-03	1.32E+00	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	1.32E-02	6.58E-03	5.64E-02	F04a
large mammal, on site	5.43E-01	1.81E-01	5.11E+00	F11a
large bird, on site	8.50E-01	2.83E-01	8.00E+00	F13a
Contaminated water				
small mammal	2.20E-05	3.66E-06	3.29E-05	F07
Contaminated fish				
predatory bird	1.80E-04	1.50E-05	4.05E-04	F09

Clopyralid / Typical Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	8.49E+00	8.49E+00	8.49E+00	F02a
bee, 100% absorption	5.61E+01	5.61E+01	5.61E+01	F02b
Contaminated vegetation				
small mammal	4.38E-01	4.38E-01	9.38E-01	F03

large mammal	6.02E+00	6.02E+00	1.70E+01	F10
large bird	9.42E+00	9.42E+00	2.66E+01	F12
Contaminated water				
small mammal, spill	4.65E-01	1.11E-01	2.33E+00	F05
Contaminated insects				
small mammal	8.10E+00	8.10E+00	2.43E+01	F14a
small bird	1.32E+01	1.32E+01	3.95E+01	F14b
Contaminated prey				
predatory mammal (small mammal)	7.34E-01	7.34E-01	7.34E-01	F16a
predatory bird (small mammal)	1.13E+00	1.13E+00	1.13E+00	F16b
predatory bird (fish)	3.18E-01	3.79E-02	2.38E+00	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	1.77E-02	7.04E-03	9.87E-02	F04a
large mammal, on site	7.29E-01	1.94E-01	8.95E+00	F11a
large bird, on site	1.14E+00	3.03E-01	1.40E+01	F13a
Contaminated water				
small mammal	3.59E-04	5.12E-05	6.66E-04	F07
Contaminated fish				
predatory bird	2.45E-04	1.75E-05	6.83E-04	F09

Clopyralid / Highest Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals			
Scenario	Dose (mg/kg/day)		
Typical	Lower	Upper	Worksheet
Acute/Accidental Exposures			
Direct spray			

Clopyralid / Highest Application Rate Only upper exposure estimates are used in this document.				
small animal, 100% absorption	1.21E+01	1.21E+01	1.21E+01	F02a
bee, 100% absorption	8.01E+01	8.01E+01	8.01E+01	F02b
Contaminated vegetation				
small mammal	6.25E-01	6.25E-01	1.34E+00	F03
large mammal	8.60E+00	8.60E+00	2.43E+01	F10
large bird	1.35E+01	1.35E+01	3.80E+01	F12
Contaminated water				
small mammal, spill	6.65E-01	1.58E-01	3.32E+00	F05
Contaminated insects				
small mammal	1.16E+01	1.16E+01	3.47E+01	F14a
small bird	1.88E+01	1.88E+01	5.64E+01	F14b
Contaminated prey				
predatory mammal (small mammal)	1.05E+00	1.05E+00	1.05E+00	F16a
predatory bird (small mammal)	1.62E+00	1.62E+00	1.62E+00	F16b
predatory bird (fish)	4.54E-01	5.41E-02	3.41E+00	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	2.52E-02	1.01E-02	1.41E-01	F04a
large mammal, on site	1.04E+00	2.77E-01	1.28E+01	F11a
large bird, on site	1.63E+00	4.33E-01	2.00E+01	F13a
Contaminated water				
small mammal	5.12E-04	7.32E-05	9.52E-04	F07
Contaminated fish				
predatory bird	3.50E-04	2.50E-05	9.75E-04	F09

Dicamba / Typical Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	7.27E+00	7.27E+00	7.27E+00	F02a
larger mammal, 100% absoption	1.69E+00	1.69E+00	1.69E+00	F02c
bee, 100% absorption	4.81E+01	4.81E+01	4.81E+01	F02b
Contaminated vegetation				
small mammal	3.75E-01	3.75E-01	8.04E-01	F03
large mammal	5.16E+00	5.16E+00	1.46E+01	F10
large bird	8.08E+00	8.08E+00	2.28E+01	F12
Contaminated water				
small mammal, spill	1.55E-01	2.22E-02	1.33E+00	F05
Contaminated insects				
small mammal	6.94E+00	6.94E+00	2.08E+01	F14a
small bird	1.13E+01	1.13E+01	3.38E+01	F14b
Contaminated prey				
predatory mammal (small mammal)	6.29E-01	6.29E-01	6.29E-01	F16a
predatory bird (small mammal)	9.70E-01	9.70E-01	9.70E-01	F16b
predatory bird (fish)	6.99E-02	5.00E-03	8.99E-01	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	5.41E-03	2.70E-03	2.32E-02	F04a

Dicamba / Typical Application Rate
Only upper exposure estimates are used in this document.

large mammal, on site	2.23E-01	7.44E-02	2.10E+00	F11a
large bird, on site	3.49E-01	1.16E-01	3.29E+00	F13a
Contaminated water				
small mammal	4.39E-07	2.20E-07	1.32E-06	F07
Contaminated fish				
predatory bird	1.98E-07	4.95E-08	8.91E-07	F09

Dicamba / Highest Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	4.85E+01	4.85E+01	4.85E+01	F02a
larger mammal, 100% absorption	1.12E+01	1.12E+01	1.12E+01	F02c
bee, 100% absorption	3.21E+02	3.21E+02	3.21E+02	F02b
Contaminated vegetation				
small mammal	2.50E+00	2.50E+00	5.36E+00	F03
large mammal	3.44E+01	3.44E+01	9.71E+01	F10
large bird	5.38E+01	5.38E+01	1.52E+02	F12
Contaminated water				
small mammal, spill	1.03E+00	1.48E-01	8.87E+00	F05
Contaminated insects				
small mammal	4.63E+01	4.63E+01	1.39E+02	F14a
small bird	7.52E+01	7.52E+01	2.26E+02	F14b

Contaminated prey				
predatory mammal (small mammal)	4.20E+00	4.20E+00	4.20E+00	F16a
predatory bird (small mammal)	6.46E+00	6.46E+00	6.46E+00	F16b
predatory bird (fish)	4.66E-01	3.33E-02	6.00E+00	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	3.60E-02	1.80E-02	1.54E-01	F04a
large mammal, on site	1.49E+00	4.96E-01	1.40E+01	F11a
large bird, on site	2.33E+00	7.76E-01	2.19E+01	F13a
Contaminated water				
small mammal	2.93E-06	1.46E-06	8.78E-06	F07
Contaminated fish				
predatory bird	1.32E-06	3.30E-07	5.94E-06	F09

Glyphosate / Typical Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	4.85E+01	4.85E+01	4.85E+01	F02a
bee, 100% absorption	3.21E+02	3.21E+02	3.21E+02	F02b
Contaminated vegetation				
small mammal	8.57E-01	8.57E-01	2.11E+00	F03
large mammal	3.44E+01	3.44E+01	9.71E+01	F10
large bird	5.38E+01	5.38E+01	1.52E+02	F12
Contaminated water				

Glyphosate / Typical Application Rate
Only upper exposure estimates are used in this document.

small mammal, spill	2.66E+00	1.06E+00	5.32E+00	F05
Contaminated insects				
small mammal	4.63E+01	4.63E+01	1.39E+02	F14a
small bird	8.E+01	7.52E+01	2.26E+02	F14b
Contaminated prey				
predatory mammal (small mammal)	4.20E+00	4.20E+00	4.20E+00	F16a
predatory bird (small mammal)	6.46E+00	6.46E+00	6.46E+00	F16b
predatory bird (fish)	9.45E-01	1.89E-01	2.83E+00	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	4.69E-02	2.35E-02	2.31E-01	F04a
large mammal, on site	5.65E+00	1.88E+00	5.32E+01	F11a
large bird, on site	8.84E+00	2.95E+00	8.32E+01	F13a
Contaminated water				
small mammal	2.93E-04	2.93E-05	2.34E-03	F07
Contaminated fish				
predatory bird	1.04E-04	5.20E-06	1.25E-03	F09

Glyphosate / Highest Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	1.70E+02	1.70E+02	1.70E+02	F02a

Glyphosate / Highest Application Rate Only upper exposure estimates are used in this document.				
bee, 100% absorption	1.12E+03	1.12E+03	1.12E+03	F02b
Contaminated vegetation				
small mammal	3.00E+00	3.00E+00	7.38E+00	F03
large mammal	1.20E+02	1.20E+02	3.40E+02	F10
large bird	1.88E+02	1.88E+02	5.32E+02	F12
Contaminated water				
small mammal, spill	9.31E+00	3.72E+00	1.86E+01	F05
Contaminated insects				
small mammal	1.62E+02	1.62E+02	4.86E+02	F14a
small bird	3.E+02	2.63E+02	7.90E+02	F14b
Contaminated prey				
predatory mammal (small mammal)	1.47E+01	1.47E+01	1.47E+01	F16a
predatory bird (small mammal)	2.26E+01	2.26E+01	2.26E+01	F16b
predatory bird (fish)	3.31E+00	6.61E-01	9.92E+00	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	1.64E-01	8.21E-02	8.07E-01	F04a
large mammal, on site	1.98E+01	6.59E+00	1.86E+02	F11a
large bird, on site	3.09E+01	1.03E+01	2.91E+02	F13a
Contaminated water				
small mammal	1.02E-03	1.02E-04	8.20E-03	F07
Contaminated fish				
predatory bird	3.64E-04	1.82E-05	4.37E-03	F09

Imazapic / Typical Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	2.42E+00	2.42E+00	2.42E+00	F02a
bee, 100% absorption	1.60E+01	1.60E+01	1.60E+01	F02b
Contaminated vegetation				
small mammal	1.25E-01	1.25E-01	2.68E-01	F03
large mammal	1.72E+00	1.72E+00	4.86E+00	F10
large bird	2.69E+00	2.69E+00	7.60E+00	F12
Contaminated water				
small mammal, spill	2.42E+00	2.42E+00	2.42E+00	F05
Contaminated insects				
small mammal	2.31E+00	2.31E+00	6.94E+00	F14a
small bird	3.76E+00	3.76E+00	1.13E+01	F14b
Contaminated prey				
predatory mammal (small mammal)	2.10E-01	2.10E-01	2.10E-01	F16a
predatory bird (small mammal)	3.23E-01	3.23E-01	3.23E-01	F16b
predatory bird (fish)	1.67E-02	5.00E-03	7.49E-02	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	8.02E-04	1.20E-04	1.02E-02	F04a
large mammal, on site	3.31E-02	3.31E-03	9.29E-01	F11a
large bird, on site	5.18E-02	5.18E-03	1.45E+00	F13a

Imazapic / Typical Application Rate
Only upper exposure estimates are used in this document.

Contaminated water				
small mammal	2.93E-07	1.46E-07	4.39E-07	F07
Contaminated fish				
predatory bird	2.20E-08	5.50E-09	4.95E-08	F09

Imazapic / Highest Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	4.36E+00	4.36E+00	4.36E+00	F02a
bee, 100% absorption	2.89E+01	2.89E+01	2.89E+01	F02b
Contaminated vegetation				
small mammal	2.25E-01	2.25E-01	4.82E-01	F03
large mammal	3.10E+00	3.10E+00	8.74E+00	F10
large bird	4.85E+00	4.85E+00	1.37E+01	F12
Contaminated water				
small mammal, spill	4.21E-01	2.53E-01	1.26E+00	F05
Contaminated insects				
small mammal	4.16E+00	4.16E+00	1.25E+01	F14a
small bird	6.77E+00	6.77E+00	2.03E+01	F14b
Contaminated prey				
predatory mammal (small mammal)	3.78E-01	3.78E-01	3.78E-01	F16a
predatory bird (small mammal)	5.82E-01	5.82E-01	5.82E-01	F16b

Imazapic / Highest Application Rate Only upper exposure estimates are used in this document.				
predatory bird (fish)	3.16E-02	9.49E-03	1.42E-01	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	1.44E-03	2.16E-04	1.84E-02	F04a
large mammal, on site	5.95E-02	5.95E-03	1.67E+00	F11a
large bird, on site	9.32E-02	9.32E-03	2.62E+00	F13a
Contaminated water				
small mammal	5.27E-07	2.64E-07	7.91E-07	F07
Contaminated fish				
predatory bird	3.96E-08	9.90E-09	8.91E-08	F09

3.38E-05

F09

Imazapyr / Typical Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	1.09E+01	1.09E+01	1.09E+01	F02a
bee, 100% absorption	7.21E+01		7.21E+01	7.21E+01
Contaminated vegetation				
small mammal	5.63E-01	5.63E-01	1.21E+00	F03
large mammal	7.74E+00	7.74E+00	2.19E+01	F10
large bird	1.21E+01	1.21E+01	3.42E+01	F12
Contaminated water				
small mammal, spill	5.98E-01	2.99E-01	1.22E+00	F05
Contaminated insects				
small mammal	1.04E+01	1.04E+01	3.12E+01	F14a
small bird	1.69E+01	1.69E+01	5.08E+01	F14b
Contaminated prey				
predatory mammal (small mammal)	9.44E-01	9.44E-01	9.44E-01	F16a
predatory bird (small mammal)	1.45E+00	1.45E+00	1.45E+00	F16b
predatory bird (fish)	2.04E-01	5.11E-02	6.25E-01	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	2.13E-02	6.66E-03	1.17E-01	F04a

Imazapyr / Typical Application Rate
Only upper exposure estimates are used in this document.

large mammal, on site	8.80E-01	1.83E-01	1.06E+01	F11a
large bird, on site	1.38E+00	2.87E-01	1.65E+01	F13a
Contaminated water				
small mammal	6.59E-06	6.59E-07	6.59E-05	F07
Contaminated fish				
predatory bird	2.25E-06	1.13E-07		
Upper	Worksheet		Typical	Lower
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	3.03E+01	3.03E+01	3.03E+01	F02a

Imazapyr / Highest Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
bee, 100% absorption	2.E-01	2.E-01	2.E-01	F02b
Contaminated vegetation				
small mammal	1.56E+00	1.56E+00	3.35E+00	F03
large mammal	2.15E+01	2.15E+01	6.07E+01	F10
large bird	3.37E+01	3.37E+01	9.50E+01	F12
Contaminated water				
small mammal, spill	1.66E+00	8.31E-01	3.39E+00	F05
Contaminated insects				
small mammal	2.89E+01	2.89E+01	8.67E+01	F14a
small bird	4.70E+01	4.70E+01	1.41E+02	F14b
Contaminated prey				
predatory mammal (small mammal)	2.62E+00	2.62E+00	2.62E+00	F16a

predatory bird (small mammal)	4.04E+00	4.04E+00	4.04E+00	F16b
predatory bird (fish)	5.68E-01	1.42E-01	1.73E+00	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	5.92E-02	1.85E-02	3.24E-01	F04a
large mammal, on site	2.44E+00	5.09E-01	2.93E+01	F11a
large bird, on site	3.83E+00	7.97E-01	4.59E+01	F13a
Contaminated water				
small mammal	1.83E-05	1.83E-06	1.83E-04	F07
Contaminated fish				
predatory bird	6.25E-06	3.13E-07	9.38E-05	F09

Metsulfuron methyl / Typical Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	7.27E-01	7.27E-01	7.27E-01	F02a
bee, 100% absorption	4.81E+00	4.81E+00	4.81E+00	F02b
Contaminated vegetation				
small mammal	3.75E-02	3.75E-02	8.04E-02	F03
large mammal	5.16E-01	5.16E-01	1.46E+00	F10
large bird	8.08E-01	8.08E-01	2.28E+00	F12
Contaminated water				
small mammal, spill	1.11E-02	1.11E-03	4.43E-02	F05
Contaminated insects				

Metsulfuron methyl / Typical Application Rate
Only upper exposure estimates are used in this document.

small mammal	6.94E-01	6.94E-01	2.08E+00	F14a
small bird	1.13E+00	1.13E+00	3.38E+00	F14b
Contaminated prey				
predatory mammal (small mammal)	6.29E-02	6.29E-02	6.29E-02	F16a
predatory bird (small mammal)	9.70E-02	9.70E-02	9.70E-02	F16b
predatory bird (fish)	1.59E-03	7.95E-05	9.54E-03	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	1.58E-03	7.89E-04	6.76E-03	F04a
large mammal, on site	6.51E-02	2.17E-02	6.13E-01	F11a
large bird, on site	1.02E-01	3.40E-02	9.60E-01	F13a
Contaminated water				
small mammal	8.78E-07	4.39E-07	1.76E-06	F07
Contaminated fish				
predatory bird	1.27E-06	3.17E-07	3.80E-06	F09

Metsulfuron methyl / Highest Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	3.64E+00	3.64E+00	3.64E+00	F02a
bee, 100% absorption	2.40E+01	2.40E+01	2.40E+01	F02b
Contaminated vegetation				

Metsulfuron methyl / Highest Application Rate **Only upper exposure estimates are used in this document.**				
small mammal	1.88E-01	1.88E-01	4.02E-01	F03
large mammal	2.58E+00	2.58E+00	7.28E+00	F10
large bird	4.04E+00	4.04E+00	1.14E+01	F12
Contaminated water				
small mammal, spill	5.54E-02	5.54E-03	2.22E-01	F05
Contaminated insects				
small mammal	3.47E+00	3.47E+00	1.04E+01	F14a
small bird	5.64E+00	5.64E+00	1.69E+01	F14b
Contaminated prey				
predatory mammal (small mammal)	3.15E-01	3.15E-01	3.15E-01	F16a
predatory bird (small mammal)	4.85E-01	4.85E-01	4.85E-01	F16b
predatory bird (fish)	7.95E-03	3.97E-04	4.77E-02	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	7.89E-03	3.95E-03	3.38E-02	F04a
large mammal, on site	3.26E-01	1.09E-01	3.07E+00	F11a
large bird, on site	5.10E-01	1.70E-01	4.80E+00	F13a
Contaminated water				
small mammal	4.39E-06	2.20E-06	8.78E-06	F07
Contaminated fish				
predatory bird	6.33E-06	1.58E-06	1.90E-05	F09

Picloram / Typical Application Rate **Only upper exposure estimates are used in this document.**	
Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals	
Scenario	Dose (mg/kg/day)

Picloram / Typical Application Rate
Only upper exposure estimates are used in this document.

Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	2.E-01	2.E-01	2.E-01	F02a
bee, 100% absorption	6.E-02	6.E-02	6.E-02	F02b
Contaminated vegetation				
small mammal	1.E-02	1.E-02	3.E-02	F03
large mammal	2.E-01	2.E-01	5.E-01	F10
large bird	6.E-03	6.E-03	2.E-02	F12
Contaminated water				
small mammal, spill	5.E-03	1.E-03	3.E-02	F05
Contaminated insects				
small mammal	2.38E-01	2.38E-01	7.14E-01	F14a
small bird	9.E-03	9.E-03	3.E-02	F14b
Contaminated prey				
predatory mammal (small mammal)	2.16E-02	2.16E-02	2.16E-02	F16a
predatory bird (small mammal)	7.54E-04	7.54E-04	7.54E-04	F16b
predatory bird (fish)	7.E-05	1.E-05	6.E-04	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	8.E-04	4.E-04	3.E-03	F04a
large mammal, on site	3.E-02	1.E-02	3.E-01	F11a
large bird, on site	5.E-02	2.E-02	5.E-01	F13a
Contaminated water				
small mammal	7.E-06	7.E-07	3.E-05	F07

Picloram / Typical Application Rate
Only upper exposure estimates are used in this document.

