EAST TUMBULL ENVIRONMENTAL ASSESSMENT

BEND/FORT ROCK RANGER DISTRICT

DESCHUTES NATIONAL FOREST

Document Format

The Forest Service has prepared this Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. The document is organized into four chapters, and appendix data as described:

Chapter 1. Purpose and Need for Action: This chapter includes information on the history of the project proposal, issues, and the purpose of and need for the project, and the agency's proposed action for achieving that purpose and need. It includes a discussion on the relation of this NEPA document to other broader NEPA documents and specific land management allocations important to understanding the need for the proposed action.

Chapter 2. Alternatives Considered: This chapter provides a more detailed description of the proposed action. It identifies mitigation measures that were developed based on the issues and designed to achieve the stated purpose.

Chapter 3. Environmental Effects: This chapter discusses the relevant natural and social environment, the affected environment, and the environmental effects of implementing the proposed action and no action alternative. This chapter is organized by resources.

Chapter 4. Consultation with Others: This chapter provides a listing of the people, agencies and organizations contacted with a short summary of those responding and how their collaborative input was used or addressed in the proposed action.

Appendices: The appendices provide more detailed information to support the analyses and summary presented in the EA. Reference the Table of Contents for location and subject of specific appendix files.

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East Tumbull Hazardous Fuels Reduction Project Environmental Assessment
Bend/Fort Rock Ranger District, Deschutes National Forest

CHAPTER 1 PURPOSE AND NEED FOR ACTION

Introduction

The East Tumbull Hazardous Fuels Reduction Project (East Tumbull project) is proposed to reduce hazardous fuels in the Wildland-Urban Interface (WUI) around and adjacent to Sunriver, Inn of the 7th Mountain and the city of Bend (Highlands subdivision) on the Bend/Fort Rock Ranger District of the Deschutes National Forest.

During the 1920s, the Shevlin-Hixon company clear-cut harvested the large diameter ponderosa pine stands within the project area. These lands were subsequently purchased by the federal government in the 1920s and 1940s for inclusion into the Deschutes National Forest. Since almost all the area was clear-cut harvested in the past, the vegetation conditions and attributes have been significantly altered from their historical range with almost a complete absence of large, old trees and open, fire-maintained ponderosa pine stands. Fire suppression during the preceding 80 years, vegetation growth and high stand densities have created a continuous vertical fuel ladder from the ground to the crowns of the trees and a horizontal layer of fuels such as shrubs, needles, limbs, and beetle killed lodgepole pine trees resulting in an unacceptable risk of stand replacement wildfire.

Sunriver and Bend Community Wildfire Protection Plans Sunriver and Bend are both identified as "*Urban-Wildland Interface Communities in the Vicinity of Federal Lands That Are at High Risk From Wildfire*" published in the Federal Register, Volume 66, No. 160, January 4, 2001. The at-risk communities of Sunriver and Bend, along with land management agencies and the public, developed the Sunriver Community Wildfire Protection Plan (CWPP), signed May, 2005, and the Bend CWPP, signed May, 2006. The East Tumbull project would implement a portion of the work directed by these CWPPs (see map page 11). Project area boundaries were designed to tie into the recently completed Katalo fuels reduction project that is located along the entire western boundary. The Katalo project (Appendix G) is a feature that can aid in creating an effective fire break.

Location and Setting

The East Tumbull project area (pages 10, 11) is on national forest lands adjacent to the communities of Bend and Sunriver where those communities meet the east flank of the Cascades Range. The project area is located outside the range of the northern spotted owl and includes approximately 10,555 acres within the 147,978 acre Pilot Butte watershed; 390 acres of which are lands that are not national forest. It completely surrounds the Inn of the 7th Mountain Resort, and includes a portion of the Upper Deschutes Wild and Scenic River corridor and the associated developed recreation sites of Besson Day Use Area, Benham Falls, Aspen Day Use Area, Dillon Falls, Lava Island Falls, Big Eddy and Meadow Picnic Area. Also included are some or all of the evacuation routes for these communities and recreation sites. The Cascades Lakes Highway, City of Bend municipal water storage tanks and pipelines, major electric utility corridors for Mt. Bachelor Ski Resort and other developments are also found within the project area.

The legal description is as follows: T 18 S, R 11 E, Sections 3, 10, 11, 14, 15, 22, 23, 27, 28, 33; T 19 S, R 11 E, Sections 4, 5, 7, 8, 9, 16-20, 30, 31; T 20 S, R 11 E, Sections 6, 7; T 19 S, R 10 E, Sections 24, 25, 36; T 20S, R 10 E, Section 1, Willamette Meridian, Deschutes County, Oregon. None of the federal lands considered for fuels reduction are in wilderness areas, wilderness study areas, or areas where the removal of vegetation is prohibited (see map page 28 for township, range and section lines).

Management Direction and Guidance

On August 8, 2000, President Clinton asked the Secretaries of Agriculture and Interior to prepare a report recommending how best to respond to the severe fires of 2000, reduce the impacts of those fires on rural

communities, and ensure sufficient firefighting resources in the future. On September 8, 2000, the President accepted their report, *Managing Impacts of Wildfires on Communities and the Environment-A Report to the President*. This report provided the initial framework for implementing fire management and forest health programs known as the National Fire Plan.

Protecting People and Sustaining Resources in Fire-Adapted Ecosystems, A Cohesive Strategy (2000) is a report providing the strategic framework for reducing hazardous fuels buildup within WUI communities, municipal watersheds, threatened and endangered species habitat, and other important local features. The objective of this strategy is to describe actions that could restore healthy, diverse, and resilient ecosystems to conditions that minimize the potential for uncharacteristically intense fires. Methods recommended include removal of excessive vegetation and dead fuels through thinning, prescribed fire, and other treatments. *A Cohesive Strategy* responds to Congressional direction to provide guidance on reducing wildfire hazard and restoring ecosystem health as part of the National Fire Plan. Companion publications to the *Cohesive Strategy* include *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment – 10-Year Comprehensive Strategy* (2001) and *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment – 10-Year Comprehensive Strategy Implementation Plan* (2002).

The *Healthy Forests Restoration Act of 2003 Public Law 108-148* (HFRA) was signed into law on December 3, 2003 by President George W. Bush and based on strategies and direction contained in the above mentioned reports. The HFRA is designed to improve the capacity of the Departments of Interior and Agriculture to conduct hazardous fuels reduction projects to protect communities, watersheds, and other at-risk lands from catastrophic wildfire, enhance watershed protection and address threats to forest health. Sunriver and Bend qualify as "at-risk communities" under the HFRA because they were published in the Federal Register and they are within and contiguous to Federal lands that have conditions that are conducive to large-scale wildland fire disturbance events which pose a threat to human life and property (HFRA, section 101).

This EA is tiered to the *FEIS for the Deschutes National Forest Land and Resource Management Plan* (Deschutes LRMP, 1990). The Deschutes LRMP guides all natural resource management activities and provides standards and guidelines for the Deschutes National Forest. The Management Areas (MA) for the East Tumbull Project Area from the LRMP is shown in Figure 1-1, page 10. A brief summary of the direction for MAs where treatment is proposed, total acres within the project area in the MA and acres of proposed treatment follows:

Deer Habitat (905 of 2012 acres, LRMP pages 4-113 to 4-116) – MA-7 is managed to provide optimum habitat conditions on deer winter and transition range while providing wood products, visual quality and recreation opportunities.

General Forest (201 of 286 acres, LRMP pages 4-117 to 4-120) - MA-8 emphasizes timber production while providing visual quality, wildlife habitat, and recreational opportunities for public use and enjoyment.

Scenic Views (1012 of 2178 acres, LRMP pages 4-121 to 4-131) - The goal of MA-9 (Scenic Views) is to provide high quality scenery that represents the natural character of Central Oregon. Landscapes seen from selected travel routes and use areas will be managed to maintain or enhance their appearance and forest health.

Intensive Recreation (863 of 1617 acres, LRMP 4-135 to 4-139) - MA-11 provides a wide variety of quality outdoor recreation opportunities within a Forest environment where the localized settings may be modified to accommodate large number of visitors at both developed and undeveloped recreation sites. Vegetation management is done to provide visual diversity, public safety and forest health.

Wild and Scenic Rivers (1230 of 4051 acres) - The primary objectives of MA-17 for managing waterways that are components of the National Wild and Scenic Rivers System is to protect the outstandingly remarkable values identified for each river segment in the Upper Deschutes River Management Plan. The Upper Deschutes River Plan of 1996 identified actions needed to restore, maintain and enhance the vegetation values within the ponderosa pine plant association group while also reducing fuels within the urban interface area. These actions include reducing the lodgepole component within historic ponderosa pine forests, density reduction to lower competition and fuels treatments to lower wildfire risk.

Key Elk Area (LRMP 4-56 to 4-58) - Elk are found in certain key habitat areas, within which management provides conditions needed to support summering and wintering elk. A total of 7,660 acres of the 21,462 acre Ryan Ranch Key Elk Habitat (KEHA, LRMP Appendix 16-2, or Appendix G-14 map) is found within the project area and 3,046 acres is proposed for treatment.

In addition, management direction for the area is provided in three major LRMP amendments. Amended LRMP direction pertinent to the project area includes the *Record of Decision for the Upper Deschutes River Management Plan* (Upper Deschutes River Plan)*; the Decision Notice for the Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales*, (Eastside Screens, 1995), and the *Decision Notice for Inland Native Fish Strategy* (INFISH, 1995). This EA relies upon the analysis described in these documents and focuses upon implementing the management direction of the Deschutes LRMP, as amended.

Purpose and Need

The need for the East Tumbull project is based on a comparison of the existing conditions found in the East Tumbull area and the desired condition provided in management direction and guidance. In summary, forests in the East Tumbull area generally burned historically with low severity fire every 0-35 years, but now have fuel loads that are substantially in excess of historic or desirable conditions; threatening resource values, public and firefighter safety. This condition results in uncharacteristic and undesirable wildland fire risk, especially within the zone adjacent to at-risk communities known as the WUI. This condition also results in uncharacteristic increased risk of crown fires and makes efforts to control wildfire around homes, camps, recreation sites, escape and access routes more difficult.

The desired condition for the East Tumbull project area is based on the HFRA, the amended Deschutes National Forest Land and Resource Management Plan (LRMP), the National Fire Plan (2000), *Protecting People and Sustaining Resources in Fire-Adapted Ecosystems, A Cohesive Strategy* (2000), and the Sunriver and Bend CWPPs.