Contaminated fish				
predatory bird	5.E-06	3.E-07	3.E-05	F09

Picloram / Highest Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	2.42E+01	2.42E+01	2.42E+01	F02a
bee, 100% absorption	1.60E+02	1.60E+02	1.60E+02	F02b
Contaminated vegetation				
small mammal	1.25E+00	1.25E+00	2.68E+00	F03
large mammal	1.72E+01	1.72E+01	4.86E+01	F10
large bird	2.69E+01	2.69E+01	7.60E+01	F12
Contaminated water				
small mammal, spill	4.43E-01	1.33E-01	2.53E+00	F05
Contaminated insects				
small mammal	2.31E+01	2.31E+01	6.94E+01	F14a
small bird	3.76E+01	3.76E+01	1.13E+02	F14b
Contaminated prey				
predatory mammal (small mammal)	2.10E+00	2.10E+00	2.10E+00	F16a
predatory bird (small mammal)	3.23E+00	3.23E+00	3.23E+00	F16b
predatory bird (fish)	3.03E-01	4.54E-02	2.60E+00	F08
Longer-term Exposures				

Picloram / Highest Application Rate
Only upper exposure estimates are used in this document.

Contaminated vegetation				
small mammal, on site	1.60E-02	8.01E-03	6.87E-02	F04a
large mammal, on site	6.61E-01	2.20E-01	6.22E+00	F11a
large bird, on site	1.04E+00	3.45E-01	9.74E+00	F13a
Contaminated water				
small mammal	1.46E-04	1.46E-05	5.86E-04	F07
Contaminated fish				
predatory bird	1.00E-04	5.00E-06	6.00E-04	F09

Sethoxydim / Typical Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	7.27E+00	7.27E+00	7.27E+00	F02a
bee, 100% absorption	4.81E+01	4.81E+01	4.81E+01	F02b
Contaminated vegetation				
small mammal	3.75E-01	3.75E-01	8.04E-01	F03
large mammal	5.16E+00	5.16E+00	1.46E+01	F10
large bird	8.08E+00	8.08E+00	2.28E+01	F12
Contaminated water				
small mammal, spill	3.99E-01	6.21E-02	9.97E-01	F05
Contaminated insects				
small mammal	6.94E+00	6.94E+00	2.08E+01	F14a
small bird	1.13E+01	1.13E+01	3.38E+01	F14b

Sethoxydim / Typical Application Rate
Only upper exposure estimates are used in this document.

Contaminated prey				
predatory mammal (small mammal)	6.29E-01	6.29E-01	6.29E-01	F16a
predatory bird (small mammal)	9.70E-01	9.70E-01	9.70E-01	F16b
predatory bird (fish)	9.81E-01	7.63E-02	3.68E+00	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	1.80E-03	9.02E-04	7.73E-03	F04a
large mammal, on site	7.44E-02	2.48E-02	7.01E-01	F11a
large bird, on site	1.17E-01	3.88E-02	1.10E+00	F13a
Contaminated water				
small mammal	3.51E-05	8.78E-07	5.27E-05	F07
Contaminated fish				
predatory bird	5.04E-04	6.30E-06	1.13E-03	F09

Sethoxydim/ Highest Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	9.09E+00	9.09E+00	9.09E+00	F02a
bee, 100% absorption	6.01E+01	6.01E+01	6.01E+01	F02b
Contaminated vegetation				
small mammal	4.69E-01	4.69E-01	1.00E+00	F03
large mammal	6.45E+00	6.45E+00	1.82E+01	F10

Sethoxydim/ Highest Application Rate
Only upper exposure estimates are used in this document.

large bird	1.01E+01	1.01E+01	2.85E+01	F12
Contaminated water				
small mammal, spill	3.99E-01	6.21E-02	9.97E-01	F05
Contaminated insects				
small mammal	8.67E+00	8.67E+00	2.60E+01	F14a
small bird	1.41E+01	1.41E+01	4.23E+01	F14b
Contaminated prey				
predatory mammal (small mammal)	7.87E-01	7.87E-01	7.87E-01	F16a
predatory bird (small mammal)	1.21E+00	1.21E+00	1.21E+00	F16b
predatory bird (fish)	9.81E-01	7.63E-02	3.68E+00	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	2.25E-03	1.13E-03	9.66E-03	F04a
large mammal, on site	9.30E-02	3.10E-02	8.76E-01	F11a
large bird, on site	1.46E-01	4.86E-02	1.37E+00	F13a
Contaminated water				
small mammal	4.39E-05	1.10E-06	6.59E-05	F07
Contaminated fish				
predatory bird	6.30E-04	7.88E-06	1.42E-03	F09

Sulfometuron methyl / Typical Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals			
Scenario	Dose (mg/kg/day)		
Typical	Lower	Upper	Worksheet
Acute/Accidental Exposures			

Sulfometuron methyl / Typical Application Rate
Only upper exposure estimates are used in this document.

Direct spray				
small animal, 100% absorption	1.09E+00	1.09E+00	1.09E+00	F02a
bee, 100% absorption	7.21E+00	7.21E+00	7.21E+00	F02b
Contaminated vegetation				
small mammal	5.63E-02	5.63E-02	1.21E-01	F03
large mammal	7.74E-01	7.74E-01	2.19E+00	F10
large bird	1.21E+00	1.21E+00	3.42E+00	F12
Contaminated water				
small mammal, spill	4.43E-02	1.44E-02	1.22E-01	F05
Contaminated insects				
small mammal	1.04E+00	1.04E+00	3.12E+00	F14a
small bird	1.69E+00	1.69E+00	5.08E+00	F14b
Contaminated prey				
predatory mammal (small mammal)	9.44E-02	9.44E-02	9.44E-02	F16a
predatory bird (small mammal)	1.45E-01	1.45E-01	1.45E-01	F16b
predatory bird (fish)	1.06E-01	1.72E-02	4.37E-01	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	9.00E-04	4.50E-04	3.86E-03	F04a
large mammal, on site	3.71E-02	1.24E-02	3.50E-01	F11a
large bird, on site	5.81E-02	1.94E-02	5.47E-01	F13a
Contaminated water				
small mammal	2.64E-07	6.59E-08	4.61E-07	F07
Contaminated fish				
predatory bird	1.08E-06	1.35E-07	2.84E-06	F09

Sulfometuron methyl / Highest Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	9.21E+00	9.21E+00	9.21E+00	F02a
bee, 100% absorption	6.09E+01	6.09E+01	6.09E+01	F02b
Contaminated vegetation				
small mammal	4.75E-01	4.75E-01	1.02E+00	F03
large mammal	6.54E+00	6.54E+00	1.85E+01	F10
large bird	1.02E+01	1.02E+01	2.89E+01	F12
Contaminated water				
small mammal, spill	3.74E-01	1.22E-01	1.03E+00	F05
Contaminated insects				
small mammal	8.79E+00	8.79E+00	2.64E+01	F14a
small bird	1.43E+01	1.43E+01	4.29E+01	F14b
Contaminated prey				
predatory mammal (small mammal)	7.97E-01	7.97E-01	7.97E-01	F16a
predatory bird (small mammal)	1.23E+00	1.23E+00	1.23E+00	F16b
predatory bird (fish)	8.95E-01	1.45E-01	3.69E+00	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	7.60E-03	3.80E-03	3.26E-02	F04a
large mammal, on site	3.14E-01	1.05E-01	2.95E+00	F11a
large bird, on site	4.91E-01	1.64E-01	4.62E+00	F13a

Sulfometuron methyl / Highest Application Rate
Only upper exposure estimates are used in this document.

Contaminated water				
small mammal	2.23E-06	5.56E-07	3.89E-06	F07
Contaminated fish				
predatory bird	9.12E-06	1.14E-06	2.39E-05	F09

Triclopyr acid / Typical Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	2.42E+01	2.42E+01	2.42E+01	F02a
bee, 100% absorption	1.60E+02	1.60E+02	1.60E+02	F02b
Contaminated vegetation				
small mammal	3.30E-01	3.30E-01	4.95E-01	F03
large mammal	1.72E+01	1.72E+01	4.86E+01	F10
large bird	2.69E+01	2.69E+01	7.60E+01	F12
Contaminated water				
small mammal, spill	5.32E-01	3.32E-01	2.66E+00	F05
Contaminated insects				
small mammal	2.31E+01	2.31E+01	6.94E+01	F14a
small bird	3.76E+01	3.76E+01	1.13E+02	F14b
Contaminated prey				
predatory mammal (small mammal)	2.10E+00	2.10E+00	2.10E+00	F16a
predatory bird (small mammal)	3.23E+00	3.23E+00	3.23E+00	F16b

Triclopyr acid / Typical Application Rate
Only upper exposure estimates are used in this document.

predatory bird (fish)	3.02E-01	9.42E-02	2.26E+00	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	1.62E-02	6.20E-03	6.52E-02	F04a
large mammal, on site	2.52E+00	6.46E-01	3.20E+01	F11a
large bird, on site	3.95E+00	1.01E+00	5.01E+01	F13a
Contaminated water				
small mammal	4.39E-03	1.17E-03	7.32E-03	F07
Contaminated fish				
predatory bird	2.49E-03	3.32E-04	6.23E-03	F09

Triclopyr acid / Highest Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	2.42E+02	2.42E+02	2.42E+02	F02a
bee, 100% absorption	1.60E+03	1.60E+03	1.60E+03	F02b
Contaminated vegetation				
small mammal	3.30E+00	3.30E+00	4.95E+00	F03
large mammal	1.72E+02	1.72E+02	4.86E+02	F10
large bird	2.69E+02	2.69E+02	7.60E+02	F12
Contaminated water				
small mammal, spill	5.32E+00	3.32E+00	2.66E+01	F05
Contaminated insects				

Triclopyr acid / Highest Application Rate
Only upper exposure estimates are used in this document.

small mammal	2.31E+02	2.31E+02	6.94E+02	F14a
small bird	3.76E+02	3.76E+02	1.13E+03	F14b
Contaminated prey				
predatory mammal (small mammal)	2.10E+01	2.10E+01	2.10E+01	F16a
predatory bird (small mammal)	3.23E+01	3.23E+01	3.23E+01	F16b
predatory bird (fish)	3.02E+00	9.42E-01	2.26E+01	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	1.62E-01	6.20E-02	6.52E-01	F04a
large mammal, on site	2.52E+01	6.46E+00	3.20E+02	F11a
large bird, on site	3.95E+01	1.01E+01	5.01E+02	F13a
Contaminated water				
small mammal	4.39E-02	1.17E-02	7.32E-02	F07
Contaminated fish				
predatory bird	2.49E-02	3.32E-03	6.23E-02	F09

Triclopyr BEE / Typical Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	2.42E+01	2.42E+01	2.42E+01	F02a
bee, 100% absorption	1.60E+02	1.60E+02	1.60E+02	F02b
Contaminated vegetation				

Triclopyr BEE / Typical Application Rate
Only upper exposure estimates are used in this document.

small mammal	3.30E-01	3.30E-01	4.95E-01	F03
large mammal	1.72E+01	1.72E+01	4.86E+01	F10
large bird	2.69E+01	2.69E+01	7.60E+01	F12
Contaminated water				
small mammal, spill	5.32E-01	3.32E-01	2.66E+00	F05
Contaminated insects				
small mammal	2.31E+01	2.31E+01	6.94E+01	F14a
small bird	3.76E+01	3.76E+01	1.13E+02	F14b
Contaminated prey				
predatory mammal (small mammal)	2.10E+00	2.10E+00	2.10E+00	F16a
predatory bird (small mammal)	3.23E+00	3.23E+00	3.23E+00	F16b
predatory bird (fish)	3.02E-01	9.42E-02	2.26E+00	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	1.62E-02	6.20E-03	6.52E-02	F04a
large mammal, on site	2.52E+00	6.46E-01	3.20E+01	F11a
large bird, on site	3.95E+00	1.01E+00	5.01E+01	F13a
Contaminated water				
small mammal	4.39E-03	1.17E-03	7.32E-03	F07
Contaminated fish				
predatory bird	2.49E-03	3.32E-04	6.23E-03	F09

Triclopyr BEE / Highest Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals	
Scenario	Dose (mg/kg/day)

Triclopyr BEE / Highest Application Rate
Only upper exposure estimates are used in this document.

Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	2.42E+02	2.42E+02	2.42E+02	F02a
bee, 100% absorption	1.60E+03	1.60E+03	1.60E+03	F02b
Contaminated vegetation				
small mammal	3.30E+00	3.30E+00	4.95E+00	F03
large mammal	1.72E+02	1.72E+02	4.86E+02	F10
large bird	2.69E+02	2.69E+02	7.60E+02	F12
Contaminated water				
small mammal, spill	5.32E+00	3.32E+00	2.66E+01	F05
Contaminated insects				
small mammal	2.31E+02	2.31E+02	6.94E+02	F14a
small bird	3.76E+02	3.76E+02	1.13E+03	F14b
Contaminated prey				
predatory mammal (small mammal)	2.10E+01	2.10E+01	2.10E+01	F16a
predatory bird (small mammal)	3.23E+01	3.23E+01	3.23E+01	F16b
predatory bird (fish)	3.02E+00	9.42E-01	2.26E+01	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	1.62E-01	6.20E-02	6.52E-01	F04a
large mammal, on site	2.52E+01	6.46E+00	3.20E+02	F11a
large bird, on site	3.95E+01	1.01E+01	5.01E+02	F13a
Contaminated water				
small mammal	4.39E-02	1.17E-02	7.32E-02	F07

Triclopyr BEE / Highest Application Rate **Only upper exposure estimates are used in this document.**				
Contaminated fish				
predatory bird	2.49E-02	3.32E-03	6.23E-02	F09

2,4-D / Typical Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower	Upper	Worksheet	
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	2.42E+01	2.42E+01	2.42E+01	F02a
bee, 100% absorption	1.60E+02	1.60E+02	1.60E+02	F02b
Contaminated vegetation				
small mammal	1.25E+00	1.25E+00	2.68E+00	F03
large mammal	1.72E+01	1.72E+01	4.86E+01	F10
large bird	2.69E+01	2.69E+01	7.60E+01	F12
Contaminated water				
small mammal, spill	6.64E-01	6.64E-01	6.64E-01	F05
Contaminated insects				
small mammal	2.31E+01	2.31E+01	6.94E+01	F14a
small bird	3.76E+01	3.76E+01	1.13E+02	F14b
Contaminated prey				
predatory mammal (small mammal)	2.10E+00	2.10E+00	2.10E+00	F16a
predatory bird (small mammal)	3.23E+00	3.23E+00	3.23E+00	F16b
predatory bird (fish)	4.53E+00	2.27E+00	6.80E+00	F08
Longer-term Exposures				
Contaminated vegetation				
small mammal, on site	2.77E-02	1.39E-02	1.19E-01	F04a
large mammal, on site	1.14E+00	3.81E-01	1.08E+01	F11a
large bird, on site	1.79E+00	5.97E-01	1.69E+01	F13a

Contaminated water				
small mammal	2.93E-04	1.46E-04	5.86E-04	F07
Contaminated fish				
predatory bird	2.00E-03	5.00E-04	6.00E-03	F09

2,4-D / Highest Application Rate
Only upper exposure estimates are used in this document.

Worksheet G01 (modified): Summary of Exposure Scenarios for Terrestrial Animals				
Scenario	Dose (mg/kg/day)			
Typical	Lower		Upper	Worksheet
Acute/Accidental Exposures				
Direct spray				
small animal, 100% absorption	4.85E+01	4.85E+01	4.85E+01	F02a
bee, 100% absorption	3.21E+02	3.21E+02	3.21E+02	F02b
Contaminated vegetation				
small mammal	2.50E+00	2.50E+00	5.36E+00	F03
large mammal	3.44E+01	3.44E+01	9.71E+01	F10
large bird	5.38E+01	5.38E+01	1.52E+02	F12
Contaminated water				
small mammal, spill	1.33E+00	1.33E+00	1.33E+00	F05
Contaminated insects				
small mammal	4.63E+01	4.63E+01	1.39E+02	F14a
small bird	7.52E+01	7.52E+01	2.26E+02	F14b
Contaminated prey				
predatory mammal (small mammal)	4.20E+00	4.20E+00	4.20E+00	F16a
predatory bird (small mammal)	6.46E+00	6.46E+00	6.46E+00	F16b
predatory bird (fish)	9.07E+00	4.53E+00	1.36E+01	F08
Longer-term Exposures				

2,4-D / Highest Application Rate Only upper exposure estimates are used in this document.				
Contaminated vegetation				
small mammal, on site	5.55E-02	2.77E-02	2.38E-01	F04a
large mammal, on site	2.29E+00	7.63E-01	2.15E+01	F11a
large bird, on site	3.58E+00	1.19E+00	3.37E+01	F13a
Contaminated water				
small mammal	5.86E-04	2.93E-04	1.17E-03	F07
Contaminated fish				
predatory bird	4.00E-03	1.00E-03	1.20E-02	F09

Thank you

Appendix D – Soil and Water

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General Herbicide Properties in Relation to Soil

General characteristics for the proposed herbicides are displayed below; these were compiled from the R6 2005 FEIS, label information and SERA Risk Assessments, the Mount Hood National Forest and Columbia River Gorge National Scenic Area (Oregon side) Site-Specific Invasive Plant Treatment FEIS, and the Deschutes, Ochoco and Crooked River National Grasslands Invasive Plants EIS.

Chlorsulfuron

Studies on the effects of chlorsulfuron on soil biota include lab and field studies on nematodes; fungi; populations of actinomycetes, bacteria, and fungi; 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.
- 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 sandy or loamy 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.

Clopyralid

Studies of clopyralid effects on soil invertebrates have been conducted, including field studies on the effects to 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.
- 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 90 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 a moderate leaching potential overall but high leaching potential in sandy soils.
- Modeling results indicate clopyralid runoff is highest in clay soils with peaks after rainfall events.
- Clopyralid percolation is highest in sandy loam soils.

Glyphosate

Numerous soil bacteria, fungi, invertebrates, and other microorganisms have been studied for effects of glyphosate application.

- 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.
- 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.
- Modeling results indicate glyphosate runoff is highest in loam soils with peaks after the first rainfall.

Imazapic

Imazapic is a relatively new herbicide, and there are no studies on the effects of imazapic on either soil invertebrates or soil microorganisms.

- 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.
- 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.

Imazapyr

There are no studies on the effects of imazapyr on soil invertebrates, and incomplete information on the effects on soil microorganisms.

- 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.
- 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 imazapyr remains in the top 20 inches of soil and do not indicate any potential for imazapyr 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

Metsulfuron methyl

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
- 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.

Picloram

Picloram is a restricted use pesticide in the state of Washington, meaning it may only be used by a certified applicator (this is also a standard for all herbicide use on the Gifford Pinchot National Forest and Columbia River Gorge National Scenic Area). The persistence of picloram increases with soil concentration, thus increasing the likelihood that it becomes toxic to soil microorganisms in the short-term (1 to 3 years).

- Since picloram is toxic to microorganisms at low levels, toxic effects can last for some time after application.
- Persistence in soils could affect soil microorganisms by decreasing nitrification.
- Long-term effects to soil microorganisms are unknown.
- Picloram applied at a typical application rate is likely to change microbial metabolism, though detectable effects to soil productivity are not expected.
- Field studies have not noted substantial adverse effects associated with the normal application of picloram that might be expected if soil microbial activity were substantially damaged.
- Substantial effects to soil productivity from the use of picloram over the last 40 years have not been noted.
- 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. However, 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.
- Picloram percolation is highest in loam and sandy soils. However, modeling results indicate picloram runoff (not percolation) is highest in clay soils.

Sethoxydim

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.
- Sethoxydim is degraded by soil microbes, with an estimated half-life of 1 to 60 days. Adsorption of sethoxydim varies with organic material content.
- Modeling results indicate sethoxydim runoff is highest in clay and loam soils with peaks after the first rainfall.

Sulfometuron methyl

There are no studies on the effects of sulfometuron methyl on soil invertebrates. However, it is toxic to soil microorganisms. Microbial inhibition is likely to occur at typical application rates and could be substantial. Soil residues may alter composition of soil microorganisms. Sulfometuron methyl applied to vegetation at rates to control undesirable vegetation would probably be accompanied by secondary changes in the local environment that affect the soil microbial community more certainly than direct toxic action of sulfometuron methyl on microorganisms.

- The typical half-life for sulfometuron methyl varies from 10 to 100 days, depending on soil texture. Half-life decreases as soil particle size decreases. Presence of soil microorganisms also decreases half-life, though microbial breakdown occurs slowly. 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.
- 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.

Triclopyr

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.

- Triclopyr has not been studied on soil invertebrates.
- 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.

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Appendix E – Aquatics

List of Roads with Proposed Chemical Treatments within 100 Feet of a Fish-Bearing Stream

Table 3 - List of roads proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams

5th Field Watershed	Stream	Road Name (Road #)	Miles of road proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams	TES Fish Species Present at Site	TES Fish Species Present in Watershed
Upper Tucannon River Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 0.39 miles	Tucannon River	Tucannon River Road (4700)	0.13	SRC, BT	SRS, SRC, BT
	Unnamed Trib to Tucannon River	Cummings Creek Rd (470020)	0.07	BT	
	Hixon Canyon	Hixon Canyon Rd (4700165)	0.13		
	Panjab Creek	Panjab CG Rd (4713020)	0.02		
		Meadow Creek Road (4713)	0.04	BT	
Pataha Creek Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 0.02 miles	Pataha Creek	Stevens Ridge Rd (4016)	0.02		NF
Asotin Creek Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 0.05 miles	Lick Creek	Sourdough Gulch Rd (4100350)	0.05		SRS, SRC, BT

5th Field Watershed	Stream	Road Name (Road #)	Miles of road proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams	TES Fish Species Present at Site	TES Fish Species Present in Watershed
Lookingglass Creek	Mottet Creek	Lookingglass Rd (6300)	0.21	SRS	SRS, SRC, BT
Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 0.38 miles		Jubilee Rd (6400)	0.17		
Grande Ronde River/Grossman Creek	Sheep Creek	Unnamed Rd (6234)	0.14		SRS, SRC, BT
Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 0.14 miles					
Grande Ronde River/Cabin Creek	Phillips Creek	Glenn Canyon Rd (3148)	0.04	SRS	SRS
		Phillips Creek Rd (3738)	1.0	SRS	
Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 6.33 miles	Little Phillips Creek	Middle Ridge Rd (3734)	0.08	SRS	
	Phillips Creek	Unnamed Rd (3738090)	0.03	SRS	
	Phillips Creek	Craig's Cabin Rd (3740)	0.02	SRS	
	Little Phillips Creek	Oregon SR - 204	5.16	SRS	
Upper Umatilla River	Thomas Creek	Corporation Rd (3200)	2.11	MCS, MCC, BT	MCS, MCC, BT
Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 2.74 miles	South Fork Umatilla River	Corporation Rd (3200)	0.38	MCS, MCC	
		Umatilla Forks CG Rd (3200035)	0.08		
		Buck Creek Rd (3200045)	0.06		
	Umatilla River	Corporation Rd (3200)	0.07		
	Unnamed Trib to Umatilla River	Corporation Rd (3200)	0.04		

5th Field Watershed	Stream	Road Name (Road #)	Miles of road proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams	TES Fish Species Present at Site	TES Fish Species Present in Watershed
Meacham Creek	Meacham Creek	Meacham Creek Rd (3000030)	0.04	MCC	MCS, MCC, BT
Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 4.64 miles	Camp Creek	Camp Creek Rd (3000035)	0.12		
	Meacham Creek	Butcher Creek Rd (3102020)	0.009	MCS	
	Meacham Creek	Meacham Creek Rd (3000030)	4.37	MCC, MCS	
	Unnamed Trib to Meacham Creek	Meacham Creek Rd (3000030)	0.06	BT	
	Unnamed Trib to Meacham Creek	Meacham Creek Rd (3000030)	0.04		
Birch Creek	Pearson Creek	Pearson Creek Rd (5400)	1.81		MCS
Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 1.81 miles					
Upper Camas Creek	Dry Camas Creek	Unnamed Rd (5226300)	0.02		MCS, MCC, BT
Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 2.41 miles		Unnamed Rd (5226320)	0.03		
	Hideaway Creek	Pearson Creek Rd (5400)	0.14		
		Unnamed Rd (5445)	0.01	MCS	
	Camas Creek	Pearson Creek Rd (5400)	0.07	MCS	
		Oregon – 244	1.95	MCS	
	Bear Wallow Creek	Pearson Creek Rd (5400)	0.04	MCS	
	Bowman Creek	Unnamed Rd (5916040)	0.10	MCS	
	Camas Creek	Tower Mtn Rd (5226)	0.05		
North Fork John Day River/Big Creek	Big Creek	Big Creek Meadows CG (5225020)	0.05		MCS, MCC
Total miles	North Fork John Day	Texas Bar Rd (5500)	0.05	MCS	

5th Field Watershed	Stream	Road Name (Road #)	Miles of road proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams	TES Fish Species Present at Site	TES Fish Species Present in Watershed
proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 1.49 miles	River	Unnamed Rd (5500053)	0.01		
		Unnamed Rd (5505)	0.009		
		North Fork River Rd (5506)	0.61	MCS, MCC	
	Texas Bar Creek	Texas Bar Rd (5500)	0.09	MCS	
	Oriental Creek	Unnamed Rd (5506100)	0.06		
	Big Creek	North Fork River Rd (5506)	0.61	MCS	
Granite Creek Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 1.17 miles	Granite Creek	Olive Lake Drive (1000)	0.04	MCC	WCT, MCS, MCC, BT
		Granite Creek Rd (1035)	0.10	MCC	
		Unnamed Rd (1035012)	0.27	MCC	
		W730000	0.41	MCS	
	Unnamed Trib to Granite Creek	Unnamed Rd (1300)	0.28	WCT	
	Squaw Creek	Unnamed Rd (1035032)	0.06	MCS	
	Ten Cent Creek	Unnamed Rd (7350)	0.01	MCS	
Lower Camas Creek Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 0.04 miles	Sugarbowl Creek	Western Rte (5300)	0.02	MCS	MCS, MCC
	FiveMile Creek	Western Rte (5300)	0.02	MCS	
	Tribble Creek	Unnamed Rd (5300140)	0.003	MCS	
Willow Creek Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 0.05 miles	Dry Creek	Dry Creek Spring Rd (3200120)	0.01		NF
		Unnamed Rd (3200130)	0.01		
		Moonshine Rd (3200160)	0.02		
		UNI-22	0.02		

5th Field Watershed	Stream	Road Name (Road #)	Miles of road proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams	TES Fish Species Present at Site	TES Fish Species Present in Watershed
North Fork John Day River/Potamus Creek Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 2.24 miles	Ditch Creek	Olde Western Rt (2100)	0.48	MCS	MCS, RT, MCC
		Penland Lake Rd (2103)	0.01	MCS	
		Ritter Rd (2104120)	0.01		
		Western Rte (5300)	0.04		
	Long Canyon	Ritter Rd (2104)	0.02		
	Unnamed Trib to Potamus Creek	Kelly Fire Trail (5300210)	0.06		
	Martin Creek	Unnamed Rd (2107)	0.02		
	West Fork Meadow Brook	Trailer Court (3900105)	0.34	MCS	
		Unnamed Rd (3900101)	0.06		
		Helport Rd (3900110)	0.05	MCS	
		Unnamed Rd (3969)	0.07		
	Hinton Creek	Bone Point Rd (3963)	0.35	MCS	
		Unnamed Rd (3963016)	0.10		
	North Fork John Day River	Bone Point Rd (3963)	0.17	MCC	
	East Fork Meadow Brook Creek	Unnamed Rd (3971)	0.03	MCS	
		Unnamed Rd (3972)	0.08	MCS	
	Pole Creek	Western Rte (5300)	0.12		
	Unnamed Trib to Stalder Creek	Unnamed Rd (2106060)	0.01		
	Martin Creek	Upper Rhea Creek Rd (2100050)	0.04		
	East Fork Meadow Brook Creek	Unnamed Rd (3969)	0.17	MCS	
	West Fork	US 395	0.01	MCS	

5th Field Watershed	Stream	Road Name (Road #)	Miles of road proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams	TES Fish Species Present at Site	TES Fish Species Present in Watershed
Wall Creek Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 4.63 miles	Meadow Brook Creek Wilson Creek	Unnamed Rd (2300)	0.02		MCS, RT
	Swale Creek	Unnamed Rd (2100090)	0.40		
	Swale Creek	Unnamed Rd (5350)	0.04		
	Unnamed Trib to Wilson Creek	Bull Pr CG Rd (2039030)	0.002		
	Little Wall Creek	Unnamed Rd (2122)	0.42		
		Unnamed Rd (2122025)	0.02		
		Unnamed Rd (2122047)	0.01		
		Unnamed Rd (2202065)	0.41	MCS	
	Moreland Canyon	Unnamed Rd (2120045)	0.35		
	Wilson Creek	Unnamed Rd (2128)	0.72	MCS	
	Lovlett Creek	Unnamed Rd (2200019)	0.02		
	Three Trough Creek	Morphine/Three Trough Rd (2202)	0.03		
	Bacon Creek	Unnamed Rd (2202090)	1.49		
	Big Wall Creek	Unnamed Rd (2300)	0.41		
		Unnamed Rd (2300080)	0.01	MCS	
		Unnamed Rd (2300100)	0.08		
	Unnamed Trib to Big Wall Creek	Unnamed Rd (2300101)	0.03		
	South Fork Big Wall Creek	Unnamed Rd (2402)	0.17		
Lower John Day River/Kahler Creek	Kahler Creek	Oregon State Hwy - 207	0.08		RT

5th Field Watershed	Stream	Road Name (Road #)	Miles of road proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams	TES Fish Species Present at Site	TES Fish Species Present in Watershed
Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 0.08 miles					
Desolation Creek	Desolation Creek	Toll Bridge Rd (1000023)	0.04	MCS	WCT, MCS, MCC, BT
Total miles proposed for herbicide treatment within 100 feet of Class 1 & 2 Streams = 0.04 miles					

Effects of Active Ingredients in Herbicide to Aquatic Organisms

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 discountable effects. Table 2 lists the toxicity indices for fish used for the R6 2005 FEIS BA. Values in bold are the values used to assess risk to fish from acute exposures. Indices represent the most sensitive endpoint from the most sensitive species for which adequate data are available. Numbers in bold indicate the toxicity index used in calculating the hazard quotient for exposures to listed fish. Generally, the lowest toxicity index available for the species most sensitive to effects was used. Measured chronic data (NOEC) was used when they were lower than 1/20th of an acute LC50 because they account for at least some sublethal effects, and doses that are protective in chronic exposures are more certain to be protective in acute exposures.

Table 4 - Toxicity Indices for Fish Used for the R6 2005 FEIS

Herbicide	Duration	Endpoint	Dose	Species	Effect Noted at LOAEL (Lowest Observable Adverse Effect Level)
Chlorsulfuron	Acute	NOEC *	**2 mg/L (1/20th** of LC50)	Brown trout	LC50 at 40 mg/L
	Chronic	NOEC[1]	3.2 mg/L	Brown trout	rainbow trout length affected at 66mg/L
Clopyralid	Acute	NOEC	**5 mg/L (1/20th** of LC50)	Rainbow trout	LC50 at 103 mg/L
	Chronic				none available
Glyphosate (no surfactant)	Acute	NOEC	**0.5 mg/L** (1/20th/LC50)	Rainbow trout	LC50 at 10 mg/L
	Chronic	NOEC	2.57 mg/L[2]	Rainbow trout	Life-cycle study in minnows; LOAEL not given
Glyphosate with POEA surfactant	Acute	NOEC	**0.065 mg/L** (1/20th of LC50)	Rainbow trout	LC50 at 1.3 mg/L for fingerlings (surfactant formulation)
	Chronic	NOEC	0.36 mg/L	salmonids	estimated from full life-cycle study of minnows (surfactant formulation)
Imazapic	Acute	NOEC	100 mg/L	all fish	at 100 mg/L, no statistically sig. mortality
	Chronic	NOEC	**100 mg/L**	fathead minnow	No treatment related effects to hatch or growth
Imazapyr	Acute	NOEC	**5 mg/L** (1/20th LC50)	trout, catfish, bluegill	LC50 at 110-180 mg/L for North American species
	Chronic	NOEC	43.1 mg/L	Rainbow	"nearly significant" effects on early life stages at 92.4 mg/L
Metsulfuron methyl	Acute	NOEC	10 mg/L	Rainbow	lethargy, erratic swimming at 100 mg/L
	Chronic	NOEC	**4.5 mg/L**	Rainbow	standard length effects at 8 mg/L

Herbicide	Duration	Endpoint	Dose	Species	Effect Noted at LOAEL (Lowest Observable Adverse Effect Level)
Picloram	Acute	NOEC	**0.04 mg/L** (1/20th LC50)	Cutthroat trout	LC50 at 0.80 mg/L
	Chronic	NOEC	0.55 mg/L	Rainbow trout	body weigh and length of fry reduced at 0.88 mg/L
Sethoxydim	Acute	NOEC	**0.06 mg/L** (1/20th LC50)	Rainbow trout	LC50 of Poast at 1.2 mg/L
	Chronic	NOEC			none available
Sulfometuron methyl	Acute	NOEC	7.3 mg/L	Fathead minnow	No signs of toxicity at highest doses tested
	Chronic	NOEC	**1.17 mg/L**	Fathead minnow	No effects on hatch, survival or growth at highest doses tested
Triclopyr acid	Acute	NOEC	**0.26 mg/L** (1/20th LC50)	Chum salmon	LC50 at 5.3 mg/L[3]
	Chronic	NOEC	104 mg/L	Fathead minnow	Reduced survival of embryo/larval stages at 140 mg/L
Triclopyr BEE	Acute	--	**0.012 mg/L**	Bluegill sunfish	LC50 at 0.25 mg/L
	Chronic[4]	NOEC	104 mg/L	Fathead minnow	Reduced survival of embryo/larval stages at 140 mg/L
NPE Surfactants	Acute[5]	NOEC	**0.2 mg/L** (1/20th LC50)	fathead minnow, rainbow trout	LC50 at 4.0 mg/L
	Chronic[6]	NOEC	1.0 mg/L	trout	no LOEL given

1 Chronic value for brown trout (sensitive sp.) was estimated using relative potency in acute and chronic values for rainbow trout, and the acute value for brown trout.

2 Estimated from minnow chronic NOEC using the relative potency factor method (SERA Glyphosate 2003).

3 Using Wan et al. (1989) value for lethal dose.

4 Chronic and subchronic data for triclopyr are limited to triclopyr TEA. No data is available for triclopyr BEE.

5 Exposure includes small percentage of NP and NP1-2E (Bakke, 2003).

6 Chronic exposure is from degredates NP1EC and NP2EC, because NPE breaks down rapidly and NPEC's are more persistent (Bakke, 2003).

Indices represent the most sensitive endpoint from the most sensitive species for which adequate data are available. Numbers in bold indicate the toxicity index used in calculating the hazard quotient for exposures to listed fish. Generally, the lowest toxicity index available for the species most sensitive to effects was used. Measured chronic data (NOEC) was used when they were lower than 1/20th of an acute LC50 because they account for at least some sublethal effects, and doses that are protective in chronic exposures are more certain to be protective in acute exposures.

*NOEC = No Observed Effect Concentration

Results of the exposure scenarios as applied to listed fish on the Umatilla National Forest are displayed in Table 5. The R6 2005 FEIS Fish BA displayed the results by placing stars (*) and diamonds (♦) where there was an exceedence in the level of concern (LOC). For purposes of this BA, the table of stars and diamonds has been modified to show the hazard quotients (HQ) value in order to exemplify the magnitude of difference between typical and high application rates, and aquatic and non-aquatic formulations. The cells that contain a slash and no number mean that there was no exceedence in level of concern (LOC).

The LOC exceedences occur when the HQ value exceeds 1. Exceedences in LOC indicate occasions where the expected exposure concentration (EEC) is greater than the no observable effect concentration (NOEC) value used for that aquatic species group, which may lead to an indirect effect to listed aquatic species if conditions were similar to what was modeled in the SERA risk assessments. To calculate an HQ, simply take the ratio of EEC/NOEC values. Toxicity indices used in the R6 2005 FEIS for aquatic organisms are NOEC values, refer to table above. Two types of indirect effects are possible, those toxic to the listed aquatic species, and those mediated by toxic effects to an ecosystem component that is part of the Primary Constituent Elements (PCE) or associated essential habitat features.

Table 5 - Hazard Quotient Values for Acute Exposure Estimates for Sensitive Aquatic Organisms from the R6 2005 FEIS Broadcast Spray Scenarios

Aquatic Species Group	Application Rate	Chlorsulfuron	Clopyralid	Glyphosate w/o surfactant8*	Glyphosate w/ surfactant	Imazapic	Imazapyr**	Metasulferon Methyl	Picloram	Sethoxydin	Sulfometeron Methyl	Triclopyr TEA*	Triclopyr BEE	NPE Surfactant
Fish	High	--	--	6	43	--	--	--	5	3	--	15	125	--
	Typical	--	--	2	12	--	--	--	2	2.5	--	1.5	13	--
Aquatic Invertebrate	High	--	--	--	2.5	--	--	--	--	--	--	--	1.8	--
	Typical	--	--	--	--	--	--	--	--	--	--	--	--	--
Algae	High	5	--	--	3.1	--	5	--	--	--	3	9.5	214	--
	Typical	--	--	--	--	--	2	--	--	--	--	--	21	--
Aquatic Macrophytes	High	1064	--	--	--	1.4	8	9	2	--	36	9.5	214	--
	Typical	234	--	--	--	--	3	2	--		4		21	

'--' Predicted concentrations less than or equal to the estimated or measured 'no observable effect concentration' at both typical and high application rates.
'*' Aquatic formulations analyzed in the R6 2005 FEIS.