Fuels reduction within the WUI is the primary purpose of the proposed action, although other important forest values at risk from uncharacteristic wildfire are considered at the landscape level. Strategic placement and design of fuels treatments can reduce present risk to these values in combination with reducing risk to communities, and improve the long-term sustainability of desired forest conditions.

The purpose and need for the East Tumbull Project is to reduce hazardous fuels to:

1) Reduce wildland fire risk to communities and present forest values. The purpose of the proposed action is to reduce the percentage of the project area that has a moderate to extreme fire hazard to 50 percent or less by reducing horizontal and ladder fuels within the WUI and along identified evacuation routes.

2) Provide obvious, defensible space access and escape routes. The purpose of the proposed action is to provide obvious, improved (defensible space) evacuation routes from private property and developed recreation sites, and to develop defensible space along routes which would provide improved conditions from which to engage

in fire suppression action in the event of a wildfire along the Cascade Lakes Highway (46), Skyliners Road (4601), Conklin Road (41), Meadow Picnic Area (4600100), Phil's Trailhead Road (4601220), Lava Camp Road (4100700), Ryan Ranch Road (4120), Benham Falls Road 4120100), Cardinal Bridge Road (4100280), and Besson Camp Road (4100240) (see map page 152).

3) Reduce wildland fire risk to future forest values. The purpose of the proposed action is to reduce the future landscape risk for uncharacteristic crown fire by strategically decreasing stand densities and susceptibility to insects and disease, improve the sustainability of frequent fire in our future forests, and eliminate unnecessary roads (see map page 152) that contribute to elevated wildland fire risk.

Proposed Action

The following table (Table 1-1) provides a summary of the Purpose and Need and how the proposed actions respond to those underlying needs. A detailed description, silvicultural treatment (Table 2-1) and maps (page 27 to 28) of the proposed treatment units (EA units) are included in Chapter 2.

Purpose and Need	Summary of Proposed Action	EA Unit
Reduce wildland fire risk to communities and present forest values	Approximately 4,211 acres would either be thinned, prescribe burned or mowed to reduce the percent of the project area rated as moderate to extreme for fire behavior from 73 percent to 35 percent.	102 to 105, 108 to 110, 112, 114 to 117, 119, 130, 132E to 135, 136, 138 to 149
Provide obvious, safe access and evacuation routes	Thirteen miles of roadside thinning, mowing and underburning within 500 feet to reduce flame heights to less than four feet. Approximately 11.9 miles of undesignated evacuation routes would be closed to public use and 26.5 miles decommissioned.	102 to 104, 110, 112, 114 to 117, 130, 136, 138, 140, 144, 148E, 148W, 149, **118**, **120 to 122**, **124 to 126**, **176**
Reduce wildland fire risk to future forest values	The strategic juxtaposition of EA units and crown density reduction is designed to reduce the risk of a large crown fire and beetle epidemic occurring within the project area for the next 10 to 20 years while also providing for the return of fire to portions of the project area as an agent of fuels reduction	104, 109, 117, 120, 122, 130, 132E, 132W, 134, 135, 136, 138 to 140, 142, 144, 146 to 149

Note: **Bolded** EA units are reasonably foreseeable activities included with the Met Categorical Exclusion (CE) along recreational evacuation and access roads. These EA units would not be included in the Decision Notice for the East Tumbull project because they are not needed for evacuation and access routes from private land and they are located beyond 1.5 miles from an at-risk community. They are included for simplicity and reader clarity under the proposed action (Alternative 2) throughout this document including the direct, indirect and cumulative effects section of Chapter 3.

This project was designed to meet the intent of the HFRA by reducing hazardous fuel levels on National Forest lands near the above mentioned communities, structures and facilities while being consistent with the LRMP and other management direction.

The East Tumbull project is an Authorized Hazardous Fuels Reduction Project under HFRA Section 102 because: (1) the site-specific, ecologically appropriate, and cost effective measures and methods used to implement this project include prescribed fire, and various mechanical methods, such as mowing, tractor and hand piling, thinning, and pruning; (2) the project is on Federal lands in WUI areas; and (3) the project is being conducted under sections 103 and 104 (d)(2) of the HFRA that only requires one action alternative if within 1.5 miles of an at-risk community with a signed CWPP or that has a geographic feature that aids in creating an effective fire break, or is in condition class 3.

The proposed action integrates fuels reduction and forest health treatments to improve the short and long-term efficacy of proposed treatments for an area. All EA units include integrated fuels reduction treatments of the shrub layer, understory and, if appropriate, thinning from below to reduce crown density while generally retaining the tallest and largest diameter trees. For example, thinning would include whole tree yarding or hand piling to dispose of any activity generated fuels. This would be followed by prescribed burning or mowing of

the shrub layer within the stand to reduce accumulated fuels and to negate any increase in short term risk of higher intensity surface fires.

Timber harvest in East Tumbull is proposed within land allocations (MAs) where such harvest is programmed or permitted under the Deschutes LRMP, as amended. Within the areas treated to reduce fuel loading, 3,631 acres of the 4,211 acres (includes 482 acres in Met CE consisting of 466 acres of thinning and 16 acres of underburning in EA units 118, 120-122, 124-126, 176) of ponderosa pine and mixed lodgepole and ponderosa pine would be thinned. Ponderosa pine would be retained over lodgepole pine and juniper in all areas because it attains a greater age and diameter and is more resistant to fire, insects and disease than thin barked lodgepole pine and juniper. No trees of any species over 21 inches in diameter (dbh) or any dead standing or down trees would be removed. An estimated 70 percent of the fiber volume removed would be small diameter (11 inch average dbh) ponderosa pine. The remaining fiber removed would be small diameter lodgepole pine (30 percent) and juniper (<1 percent) with an average diameter of 8 inches dbh.

As an outcome of the vegetation management, an estimated 9,500 hundred cubic feet (CCF) of commercial wood (4.9 million board feet; total includes 150 MBF from 141 acres in EA units 120, 122, 176 of the Met CE) would be available for sale. This is generally considered to be material that is 12"dbh or greater. Some or all of the acres currently considered for thinning less than 12" dbh may have value for biomass production. In the event there is a market for biomass at the time the project is implemented, that material would become available. If there are no markets available, that material would be piled and burned.

To provide obvious, clear evacuation and access roads a total of 38.4 miles of unneeded roads would be closed to public travel or decommissioned if not needed for administrative access (map page 152, Appendix H).

Project implementation would begin in 2006 and be completed within 5 to 10 years. Many EA units, as discussed above, would receive more than one type of treatment, such as thinning followed by prescribed burning or mowing of the understory. Fuels reduction activities are planned to occur for up to ten years to allow adequate time for contract work to be performed, and to maximize the potential to have ideal atmospheric conditions for conducing prescribed burning operations. The project would be implemented through a combination of timber sale and service contracts, Forest Service work crews, and partnerships.

Decision to be Made

Based on the analyses documented by this EA, the District Ranger of the Bend/Fort Rock Ranger District, Deschutes National Forest would determine which alternative would be implemented and if so, under what conditions. In doing this, the Deciding Officer will consider the following:

Scoping, Collaboration and Public Involvement

Scoping and public involvement are ongoing processes used to invite public participation and to obtain input on a particular proposed action. Since information received during these processes is used to help determine the extent of the analysis needed to reach an informed decision; public scoping is begun early in the planning process in order to integrate issues, comments and concerns into the design of the proposed action.

The initial notification process for this project began with the listing of the proposed project on the Forest Schedule of Proposed Actions newsletter for the winter of 2004 and a newspaper article in *The Bulletin* in October of 2004. This was followed by the development of the proposed action in collaboration with the United States Fish and Wildlife Service (USFWS), Oregon Department of Fish and Wildlife (ODFW), interested individuals, and the at-risk communities of Sunriver, Inn of the 7th Mountain Resort, city of Bend, and the Highlands at Broken Top subdivision (Highlands). The proposed action was further modified after consultation with representatives of the Oregon Natural Resources Council (ONRC) and The Nature Conservancy (TNC).

The East Tumbull project area is within the areas of interest to the Klamath Tribes, the Confederated Tribes of the Warm Springs Reservation and the Burns Paiute Tribe. All three tribes were consulted with on both a government-to-government and staff-to-staff basis prior to and during project scoping. None of the governments raised any issues with the proposed project.

A total of 65 public scoping letters, containing the detailed, collaboratively developed proposed action, were sent on May 31, 2005 to adjacent landowners, businesses, media, other agencies, organizations, and members of the public who had previously expressed interest in vegetation management projects. The text of this letter, maps and all subsequent public correspondence was posted on the Deschutes National Forest website. This letter informed the public that the East Tumbull Project would be analyzed and reviewed under the HFRA and included an invitation to a public meeting on June 9. Written comments were invited on the proposed action for 27 days.

An East Tumbull HFRA Scoping Notice requesting public input and comment was published in T*he Bulletin* on June 10, 2005 and an additional letter containing the text of the scoping notice, and if appropriate the proposed action, was mailed to an expanded list of 90 people on June 14. In the letter and *The Bulletin* advertisement the time period for submitting written comments on the proposed action was extended to July 11, 2005. Also included in this mailing and legal advertisement was the websites for reviewing the HFRA and for submitting electronically written comments. The June 14 public scoping letter included an invitation to attend an additional public meeting on June 22. *The Bulletin* and local radio stations ran and broadcast articles on the East Tumbull project on June 21 that contained the date and time of the June 22 public meeting. This was followed by a KVTZ lead story on the project, on the evening of June 22, which included contact information, an interview with the Interdisciplinary (ID) team leader and participants of the June 22 public meeting, and the July 11 time period for submitting written comments. A summary of the people and organizations contacted during collaboration and scoping with input of those who participated or responded may be seen in Chapter 4.

Issues

Normally, issues identified during scoping are used to generate alternatives to the proposed action; however, no alternatives are required for this HFRA project (see Chapter 2, Alternatives Considered). Instead, the interdisciplinary team (ID team) considered all the comments received during collaboration and scoping and refined the proposal presented in Chapter 2 to address the following types of issues: (1) *Design Issues* - Issues used to develop specific project design criteria for the proposed action; (2) *Analysis Issues* – Specific resources addressed in the effects analysis and frequently used to compare differences between alternatives. They are described in detail and analyzed in Chapter 3.

The effects analysis in Chapter 3 uses measures or indicators, where appropriate, to evaluate how each of the alternatives addresses the design and analysis issues. Measures were used to clarify and compare the differences between the two alternatives and generally are not a strict quantitative measure of environmental effects.

Design Issues The following issues reflect potential effects of the proposed action that have been addressed with specific project design criteria to eliminate or mitigate effects.

Threatened, Endangered, and Sensitive (TES) species, other wildlife. The activities proposed in East Tumbull could have an effect on both plant and animal TES species and other wildlife species such as Management Indicator Species; Ecological Indicator Species; Species of Concern; and Resident and Migratory Landbirds. Project design elements to minimize or eliminate effects to species are included in Chapter 2, description of Alternative 2. Effects to population trends and habitat such as change in existing structure, restoration of open ponderosa pine habitat, and seasonal operating restrictions is discussed in the effects section.

Noxious Weeds/Invasive Species. Vegetation management, fuels treatment and access may spread noxious weeds. An integrated weed management plan was prepared for the project and design elements aimed at preventing the introduction and spread of noxious weeds are incorporated into the proposed action (see Chapter 2, description of Alternative 2) The effects of the two alternatives on noxious weeds are described in Chapter 3.

Hydrology (Water Quality)/Fisheries. The segment of the Deschutes River that flows through the project area is 303(d) listed under the Clean Water Act. The Deschutes River does not meet water quality standards in the East Tumbull project area for the parameters of dissolved oxygen all year, turbidity spring and summer, Chlorophyll *a* from June 1 to September 30, high water temperatures September 1 to June 30, and sedimentation, undefined season. The draft 2004 ODEQ 303(d) list, currently under review, is identical to the 2002 list for this river reach with the exception of extending the violation of the water temperature standard to year-round. Fisheries habitat is largely dependent on water quality. The Upper Deschutes River Plan identified and discussed at length solutions to these water quality problems which are largely related to the regulated irrigation flows controlled by Crane Prairie and Wickiup Dams. Design elements aimed at ensuring that resource management activities are consistent with and supportive of water quality recovery are incorporated into the proposed action (See Chapter 2, description of Alternative 2, and Chapter 3).

Soil Productivity. The proposed use of ground-based equipment can potentially increase the amount and distribution of detrimental soil conditions within the individual activity areas proposed for mechanical treatments. The removal of trees from activity areas can potentially cause adverse changes in organic matter levels. Design elements aimed at ensuring that resource management activities are consistent with and supportive of soil productivity standards are incorporated into the proposed action (See Chapter 2, description of Alternative 2, and Chapter 3).

Scenic Quality. Vegetation management activities may negatively affect short-term visual quality. Design elements aimed at maintaining the "sense of place" by reducing stand replacement wildland fire risk and enhancing scenic quality has been incorporated into the proposed action. Design elements aimed at ensuring that resource management activities are consistent with and supportive of scenic quality objectives are incorporated into the proposed action (See Chapter 2, description of Alternative 2). The effects of the two alternatives on scenic quality are described in Chapter 3.

Cultural Resources. Design elements to avoid project related impacts to cultural resources have been incorporated into the proposed action. This has resulted in a finding by the Forest Specialist of No Effect under Section 106 of the National Historic Preservation Act (NHPA) and concurred with by Oregon State Historic Preservation Office (SHPO) staff.

Air Quality/Smoke Management. Smoke from prescribed fires and pile burning may intrude into the communities of Bend, Sunriver and Inn of the 7th Mountain or the Three Sisters Wilderness area, potentially causing impaired visibility, discomfort, and possible health hazards. Bend is a Designated Area with a high population density and closely monitored for smoke intrusion from prescribed fire. All prescribed burning would comply with the Clean Air Act and would be coordinated with the Oregon State Department of Environmental Quality and Oregon State Department of Forestry. All prescribed burning would be in compliance with State smoke management plans and ignition would occur only under prescribed conditions. Project design elements to minimize or eliminate effects air quality are included in Chapter 2, description of Alternative 2.

Analysis Issues The following potentially affected resoures are also evaluated in the analysis:

Ecosystem Health. Currently there is essentially no open, large, single-stratum ponderosa pine within the project area and 67 percent and 73 percent of the acres are at risk from beetle attack or stand replacement fire, respectively. The effects of the two alternatives on short and long-term ecosystem health are described in Chapter 3.

Recreation (trails/roads/developed sites). Road management proposed actions have been identified as a connected action as a result of an ID team roads analysis review of the Upper Deschutes River Plan and big game cover reduction caused by vegetation management activities as it affects wildlife habitat effectiveness with maintenance of the current road density. Road closures were also identified as a potential resource enhancement project (see Sale Area Improvement Plan, Chapter 2).

The area contains numerous points of interest and dozens of miles of hiking, horse back riding and biking trails that could possibly be affected by proposed treatments. At the same time the roads and trails provide a risk of human-caused fires. The effect of the two alternatives on recreation both developed and dispersed and associated wildland fire risk is described in Chapter 3.

Commercial Timber Harvest, Economic and Social analysis There are costs and benefits associated with implementing either alternative. The economic and social analysis focuses on the financial efficiency and the effects of the two alternatives on the communities of Central Oregon and their ties to forest management through employment, income, recreation, and commercial timber harvest.

Roads No new permanent roads are planned. Temporary road effects, that could potentially lead to a short-term increase in road density and effects on other resources, are included in Chapter 3.

Issues Not Addressed in Detail Concerns about resources not affected by the proposed action, or beyond the scope of this project**.** Refer also to the scoping summary in Appendix G, Correspondence Appendix J. and Chapter 4, Consultation with Others.

Wilderness/Roadless Characteristics There is no designated Wilderness within or adjacent to the project area. The nearest wilderness is the Three Sisters Wilderness, approximately 10.5 miles west of the project area, There are no Inventoried Roadless Areas or areas with unroaded characteristics within or adjacent to the project area. During scoping areas with unroaded characteristics was not raised as an issue. The nearest Inventoried Roadless Area is the Bend Watershed Roadless area, 8.0 miles west. As previously identified, the project area was clear-cut harvested in the 1920s and the current open road density is 4.53 miles per square mile.

Owl Critical Habitat, Pacific Yew and the Northwest Forest Plan. The project area is located outside of the range of the northern spotted owl and no owl critical habitat or Pacific Yew exist within or adjacent to the project area. Management guidance from the Northwest Forest Plan does not apply.

<u>Current Condition</u>

Wildland Fire Risk for Communities and Present and Future Forest Values There is an almost complete absence of large, old trees (less than 5 percent) across the project area, and there are no examples of historic, open, fire-maintained ponderosa pine stands (Table 3-7) remaining. The stands have had their fire regimes moderately to significantly altered from historic fire return intervals by clearcut logging in the 1920s and 30s. Fire size, intensity, severity, and landscape patterns have been dramatically changed as a result. The risk of losing key ecosystem components is moderate to high.

The young ponderosa pine dominated forestlands which developed within the project area after clear-cut harvesting would best be characterized by Fire Regime Group I, Condition Classes 2 and 3. Fire Regime Group

I lands evolved with frequent, low-intensity ground fires with average historic fire return intervals from 0 to 35 years. Condition Class 2 and 3 characterizes those lands that have had their fire regimes moderately to significantly altered from their historical range.

High stand densities cause the growth rate of trees to be low because of competition for water, nutrients, and growing space. The low level of tree and stand vigor because of this competition makes trees more susceptible to insect attack and disease mortality. Insect and disease attack in turn create more fuels, exacerbating the existing condition. An estimated 68 percent of the project area is susceptible to epidemic bark beetle attack based on areas that have current crown cover of over 30 percent.
Fire hazard and fuel levels in these areas are a mosaic of low to high levels. There is increased potential for higher severity fires because of encroachment of lodgepole pine and juniper, high stand densities, vertical fuel ladder from the ground to the crowns of trees, and a continuous horizontal layer of fuels such as shrubs, needles, limbs, and beetle killed lodgepole pines. Young ponderosa pine stands cause the adjacent communities to be at high risk for stand-replacing wildfires. An estimated 73 percent of the project area is rated as moderate to extreme for fire hazard.

Values at risk include the upland and riparian vegetation associated with the Upper Deschutes Wild and Scenic River, scenic views, water quality, key elk and deer habitat, and the Bend municipal water supply infrastructure.

Access and Emergency Escape Routes There are various human uses in the project area, including seasonal and full-time residents, businesses, recreation sites, trails, and resorts. High fuels and wildland fire risk occur along roads throughout the project area and along roads that provide access in and out of private property and developed recreation. Escape routes are not clearly designated, and numerous unneeded roads add confusion and potential hazards to evacuees and firefighters in the case of a wildfire in these heavily populated and used areas. These conditions could make using the roads dangerous in the event of a wildfire, and could leave forest visitors and residents trapped or make it more difficult and dangerous to fight a wildfire. In addition, an estimated 60 percent of the fire starts within the project area are associated with roads and human use.

Desired Condition

Wildland Fire Risk for Communities and Present and Future Forest Values The long term (50 to 100 years) target condition would be to have up to 60 percent of the ponderosa pine in late and old structural stages versus the current 1 percent. For the East Tumbull project the desired condition is to have less than 50 percent of the project area in the moderate to extreme fire behavior category and less than 40 percent at risk of epidemic beetle attack for the coming two decades.

Access & Emergency Escape Route Defensible space is to be provided at least 500 feet wide on either side of roads, with potential flame heights less than four feet. Escape routes should be clearly designated and distinguishable during a wildfire event. Fire regime condition classes adjacent to roads would be at a condition class 1.