The exposure scenarios do not account for factors such as timing of application, animal behavior and feeding strategies, animal presence within a treatment area, or other relevant factors such as site-specific conditions. However, the SERA risk assessments do represent a worst-case scenario that is a good benchmark for assessing true concerns with actual application. Results of triclopyr exposures take into account the strict limitations on use identified in the forest plan standards, which makes the exposure scenarios implausible or impossible. Table 5 displays the results of exposure if all "worst-case" conditions reflected in the scenario occur, which is highly unlikely for Umatilla National Forest.

Chronic and Acute Exposures

The toxicity metric values (estimated or measured NOEC values) used in the R6 2005 FEIS analyses were selected as the most likely to protect against sub-lethal effects. For assessing potential risk to listed fish, while accounting for uncertainty regarding sub-lethal effects, the 1/20th of the acute LC50 (U.S. EPA 2004) or a lower chronic NOEC value was used for the acute toxicity index. Therefore, a LOC exceedence listed in Table 5 represents at least a greater than discountable risk of sub-lethal effects at the R6 2005 FEIS scale. For the action alternatives, effects analysis tiers to the results of the R6 2005 FEIS for chronic and acute exposures, and analyzes the potential for more than a discountable risk of sub-lethal effects as well as indirect effects from impacts to the food web.

Results of the R6 2005 FEIS analysis indicates that chronic exposures to fish are not plausible, in other words not mathematically possible. Therefore, chronic exposures to fish for the action alternatives are unlikely to occur. It is safe to assume that it is highly unlikely to reach a LOC for chronic exposures herbicide treatments on UNF.

The R6 FEIS identified three herbicides that mathematically exceeded the LOC for aquatic plants: Imazapyr, Metsulfuron, and Chlorsulfuron. The R6 2005 FEIS concluded that exposure of aquatic plants to chronic toxicity concentrations of imazapyr may be mathematically possible, but not plausible. Therefore, it is not plausible for the action alternatives to result in chronic toxicity of imazapyr for aquatic plants. For metsulfuron, the peak modeled stream concentration reported in the SERA risk assessment is 0.006 mg/l, which is approximately equal to the 0.005 mg/l that was calculated as the mathematically highest possible average stream concentration (with direct input). This indicates that the true 21 day concentration for non-fish species is likely much lower. Based on this, it is unlikely that exposure to chronic toxicity of metsulfuron to plants will occur for the action alternatives, even if there were no buffers.

The risk assessment for chlorsulfuron lists the highest average modeled stream concentration as 0.0022 mg/l, approximately 46 times higher than the estimated acute NOEC of 0.000047 mg/l. However, chronic toxicity to plants is unlikely to occur for the action alternatives because of Project Design Features that limit broadcasting chlorsulfuron.

The effects analysis for this EIS focus on the probability and magnitude of acute exposures from herbicide treatments based on results from the SERA risk assessments. It must be made clear that the risk categories for herbicides identified in the R6 2005 FEIS Fish BA is risk to aquatic organisms (fish, invertebrates, algae, aquatic macrophytes) among the herbicides analyzed for the R6 2005 ROD. The herbicides analyzed in the R6 2005 FEIS were compared to each other and placed in a risk level category according to results from worst-case acute exposure scenario used in the SERA risk assessments. Herbicides analyzed in the R6 2005 FEIS were displayed in the following category of risk:

- Lowest risk: results from SERA risk assessments indicated no risk or a plausible risk to aquatic macrophytes only (includes chlopyralid, imazapic and metsulfuron methyl),
- Moderate risk: results from SERA risk assessments indicated a plausible risk to algae or invertebrates, in addition to plants (includes chlorsulfuron, imazapyr and sulfometeron methyl),
- Highest risk: results from SERA risk assessments indicated a plausible risk to fish which may or may not be a risk to algae, invertebrates, or macrophytes (includes sethoxydim, picloram, non-aqueous glyphosate and triclopyr).

The lowest risk group contains those herbicides for which LOCs were either not exceeded, or only exceeded the LOC for aquatic macrophytes. The moderate risk group contains those herbicides for which LOCs were exceeded for two aquatic species groups other than fish. The higher risk group contains those herbicides for which LOCs for fish were exceeded.

The ability of herbicides to come in contact with water once in the soil depends on complex toxicological properties and environmental parameters. A discussion of herbicide characteristics in soil is discussed in the Watershed Analysis for this project. Understanding how the herbicide reacts in soil helps in understanding the probability of adverse effects to aquatic organisms should the herbicide come in contact with water. These characteristics were considered for the analysis of effects from the action alternatives on federally listed and sensitive fish and their habitat.

Clopyralid (Lowest Risk Category)

Studies of clopyralid effects on soil invertebrates have been conducted, including field studies on the effects to 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.
- 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 90 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 a moderate leaching potential overall but high leaching potential in sandy soils.

Modeling results indicate clopyralid runoff is highest in clay soils with peaks after rainfall events. Clopyralid percolation is highest in sandy loam soils.

There is no probability of exceeding levels of concern for aquatic organisms under the proposed action because expected exposure concentrations in the SERA risk assessments did not exceed any NOEC value for any aquatic organisms analyzed. In addition, there would be no impact to the food web.

Imazapic (Lowest Risk Category)

Imazapic is a relatively new herbicide, and there are no studies on the effects of imazapic on either soil invertebrates or soil microorganisms.

- 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.
- 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.

There is no probability of exceeding levels of concern for fish, invertebrates, or algae under the proposed action because expected exposure concentrations in the SERA risk assessments did not exceed NOEC values. However, at the high application rate (keeping in mind worst-case scenario assumptions) the peak modeled stream concentration of 0.0018 Mg/L did exceed the NOEC value of 0.00127 Mg/L for aquatic macrophytes. The magnitude of difference between these two concentrations is extremely small, a difference of 0.00053. This indicates that the true concentration for aquatic macrophytes is likely to be much lower under the action alternatives, even if there were no buffers. Therefore, it is nearly impossible to indirectly adversely affect fish via the food web under the action alternatives.

Metsulfuron methyl (Lowest Risk Category)

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
- 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.

There is no probability of exceeding levels of concern for fish, invertebrates, or algae under the proposed action because expected exposure concentrations in the SERA risk assessments did not exceed NOEC values. However, at the high and typical application rates (keeping in mind worst-case scenario assumptions) the peak modeled stream concentration of 0.0015 Mg/L for high application rate and 0.0003 Mg/L for typical did exceed the NOEC value of 0.00016 Mg/L for aquatic macrophytes. The magnitude of difference between these two concentrations is very small, a difference of 0.00053 for high application rates and 0.00284 for typical. Therefore, there is a very low probability of indirectly adversely affecting fish via the food web under the proposed action.

Chlorsulfuron (Moderate Risk Category)

Studies on the effects of chlorsulfuron on soil biota include lab and field studies on nematodes; fungi; populations of actinomycetes, bacteria, and fungi; 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.
- 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 sandy or loamy 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.

There is no probability of exceeding levels of concern for fish or invertebrates under the proposed action because expected exposure concentrations in the SERA risk assessments did not exceed NOEC values. However, at the high application rate the peak modeled stream concentration of 0.05 Mg/L did exceed the NOEC value of 0.01 Mg/L for algae. For aquatic macrophytes, the NOEC value of .000047 Mg/L was exceeded at both typical and high application rates (keeping in mind worst-case scenario assumptions). The NOEC value used in the SERA risk assessment for aquatic macrophytes is 1/10th of the EC50, indicative of a conservative approach in the SERA risk assessments. The magnitude of difference between the expected exposure concentrations and the NOEC value for algae is small and unlikely to be reached under the action alternatives because of PDFs and buffers, as well as label directions.

There is a large magnitude of difference for aquatic macrophytes because of the NOEC value used and the sensitive nature of aquatic macrophytes. Under the proposed action, there is a low risk of impacting aquatic macrophytes, however, impacts would be localized and directed at the individual macrophyte where chlorsulfuron comes in contact with water. However, it is very unlikely that chlorsulfuron would come in contact with water at peak modeled concentrations under the SERA risk assessment because of PDFs, buffers and label direction. If it were to come in contact with water under the proposed action, impacts would not be of any magnitude that would lead to an adverse affect on fish. Therefore, there is a very low probability of indirectly adversely affecting fish via the food web under the action alternatives.

Imazapyr (Moderate Risk Category)

There are no studies on the effects of imazapyr on soil invertebrates, and incomplete information on the effects on soil microorganisms.

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.
- 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 imazapyr remains in the top 20 inches of soil and do not indicate any potential for imazapyr 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

There is no probability of exceeding levels of concern for fish or invertebrates under the proposed action because expected exposure concentrations (EEC) in the SERA risk assessments did not exceed NOEC values. However, at high application rates the peak modeled stream concentration of 1.0 Mg/L did exceed the NOEC value of 0.02 Mg/L for algae and 0.013 Mg/L for aquatic macrophytes. At typical application rates the peak modeled stream concentration of 0.036 Mg/L also exceeded the NOEC values for algae and aquatic macrophytes. The NOEC value used in the SERA risk assessment for aquatic macrophytes is 1/10th of the EC50, indicative of a conservative approach in the SERA risk assessments. The magnitude of difference between the expected exposure concentrations and the NOEC values for algae and aquatic macrophytes is relatively small and unlikely to be reached under the proposed action because of PDFs and buffers, as well as label directions.

Under the proposed action, there is little risk of impacting algae and aquatic macrophytes since emergent vegetation would not be treated. In the event that imazapyr did come into contact with water, impacts would be localized and of short duration, directed at the individual organism that were contacted. It is unlikely that impacts would be of a magnitude that would lead to an adverse affect on fish or invertebrates. Therefore, there is a very low probability of indirectly adversely affecting fish via the food web under the proposed action.

Sulfometuron methyl (Moderate Risk Category)

There are no studies on the effects of sulfometuron methyl on soil invertebrates. However, it is toxic to soil microorganisms. Microbial inhibition is likely to occur at typical application rates and could be substantial. Soil residues may alter composition of soil microorganisms. Sulfometuron methyl applied to vegetation at rates to control undesirable vegetation would probably be accompanied by secondary changes in the local environment that affect the soil microbial community more certainly than direct toxic action of sulfometuron methyl on microorganisms.

- The typical half-life for sulfometuron methyl varies from 10 to 100 days, depending on soil texture. Half-life decreases as soil particle size decreases. Presence of soil microorganisms also decreases half-life, though microbial breakdown occurs slowly. 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.
- 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.

There is no probability of exceeding levels of concern for fish or invertebrates under the proposed action because expected exposure concentrations (EEC) in the SERA risk assessments did not exceed NOEC values. However, at high application rates the peak modeled stream concentration of 0.0076 Mg/L did exceed the NOEC value of 0.0025 Mg/L for algae and 0.00021 Mg/L for aquatic macrophytes. At typical application rates the peak modeled stream concentration of 0.0009 Mg/L exceeded the NOEC value of 0.00021 Mg/L for aquatic macrophytes. The magnitude of difference between the expected exposure concentrations at the high application rates for aquatic macrophytes is 9 times that of the typical application rate. It comes as no surprise as sulfonureas are quite toxic to non-target vegetation. There was no concern for algae at the typical application rate. There is a very low likelihood of impacting algae and aquatic macrophytes under the proposed action because of PDF and buffers, as well as label directions. If any sulfometuron methyl were to come in contact with water, impacts to aquatic macrophytes under the proposed action would be localized and of short duration, directed at the individual organism where the herbicide comes in contact with water. It is unlikely that impacts would be of a magnitude that would lead to an adverse affect on fish or invertebrates. Therefore, there is a very low probability of indirectly adversely affecting fish via the food web under the action alternatives.

Sethoxydim (Poast product, Higher Risk Category)

Sethoxydim was associated with some levels of concern in the R6 2005 FEIS; however risk assessments incorporated the toxicity of the naptha solvent in the Poast® formulation of this herbicide. The toxicity of the sethoxydim alone is about 100 times less for fish than that of the Poast® formulation. Since the naptha solvent tends to volatilize or adsorb to sediments, using Poast® formulation data to predict effects from runoff may overestimate potential effects (SERA 2001). Adverse affects to fish and other aquatic organisms are not likely because the amount of sethoxydim used for this project would be lower than toxic levels, even if the Poast® formulation were used.

- Sethoxydim is degraded by soil microbes, with an estimated half-life of 1 to 60 days. Adsorption of sethoxydim varies with organic material content.
- Modeling results indicate sethoxydim runoff is highest in clay and loam soils with peaks after the first rainfall.

There is no probability of exceeding levels of concern for invertebrates, algae, or aquatic macrophytes under the proposed action because expected exposure concentrations (EEC) in the SERA risk assessments did not exceed NOEC values. However, at both high and typical application rates the peaks modeled stream concentrations of 0.19 Mg/L and 0.15 Mg/L, respectively, did exceed the NOEC value of 0.06 Mg/L for fish and were nearly equal in difference between the EEC and NOEC value. There is very little concern for the magnitude of difference between the EEC and NOEC because it is highly unlikely that sethoxydim (Poast® formulation) would come in contact with water at toxic levels due to the restricted use in riparian areas. Therefore, there is a very low probability of adversely affecting fish.

Picloram (Higher Risk Category)

Picloram is a restricted use pesticide in the states of Washington and Oregon. The persistence of picloram increases with soil concentration, thus increasing the likelihood that it becomes toxic to soil microorganisms in the short-term.

- Since picloram is toxic to microorganisms at low levels, toxic effects can last for some time after application.
- Persistence in soils could affect soil microorganisms by decreasing nitrification.
- Long-term effects to soil microorganisms are unknown.
- Picloram applied at a typical application rate is likely to change microbial metabolism, though detectable effects to soil productivity are not expected.
- Field studies have not noted substantial adverse effects associated with the normal application of picloram that might be expected if soil microbial activity were substantially damaged.
- Substantial effects to soil productivity from the use of picloram over the last 40 years have not been noted.
- 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.

- 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.
- Picloram percolation is highest in loam and sandy soils. However, modeling results indicate picloram runoff (not percolation) is highest in clay soils.

There is no probability of exceeding levels of concern for invertebrates or aquatic macrophytes under the proposed action because expected exposure concentrations (EEC) in the SERA risk assessments did not exceed NOEC values. However, at high and typical application rates the peak modeled stream concentrations of 0.20 Mg/L and 0.07 Mg/L, respectively, did exceed the NOEC value of 0.04 Mg/L (1/20th LC50) for fish. The HQ at typical application rate is 2 compared to 5 at the high application rate for fish, suggesting that exceedances are within the same low range of difference.

Acute exposures can affect fish development, growth, swimming response, and liver histopathology; all referred to as sublethal effects. To account for the potential of sublethal effects, the 1/20th of the LC50 was used in the SERA risk assessment. Exposures that lead to such sublethal effects use an amount of picloram much greater than what would be applied at each treatment site on the Umatilla National Forest.

Acute toxicity of picloram varies considerably with formulation and with fish species. Formulations like Tordon 22K (potassium salt) is known to be considerably less toxic to several fish species compared to ester formulations. Although leached picloram may be transported to aquatic ecosystems as a result of rainfall, studies have shown that less than 5 percent of the picloram applied to a watershed are transported in surface runoff (Norris et al. 1991). Where soil compaction has occurred or where intermittent streams have been treated, residues of picloram could be mobilized following heavy rainfalls.

Adverse affects to fish from the use of picloram under the proposed action are not likely to occur because the probability of picloram contacting water at levels of concern is low. The PDFs and buffers established for picloram greatly reduce the potential for drift, leaching, and runoff. Any amount of picloram in water as a result of drift from spot spray or hand/select applications would be negligible and more than likely not detected because of vegetation interception and distance from the ordinary high water line or bankfull.

For aquatic macrophytes, only the high application rate exceeded the NOEC value of 0.10 (LOEC), resulting in a HQ of 2. Given the low magnitude of difference in EEC and NOEC, as well as the low range of HQs for picloram, it is unlikely that NOEC values for fish and aquatic macrophytes would be exceeded under the proposed action because of the PDFs and buffers established for streams and roads with high potential for herbicide delivery.

Glyphosate (Higher Risk Category)

Glyphosate has been extensively studied and is commonly used by State and Federal agencies within riparian areas. This section includes more information than for previous herbicides because of it’s proposed use within aquatic influence zones with spot and hand/select applications of aquatic formulations.

Glyphosate is highly soluble in water but much less so in organic solvents. In general, it is very immobile in soil, being rapidly adsorbed by soil particles, and subject to some degree of microbial degradation. The degree of glyphosate decomposition varies by soil types. Glyphosate is readily metabolized by soil microorganisms and some species can use glyphosate as a sole source of carbon.

- It is degraded by microbial action in both soil and water.
- 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.
- Modeling results indicate glyphosate runoff is highest in loam soils with peaks after the first rainfall.

The SERA 2003 risk assessment provides results for two formulations of glyphosate; glyphosate with surfactant (terrestrial formulation, most toxic formulation) and glyphosate without surfactant (aquatic, less toxic formulation).

In aquatic species, the acute lethal potency of glyphosate and glyphosate formulations has been relatively well-defined. The formulation of glyphosate with surfactants, especially the POEA surfactant commonly used in glyphosate formulations, has a pronounced effect on the acute lethal potency of glyphosate.

The primary hazards to fish appear to be from acute exposures to the more toxic formulations. At high and typical application rates, the hazard quotients for the more toxic formulation at the upper ranges of plausible exposure indicate that the 1/20th LC50 values for listed fish will be exceeded under worst-case conditions. The more toxic formulation did exceed the toxicity endpoints for invertebrates and aquatic plants at the high application rate of 7 lbs a.e./acre. In the worst-case scenarios, the exposure estimates are based on a severe rainfall (about 7 inches over a 24 hour period) in an area where runoff is favored – a slope toward a stream immediately adjacent to the application site. This is a standard worst-case scenario used in Forest Service risk assessments to guide the Forest Service in the use of herbicides. The SERA 2003 risk assessment strongly suggests that the use of the more toxic formulations near surface water is not prudent. Therefore, the proposed action has included a 100 ft buffer for broadcast applications and a 50 foot buffer for spot and hand/select applications for the more toxic formulations of glyphosate. In addition, no broadcasting is permitted on roads with high potential for herbicide delivery. This greatly lowers the probability of toxic formulations of glyphosate coming in contact with water at levels of concern.

The less toxic formulation did slightly exceed the toxicity endpoint used for fish at high and typical application rates, 6 and 2 respectively. However, there are no exceedances for invertebrates or aquatic plants. Exceedance is based on the 1/20th LC50 value rather than a NOEC. Thus, the use of less toxic formulations of glyphosate (aquatic) near bodies of water where salmonids may be found is limited to spot and hand/select methods up to the edge of water.