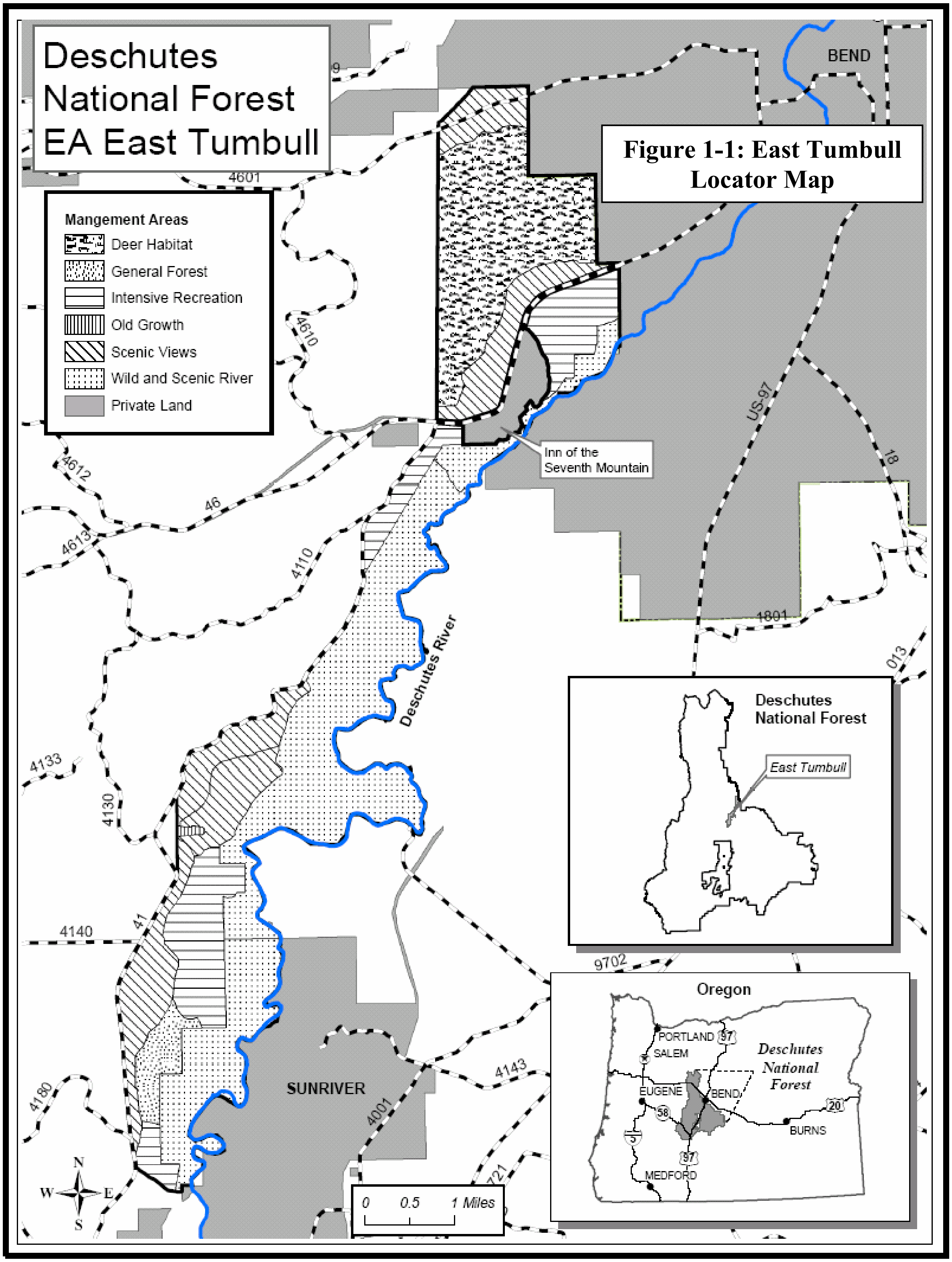
Deschutes National Forest EA East Tumbull
Figure 1-1: East Tumbull Locator Map
Mangement Areas
Deer Habitat
General Forest
Intensive Recreation
Old Growth
Scenic Views
Wild and Scenic River
Private Land
BEND
Inn of the Seventh Mountain
Deschutes River
SUNRIVER
US-97
Deschutes National Forest
East Tumbull
Oregon
PORTLAND
SALEM
EUGENE
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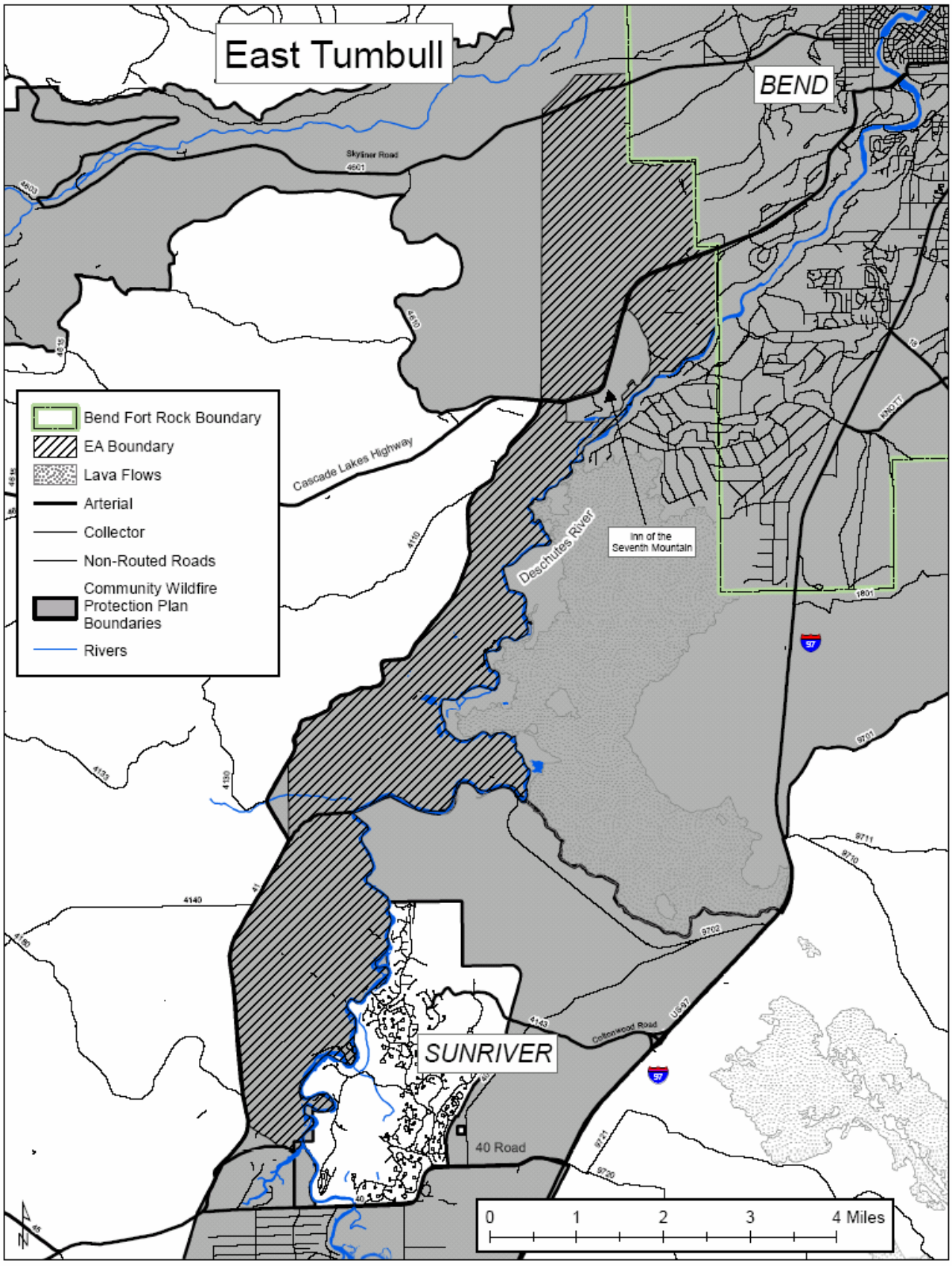
Figure 1-2 Overlay of East Tumbull Project and Sunriver and Bend CWPP WUI



CHAPTER 2 ALTERNATIVES CONSIDERED

Introduction

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The project design of the proposed action alternative, that meets the purpose and need outlined in Chapter 1, was therefore an iterative process that considered scientific literature, modeling, scoping comments, mitigation, collaboration and LRMP direction. As a result of this iterative process, the East Tumbull ID team developed one action alternative. Although the HFRA does not require development of a no action alternative (Alternative 1), Alternative 1 is analyzed and contrasted with Alternative 2 to give readers and the deciding officer enough information to understand the need for the project.

Alternatives/Areas Dropped from Further Consideration

A total of 10,555 acres were investigated in the field. The ID team narrowed this total acreage as it developed the proposed action and the no action alternative. The following alternatives and/or acres that were considered during the environmental analysis but eliminated from vegetation management consideration are described below.

1. An estimated 7,660 acres of the 21,422 acre Ryan Ranch Key Elk Habitat Area (KEHA) is located within the project area (see map, Appendix G). Monitoring of the elk that use this KEHA by ODFW has highlighted the importance of the lodgepole pine stands located adjacent to the Deschutes River in the southern portion of the project area for calving. A total of 500 acres within the lodgepole pine plant association group and the WUI were excluded from vegetation management to maintain this habitat.
2. The project area has a total of 21 acres within LRMP Management Area 15 (MA 15, Old Growth) and 676 acres within 300 feet of the Deschutes River. Areas within 300 feet of a fish bearing river or stream, 150 feet of perennial non-fish bearing streams and wetlands greater than one acre and 50 feet of seasonally flowing or intermittent streams or wetlands less than one acre are by definition (INFISH, 1995) considered a Riparian Habitat Conservation Area (RHCA). All areas within RHCAs and MA 15 were eliminated from vegetation management treatment and other activities to narrow the purpose and need and eliminate potential effects to water quality.
3. An alternative that reduced ladder and crown fuels by pruning with an 8 or 12" dbh cap on tree removal was eliminated from consideration because it did not meet the purpose and need. This alternative would still have had a high potential for accelerated beetle mortality and crown fire spread, independent of surface and ladder fuels. Crown densities of the thin $\leq$ 21" dbh EA units, included with Alternative 2, need to be reduced to lower crown fire potential, future beetle mortality and the risk to the WUI (see Chapter 4 discussion and Appendix J, page 7). The analysis in Appendix J (Thinning, Regimes, Crown Bulk Densities and Crown Fire Spread, Review of East Tumbull Stand Examinations) shows that the target basal area of 60 to 80 square feet (Appendix I-21 to I-28) included with Alternative 2 is designed to be effective at reducing beetle risk while also lowering stand replacing fire behavior for a medium rate of spread. Capping tree removal at 12" dbh reduces effectiveness of the thin $\leq$ 21" dbh EA units to below 50 percent while overall leaving more than 50 percent of the project area at risk to a stand replacing wildfire with even a low rate of spread.

Alternatives Considered in Detail

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Alternatives Considered in Detail

ALTERNATIVE 1
Alternative 1 is the No-Action alternative. This alternative assumes that none of the activities associated with the East Tumbull project, such as thinning, mowing of shrubs and underburning would occur. In the analysis of effects in Chapter 3 of this document, the Alternative 1 discussion provides baseline information on the affected resources, including expected trends. For example, fire suppression activities would continue as directed under the LRMP, Fire Management Action Plan and other pertinent direction. A total of 411 acres (BB 90 units 1, 3, 4, 10; Pine 90 unit 2; BB 89 units 8, 10; Katalo units 17, 23) of already approved, ongoing projects would be prescribed burned and an additional 26 acres (Katalo Units 8 and 10) would be mowed within the project area. The overall upward trend in the percentage of the project area classified as high and extreme for fire behavior potential would continue.

The popularity of the developed recreation sites, bike trails, horse trails and hiking trails would also grow due to population growth and the proximity to Bend. Along with increased vehicular use, existing road densities would also likely increase as user created roads become more prevalent. Current and expected future use of the project area by motorized recreationists would continue to exacerbate effects on both wildlife and vegetation while increasing the risk of human-caused ignition and complicating the safe evacuation of people during a wildfire event.

ALTERNATIVE 2 (Proposed Action)
Introduction: Alternative 2, the proposed action (maps pages 27, 28) was developed by the ID Team in collaboration with adjacent communities, organizations and individuals and it implements the recommendations contained in the Sunriver and Bend CWPP. Alternative 2 was mailed to the public (Appendix J) in May and June of 2005. In addition to describing the action alternative considered and analyzed in Chapter 3 of this document, this section provides a summary of the activities and practices that would be carried out in the specific EA units as detailed under the following Mitigation and Management Requirements section of the EA. Thinning and mowing EA units would be bound by the provisions of a Forest Service timber sale, stewardship or service contract including contract provisions to implement the Mitigation and Management requirements selected by the decision maker.

Changes: A total of 482 acres in EA units 118, 120, 121, 122, 124, 125, 126 and 176 would be covered by the Decision Memorandum for the Met CE. These EA units are located adjacent to evacuation and access routes to and from popular recreation sites in the project area but outside of 1.5 miles from an at-risk community (see "at-risk" dotted line on map page 27). They were included in scoping and collaboration as a reasonably foreseeable activity. None of these EA units are located adjacent to primary evacuation roads for Bend, Inn of the 7th Mountain or Bend although they could function as secondary routes. As discussed before as a reasonably foreseeable activity they will be included under the direct, indirect and cumulative effects discussion under Alternative 2.

Strategic Objectives: Alternative 2 would reduce wildland fire risk to communities and present forest values (Fuels/Fire Hazard Reduction, Chapter 3) by closing roads and proposing extensive fuels reduction treatments throughout the WUI and along the identified evacuation and access routes. The EA units are strategically located immediately adjacent to private property, infrastructure, recreations sites, transmission lines and evacuation routes. Whenever possible, the EA units tie into natural fuel breaks such as lava flows, rock outcrops, meadows, prior treatment areas and recent wildfires to leverage the effective treatment size and break up areas of high accumulated natural fuels. Since the greatest risk comes from wildfires with a westerly wind component, the EA units were concentrated adjacent to Bend, Sunriver and the Inn of the 7th Mountain with a north south orientation to prevent wildfires from hooking around the EA units and reaching private lands.

Although not part of this alternative, fuels reduction has also been ongoing within the communities and developments that collaborated on the development of this alternative.

Reduction of wildland fire risk to future forest values (Ecosystem Health and Diversity, Chapter 3) would be accomplished by removing most of the lodgepole pine and juniper from historic ponderosa pine stands and reducing tree density (crown bulk density) and accumulated fuels to accelerate the development of later structural stage ponderosa pine that is less susceptible to insects and diseases and more resilient to stand replacement wildfire. Diversity would also be addressed by retaining wildlife travel corridors, screening cover, and untreated patches within and adjacent to the units to maintain and or improve big game, raptor and landbird habitat. In general, wildlife cover areas and corridors would not be retained within 300 feet of houses and other structures within the EA units to ensure the treatment objective of wildland fire risk reduction is not compromised.

Reduced fire hazard and tree mortality from fire is accomplished by lowering fuel loads, removing ladder fuels and decreasing the potential for crown fires by thinning to increase the distance between tree crowns. Accumulated natural fuel loads would be treated by mowing and through the use of prescribed fire. Reintroduction of fire would occur predominantly in the southern portion of the project area within the Sunriver CWPP where prevailing wind patterns can be used to direct smoke away from developed areas. Mowing of the shrub layer would occur in areas of unfavorable wind patterns such as within the Bend and Inn of the 7th Mountain WUI and along evacuation routes where the economic feasibility of reintroducing fire is cost prohibitive. This is due to the linear nature of the EA units that parallel evacuation roads and the extensive firelines that would be needed to control prescribed burns for a relatively small area.

The Upper Deschutes River Plan roads analysis would be implemented by closing unneeded and confusing roads adjacent to high use recreation areas and subdivisions and by clearly identifying evacuation and access roads.

Scope of Work: Alternative 2 has a total of 42 EA units (includes Met CE EA units 118, 120-122, 124-126, 176) of fuels reduction that cover 4,211 acres (includes the 482 acres of the Met CE) of federal lands in the project area. Each EA unit would typically have two or more fuel reduction activities to reduce fuel loadings on 41 percent of the total project area.

A total of 19 of the 42 EA units (Table 2-1, Thin $\leq$ 21" dbh) covering 2,627 acres (141 acres in Met CE EA units 102, 122, 176) would include some level of commercial thinning on part or the entire EA unit as one in a series of integrated treatments needed to restore sustainable conditions. An estimated 9,500 hundred cubic feet (CCF) (4.9 MMBF) of fiber less than 21 inches in diameter (dbh) would be removed with commercial thinning timber sales on these 19 EA units. The remaining 22 EA units covering approximately 1,584 acres (341 acres in Met CE EA units 118, 121, 124-126) would be prescribed burned, mowed, hand piled or thinned to reduce fuel loads without commercial thinning timber sales. These EA units (Table 2-1, Thin $\leq$ 12" dbh) traditionally were noncommercially thinned. Depending on the developing biomass market some or all of this material would be utilized if economically feasible. At this time, it is anticipated that the majority of the material under 12" dbh would be piled and burned as reflected in Chapter 3.

Alternative 2 Proposed Treatments

Table 2-1 summarizes the proposed treatments by EA unit for Alternative 2 and the Met CE (**bolded**). Treatment prescriptions are designed to move the EA units toward the more open, later structural stage ponderosa pine conditions that once dominated the East Tumbull project area. Existing, dense stands with high fuel loads would be treated by a combination of thinning, brush mowing, hand and machine piling, and underburning to reduce and modify the fuel loadings and profiles of the EA units.

Thinning: Commercial thinning would include whole tree yarding of trees between 8 and 21 inches dbh to ensure that the activity does not exacerbate existing natural fuel loads followed by hand thinning and hand or mechanical piling of the small diameter trees less than 8 inches dbh. EA units with a large lodgepole pine component south of the Benham Falls road would include removal of lodgepole down to 4 inches dbh. EA units with a prescription of only thinning trees less than 12 inches dbh would typically include either hand piling or mechanical piling followed by burning of the piles with the potential for some limited utilization of the small diameter material for either personal use firewood or biomass (hog fuel) to generate electricity.

Approximately 60 square feet of basal area per acre of conifer stocking would be retained in the ponderosa and mixed stands of lodgepole pine and ponderosa pine. In general, under the thinning from below prescriptions included with this alternative, the largest and healthiest trees in the stand would be retained; in addition to all the live trees larger than 12 or 21 inches dbh. Ponderosa pine would be favored for retention over juniper and lodgepole pines because they live longer, grow to larger diameters and are more resistant and resilient to insects, disease and fire. The actual thinning would be done on a variable spacing with the retention of one to two clumps per acre of (three to seven or more) trees to mimic natural ponderosa pine development patterns.

Boom mounted shears utilizing designated skid trails or logging over snow and/or frozen ground would be done in all commercial thinning EA units. Existing landings and skid trails would be used where feasible. Temporary roads would be established to access some units and to locate landings off of main roads. The proposed temporary roads are shown in Appendix H. All temporary roads and some of the primary skid trails and landings would be obliterated by subsoiling following vegetation management activities within specific EA units. Commercial thinning in combination with the other integrated treatments described below would help reduce ladder fuels, crown fire potential and improve forest health.

Thinning of trees less than 12 inches dbh would be done by chainsaw, machine or in combination with mowing of the shrub layer. In the Met CE EA units 118 and 125, trees less than 12 inches dbh would be whole tree yarded to roads 41 and 4100-600 and utilized for personal use firewood with methods similar to those described for commercial thinning. Where feasible, piles that are to be burned would be located on existing disturbed areas such as old roads, skid trails and landings within all EA units. Pruning of individual trees would occur within 300 feet of private property lines to further reduce ladder fuels.

LOS Thinning Met CE EA unit 124 is a 13 acre thinning unit that is classified as a LOS stand this is structure stage 6. The prescription would be to cut and hand pile white fir up to 12" dbh to reduce the stress on the over story old growth ponderosa pine trees that have been experiencing accelerated mortality. There would be no commercial harvest in this EA unit.

Mowing: Brush mowing or shredding consists of mowing understory shrubs, small trees, and other vegetation to alter the fuel profile by eliminating ladder fuels and reducing flame heights and rate of spread. A mowing attachment is towed behind a tractor, or is attached to the head of an excavator or harvester (slashbuster) and the vegetation is mulched and chopped into small pieces and left on the surface. This method can often be used to complete noncommercial thinning of the understory at the same time the shrub layer is treated. An average of 25 percent of each EA unit would be retained to maintain shrubs for deer forage and wildlife habitat for other species such as landbirds and rodents. A total of approximately 2,414 acres (includes 411 acres in Met CE EA units 118, 120-122, 125, 176) would be mowed to alter the fuel profile.

Prescribed burning: Prescribed burning, also called underburning and used interchangeably throughout this document, consists of burning the surface fuels to consume dead and unwanted woody material such as needle litter, limbs, shrubs and small trees. The underburning is carried out by Forest Service hand crews, supported by engines and support vehicles in the spring and fall under prescribed fuel moisture and atmospheric conditions to minimize consumption of CWD and meet Clean Air Standards.

A total of 535 acres of previously thinned or mowed stands in EA units 112, Met CE 126, 133, 143 and 145 are in need of maintenance treatments of the understory trees and shrubs and would be prescribed burned without any other treatment. The majority of the EA units in the proposed action require thinning and/or some mowing before underburning can be done safely and effectively. Limited mowing in the vicinity of private property and along roads and hand created firelines would be applied in most of the EA units to reduce flame heights; so that underburning can be applied safely and effectively.