Sub-lethal Effects

In the SERA 2003 risk assessment, the term “sub-lethal” is intended to designate effects that may impact reproduction, behavior, or the ability to respond to other stressors. For chronic exposures to glyphosate, the most relevant study remains the life cycle toxicity studies done in fathead minnow. As summarized in the U.S. EPA/OPP (1993c), no effect on mortality or reproduction was observed at a concentration of 25.7 mg/L using 87.3% pure technical grade glyphosate. The full life-cycle toxicity study was conducted in fathead minnow, a standard chronic toxicity that was required by and accepted by the U.S. EPA (1993a). In this study, the NOEC was 25.7 mg/L (U.S. EPA, 1993a, p. 41). It is important to note that the NOEC from this full life-cycle toxicity study not only indicates a lack of mortality but also indicates that the fish were able to reproduce normally. The life cycle NOEC of 25.7 mg/L was used as the most appropriate basis for risk characterization in the SERA 2003 risk assessment.

To account for uncertainty regarding sub-lethal effects, an amount of 0.5 Mg/L was used as the toxicity threshold for listed fish under the R6 2005 FEIS. This amount is the 1/20th of the acute LC50 (U.S. EPA, 2004) for glyphosate, which is 51 times less than the chronic (long-term exposures) toxicity threshold of 25.7 Mg/L.

If a full life-cycle of fish showed no adverse affects at a long-term exposure of 25.7 Mg/L (NOEC endpoint), the probability of a fish adversely affected at short-term exposure of 0.5 Mg/L is low (See the BE for this EIS, available upon request from the Project Record at the Umatilla NF in Pendleton, OR).

Effects of Surfactants

Appendix 3c of the SERA 2003 risk assessment summarizes the available ecological information from all of the Material Safety Data Sheets (MSDS) for the formulations that are labeled for forestry applications. It is apparent that these formulations fall into relatively clear groups. The most toxic formulations appear to be Credit Systemic, Credit, Glyfos, Glyphosate, glyphosate Original, Prosecutor Plus Tracker, Razor SPI, Razor, Roundup Original, Roundup Pro Concentrate, and Roundup UltraMax. It may be presumed that these formulations contain the most toxic surfactants. Other formulations such as Aqua Neat, Aquamaster, Debit TMF, Eagre, Foresters' Non-Selective Herbicide, Glyphosate VMF, and Roundup Custom are much less acutely toxic.

For the SERA 2003 risk assessment, the uncertainties involving the presence or absence of a surfactant and the possibly differing effects of using various surfactants cannot be resolved with certainty. 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. The R6 2005 FEIS addresses this uncertainty through Standard #18.

The polyethoxylated tallow amine (POEA) surfactant used in some glyphosate formulations is substantially more toxic to aquatic species than glyphosate and substantially more toxic than other surfactants that may be used with glyphosate. Two aquatic toxicity studies (Folmar et al. 1979, Wan et al. 1989) have been conducted on glyphosate, the POEA surfactant, and a Roundup formulation which permit a quantitative assessment of the relative toxicities of glyphosate and POEA as well as an assessment of potential for toxicologic interactions (i.e., synergism or antagonism) in combined exposures to these agents. Both of these studies indicate that POEA is substantially more toxic than glyphosate and that POEA surfactant is the primary toxic agent of concern. Therefore, the proposed action PDF F3 does not allow the use of POEA within 150 feet of surface water, wetlands, or on roads with high potential for herbicide delivery.

Toxicity of Roundup to aquatic organisms because of the POEA surfactant was known by Monsanto when Roundup was originally labeled in 1978 and data were provided to the Environmental Protection Agency (EPA). This is why the formulation was not registered for aquatic use; nor are glyphosate-containing products with POEA now registered for aquatic use. Most glyphosate-containing products that are registered for aquatic use are manufactured without surfactant. Standard #18 of the R6 2005 FEIS states that only those surfactants reviewed in Forest Service hazard and risk assessment documents would be approved for use.

Nonyphenol polyethoxylate (NPE) based surfactants were also analyzed under the R6 2005 FEIS and did not exceed any LOC for fish, invertebrates, algae, or aquatic macrophytes.

Off-site drift

Estimates of drift for ground applications are included in the SERA risk assessments. In ground broadcast applications, glyphosate will typically be applied by low boom ground spray and thus these estimates are used in the SERA risk assessment. Drift associated with backpack (directed foliar applications) are likely to be much less than from broadcast.

In typical backpack ground sprays, droplet sizes are greater than 100 µ, and the distance from the spray nozzle to the ground is 3 feet or less. In mechanical sprays, raindrop nozzles might be used. These nozzles generate droplets that are usually greater than 400 µ, and the maximum distance above the ground is about 6 feet. In both cases, the sprays are directed downward.

For most applications, the wind velocity will be no more than 5 miles/hour, which is equivalent to approximately 7.5 feet/second (1 mile/hour = 1.467 feet/second). Assuming a wind direction perpendicular to the line of application, 100 µ particles falling from 3 feet above the surface could drift as far as 23 feet (3 seconds @ 7.5 feet/second). A raindrop or 400 µ particle applied at 6 feet above the surface could drift about 3 feet (0.4 seconds @ 7.5 feet/second). This suggests that there is a reasonable probability of some off-site drift from spot applications that occur up to the water's edge. Label requirements as well as PDFs and buffer distances account for significant off-site drift that could occur from broadcasting under the proposed action. For spot applications, the amount of drift is likely to be significantly less than from broadcast, therefore, the magnitude of effects on fish, invertebrates, and aquatic plants as a result of drift is very low. When spot treatments of herbicide using hand-held equipment are made, the applicator has direct control of where the spray solution is applied and little, if any, herbicide comes in contact with standing water.

Runoff

Glyphosate or any other herbicide may be transported to off-site soil by runoff or percolation. Both runoff and percolation are considered in estimating contamination of ambient water. For assessing off-site soil contamination, however, only runoff is considered. This is similar to the approach used by U.S. EPA (1995) in their exposure assessment for terrestrial plants. The approach is reasonable because off-site runoff will contaminate the off-site soil surface and could impact non-target plants. Percolation, on the other hand, represents the amount of the herbicide that is transported below the root zone and thus may impact water quality but should not affect off-site vegetation.

Based on the results of the GLEAMS modeling for the Blue Mountain Ecotype, the proportion of the applied glyphosate lost by runoff was estimated for clay, loam, and sand at rainfall rates ranging from 5 inches to 250 inches per year. Results indicate that there is the potential for glyphosate to reach streams at or above the toxicity value for fish, invertebrates, and aquatic plants under the worst-case scenario model.

In the flatter areas of UNF, such as valley bottoms, slope is likely to be less than the 10% modeled, decreasing the potential for stream herbicide concentrations. In the upper portions of the watersheds on UNF slopes exceed the 10% modeled, therefore there would be an increase of the potential for herbicide delivery from broadcast situations. However, it is highly unlikely that estimates from the GLEAMS model scenarios would be reached under the proposed action because actual application does not match well the scenario used in the model. Examples of scenario inputs that would differ at actual treatment sites include: interception of herbicide by vegetation, prohibited use of broadcasting in riparian areas, and the presence of organic matter in the soil. The presence of organic matter in soil significantly reduces delivery of glyphosate to streams.

Dose Response Assessment

The U.S. EPA/OPP (1993c) classified technical grade glyphosate as non-toxic to practically non-toxic in freshwater fish and LC50 values for glyphosate are in the range of 70 to 170 mg/L. In addition, the U.S. EPA/OPP (1993c) used the NOEC of 25.7 mg/L from life cycle toxicity study on technical grade glyphosate using fathead minnow and concluded that: “technical glyphosate should not cause acute or chronic adverse effects to aquatic environments. Therefore, minimal risk is expected to aquatic organisms from the technical glyphosate”.

The selection of the 1/20th of the LC50 as the toxicity values by U.S. EPA (2004) addresses the higher sensitivity of some species of fish to technical grade glyphosate. Trout and other salmonids have much lower LC50 than those cited by U.S. EPA/OPP in 1993, with the lowest LC50 value for salmonids of 10 mg glyphosate/L, for trout in soft-water. The use of 0.5 Mg/L for the less toxic formulation was used as the toxicity value for listed fish and accounts for potential sub-lethal effects. For the more toxic formulation a toxicity value of 0.065 Mg/L was used.

There is a magnitude of difference in toxicity between glyphosate without surfactant and glyphosate with surfactant. Using the toxicity values, glyphosate with surfactant is more toxic than glyphosate without surfactant by a factor of about 8 (HQ 43 ÷ HQ 6). It is unlikely that the proposed action would result in HQ of 6 for the less toxic formulation because of the limitations on application methods. In addition, field studies done by DOA support the expectation that amounts would not exceed any level of concern.

Eyed eggs of fish seem to be a resistant life stage, with sensitivity increasing as the fish enters the sac-fry and swim-up stages.

For invertebrates and algae, there is a very low probability of adverse affects at the highest application rates for glyphosate with surfactant. Results for the worst-case scenario using the 1/10th of the LC50 for invertebrates (1.1 Mg/L) and 0.89 NOEC for aquatic plants are not likely to be reached because there will be no broadcasting within riparian areas.

Triclopyr (Higher Risk Category)

Five commercial formulations of triclopyr, either as the triethylamine (TEA) salt or the butoxyethyl ester (BEE) are currently registered for forestry applications and are covered in the SERA 2003 risk assessment. Physical, chemical, and biochemical properties of triclopyr can be found on page 2-10 and 2-11 in the SERA 2003 Triclopyr Risk Assessment. This section includes more information than for previous herbicides because of its proposed use within aquatic influence zones with spot and hand/select applications of aquatic formulations. For aquatic formulations, there is a 15 ft buffer on waterbodies for spot applications and hand/select methods can be used up to the water’s edge.

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. In forestry applications, the primary concern is the formation of TCP as a soil metabolite. TCP is more persistent than triclopyr in soil and is relatively mobile in soil, thus able to come in contact with water near the site of application. TCP is of concern to the SERA 2003 risk assessment both because it is a metabolite of triclopyr and because the aggregate risks of exposure to TCP from the breakdown of both triclopyr and chlorpyrifos (insecticide) must be considered.

Data indicate that Garlon 3A (the triethylamine salt of triclopyr) is only slightly toxic or practically non-toxic to organisms tested. Garlon IV (butoxyethyl ester of triclopyr), however, is highly toxic to fish, whereas unformulated triclopyr is only slightly toxic. Project Design Features do not allow the use of Garlon IV within 50 feet of surface waters, thereby reducing the probability of fish coming in contact with Garlon IV. The long-term persistence of triclopyr does not seem to be a significant problem in forest settings because of its rapid disappearance. Photo-degradation is a major reason for the disappearance of triclopyr from water (Norris et al. 1991).

Exposure scenarios modeled in the SERA risk assessments are likely to significantly overestimated the risk of acute adverse affects from the application of triclopyr because triclopyr would only be applied by spot or hand methods (as per R6 2005 ROD standard 16), and not broadcast sprayed over 10 acres as depicted in the model scenario. The likelihood of toxic levels of triclopyr coming in contact with water is very low.

- 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.

Fish - There is a substantial difference between the toxicity of triclopyr acid and the toxicity of triclopyr BEE formulations, and the difference is reflected in the toxicities of the Garlon formulations (SERA 2003). As shown by Wan et al. (1989), Garlon 4 is more toxic than Garlon 3A by a factor of about 200 (150-230). This difference in toxicity is substantially greater than the difference in toxicity between triclopyr BEE and triclopyr acid. As indicated by Wan et al. (1989), the increased difference appears to be attributable to the toxicity of Garlon 3A, based on the level of triclopyr acid in this formulation. The level of triclopyr BEE in Garlon 4 appears to account for practically all of the toxicity of Garlon 4 (i.e., the ratios of observed to predicted LC50 values do not vary remarkably from unity for Garlon 4). Although Garlon 4 contains kerosene (see section 2.2 of the SERA 2003), the toxicity of kerosene to aquatic species is approximately 100-1,000 fold less than triclopyr BEE [LC50 values of approximately 200-3,000 mg/L (SERA 2003)], supporting the observation that the toxicity of Garlon 4 can be completely accounted for by the toxicity of triclopyr BEE.

Sub-lethal Effects

The sublethal effects of Garlon 4 on salmonid (rainbow trout) has been examined by Johansen and Geen (1990) using flow-through systems. Fish were found to be lethargic at concentrations of 0.32-0.43 mg/L. At levels <0.1 mg/L, fish were hypersensitive over 4-day periods of exposure. This is reasonably consistent with the threshold for behavioral changes in rainbow trout for Garlon 4 of 0.6 mg/L (Morgan et al. 1991). The corresponding threshold for behavioral changes to Garlon 3A was 200 mg/L (Morgan et al. 1991) is consistent with the relative acute lethal potencies of these two agents (SERA 2003).

Subchronic toxicity data are available only on the triethylamine salt of triclopyr and only in fathead minnows (Mayes et al. 1984; Mayes 1990c). In this study, fathead minnow eggs were exposed to concentrations of 26, 43, 65, 104, 162, and 253 mg/L for 28 days covering the development from egg to fry. The survival of fathead minnows (embryo-larval stages) was significantly reduced at 253 mg/L compared with control animals. At 162 mg/L, there was a slight decrease in body length. No effects were noted at any of the lower concentrations (SERA 2003). Janz et al. (1991) noted that sublethal exposures of coho salmon to various formulations of triclopyr do not appear to cause signs of physiological stress.

To account for uncertainty regarding sub-lethal effects from triclopyr acid and triclopyr BEE, the toxicity values of 0.26 Mg/L and 0.012 Mg/L, respectively, was for the R6 2005 FEIS. Both amounts are the 1/20th of the acute LC50 (U.S. EPA, 2004) for triclopyr, compared to the chronic NOEC of 104 Mg/L.

Aquatic Invertebrates

The available LC50 values cited in SERA 2003 suggest that most invertebrates are about equally or somewhat less sensitive than fish to the various forms of triclopyr. Some families of invertebrates (Ephemeroptera, Plecoptera, Trichoptera, Odonata) are much more resistant than fish to Garlon 4 (SERA 2003). The 1/10th of the LC50 (0.855 Mg/L) was used for the R6 2005 FEIS and was barely exceeded by 0.645 for triclopyr BEE at the high application rate.

Aquatic Plants

Triclopyr and triclopyr formulations have been subject to a standard set of bioassays in aquatic plats, both algae and macrophytes, that are required for the registration of herbicides. Based on EC50 values, triclopyr TEA is about equally toxic to both algae (lowest EC50 of 5.9 ppm a.i.) and macrophytes (lowest EC50 of 8.8 ppm a.i.). As with toxicity to fish and invertebrates, triclopyr BEE is more toxic with EC50 values as low as 0.88 ppm a.i. for macrophytes and 0.1 ppm for algae (SERA 2003). The R6 2005 FEIS used a toxicity value of 0.007 Mg/L (1/10th of EC50) for triclopyr BEE and 0.42 Mg/L (1/10th of EC50) for aquatic plants. There is a magnitude of difference between the exposures of triclopyr BEE and triclopyr acid at high application rates.

Off-site Drift

This is the same as for glyphosate. Under the proposed action, spot applications have a 15 foot buffer from the ordinary high water mark or bankfull.

Run-off

This is the same as for glyphosate. There are also substantial differences in the environmental fate of triclopyr TEA and triclopyr BEE. Both of these factors were considered in the SERA risk assessment. Triclopyr TEA will dissociate almost instantaneously to triclopyr acid in water. Thus, the toxicity of triclopyr TEA and triclopyr acid are essentially the same when expressed as acid equivalents. Triclopyr BEE, on the other hand, will degrade quickly but not instantaneously to triclopyr acid. This makes a substantial difference in the results from acute toxicity bioassays because, as summarized in the SERA 2003 risk assessment, the octanol water partition coefficient for triclopyr BEE (about 10,233) is higher than that of triclopyr acid (about 0.35 at pH 7) by a factor of nearly 30,000 [10,233÷0.35=29,237]. The much higher octanol water partition coefficient for triclopyr BEE will lead to much more rapid uptake of this form relative to triclopyr acid and this probably accounts for the much higher acute toxicity of triclopyr BEE relative to triclopyr acid.

Both forms of triclopyr will rapidly leach in very sandy soils after heavy rainfall. Since the maximum concentrations from the GLEAMS modeling is based on a rainfall event that occurs one day after application, relatively little triclopyr BEE is transformed to triclopyr acid and the peak concentrations are essentially equivalent. For both clay and loam soils, the maximum concentrations of triclopyr BEE (66 ppb in clay and 92 ppb in loam) are less than that of triclopyr acid (428 ppb for clay and 308 ppb for loam) because of the somewhat higher binding to organic matter in soil and consequent lesser runoff of triclopyr BEE relative to triclopyr acid in these soils. Triclopyr BEE will rapidly hydrolyze to triclopyr acid in water and “chronic” exposure to triclopyr BEE is not possible.

Dose Response Assessment

The acute risks associated with the use of triclopyr TEA are extremely low but the risks associated with the use of triclopyr BEE are obvious. TCP is about as acutely toxic to fish as triclopyr BEE.

Although triclopyr BEE is much more toxic to aquatic species than triclopyr TEA or triclopyr acid, the potential for exposure under the proposed action is much less because of the rapid hydrolysis of triclopyr BEE to triclopyr acid as well as the lesser runoff of triclopyr BEE because of it’s lower water solubility and higher affinity for soils. Buffers and PDFs will reduce the likelihood of triclopyr BEE coming in contact with water.

TCP

TCP (3,5,6-trichloro-2-pyridinol) is a major metabolite of triclopyr and is found in both soil and water. In mammals, TCP has about the same toxicity as triclopyr. Whereas, in fish TCP is substantially more toxic than either triclopyr acid or triclopyr TEA, with acute LC50 values in the range of about 2 to 10 ppm, similar to the toxicity of triclopyr BEE. An early life-stage study has been conducted in rainbow trout by Marino et al. 1999 (SERA 2003). The most sensitive endpoint involved growth – i.e., length and weight– with an NOEC of 0.0808 mg/L and an LOEC of 0.134 mg/L. Thus, TCP appears to be much more toxic than triclopyr TEA, for which the corresponding values in an early life stage study in the fathead minnow are 104 mg/L and 162 mg/L.

Because triclopyr and chlorpyrifos degrade at different rates, maximum concentration in soil, and hence maximum runoff to water, will occur at different times. Thus, in order to provide the most conservative estimate of exposure to TCP, the maximum concentrations reported in SERA 2003 reflect applications of triclopyr and chlorpyrifos spaced in such a way as to result in the maximum possible concentrations of TCP in water. This extremely conservative approach is discussed further in SERA 2003.

There are substantial differences in the toxicity of triclopyr TEA and triclopyr BEE to aquatic species and substantial differences in the environmental fate of triclopyr TEA and triclopyr BEE. Thus, the SERA Risk Assessment for Triclopyr ran a separate set of GLEAMS models using triclopyr BEE as the parent compound and triclopyr acid as the metabolite.