Underburning, with the exception of recently mowed EA unit 112, would not occur within the Bend and Inn of the 7th Mountain WUI. An average of 10 percent of the prescribed burning EA units would not be treated to provide wildlife habitat. A total of 1,587 (includes 16 acres in Met CE unit 126) acres would be prescribed burned under Alternative 2 within the next 7 to 10 years. Further details about the proposed treatments may be found in the silvicultural report located in the appendices and the project record.

Forest Roads: A total of 13 miles of evacuation and access roads would be treated within the EA units discussed above to provide defensible space. Access to designated EA units for harvest and hauling of commercial wood products would predominately be on existing forest roads. An estimated 5.8 miles (total) of temporary roads would be established to access portions of the EA units that are not readily accessible from existing forest roads. For example, locating the landing off a major road to provide for public safety and a safe place for limbing and loading logs would require a 100 foot temporary road to access the landing. When feasible, existing logging facilities used during the previous harvesting entries would be reused.

Temporary roads would be closed and subsoiled after use in addition to 26.5 miles of road decommissioning and 11.9 miles of road closures (Appendix H). There would be no decommissioning (subsoiling) of roads or dispersed sites within the RHCA. Closures of access roads to the RHCAs would be done outside of the RHCA. These unneeded roads were identified during a roads analysis done for the Upper Deschutes River Plan and they are redundant for evacuation and firefighter access routes and serve as a vector for human caused ignitions. Closing the roads would also increase habitat effectiveness in the Ryan Ranch KEHA. Prior to decommissioning roads would be surveyed for noxious weeds and, if found, hand pulled.

Wildlife habitat: All dead standing trees (snags) and down trees (CWD) within the project area would be left to provide habitat for cavity dependent species. Due to the extensive clear-cut harvesting, the existing young stands of ponderosa pine are generally lacking adequate levels of snags in the larger size classes over 20 inches dbh. As the stands continue to grow larger in diameter over the next two to three decades, this unbalanced snag distribution would gradually disappear. To provide some interim habitat for species that favor larger snags some of the larger trees between 20 and 26 inches dbh would be topped (see Sale Area Improvement Plan). Existing down wood (CWD) combined with current levels of standing dead trees would be managed at levels based on the ponderosa pine, dry Plant Association groups (PAG).

Consistent with Eastside screens, wildlife connectivity corridors were designated to connect stands within and adjacent to the project area including an important east-west elk movement corridor north of Sunriver. In addition to the no shrub treatment areas excluded from mowing and prescribed burning; on average 20 percent of the EA thinning units less than 12 inches dbh, and 30 percent of the EA thinning units less than 21 inches dbh would be left in wildlife cover patches of from 2 to 30 acres in size. Where feasible they would be located around rock outcrops and other sensitive areas. These areas are in addition to the aforementioned one to two clumps per acre of 3 to 7 trees that would be retained within areas actually thinned.

Mitigation and Management Requirements

These mitigation and management requirements are an integral part of the action alternative. Mitigation measures are specific actions that could be taken to minimize, avoid or eliminate impacts on the resources that

would be affected by the action alternative or rectify the impact by restoring the affected environment. Management requirements are mitigation measures typically derived from LRMP standards and guidelines, but other sources can also be existing laws and regulations, or guidelines for practices required by site-specific conditions. In general, management requirements represent standard operating procedure for the protection of forest resources and they are generally addressed in timber sale and service contract provisions or EA unit layout. These standard operating procedures that are incorporated into project design are also called *project design criteria* or resource protection measures.

Effectiveness Ratings provide a qualitative assessment of expected effectiveness that the implemented practice will have on preventing or reducing impacts on resources. The effectiveness of each measure is rated at high, moderate, or low. These mitigation measures and management requirements are considered in the effects discussions of Chapter 3.

Effectiveness ratings of High, Moderate or Low are based on the following criteria: (1) Literature and Research; (2) Administrative Studies (local or within similar ecosystem); (3) Experience (judgment of qualified personnel by education and/or experience); (4) Fact (obvious by reasoned, logical response)

HIGH: Practice is highly effective (greater than 90 percent), meets one or more of the rating criteria, and documentation is available.

MODERATE: Documentation shows that practice is 75 to 90 percent effective; or Logic indicates that practice is highly effective, but there is no documentation. Implementation and effectiveness of this practice needs to be monitored and the practice will be modified if necessary to achieve the mitigation objective.

LOW: Effectiveness is unknown or unverified, and there is little or no documentation; or applied logic is uncertain and practice is estimated to be less than 60 percent effective. This practice is speculative and needs both effectiveness and validation monitoring.

Soils Mitigation and Management Requirements: The following mitigation measures are designed to avoid or minimize potentially negative effects to soils by controlling equipment operations to locations and conditions that are less susceptible to resource damage. This type of mitigation has been built into Alternative 2 as part of the project design. The management requirements listed for the soil resource are to be implemented during or after the project in order to meet the stated objectives for protecting and maintaining soil productivity.

***Soils Management Requirements*:** Apply appropriate Best Management Practices (BMPs) to all ground-disturbing management activities, as described in General Water Quality Best Management Practices (Pacific Northwest Region, 1988). These BMPs are tiered to the Soil and Water Conservation Practices (SWCP) Handbook (FSH 2509.22), which contains conservation practices that have proven effective in protecting and maintaining soil and water resource values. The Deschutes LRMP states that BMPs will be selected and incorporated into project plans in accordance with the Clean Water Act for protection of waters of the State of Oregon LRMP 4-69).

Specific BMPs commonly used to minimize the effects of road systems, fuels and timber management activities on the soil resource are briefly described for this project proposal.

- Use old landings and skidding networks whenever possible. Assure that water control structures are installed and maintained on skid trails that have gradients of 10 percent or more. Ensure erosion control structures are stabilized and working effectively (LRMP SL-1; Timber Management BMP T-16, T-18). *High effectiveness.*
- In all proposed activity areas, locations for new yarding and transportation systems would be designated prior to the logging operations. This includes temporary roads, spur roads, log

landings, and primary (main) skid trail networks. (LRMP SL-1 & SL-3; Timber Management BMP T-11, T-14 & T-16). *Moderate effectiveness.*

- *Surface Drainage on Temporary Roads* – minimize the erosive effects of concentrated water through the proper design and construction of temporary roads (Road BMP R-7). *Moderate effectiveness*
- *Road Maintenance* – conduct regular preventive maintenance to avoid deterioration of the road surface and minimize the effects of erosion and sedimentation (Road BMP R-18, R-19). *Moderate to High effectiveness.*
- *Protect Soils and Water during prescribed burn operations* – A burn plan addressing compliance with all applicable LRMP standards and guidelines and Best Management Practices will be completed before the initiation of prescribed fire treatments in planned activity areas. Prescribed burn plans need to include soil moisture guidelines to minimize the risk of intense fire and adverse impacts to soil and water resources (LRMP SL-1 & SL-3; Timber BMP T-2, T-3 & T-13; Fuels Management BMP F-2, F-3). *Moderate to High effectiveness*.
- *Coarse Woody Debris/Down Wood* - Assure that on ponderosa pine sites, a minimum of 5 to 10 tons per acre (greater than 3-inches in diameter) is retained within activity areas (10 to 15 tons per acre in MA 17) to provide organic matter reservoirs for nutrient cycling that helps maintain long-term site productivity (LRMP SL-1). Assure that on mixed conifer sites, a minimum of 10 to 15 tons per acre (12 to 24 tons per acre in MA 17) is retained for long-term nutrient cycling. *Moderate effectiveness.*
- *Maintain duff layer* – Strive to maintain fine organic matter (organic materials less than 3-inches in diameter; commonly refered to as the duff layer) over at least 65 percent of an activity area (pertains to both harvesting and post-harvest operations). If the potential natural plant community (i.e., site) is not capable of producing fine organic matter over 65 percent of the area, adjust minimum amounts to reflect potential vegetation site capabilities (LRMP SL-6; Fuels Management BMP F-2; Timber Management BMP T-13). *Moderate effectiveness.*
- Use sale area maps for designating soil and water protection needs (Timber Management BMP T-4). *Moderate effectiveness.*

Minimize the extent of new soil disturbance from mechanical treatments by implementing appropriate design features for avoiding or minimizing detrimental soil impacts from project activities. Options include using some or all of the following:

- Use existing log landings and skid trail networks (whenever possible) or designate locations for new skid trails and landings.
- Designated locations for new trails and landings need to best fit the terrain and minimize the extent of soil disturbance.
- Maintain spacings of 100 to 150 feet for all primary (main) skid trail routes, except where converging at landings. Closer spacings due to complex terrain must be approved in advance by the Timber Sale Administrator. Main skid trails have typically been spaced 100 feet apart (11 % of the unit area) from 1994 to present. For the larger activity areas (greater than 40 acres) that can accommodate wider spacing distances, it is recommended that distance between main skid trials be increased to 150 feet to reduce the amount of detrimentally disturbed soil to 7 percent of the unit area (Froehlich, 1981, Garland, 1983). This would reduce the amount of surface area where restoration treatments, such as subsoiling, would be required to mitigate impacts to achieve soil management objectives.
- Restricting skidders and tractors to designated areas (i.e., roads, landings, designated skid trails), and limiting the amount of traffic from other specialized equipment off designated areas. Harvester shears will be authorized to operate off designated skid trails at 30 foot intervals and make no more than two equipment passes on any site-specific area to accumulate materials.

- Use of directional felling techniques from pre-approved skid trails, and suspending the leading end of logs during skidding operations.
- Avoid equipment operations during times of the year when soils are extremely dry and subject to excessive soil displacement.
- Avoid equipment operations during periods of high soil moisture, as evidenced by equipment tracks that sink deeper than during dry or frozen conditions.
- Operate equipment over frozen ground or a sufficient amount of compacted snow to protect mineral soil. Equipment operations should be discontinued when frozen ground thaws or when there is too little compacted snow and equipment begins to cause soil puddling damage (rutting).

Objective: Reduce displacement and compaction damage to soils by limiting the amount of surface area covered by logging facilities and limiting equipment operation to specified areas and ground conditions.
Effectiveness: High
Basis: LRMP Standards and Guidelines (SL-1 and SL-3); Timber Management BMPs T-2, T-4, T-9, T-11 and T-12; Forest Service Soil and Water Conservation Practices Handbook (FSH 2509.22); Froehlich et al 1981; Clayton, 1990; Garland, 1983; Fact; Experience

Soils Project Design Criteria Restrict mechanical disturbance on slopes greater than 30 percent to designated areas (i.e., roads, landings, designated skid trails) at all times and require operators to winch logs to skidders. Hand felled trees shall be directionally felled toward pre-approved skid trails. Exceptions for areas that make up less than 10 percent of an activity area (EA units) would be subject to Forest Service approval. Assure that water control structures are installed and maintained on skid trails that have gradients of 10 percent or more.

Portions of the following ten EA units proposed for mechanical treatment contain slopes greater than 30 percent: 115, 117, 124, 132E, 139E, 142, 146, 147, 148E, and 176. Sustained slopes longer than 150 feet within these EA units would be excluded from mechanized thinning and fuels reduction activities. These sensitive areas would either be retained as untreated patches for wildlife objectives or hand treatments would be required to reduce fuel loadings.

Objective: Reduce displacement and compaction damage to soils by limiting equipment operations to specified areas and ground conditions.
Effectiveness: High
Basis: LRMP Standards and Guidelines (SL-1 and SL-3); Timber Management BMPs T-2, T-4, T-9, T-11 and T-12; Forest Service Soil and Water Conservation Practices Handbook (FSH 2509.22); Froehlich et al 1981; Clayton, 1990; Experience

Soils Project Design Criteria Restrict mechanical disturbance in potentially wet areas that contain high water tables. Locate designated skid trails and log landings on well-drained sites, upslope from potentially wet areas. Restrict equipment operations to roads and designated logging facilities at all times. Exceptions would be subject to Forest Service approval.

Portions of the following five EA units contain sensitive soils with seasonally high water tables: 117, 121, 147, 148E, and 149. Sensitive soils within these EA units would be excluded from mechanical treatment by incorporating the areas into wildlife cover areas or completing by hand.

Objective: Protect or maintain the quality of soil properties and shallow rooted vegetation by controlling equipment operations to locations and conditions that are less susceptible to soil puddling and compaction damage. Confine equipment impacts to designated areas that can be mitigated following harvest and post-harvest activities.

Effectiveness: High
Basis: LRMP Standards and Guidelines for Soil, Water and Riparian Resources (SL-1 and SL-3); General Water Quality Best Management Practices (Pacific Northwest Region, 1988), Timber Management BMPs T-2, T-4, T-11 and T-12, Fuels Management BMP F-2; Forest Service Soil and Water Conservation Practices Handbook (FSH 2509.22); Froelich et al 1981; Clayton, 1990; Experience

Soils Mitigation Measure: The following mitigation measure is designed to rectify impacts to the soil resource by reducing cumulative levels of detrimental soil conditions that are expected to exceed Regional and LRMP standards and guidelines.

Reclaim specific segments of local system roads, all temporary roads, log landings and main skid trails by applying appropriate rehabilitation treatments in activity areas where detrimental soil conditions are expected to exceed Regional Policy guidelines (above). Decommission (obliterate) logging facilities that will not be needed for future management. Options for mitigating the effects of project activities include the use of subsoiling equipment to loosen compacted soils on temporary roads and logging facilities, redistributing humus-enriched topsoil in areas of soil displacement damage, and pulling available slash and woody materials over the treated surface to establish effective ground cover protection.

Reclaim all temporary roads and some of the primary logging facilities in portions of the following five EA units which are expected to not meet allowable limits of detrimental soil conditions following mechanical treatments: 135, 140, 141, 144, and 149.

Decommissioning (subsoiling) treatments of local system roads to reclaim and restore compacted road surfaces in portions of the following 23 EA units: 104 (0.3 miles), 108 (0.2 miles), 112 (1.4 miles), 115 (0.7 miles), 116 (0.5 miles), 117 (3.1 miles), 118 (0.3 miles), 119 (< 0.1 miles), 121 (< 0.1 miles), 124 (0.2 miles), 130 (0.6 miles), 136 (0.6 miles), 130 (0.3 miles), 138 (0.8 miles), 139E (1.4 miles), 140 (0.3 miles), 141 (1.0 miles), 144 (1.0 miles), 146 (< 0.1 miles), 147 (0.5 miles), 148E (1.2 miles), 148W (0.2 miles), 149 (1.2 miles), and 176 (1.4 miles). Subsoiling would be considered an enhancement except in the five EA units mentioned in the paragraph above. Noxious weeds would be hand pulled, if found, from all areas before subsoiling.

Objectives: Reduce the extent of detrimentally disturbed soil to meet management objectives. Restore and stabilize detrimentally disturbed soils prior to seasonal runoff events.
Effectiveness: High
Basis: LRMP Standards and Guidelines for Soil, Water and Riparian Resources (SL-1 and SL-4); Watershed Management BMP W-1; Cafferata, 1983; Garland, 1983; Experience, Logic

Hydrology/Fisheries Mitigation and Management Requirements: The following mitigation measures are designed to avoid the potential for negative effects to water quality and fisheries. The management requirements listed are to be implemented during or after the project in order to meet the stated objectives for protecting and maintaining water quality.

***Hydrology/Fisheries Management Requirements*:** Apply appropriate BMPs to all ground-disturbing management activities, as described in General Water Quality Best Management Practices (Pacific Northwest Region, 1988). These BMPs are tiered to the Soil and Water Conservation Practices (SWCP) Handbook (FSH 2509.22), which contains conservation practices that have proven effective in protecting and maintaining soil and water resource values. The Deschutes LRMP states that BMPs will be selected and incorporated into project plans in accordance with the Clean Water Act for protection of waters of the State of Oregon LRMP 4-69).

Specific BMPs commonly used to minimize the effects of road systems, fuels and timber management activities on water quality in addition to those described above for soils follows:

- *Landings and Equipment Staging Areas*-All log landings, servicing and refueling of equipment shall be located outside the RHCAs to prevent the potential for sedimentation and pollutants from entering the water (LRMP RP-1, WT-2; Timber Management BMP T-10, T-11, INFISH TM-1, RA-4). *High effectiveness.*
- *Timing of Road Decommissioning*- Decommissioning of 26.5 miles of system road and 5.8 miles of temporary road to occur during periods of dry weather to prevent overland flow of water. Termini of road decommissioning would be located outside of RHCAs on gentle slopes by the district fisheries biologist where the potential for overland flow to affect water quality is nonexistent. (Road BMP R-3, R-23, INFISH RM-2). *High effectiveness*

Hydrology/Fisheries Project Design Criteria Exclude all perennial, intermittent, ephemeral streams, and water bodies RHCAs from EA units and activity areas.

Objective: Eliminate the potential for negative effects to water quality and fisheries habitat.
Effectiveness: High
Basis: LRMP Standards and Guidelines (RP-1, WT-1, Experience, logic

Cultural Resources Management Requirements: Known heritage resource sites would be avoided by all proposed activities or completed by hand. Heritage resource sites discovered during harvest and vegetation management activities operations would be avoided from any further disturbance.

Cultural Resources Project Design Criteria One EA unit would have thinning by hand to avoid damage to an unevaluated site. Handpiles would be located outside of the site before they were burned or trucked to a biomass energy plant.

Objectives: Maintain and protect identified and unidentified sites until sites can be researched.
Effectiveness: High
Basis: LRMP Standards and Guidelines for Cultural Resources (LE-7); Experience, Logic, Fact.

Scenic and Recreation Management Requirements: These recommendations are designed to help maintain or enhance short-term and long-term scenic views, meet or exceed LRMP standards and guidelines for scenic views, and meet the LRMP Desire Future Scenic Condition through the perpetuation of scenic components and landscape elements.

Scenic and Recreation Project Design Criteria The following management requirements are designed to eliminate or reduce effects brought on by the proposed management activities, while meeting the LRMP standard and guideline directions for Scenic Views.

Minimize the use of paint where feasible, especially within the immediate Foreground landscape. Where paint is needed along scenic routes, utilize backside tree marking to minimize visibility. Flush cut stump (8 inches or less) within immediate Foreground landscape (0 to 300 feet). Where possible, design and locate skid trails and landings at least 300 feet away from Forest Road 4601 (Skyliners Road, EA unit 104), 46 (Cascade Lakes Highway, EA Unit 104), 41 (EA units 117, 122, 130, 136, 140, 144, 148W, 149).

Slash treatment within scenic corridor to be completed within one and two year's period, respectively, for SV-1 and SV-2 scenic views allocation area.

Keep the scorching of tree crown during a prescribed burning to approximately 1/3 of live crown ratio.

Removal of all boundary flagging as part of the post treatment activities, within one and two years period, respectively, for SV-1 and SV-2 along scenic corridors.

To eliminate recreational and visual conflicts, vegetation management activities involving mechanized tree removal, machine piling, mowing and prescribed underburning that overlay trails within EA units 103, 104, 108, 109, 110, 115, 117, 119, 139E and 147 would occur outside of the normal recreation season of May 15 to September 1.

Objectives: Maintain and move towards management objectives for Scenic Views.
Effectiveness: Moderate to High
Basis: LRMP Standards and Guidelines for Scenic Views (M9-4 to M9-19); Experience, Fact.

Noxious Weeds Management Requirements: Machinery involved in vegetation management and fuels reduction activities, road building, and road closures must be washed prior to entry into the project area. Use the timber sale contract equipment washing clause and service contract provisions to reduce the possibility of importing noxious weeds to the area. Machinery involved in project activities must be washed prior to going to the next work site. A map of all known weed sites would be provided to project implementers during standard pre-work meetings in order to avoid spreading weeds and avoid staging equipment on known spotted knapweed, dalmation toadflax and cheatgrass.

Objectives: Reduce or eliminate the introduction or spread of noxious weeds.
Effectiveness: Moderate to High
Basis: Forest Service Manual (FSM) 2081.03, 29); October 2005 ROD for the Pacific Northwest Region Final Environmental Impact Statement for the Invasive Plant Program, 2005, Experience, Fact

Noxious Weed Project Design Criteria To avoid weed spread, equipment used to do activities within EA units 115 to 118, 122, 125, 126, 130, 136, 140, 144, 148W, 149 (Road 41) and EA units 102, 103 (Skyliners Road) would not be allowed to move or track within 20 feet of the 41 and 4601 road shoulders.

The district botanist will identify and flag out areas of weed infestation to avoid the sites within Inn of the 7th Mountain Fire (EA units 110, 114), the sites at Phil's Trailhead (EA unit 104) and the site near Skyliners Road (EA units 102, 104).

To avoid spreading spotted knapweed, equipment or other vehicles need to avoid off road parking and travel within the three quarries located south of Phil's Trailhead (EA units 104, 105, 108).

To avoid knapweed spread in EA unit 115 all thinning and piling would be done by hand. District botanist will flag out infestations to avoid during mowing (currently bounded by the powerline, 41, 4100800 roads). Mowing equipment would be washed prior to moving to the next EA unit.