Barron et al. (1991) investigated the pharmacokinetics and metabolism of triclopyr (BEE) in yolk-sac fry of the coho salmon (Oncorhynchus kisutch) and found that the accumulation of triclopyr BEE was limited in the fish due to rapid hydrolysis to triclopyr acid, which was the principal metabolite in fish and water, accounting for over 99% of total residue. No TCP was detected in any residue or in test water.

The risk assessment by EPA does not specifically address concerns for contamination of water wit TCP as a soil metabolite of triclopyr and chlorpyrifos. Concentrations of TCP in a small stream could reach up to 11 ppb from the use of triclopyr at a rate of 1 lb/acre and up to 68 ppb in a small stream from the use of triclopyr at a rate of 1 lb/acre and chlorpyrifos at a rate of 1 lb/acre. Much lower peak concentrations would be expected in small ponds.

There is very little monitoring data with which to assess the plausibility of the modeling for TCP (SERA 2003). As discussed by U.S. EPA/OPP (1998a, p. 65ff), TCP is seldom detected in surface water after applications of triclopyr that result in triclopyr concentrations of up to about 25µg/L, with a limit of detection (LOD) for TCP of 10 µg/L. Thompson et al. (1991) examined the formation of TCP from triclopyr in a forest stream. Consistent with the results reported by U.S. EPA, these investigators failed to detect TCP (LOD=50 µg/L) in stream water with concentrations of triclopyr up to 140 µg/L. This is at least consistent with the GLEAMS modeling of both triclopyr and TCP. As shown in SERA 2003, the maximum modeled concentrations of triclopyr in stream water range from about 161 to 428 µg/L (for sandy and clay soils respectively) and the corresponding maximum modeled concentration of TCP in stream water range from about 5 to 11 µg/L. Thus, given the LOD of 50 µg/L in the study by Thompson et al. (1991), the failure to find TCP in stream water is consistent with the GLEAM modeling (SERA 2003).

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Appendix F – Aerial Spray Guidelines

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AERIAL SPRAY GUIDELINES

These guidelines are intended as a practical field guide for weed managers who may be considering use of aerial herbicide application as part of an integrated pest management program. Some of the terminology and work force, fiscal year, planning references are specific to Forest Service project planning. The information and observations in this guide are specific to large droplet liquid herbicide applications and does not address pellet, insecticide or other fine droplet aerial application projects.

Why Aerial Spray?

Scale: The impacts of weeds on native vegetation, wildlife, soils, fisheries, aesthetics, wilderness and a host of other resources are widely recognized by both the public and land managers. At the same time, the invasive plant problem in the northern Rockies has grown beyond the scale of ground based weed control.

While ground based and biological weed management practices still are important elements in an IWM program, they have site and species limitations. Ground based application methods such as truck, ATV, horseback, backpack or atomizer applications are generally most effective on:

- New or small infestations or
- Infestations on flat and/or open ground and
- Near a road or trail

Biological control alone, while effective and applicable in certain situations, is:

- Often cyclic,
- Not available for many weed species,
- Not as effective on weed infestations with several weed species and
- Not effective for small or pioneering infestations scattered over a large landscape.
- Not effective on complex terrain with a wide range of slope, aspect, soil and canopy combinations.

Aerial application is an efficient and useful method land mangers can add to their IWM toolboxes for weed infestations involving:

- Multiple weed species,
- At landscape scale, and
- On steep and remote areas

Cost: Aerial application reduces costs in at least two ways. Helicopter aerial application in the area costs around $42 / acre. Ground based applications can range from $100 to $125 / acre for truck based broadcast spraying or backpack applications. The lower application cost combined with the growing scale of the problem puts aerial application in a useful position when we consider that weed infestations are growing faster than any anticipated increases in weed budgets.

Access: Many wildland infestations are occurring in remote and/or very steep topography. Aerial application can quickly (in terms of application time), safely (in regards to applicator and public exposure) and efficiently (in terms of infested area coverage) treat infestations far from roads and trails and in steep or otherwise undrivable terrain.

Safety: Exposure: Aerial application improves safety and reduces worker and public exposure to herbicides. Worker exposure and risk are influenced by the:

- Time a worker is exposed to a product,
- Physical proximity and exposure to a product,
- Personal protective equipment and safe handling practices,
- Toxicity of the product,
- Terrain, hazards, and weather in the treatment area.

Aerial application reduces application time and the time a worker is exposed to a product. It also reduces the number of applicators needed to accomplish a project and the chance of slips, falls and spills associated with ground based treatments in steep, remote or hazardous terrain.

Aerial applications require All aviation activities shall be in accordance with FSM 5700 (Aviation Management), FSH 5709.16 (Flight Operations Handbook)FSM 2150 (Pesticide Use Management and Coordination), , FSH 2109.14, 50 (Quality Control Monitoring and Post-Treatment Evaluation).

Public impacts are influenced by:

- The time it takes to treat an area and the resulting limitations on public use / access,
- Individual physical or philosophical sensitivity to a product, and
- Toxicity of the product.

Aerial application reduces the time that a treatment area is unavailable to the public. It also provides an aerial platform from which an applicator can see people who may have unknowingly entered a treatment area.

Weather and wind patterns also affect worker and public exposure. Aerial application reduces the potential for both worker and public exposure from weather related factors because you can accomplish more acres in less time and thereby capitalize on favorable weather conditions. Worker and public exposure are reduced when it takes less time to treat a larger area.

Efficacy: Aerial application allows a manager to quickly complete projects when the target weed(s) is at the most susceptible phenological stage and weather conditions are most favorable for efficacy. This maximization of efficacy factors can reduce the number and scale of follow up treatments.

Overgrazing and Grazing Animal Distribution: Lower application costs allow for more ecologically compatible weed management. With lower application costs, a manager can afford to treat a larger project area at once. Higher treatment costs may necessitate treatment of only a portion of a project area each year. This can inadvertently attract big game or livestock to the treated area and result in overgrazing. Overgrazing in turn can reduce the retreatment interval. By treating larger areas at one time, big game and livestock will be better distributed over a larger area as they express preference for the improved forage resulting from the treatment.

Reduced Wildlife Disturbance: The short operational time needed for aerial treatment minimizes wildlife disturbance and use of an area. Aerial applications may typically take only one operational day compared to a week to a month for ground-based treatments.

Visual Quality: Lower application costs that allow treatment of larger areas with a single entry reduce the visual impacts that result from annual treatment of only a portion of the project area.

The color and texture of a landscape scale treatment is homogeneous rather than broken up by color, texture and straight lines.

Aerial Spray Control Strategies

Weed management objective: Weed managers should develop realistic and obtainable weed management objectives before beginning a direct weed control program. Even selective herbicides will affect non-target forbs. The effect of invasive weeds on native or desirable vegetation needs to be recognized and considered in relation to the effect of herbicides on non-target vegetation. Aerial application is a general treatment and it can be difficult to avoid small or isolated non-target vegetation. Non-target vegetation can be flagged and smaller sites can be tarped to avoid treatment, but the effect of weed control on individual non-target plant species should be carefully weighed in relation to the effect of unchecked weed spread on the overall population viability of non-target species both on and off the treatment site.

The herbicides and rates used for weed control in the area are generally selective (depending on rate) and many do not generally kill woody vegetation or grasses. While woody vegetation may show short-term effects, widespread mortality or damage is uncommon. Forbs are the non-target plants most at risk from the use of wildland weed herbicides. Whether native forb impacts are long term or short term depends on the rate and frequency of treatment, which is influenced by size of the infestation and whether you have rhizomatous or non-rhizomatous weeds.

While an objective to “Restore native plant communities” may be desirable, it may be unrealistic or unobtainable on widespread or rhizomatous weed infestations. More realistic and obtainable objectives may include:

- Improving or protect existing or adjacent native plant communities,
- Improving wildlife forage areas,
- Preventing new weed species from establishing in an area,
- Containing or reducing the acreage of difficult to control weeds (such as rhizomatous species) and/or
- Controlling areas of weeds growing in large difficult terrain to access by ground.
- Controlling widespread weeds on areas with high resource value (such as concentrated public recreation areas, big game winter ranges, or adjacent to neighboring landowners with active weed control programs).

Spring vs. Fall Treatments

Both spring and fall treatments have advantages and disadvantages. Fall treatments have less effect on non-target forbs. Climatologically, the weather is more consistent in the fall, but may be consistently too cold, especially in the morning. A drawback is that there is greater annual variability in the fall treatment window. It is difficult to know (and plan) when the fall treatment window will arrive. On some years there may be no fall treatment window due to warm weather and no rainfall. If it does arrive, it may last only a week or as long as several weeks. The end of the fall window can arrive abruptly with the snowfall and cold windy weather.

The spring treatment window is relatively long and dependable in terms of start and end date and falls at a time when you know and can plan for budget and staff. The days are longer in the spring, which allows more application time (and acres) each day. Late sunset gives application operations the option of shutting down midday if the wind comes up and resuming in the evening when the wind dies down. Both seasons can conflict with aircraft availability as a result of prescribed burning or wildfires.

Re-treatment Considerations

Before beginning an aerial treatment program, re-treatment needs, funding and scheduling should be considered. Keep in mind that the objective is not to simply kill the existing standing weed crop, but to:

- Restore and/or encourage desirable and competitive vegetation and
- Deplete the weed seed soil bank.

With these objectives in mind, a single treatment may be insufficient. As with all weed control methods, initial herbicide treatments should include planning for follow up treatments. Follow up treatment frequency should be influenced by the soil seed life of the most abundant and longest-lived weed on the site and the residual control provided by the herbicide selected. Spotted knapweed for example, has a soil seed life of about eight to 10 years. Once a treatment program begins, managers should plan for follow up treatments based on the soil seed life of the weeds present and the residual control of the herbicide selected.

For example, if spotted knapweed is being treated with picloram, a manager may consider follow up treatments every three growing seasons (the approximately residual control period for picloram) for three to four cycles (3 growing seasons x 3 to 4 cycles = 9 to 12 years – the approximately soil seed life for knapweed). Commitment to this program is important because if a cycle is missed and a weed seed crop is allowed to develop, the treatment cycle may have to be extended.

Pre-field Project Preparation

It is helpful to develop a checklist of the protection measures and management requirements. This checklist should clearly identify tasks and provide a place to date and sign off as each task is completed. This checklist should be filed in the project file. Some of the items that can go on the checklist include:

- Protection Measures from NEPA decision.
- Pesticide Use Proposal
- Notification of neighbors (Note: neighboring landowners may want to treat their lands when they learn a project is scheduled next to them)
- Pretreatment monitoring plots (these plots should be established during the growing season prior to the treatment)
- Designation of Aerial Equipment Manager (helicopter manager)
- Recon and selection of a helibase (close to treatment area, good road access, away from waterways, reviewed and OK’d by pilot)
- Posting of the area to be treated
- Establish temporary closure orders, when needed.
- Identification and marking of sensitive areas to be avoided
- TES plant and animal considerations

Field Project Layout

It is difficult to pre-determine the treatment day due to weed phenology, weather, and aircraft availability. It is recommended that aerial spray projects be prepped well in advance (2 to 4 weeks) of the anticipated treatment date.

Ground truthing: Treatment units should be carefully ground truthed prior to treatment to determine:

- Weed species and distribution •
- Road system and any differences in roadside infestations in relation to off road infestations
- Herbicide prescription considering both weeds and native vegetation
- Live water, wet areas or other sensitive resources you want to avoid
- Overstory canopy closure

This information can be recorded on aerial photographs that include project boundaries and other adjacent or in holding ownerships. Two copies of these aerial photos should be made, one copy for the project manager and one set for the application pilot to have on board the aircraft. When possible, geo-reference the aerial photo information in order to be able to give the pilot GPS location information.

Buffers and No Treatment Areas: Buffer and no treatment areas should be established around any sensitive resource you want to avoid. These areas may include live water, wet areas, other land ownerships, TES plants or occupied areas. Aerial treatment buffer zones may vary depending on site characteristics. Treatments may also be designed to avoid any aerial treatment near sensitive resources. The width of an aerial treatment buffer zone near sensitive resources should consider:

- Slope (steeper = wider)
- Vegetation (less overstory vegetation = wider)
- Wind prescription (applications should be made only with low upslope winds)
- Overstory vegetation (which determines release height - higher release height = wider buffer)
- Use of a drift agent (no drift agent = wider buffer- drift reduction agents are recommended near buffer areas)
- Droplet size (smaller droplet size = wider buffer)
- Topographic position (narrow deep draws = wider buffer areas)
- Sensitivity of neighboring landowners (more sensitive = wider buffer)

Buffer Monitoring: Water sensitive “drift cards” can be placed as needed within the buffer zones to document herbicide placement. The number of drift card lines should be determined by the sensitivity of the resource and the size of the area. The number of card lines should be considered carefully because they are time intensive and require additional project staff. Cards should:

- Be placed equidistance within the buffer from the sensitive resource to the beginning of the treatment area.
- Have the Line # and location on the line recorded on each card at the time of placement. • be placed 10 feet to 10 yards apart depending on the width of the buffer area.
- Be placed on drift cardholders.

- Be placed immediately before application and picked up and stored in waterproof bags immediately after treatment.
- Not be placed the day or evening before early morning applications due to dew, fog or humidity contamination.
- Be laid out in a dry office setting in the order they were placed and interpreted as soon as practical. (Cards often come with interpretation information and sampling square templates.)
- Filed in waterproof bags in the project file.

It is critical that those placing drift cards be briefed on handling, placement, contamination, collection and storage of the cards. Those placing and picking up the cards should carefully check the card condition as they are placed and picked up and note any non-herbicide contamination. Contamination can include fog, high humidity, dew droplets off leaves, moisture on your hands, improper card handling, rodent urine or foot prints, wildlife or insect moisture and/or feeding on the cards.

If drift cards are used, card lines should also be placed in treatment areas under full spray conditions to serve as a reference for determining percentage of full spray on cards in buffer areas that have detection. The purpose of buffers is to protect the resource that is at the end of the buffer area, so detection within the buffer areas may be acceptable as long as the sensitive area itself is protected.

In-stream water sampling has limitations in that it is expensive, should be sterile and automated to avoid contamination, only indicates whether herbicide reached a water way in detectable quantities, does not indicate how close herbicide may have come to the sensitive resource and is subject to dilution depending on stream volume and velocity.

Drift Mitigation Measures: Drift mitigation measures may include:

- Use of a drift agent
- Use of buffer areas next to sensitive resources
- On site weather monitoring
- Treatment next to sensitive areas when wind is upslope and gentle
- No treatment during inversions
- No treatment when winds in the project area are > 6 mph
- No treatment when weather forecasts predict rain in next 24 hours

Unit Marking Strategies: In agricultural or residential settings treatment area boundaries are clearly defined by fences, roads and / or buildings. Wildland project managers should identify treatment areas on the ground and be sure the application pilots know where treatment and no treatment areas are. Wildland unit marking strategies fall into two general categories:

- Identification of specific treatment polygons and delineation of where to treat within a larger project area, or
- Identification of the general project area and delineation of areas not to treat.

Large wildland treatment areas that include many polygons and a mix of timbered and open areas may be difficult to mark and find from the air. If treatment units are large and there are only three to five in the project area it may be practical to mark each individual unit. If there are many units in a large area, it may be more efficient to mark the project area boundary and buffers and instruct the pilot which areas not to treat within the larger project area. The no treatment areas could include marked buffer areas (which would include waterways and wet areas), talus, rock and cliffs and areas with a closed overstory canopy.

On the Ground Unit Marking: Technology is rapidly developing that allows managers to mark treatment units digitally. On the ground block marking is the most expensive part of project layout and through the use of digital marking may be eventually eliminated. Some on the ground features and topography may require some degree of on the ground marking.

When on the ground marking is needed, uniform unit marking is recommended to ensure consistency between treatment blocks, different ranger districts and to reduce pilot workload. Unit marking can be done with high contrast, high strength flagging staked or rocked to the ground or with aerosol survey paint. Markings should be kept as simple as possible. Frequency of marking should depend on the specific site and site features. Some suggested unit markings are:

- Treatment unit boundary: The vertical line should be on the unit boundary with the perpendicular line pointing into the treatment unit. These markings can also be places were roads enter and leave the treatment units. A unit number can be added for further aerial orientation.
- A horizontal line to mark the edge of a buffer or area to be avoided. The line should be parallel to the feature inside the buffer area.

All ground marking schemes should be closely coordinated with the application pilot.

Digital Unit and Treatment Marking: GPS guided navigational devices are available that allow an aircraft to develop a digital treatment polygon file from either a recon flight or an on the ground unit layout. These digital shapes appear on a navigational screen in the aircraft and are used to guide the pilot to the units. GPS line files are collected for each spray swath and are displayed on the polygon on the screen during application. These swath lines can be printed after application to provide a digital map record of the treated area. The swath width can be loaded into the program to generate area treated based on swath length and width.

Pretreatment Recon Flight: On or before treatment day, the pilot and project manager should fly the project area with aerial photos in hand to review and discuss treatment area, boundaries, other ownerships, buffer zones and on the ground marking. It is helpful for the project manager to GPS key project locations (such as unit corners or sensitive areas) prior to the flight to allow the pilot and project manager to quickly and efficiently orient from within the aircraft. Things can look different from an aircraft than from the ground and this step can save flight time.

Equipment

Helicopter and fixed wing aircraft are available for aerial application work. Helicopters have been better suited to the steep topography and diverse vegetation.

Aerial applicators typically come with a mix truck equipped with aviation fuel tanks, water tanks, a mix tank and a mix master. Water can be supplied by the Forest Service or by the applicator. Applicator mix trucks are not typically suited to travel over rough or steep forest roads so it is recommended to select a mix site / helibase with relatively easy road and water access. Forest Service rented water tenders can add expense to the project and Forest Service engines may be difficult to schedule during wildfire or prescribed burning season. Pump and hose fitting need to be compatible between Forest Service engines and mix trucks. Water should be clean or potable to avoid plugging up the spray system.

Aerial Spray Recommendations

The treatment block should be marked with flagging to mark the block corners or clearly described and reviewed with applicator. It is be desirable to have a GPS system on board to record helicopter swaths, position, and boom on and off times and location.

In canyon areas, winds should follow the typical diurnal pattern of upslope during the day and down slope during the night. These diurnal winds result from heating and cooling of the surface. Clear skies with solar radiation reaching the surface during the day cause up canyon and upslope winds. Cooling that occurs after sunset generates upslope or drainage winds. Given that waterways/riparian areas are often located in the bottom of canyon areas, it is essential to avoid drift down canyon and downslope. Down canyon and downslope winds will likely occur on clear days following daytime hours. To prevent spray from drifting down canyon/downslope, winds should be up canyon and upslope. Also, inversion can result in spray drifting off site; winds indicate that an inversion is not present.

Avoid spray drift impacting non-target sites by taking the following steps:

- When treating next to sensitive areas spray in the morning when up canyon and upslope winds are well established and blowing up canyon (most sensitive areas are down canyon). The specific time will need to be determined by real-time weather monitoring.
- Maintain boom pressure at less than 40psi.
- Monitor spray pressure during flight, since changes in pressure can change the application rates and may change the drop size.
- Use nozzles designed for medium to coarse droplet size (240 to 400 microns)
- Use drift agent to help maintain large droplet size.
- Check nozzles and review calibration with pilot.
- Begin the first swath 300 feet from any sensitive area.
- Mark boundaries so they are clearly understood by the pilot. Fly area with pilot prior to treatment to verify location. Use GPS to document boundaries and record treatment flight paths.
- Monitor treatment boundaries next to sensitive areas with spray deposit cards to detect any possible drift. Train people in how to handle the cards, interpret the cards (many things can contaminate the cards such as dew, moisture from hands, insects) and also document results. Card lines should also be placed in treated areas under full spray to serve as a reference.
- Monitor and record weather in the area. The weather should be monitored in real time for operational control and to help with the post-spray analysis. Strive for winds from 3 to 6 miles per hour or per label instruction. Do not treat if rain is predicted within next 24 hours.
- Consider using Forest Service Cramer-Barry-Grim (FSCBG) or AGDISP computer models to evaluate drift potential and to develop operational and drift protection measures prior to treatment.

Post Treatment Considerations and Tasks Post treatment tasks may include:

- Monitor and document in the project file daily rainfall for up to a week after treatment

- Schedule reading of monitoring plots between 1 growing season and 1 year after treatment
- Read drift cards and complete a drift report
- Compile a treatment project file for reference for the next retreatment
- Add the project to the retreatment schedule • Pick up ribbon and any other unit markings
- Complete contract daily diary and submitting original to the Contracting Officer • Completing a Post Treatment Evaluation (FSH 2109.14 Ch 72.1)

Drift Models Currently Available

AgDrift, a new model developed by the Spray Drift Task Force in collaboration with EPA and USDA provides estimates of spray drift deposition under different application and meteorological conditions (see www.Agdrift.com).

USDA Forest Service Cramer-Barry-Grim Spray Dispersion Model analyzes data on aircraft, meterology, pesticides, and target areas to predict deposition and drift (see www.fs.fed.us/foresthealth/technology).

Invasive Plants Treatment Proposed Action
Umatilla National Forest

Background

The Umatilla National Forest proposes to control, contain, or eradicate invasive plants on nearly 25,000 acres. These plants have the potential to displace or alter native plant communities and cause long-lasting economic and ecological problems within and outside the National Forests. Invasive plants can increase fire hazards, degrade fish and wildlife habitat, eliminate rare and endangered plants, impair water quality and watershed health, and adversely affect a wide variety of other resource values such as scenic beauty and recreational opportunities. Because of their strong reproductive and competitive abilities and a lack of natural predators to keep them in check, invasive plants can spread rapidly across the landscape to non-infested areas, unimpeded by ownership or administrative boundaries.

> **Invasive plants** are defined as "non-native plants whose introduction does or is likely to cause economic or environmental harm or harm to human health" [Executive Order 13122].

At present, 24 different invasive plant species are known to occur within the boundaries of the Forest. Species of greatest concern include spotted and diffuse knapweed, yellow starthistle, leafy spurge, dalmation and yellow toadflax, scotch thistle, and rush skeletonweed, among others. Our ability to prevent or minimize the adverse impacts to native plant communities by these and other invasive plants is greatest if populations can be treated while they are small and in the early stages of invasion. Many of our current infestations occupy small areas, less than an acre. Treatment options and the likelihood of their success are greater for small or new invasive populations and can be controlled at lower costs than once the infestation becomes large.

The Pacific Northwest Region published the programmatic *Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants FEIS* (Regional Invasive Plant Program EIS), April 2005 along with its Record of Decision (*ROD*) for Invasive Plant Program Management on October 11, 2005 (Regional Invasive Plant Program EIS, ROD). This decision amended all Forest Plans in the Region, adding new direction for the control or elimination of invasive plant species using prevention practices, various mechanical and hand treatments, and an updated list of herbicides for effectively responding to invasive plant threats. The new herbicides offer many advantages over the more limited set allowed previously, including greater selectivity, less harm to desired vegetation, reduced application rates, and lower toxicity to animals and people. Prior to the use of these new herbicides, site-specific treatment prescriptions for both new and previously analyzed invasive plant sites on the Forest need to be developed based on the updated herbicide tools and management direction. The analysis presented in this document will be focused on treatment methods including the use of herbicides aimed at controlling, eliminating, or contain invasive plants on the forest landscape.

The Umatilla National Forest has been treating invasive plants under direction found in the 1995 decision implementing the *Umatilla National Forest Environmental Assessment for the Management of Noxious Weeds.* The recommended treatment methods took a conservative approach, requiring years of manual or mechanical treatments on a site prior to the use of herbicides. It did not have the ability to respond quickly to any new infestations because the process only covered those sites known at the time of the 1995 decision. Ten years of monitoring has shown us that the slow approach to allowing the use of herbicides has not been a successful strategy for reducing the impact and spread of invasive species. The strategy is labor intensive with multiple visits to sites each year and for most years the budget was not adequate to make any headway with control or eradication. The limited funds were used to control weeds along major forest roads providing funds to county weed boards for treatment costs. The Regional FEIS also provides good evidence that using herbicides only as a tool of last resort is much less effective than allowing them to be used whenever they are effective, needed, and applied according to forest plan standards and label direction.

Purpose and Need

This EIS is being prepared to allow the Umatilla National Forest to begin containing, controlling or eradicating invasive plant species within the direction found in the Regional Invasive Plant Program EIS, ROD. A large number of new and existing invasive plant populations on the Umatilla, National Forest require analysis to implement new or more effective and cost-efficient treatment actions, including the updated list of herbicides, as analyzed in the Regional Invasive Plant Program EIS. Current inventories indicate that invasive plants occupy approximately 25,000 acres on the Forest. The infestations are broadly distributed, often occurring in areas of high spread potential (e.g., along roads and trails). There are likely additional invasive plant sites that have not yet been identified and these, as well as known sites, will continue to expand and spread every year that effective treatment isn't applied.

The Purpose of this action is to provide a rapid and more comprehensive, up to date approach to the control and eradication of invasive plants that occur on the National Forest. The purpose of controlling or eradicating weed infestations is to maintain or improve the diversity, function, and sustainability of desired native plant communities and other natural resources that can be adversely impacted by invasive plant species. Specifically, there is an underlying need on the Forest to: (1) implement treatment actions to contain and reduce the extent of invasive plants at existing inventoried sites, and (2) rapidly respond to new or expanded invasive plant sites as they may occur in the future. Without action, invasive plant populations will become increasingly difficult and costly to control and will further degrade forest and grassland ecosystems. Untreated infested areas will also contribute to the spread of invasive plants onto neighboring lands.

Proposed Action

Various types of treatments would be used to contain, control, or eradicate invasive plants that include the use of herbicides, physical, and biological methods. These treatments will be used on existing or new infestations including new plant species that currently are not found on the Forest. The preferred treatment method would be determined using the decision matrix displayed in Appendix A which is based on priority plant species (see Appendix B) and site location (see Appendix C). The preferred treatment method could then be adjusted based on the management objective. For example: a site determined to use herbicide can use any of the other methods while any of the non-herbicide treatments would be interchangeable. The priority species would vary by District and could change at a later time. Species priority is based on the historic investments made to control the species, its invasive nature, and how new the species is to the Forest to demand an immediate response. The actual locations of treatment can be anywhere

Management objectives

Containment is to prevent weed spread beyond the existing infestation perimeter.
Control objectives strive to reduce the extent and density of a target weed.
Eradication focuses on complete elimination of the weed species including reproductive propagules.

on the landscape including rangelands, timber harvest areas, along roads and road rights-of-way (including decommissioned roads), along trail routes, at dispersed and developed recreation sites, and on other disturbed sites (i.e. fires, flood events, and rock sources). When needed to facilitate natural plant recovery, treatments may include low impact site rehabilitation such as competitive seeding with native grass and forbs species. Since it is hard to determine which, if any, sites would require extensive mechanical scarification at this time, they will require their own analysis and decision documentation for the rehabilitation portion of the project. This analysis is being done to determine the type of treatment a site should receive to control or eradicate the invasive plant.

Treatment Methods

The Forest has identified approximately 25,000 acres needing treatment for invasive plants (see Table I below). The number of acres proposed for treatment in any given year would depend on funding and the success of past treatments. On going monitoring of the site would dictate the treatment method, whether herbicides are needed, or the type of continued or follow-up treatments needed. In any given year it is anticipated that approximately 4,000 acres would receive treatment with herbicide, manual, mechanical, or cultural methods. If all the 4,000 treated acres used herbicide, it would be less than 0.3 percent of the Forest landscape and primarily concentrated along road right-of-ways. Biological control methods are ongoing, once started the control method is maintained by residual populations or other control agents and accounts for approximately 6,300 acres on the Forest.

Table I: Acres by treatment method for each Ranger District on the Umatilla National Forest.

	Ranger District				
Treatment Method	**Heppner**	**Pomeroy**	**North Fork John Day**	**Walla Walla**	**Total**
Biological or Physical	89	46	47	3736	3917
Chemical, Physical, or Biological	4699	3138	3933	5531	17301
Chemical/Riparian, Physical, or Biological	839	1130	621	802	3392
Physical	2	6	24	6	39
Grand Total	5629	4320	4625	10075	24649

Chemical Methods: All treatments would be done in accordance with USDA Forest Service policies, regulations and Forest Plan Standards and product label requirements. When herbicide use occurs in close proximity to sensitive areas, specific design features would be used to insure that vegetation treatments do not have an adverse impact on non- target plants or animals. Chemicals approved for use, within or outside riparian areas, are listed in the *Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants FEIS* (Regional Invasive Plant EIS), April 2005 and *ROD*. Herbicide formulations, mixtures, or for follow-up treatments can contain one or more of the following 10 active ingredients: chlorosulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. Additional herbicides may be added in the future at either the Forest Plan or project level through appropriate risk analysis and NEPA/ESA procedures. The application rates depend on the presence of the target species, condition of non-target vegetation, soil type, depth to the water table, the distance to open water sources, riparian areas, special status plants, and requirements of the herbicide label. Applications would be scheduled and designed to minimize the potential impacts to non-target plants and animals; the Regional Final Invasive Plant EIS

Standards 15-23 apply to chemical treatments plus additional Project Design Features developed to reduce potential impacts from herbicides. Monitoring of treated sites would determine what follow-up treatments would be needed.

Ground based or aerial application methods would be used based on accessibility, topography, and the size of treatment area**.** The following are examples of the proposed methods of application:

- **Spot spraying –** This method targets individual plants and is usually applied with a backpack sprayer. Spot Spraying can also be applied using a hose off a truck-mounted or ATV-mounted tank.
- **Wicking –** This hand method involves wiping a sponge or cloth that is saturated with chemical over the plant. This is used in sensitive areas, such as near water, to avoid getting any chemical on the soil or in contact with non-target vegetation.
- **Stem injection –** A new hand application technique currently being used on Japanese knotweed in western OR & WA.
- **Hand broadcast –** Herbicide would be applied by hand using a backpack or hand spreader to cover an area of ground rather than individual plants.
- **Boom broadcast –** This 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 in areas where invasive plants occupy a large percentage of cover on the site and the area to be treated makes spot spraying impractical.
- **Aerial applications –** In areas where physical features, such as topography, raise applicator safety concerns or where the cost of ground application is prohibitive, invasive plants may be treated with the use of helicopters. Aerial application of herbicide would occur on the Pomeroy District covering approximately 980 acres on 17 sites ranging in size from 1 to 290 acres.

When needed to facilitate recovery, native seed would be used to recover the site and increase competition. The method of application will consider resource protection measures specific for the site (ie. application methods would be more restricted in riparian areas). See the Project Design Features specific for chemical applications.

Physical Methods: Physical methods include manual control, hand mechanical and cultural methods.

Manual Control Methods: These methods include non-mechanized approaches, such as hand pulling or using hand tools (e.g., grubbing), to remove plants or cut off seed heads. Manual treatments are labor intensive, effective only for relatively small areas, and would be repeated several times throughout the growing season depending on the species. Manual treatments can be effective for annual and tap-rooted weeds, but are ineffective against perennial weeds with deep underground stems or roots or fine ryzomes that can be easily broken and left behind to re-sprout. Manual treatments are typically used to treat selected plants, small infestations, and in sensitive areas to avoid potential toxic impacts to non-target species or water quality.

Where sites are small or there are few individual target species, handsaws, axes, shovel, rakes, machetes, grubbing hoes, mattocks, brush hooks, and hand clippers may all be used to remove invasive plant species. Axes, shovels, grubbing hoes, and mattocks are also used to dig up and cut below the surface to remove the main root of plants. To meet control objectives or reduce the risk of activities spreading invasive plants, seed heads and flowers would be removed and disposed of using proper disposal methods. Developed flowers or seed heads are generally bagged and burned.

Hand Mechanical Control Methods: This method uses hand power tools and includes such actions as mowing, weed whipping, road brushing, root tilling methods, or foaming, steaming, infrared, and other techniques using heat to reduce plant cover and root vigor. Choosing the appropriate treatment depends on the characteristics of undesired species present (for example, density, stem size, brittleness, and sprouting ability); the need for small scale, less than 100 square feet (Forest Plan Standard for Detrimental Soil Condition), seedbed preparation and revegetation; the sites location (eg. wilderness areas), inside or outside a riparian area; and soil or topographic considerations. These activities would typically occur along roadsides, rock sources, or other confined disturbed areas and dispersed use areas.

Mowing and cutting would be used to reduce or remove above ground biomass. Seed heads and cut fragments of species capable of re-sprouting from stem or root segments would be collected and properly disposed of to prevent them from spreading into uninfested areas.

Cultural Control Methods: Approved methods include any cultural practice known to be useful for treating invasive plants such as mulching with a variety of materials, grazing animals, using fertilizer/soil amendments, competitive planting, or other local remedies that may be determined to be effective (e.g., spraying water/salt/sugar mixtures). Competitive planting would consist of a combination of methods used with planting native vegetation in small areas of disturbance, less than 100 square feet.

Grazing is often used in areas where other treatments cannot be applied, or are prohibitively expensive (e.g., large infestations), but is most effective when used in conjunction with other control methods such as herbicides or biological control. Sheep and goats have been used to control broadleaf herbs such as leafy spurge, Russian knapweed, spotted knapweed, and toadflax. Cultural treatments would be prescribed when they are known to be effective for the undesired species of concern. Cultural treatments, such as mulching with black plastic, hay, straw, or wood chips, is feasible only for relatively small areas and is not effective to control perennial weeds with extensive food reserves. Mulching would not be used when it may have undesired results to native plant species.

Biological Methods: Insects or plant pathogens that are proven natural control agents of specific weed species would be released to selectively suppress, inhibit, or control herbaceous and woody vegetation. The insect or plant pathogen attack and weaken targeted weed species and reduce its competitive or reproductive capacity. Biological controls would be used when the target species occupies extensive portions of the landscape, other methods of control are prohibitive based in cost and location, and an effective biological control regime exists. Biological weed control activities typically include the release of parasitic and `host specific" insects. Presently, insects are the primary biological control agent in use. Mites, nematodes, and pathogens are used occasionally. Treatments do not eradicate the target species but rather reduce target plant densities and competition with desired plant species for space, water and nutrients.

Biological control activities include collection of beetles/insects, development of colonies for collection, transporting, and transplanting parasitic beetles/insects, and supplemental stocking of populations. In most situations, a complex of biological control agents is needed to reduce weed density to a desirable level. As an example; a mixture of five or more biological control agents may be needed to attack flower or seed heads, foliage, stems, crowns and roots all at the same time or during the plant’s life cycle.

Typically 15 to 20 years are needed to bring about an economic control level. Bio-control agents are transported in containers that safely enclose the agent until release.

The treated areas would continue to be inventoried and monitored to determine the success of the treatments and when the released bio-control agents have reached equilibrium with the target species. Repeat visits may need to be made several times a season, and over a series of years to determine if additional release is needed or if another type of agent needs to be released or if information becomes available about new agents or combinations.

Access to work areas

Vehicle and equipment access would involve the use of open, closed, and restricted roads as well as walking or the use of ATV to access invasive plant sites located a distance from existing roads, trails, or along decommissioned roads. ATVs may be used along closed or restricted roads to treat invasive plant populations when regular size vehicles cannot be used because of the road conditions. The use of vehicles off road would be controlled so to not to attract public use or create new trails or use areas.

When helicopters are being used for the application of herbicide, a helispot used for servicing the helicopter would be designated consisting of a rock source or other disturbed area away from streams. Service vehicles would also be located at the site and if a self contained pond is not associated with the site, water would be delivered to the helispot by a truck for mixing chemicals when needed. Water drafting would occur at approved locations using appropriate fish protection measures. Chemicals will not be mixed nor would containers be rinsed inside riparian areas. The disposal of containers and cleanup will be in accordance with labels.

Decision to be Made

The Forest Supervisor will make the following decisions based on the interdisciplinary analysis.

- Whether to select the proposed invasive plant treatments with any modifications from public scoping or comments or as described in an alternative.
- What mitigation measures are needed.
- What monitoring is required.

Maps and Additional Information

Maps for this project are very large. If you need a paper copy of the maps showing the location of sites, please contact Glen Westlund at 509-522-6009 or e-mail at gwestlund@fs.fed.us. Maps can also be found on the Umatilla National Forest internet site in the NEPA Reading Room at http://www.fs.fed.us/r6/uma/projects/readroom/. When we figure a way to place the smaller scale maps on the internet, they will be available there for review (there are about 200 pages of 14x17 inch maps). All sets of maps will be available for review at the Forest Supervisor's Office in Pendleton and the District Offices at Heppner, Ukiah, Walla Walla, and Pomeroy.

General Project Design Features

Project Design Features (PDFs) were developed to reduce some of the potential impacts the various treatments may cause. PDFs provide project design direction by listing conditions or requirements that must become a part of the activity and used to avoid or minimize potential effects on sensitive resources. These PDF are standards developed in the Regional Invasive Plant Program EIS

Prevention

Standard 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.

Standard 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.

Standard 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 or a similar certification process.

Standard 4: Use only pelletized or certified weed free feed in **wilderness and wilderness trailheads**. 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.

Standard 5: 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.

Standard 6: Inspect active gravel, fill, sand-stockpiles, quarry sites, and borrow material for invasive plants before use and transport. Treat or require treatment of infested sources before any use of pit material. Use only gravel, fill, sand, and rock that is judged to be weed free by District or Forest weed specialists.

Standard 7: 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.

Standard 8: Require the establishment of a system of roads, trails, and areas designated for motor vehicle use; and prohibit the use of motor vehicles off the designated system that is not consistent with the classes of motor vehicles and if applicable, the time of year, designated for use.

Standard 9: Prioritize infestations of invasive plants for treatment at the landscape, watershed or larger multiple forest/multiple owner scale.

Standard 10: Develop a long-term site strategy for restoring/revegetating invasive plant sites prior to treatment.

Treatment Restoration

Standard 11: 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, noninvasive 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 reestablishment of native plants, 3) if native plant materials are not available, or 4) in permanently altered plant communities. Under no circumstances will nonnative invasive plant species be used for revegetation.

Standard 12: Use only APHIS and State-approved biological control agents. Agents demonstrated to have direct negative impacts on non-target organisms would not be released.

Standard 13: 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 plans.

Standard 14: 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

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.

Standard 15: When herbicide treatments are chosen over other treatment methods, document the rationale for choosing herbicides.

Standard 16: 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.

Standard 17: 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.

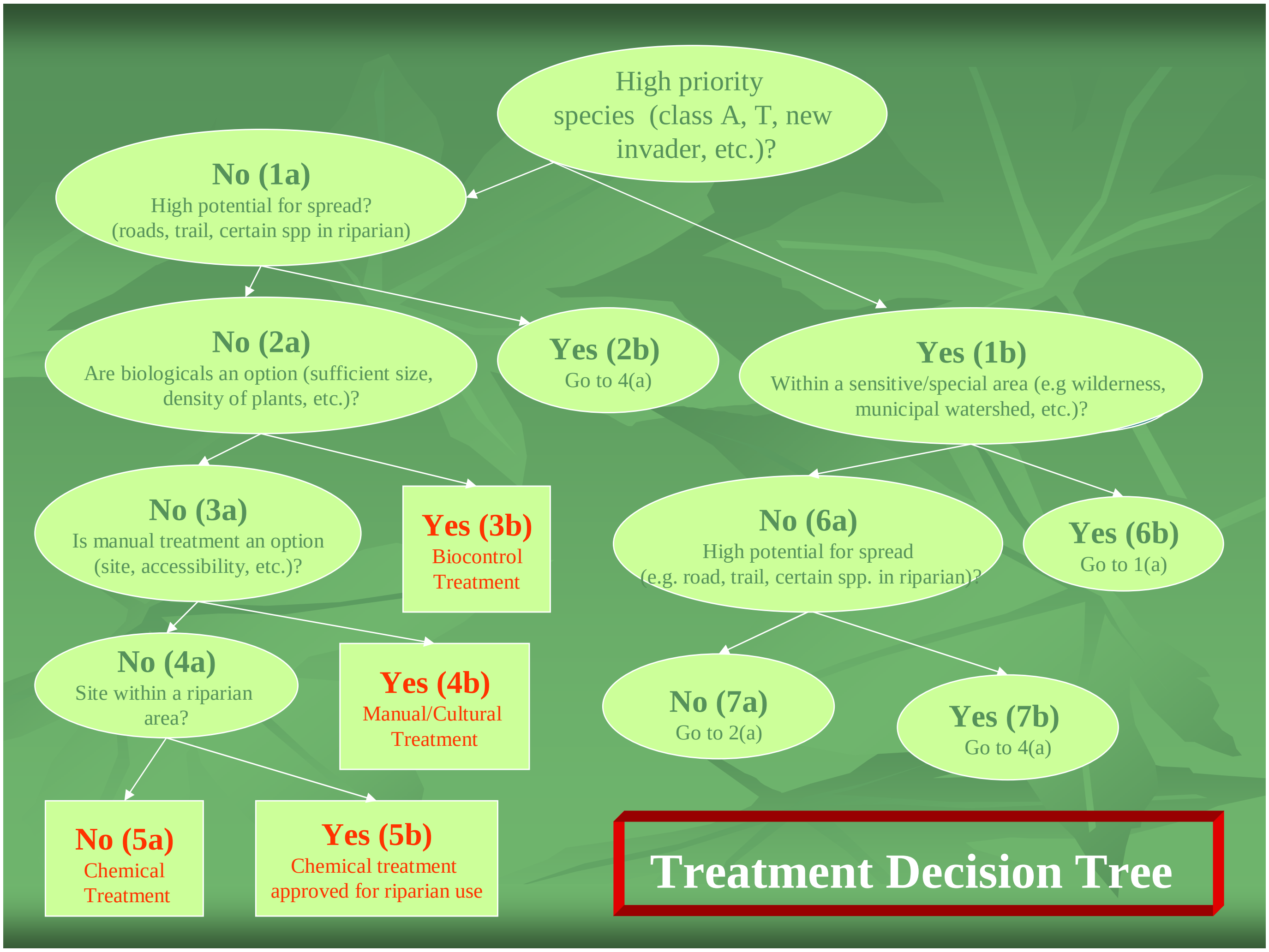
Standard 18: Design invasive plant treatments to minimize or eliminate adverse effects to species and critical habitats proposed and/or listed under the Endangered Species Act. This may involve surveying for listed or proposed plants prior to implementing actions within unsurveyed habitat if the action 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.

Standard 19: 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).

Standard 20: Prohibit aerial application of herbicides within legally designated municipal watersheds.

Standard 21: Prior to implementation of herbicide treatment projects, National Forest system staff will ensure timely public notification. Sign treatment areas to inform the public, and forest workers of herbicide application dates and herbicides used. If requested, individuals will be notified in advance of spray dates.

Appendix A: Decision tree framework for how to treat invasive plant sites.



Description

Box 1a — Site contains low priority invasive species (Priority 3 or 4). See Appendix B.

Box 1b — Site contains high priority invasive species (Priority 1 or 2). See Appendix B.

Box 2a — Site does not have a high spread potential (e.g., not in close proximity to roads, trails, or quarries).

Box 2b — Site has a high spread potential, such as sites near roads, trails, or quarries (Site Type 1, Appendix C).

Box 3a Site is not conducive to treatment with biological agents. Effective biological control agents may not be available for the target species, and/or the infestation size and plant density are not sufficient for sustaining viable biocontrol populations.

Box 3b Site is conducive to treatment with biological agents. Criteria include: (1) effective biological control agents are available for the target species, and (2) the infestation size and plant density are sufficient for sustaining viable biocontrol populations.

Box 4a Site is not conducive to manual control treatment. The infestation is greater than 3 acres and/or is not accessible via road or trail.

Box 4b Site is conducive to manual control treatment. Criteria include: (1) size is less than 3 acres, and (2) site is accessible by road or trail.

Box 5a Site is not within a PACFISH defined RHCA.

Box 5b Site is within a PACFISH defined RHCA (Site Type 5, Appendix C).

Appendix B. Invasive species priorities by Ranger District

Admin	Speciescode	Speciesname	Priority
1402	CEBI2	spotted knapweed	1
1402	LIDA	dalmation toadflax	1
1402	LIVU2	yellow toadflax	1
1402	ONAC	scotch thistle	1
1402	SEJA	tansy ragwort	1
1402	CEDI3	diffuse knapweed	2
1402	CYOF	hounds tongue	2
1402	ARMI2	common burdock	3
1402	CYSC4	scotch broom	3
1402	CIAR4	canadian thistle	4
1402	HYPE	st. john's wort	4
1404	CESO3	yellow starthistle	1
1404	HICA10	yellow hawkweed	1
1404	LIDA	dalmation toadflax	1
1404	ONAC	scotch thistle	1
1404	SEJA	tansy ragwort	1
1404	CEBI2	spotted knapweed	2
1404	CEDI3	diffuse knapweed	2
1404	PORE5	sulphur cinquefoil	2
1404	CADR	whitetop	3
1404	LIVU2	yellow toadflax	3
1404	ARMI2	common burdock	4
1404	CIAR4	canadian thistle	4
1404	CYOF	hounds tongue	4
1404	HYPE	st. john's wort	4
1405	CADR	whitetop	1
1405	CANU4	musk thistle	1
1405	CEBI2	spotted knapweed	1
1405	CEDI3	diffuse knapweed	1
1405	CESO3	yellow starthistle	1
1405	EUES	leafy spurge	1
1405	HIPI2	tall hawkweed	1
1405	LIDA	dalmation toadflax	1
1405	LIVU2	yellow toadflax	1
1405	ONAC	scotch thistle	1
1405	SEJA	tansy ragwort	1
1405	CYOF	hounds tongue	2
1405	PORE5	sulphur cinquefoil	2
1405	ARMI2	common burdock	3
1405	LALA4	everlasting peavine	3
1405	TACA8	medusahead	3
1405	CIAR4	canadian thistle	4
1405	HYPE	st. john's wort	4
1406	CANU4	musk thistle	1
1406	CESO3	yellow starthistle	1
1406	CHJU	rush skeletonweed	1
1406	CYSC4	scotch broom	1
1406	EUES	leafy spurge	1
1406	HICA10	yellow hawkweed	1
1406	LIDA	dalmation toadflax	1
1406	ONAC	scotch thistle	1
1406	SEJA	tansy ragwort	1
1406	CEBI2	spotted knapweed	2
1406	CEDI3	diffuse knapweed	2
1406	CERE6	russian knapweed	2
1406	PORE5	sulphur cinquefoil	2
1406	CADR	whitetop	3
1406	LIVU2	yellow toadflax	3
1406	ARMI2	common burdock	4
1406	CIAR4	canadian thistle	4
1406	CYOF	hounds tongue	4
1406	DACA6	wild carrot	4
1406	HYPE	st. john's wort	4
1406	PHAR3	reed canarygrass	4
1406	TACA8	medusahead	4

1402 is the Heppner District
1404 is the Pomeroy District
1405 is the North Fork John Day District
1406 is the Walla Walla District

Priority 1 = Generally State Class A or T listed species. Goal is to eradicate new populations and/or control existing populations of these aggressive and harmful species
Priority 2 = Goal is to contain existing populations of aggressive species
Priority 3 = Goal is to eradicate new populations and/or control existing populations of these less aggressive invasive species
Priority 4 = Goal is to contain existing populations of less aggressive invasive spp.

Appendix C. Invasive Plant Site Types for Umatilla Invasive Plant EIS.

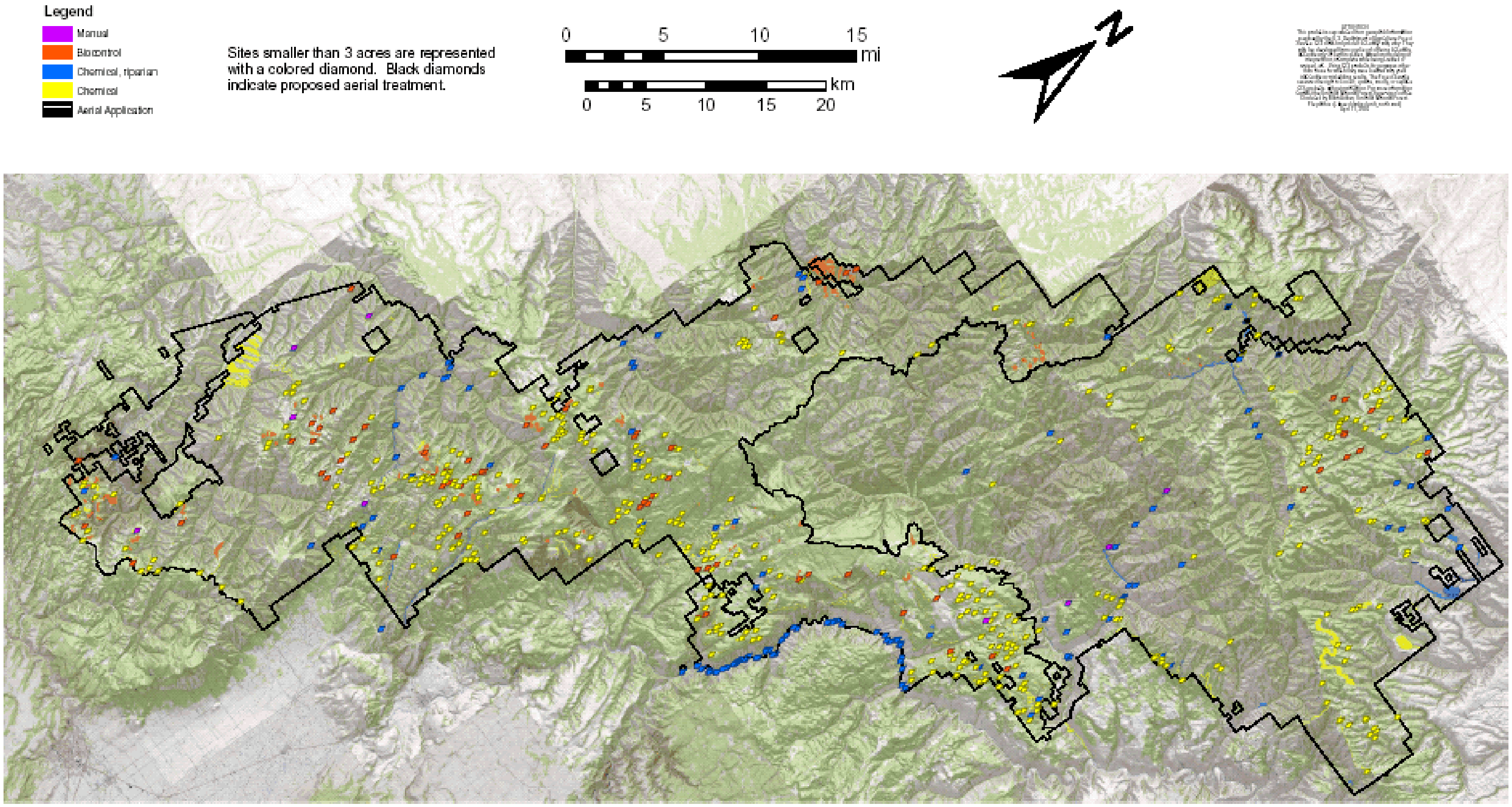
Site Type	Description
Site Type 1: High Spread Potential sites such as Road, quarries, Trails, etc.	Sites within 100 ft. of roads, trails, and quarries. This site type can range from rocky, gravelly, historically bare ground sites on road shoulders, abandoned roads, and road cutbanks, with little to no competing vegetation to roadside sites that have moderate to highly competitive plant cover or a good ability to revegetate a competitive cover. This site type also includes quarries, pits, mineral source sites, range structural improvements, developed recreation sites, parking areas, and entry portals. Sites can range from little human use to high use (e.g., OHV use).
Site Type 2: Special Management Areas	This includes areas set aside for their unique beauty and/or special features (e.g., Research Natural Areas, Special Interest Areas, Wilderness, Wild & Scenic Rivers, etc.).
Site Type 3: TES Plant and Wildlife Sites	Sites within 1000 ft. of a Threatened, Endangered, or Sensitive Plant population or Bald Eagle Conservation Area.
Site Type 4: Municipal Watershed	Sites occurring within designated Municipal Watershed lands.
Site Type 5: Wetlands/ Riparian	Invasive plant sites within PACFISH defined RHCAs. Note that small inclusions of riparian areas may be found in other site types and would require mitigations to protect the riparian areas.
Site Type 6: Upland Forest/Rangeland	Infestations occurring on lands that are not described in the above categories.

Examples of species treatment prescriptions: This is presented to give the reader an example of what would be proposed fro major species of concern. A prescription for each invasive species will be developed for the analysis.				
Taprooted Biennials or Perennials				
Spotted knapweed (CEBI2) **Diffuse knapweed** (CEDI) **Meadow knapweed** (CEDE5) Tap rooted Biennials or Perennials	*Centaurea biebersteinii* *C. diffusa* *C. jacea x nigra (C. jacea; C. nigra)*	- 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. - Mowing is possible, but timing is critical. - These treatments may take up to ten years due to long term seed viability. - If chemicals are used, manual treatments could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time. - Revegetate with desirable species at high priority sites when possible.	**Upland**: 1 - Clopyralid 2 - Picloram **Riparian/High Water Table/Porous Soils**: Aquatic labeled Glyphosate (will require the most repeated treatments)	***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. ***Roads, Recreation Sites, Special Management Areas, TES plant & wildlife sites, & any sites where more selective treatment is desired:*** Spot) spray to target individual plants. ***Wet Meadows, Riparian:*** Wick applications with appropriate chemicals to target specific plants. ***Timing:*** Preferred treatment is spring before bud stage or early summer so use less herbicide. ***Notes:*** Yearly revisits will be necessary; the number of which is dependent on the chemical used and the seedbank.
Rhizomatous Perennials				
Dalmation toadflax (LIGEDA) **Butter 'n' eggs** (LIVU) Rhizomatous Perennials	*Linaria genistifolia ssp.dalmatica* *Linaria vulgaris*	- 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. -Cutting stands in spring or early summer will eliminate plant reproduction, but not the infestation. - These treatments may take up to ten years due to long term seed viability. - If chemicals are used, manual treatments could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time. - Revegetate with desirable species at high priority sites when possible. Plant communities in good condition may recover without replanting.	**Upland:** 1. Picloram 2. Chlorosulfuron 3. Imazapic (Use in native grass stands; fall application only) **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. However, this species tends to be scattered, so spot spraying (backpack or on OHV) is usually more appropriate. ***Timing:*** Apply during active growth in spring before bloom or in late summer or fall during re-growth. ***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.

Leafy spurge (EUES) Rhizomatous perennial	*Euphorbia esula*	- Requires combination of techniques for successful control. Multiple entries per year are required. - Repeated mowing or hand cutting can control seed production but must be used with herbicides for adequate control of the site. - Repeated mowing could reduce competitive ability of desirable species. - Some success has been found with using biological control (flea beetle) with fall herbicide treatments. - Grazing when managed carefully (timing, livestock species, etc.) may help control leafy spurge (***see Common Control Measures)***.	**Upland:** 1. Picloram 2. Glyphosate 3. Imazapic **Riparian/High Water Table/Porous Soils:** Aquatic labeled Glyphosate	***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 and leafy spurge population is large. ***Moist to Wet meadows (high water table) and Riparian***: Wick application to target individual plants. ***Timing*:** ***Notes***:
Russian knapweed (ACRE3) Perennial with adventitious shoots	*Acroptilon repens*	- 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. - 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). - Discing or plowing produces broken root fragments that spread quickly and resprout. - 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. - In most situations, Russian knapweed cannot be effectively managed by herbicides alone. - 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). - Competitive plantings are usually necessary.	**Upland:** 1. Chlorosulfuron 2. Clopyralid 3. Clopyralid + Triclopyr (Redeem) 4. Glyphosate, Imazapic, or Metsulfuron **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. ***Sensitive Sites or Special Management Areas where more selective treatment is desired:*** Spot spray to target individual plants. ***Moist to Wet meadows (high water table) and wetlands/riparian***: Wick application with manual follow-up treatments. ***Timing***:

Annuals				
Yellow starthistle (CESO3) Annual	*Centaurea solstitialis*	- 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). - Mowing can be useful but timing is critical (before viable seed production, but too early can result in rapid regrowth), - 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. - 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. - Revegetate high priority sites if needed with desirable species if possible.	**Upland**: 1 - Clopyralid 2 - Picloram 3 - Glyphosate **Riparian/High Water Table/Porous Soils**:	***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. ***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. ***Timing***: ***Notes***: Yearly revisits will be necessary; the number of which is dependent on the chemical used and the seedbank.

Umatilla National Forest --- Proposed Treatments for Invasive Plants



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