Objectives: Reduce or eliminate the introduction or spread of noxious weeds.
Effectiveness: High
Basis: Forest Service Manual (FSM) 2081.03, 29); Pacific Northwest Region Final Environmental Impact Statement for the Invasive Plant Program, 2005, Experience, Logic

Fuels Treatment and Air Quality Management Requirements: Whole-Tree-Yard (WTY) or Leave-Tops-Attached (LTA) to the last log would be used on all fiber removal acres to eliminate activity fuels. Approximately 175 landing piles with an estimated 2,625 tons of limbs, needles, and tops would be used for biomass or burned and approximately 1,587 acres of accumulated fuels would be underburned. Utilization of fuel in landings piles would be an option for disposal depending on markets and economics. Brush disposal or

appropriated funds would be collected from the sale to dispose of the landings. All slash pile and prescribed burning would be in accordance with Oregon State Smoke Management Guidelines.

Objectives: Maintain and move towards resource objectives for the management areas. Eliminate disturbance to riparian areas.
Effectiveness: High
Basis: LRMP Standards and Guidelines, Fire and Fuels Management (FF-1 to FF-11, INFISH FM-1); Experience, Fact.

Wildlife Mitigation and Management Requirements: The following mitigation measures are designed to avoid or minimize negative effects to wildlife and to meet exisitng LRMP direction.

***Wildlife Management Requirements*:** Alternative 2 was designed to meet the following LRMP Standards and Guidelines and other pertinent direction:

Restrictions on motorized and OHV recreation would be retained from December 1 to March 31 under the Tumalo Cooperative Winter Range Closure Area. Harvest and other activities may be waived at the discretion of the District Wildlife Biologist or District Ranger in order to mitigate the effects on other resources (e.g. logging on snow/frozen ground to reduce soil compaction). In general, avoid logging when the area is being heavily used or crossed by migrating deer. Early logging in the winter is preferable to later periods, however, heavy snowfalls may move wintering deer out.

Cover in MA 7 would comprise 40 percent of the land area. Approximately three quarters of cover areas should be thermal cover (i.e. 30 percent) with the remainder in hiding areas. Habitat management would be designed to provide a mosaic of forested conditions which incorporates the concepts of escape, hiding, and thermal cover, travel corridors, visual screens, and harassment potential.

Forage conditions would be maintained or improved with emphasis on increasing the variety of plants available for forage and a mixture of age classes of shrubs.

Target open road densities would average 1.0 to 2.5 miles per square mile in MA 7.

Active raptor nest sites (osprey, etc) would be protected from disturbing activities within ¼ mile of the nest by restricting site disturbing operations during the species specific period of concern.

Within the Ryan Ranch KEHA provide 30 percent of the project area in screening clumps that have not been thinned for at least 20 years.

Open KEHA road densities should not exceed an overall average of 0.5 to 1.5 miles/square mile.

Public use in the Ryan Ranch KEHA will be encouraged on travel routes which will minimize conflict with elk.

Wildlife Project Design Criteria To meet the above LRMP direction and to move towards the desired condition of 1/3 of the project area each in early, middle and old forage while maintaining some current shrub habitat for wildlife, retain 10 percent of the prescribed fire EA units unburned and 25 percent of the mowing EA units unmowed. This is in addition to maintaining 30 percent of the thin less than 21 inches dbh EA units and 20 percent of the thin less than 12 inches dbh EA units in no treatment wildife clumps from 2 to 30 acres in size to meet the desired cover mosiac levels. Note that there is no prescribed burning within MA 7. The 20 to 30 percent wildlife cover patches plus the retention of 25 percent of the shrubs in mowing EA units outside of those patches would retain 45 to 55 percent of the shrubs associated with the individual EA units. This would help ensure that the desired 40 percent untreated shrub layer at the EA unit level would be met because not all cover patches necessarily have a continuous shrub layer.

A total of 38.4 miles of road would be closed or decommissioned to meet target open road densities in all

management areas, in addition to maintaining the Tumalo Cooperative Winter Range Closure Area to the general public. Motorized travel would only be on routes that minimize conflict with big game.

Objectives: Maintain and move towards forest-wide resource objectives and wildlife objectives for MA 7, 8, 9, 11, 17 and the Ryan Ranch KEHA.
Effectiveness: High
Basis: LRMP Standards and Guidelines, (MA 7-10, 14, 22; WL-3, 46, 51); Experience, Fact.

The Eastside Screens specify that 100 percent of cavity nesting potential will be provided with snags and green tree retention. Fallen trees and other woody debris will be retained in sufficient quantity, distribution, and physical characteristics to provide habitat for viable populations of dependent wildlife species over time. The Eastside Screens require incorporation of the latest scientific findings, which suggest retaining 1.4 percent of CWD coverage per acre and 2.7 snags per acre. Where logs of the recommended size and density are not available, an average of 1 slash pile or concentration per acre will be retained.

Wildlife Project Design Criteria No standing, dead or down trees of any species would be removed.

Surveys show that current snag levels meet required levels in EA units that have a silvicultural prescription of thinning all trees less than 21 inches dbh. To protect snags and CWD larger than 20 inches dbh, that are currently below desired levels in the project area, fuels would be removed from around them before burning.

Objectives: Maintain wildlife species associated with dead and down trees.
Effectiveness: Moderate to High
Basis: LRMP Standards and Guidelines WL-72, 73, Eastside Screens; Experience, Logic.

Eastside Screens require wildlife connectivity corridors between late and old structural stage (LOS) stands and designated Old Growth Management Areas and to manipulate vegetation to encourage the development of large diameter, open canopy structure, park-like stands in ponderosa pine where this condition occurred historically.

Wildlife Project Design Criteria Silvicultural prescriptions are designed to accelerate the development of LOS stage ponderosa pine. Connectivity corridors were mapped (page 52) and overlap portions of EA units 130, 138, 176. Corridors would be excluded from treatment within these EA units and included in wildlife cover areas.

Objectives: Maintain corridors for wildlife travel, dispersion and security
Effectiveness: Moderate to High
Basis: LRMP Standards and Guidelines WL-48, 46, Eastside Screens; Experience, Logic

Comparison of Alternatives Summary Table 2-1 (Met CE units bolded)

EA UNIT	MANAGEMENT AREA 1/	ACRES	1	Alternative 2 Silvicultural Prescription
102	9	18	No action	Thin ≤12" dbh/Handpile/Mow
103	9	8	No action	Thin ≤12" dbh/Handpile/Mow
105	7	60	No action	Thin ≤12" dbh/Machine pile/Mow
108	7, 9	237	No action	Thin ≤12" dbh/Handpile/Machine pile/Mow
110	7, 11	25	No action	Thin ≤12" dbh/Machine pile/Mow
115	9, 11, 17	114	No action	Thin ≤12" dbh/Handpile/Mow
116	11, 17	50	No action	Thin ≤12" dbh/Handpile/Machine pile/Mow
118	**9, 11, 17**	**197**	**No action**	**Thin ≤12" dbh/Handpile/Machine pile/Mow**
119	17	69	No action	Thin ≤12" dbh/Handpile/Mow
121	**9, 17**	**101**	**No action**	**Thin ≤12"dbh/Handpile or winter ASV/Mow**
124	**17**	**13**	**No action**	**Thin ≤12" dbh/Handpile**
125	**9**	**14**	**No action**	**Thin ≤12" dbh/Handpile/Machine pile/Mow**

141	8, 9	98	No action	Thin ≤12" dbh/Machine pile
112	9, 11, 17	357	No action	Underburn
126	**9**	**16**	**No action**	**Underburn**
133	11, 17	43	No action	Underburn
143	8, 17	48	No action	Underburn
145	8, 17	71	No action	Underburn
114	11	45	No action	Mow
104	7, 9	1002	No action	Thin ≤21" dbh/Handpile/Mow
109	7	24	No action	Thin ≤21" dbh/ Handpile/Mow
117	11, 17	326	No action	Thin ≤21" dbh/Handpile/Machine pile/Mow
120	**17**	**25**	**No action**	**Thin ≤21" dbh/Handpile/Mow**
122	**9**	**17**	**No action**	**Thin ≤21" dbh/Handpile/underburn**
130	9, 11	81	No action	Thin ≤21" dbh/Handpile/Machine pile/underburn
132E	11, 17	15	No action	Thin ≤21" dbh/Handpile/underburn
132W	11, 17	15	No action	Thin ≤21" dbh/Machine pile/underburn
134	9, 11	36	No action	Thin ≤21" dbh/underburn
135	11, 17	82	No action	Thin ≤21" dbh
136	8, 9	132	No action	Thin ≤21" dbh/Handpile/Machine pile/underburn
138	8, 9, 11, 17	121	No action	Thin ≤21" dbh/Handpile/underburn
139E	11, 17	104	No action	Thin ≤21" dbh/Handpile/Machine pile/underburn
139W	11, 17	127	No action	Thin ≤21" dbh/Machine pile/underburn
140	8, 9	24	No action	Thin ≤21" dbh/Handpile/underburn
142	8	10	No action	Thin ≤21" dbh/Machine pile/underburn
144	8, 9	17	No action	Thin ≤21" dbh/Handpile/Machine pile
146	8, 17	15	No action	Thin ≤21" dbh/Machine pile/underburn
147	17	75	No action	Thin ≤21" dbh/Handpile/Machine pile/underburn
148E	11, 17	91	No action	Thin ≤21" dbh/Handpile/Machine pile/underburn
148W	8, 9, 11, 17	92	No action	Thin ≤21" dbh/Handpile/Machine pile/underburn
149	11, 17	97	No action	Thin ≤21" dbh/Handpile/underburn
176	**17**	**99**	**No action**	**Thin ≤21" dbh/Handpile//Mow**
Cunits of commercial fiber harvest			0	9,500
Million board feet			0	4.95
Thinning ≤ 21 inches dbh (acres)			0	2,627
Thinning ≤ 12 inches dbh (acres)			0	1,004
Underburn acres without thinning			0	535
Mow acres (no thinning, underburn or handpile)			0	45
Total acres of treatment (no overlap of treatments)			0	4,211
Thinning followed by underburning acres			0	1,052
Total underburn acres (thinning and no thinning)			0	1,587
Machine piling fuel reduction acres			0	1,526
Acres of handpiling			0	1,041
Thinning followed by mowing			0	2,369
Total mow acres (thinning and no thinning)			0	2,414
Road closure miles			0	11.9
Road obliteration miles (subsoiling)			0	26.5
Road density (open roads/square mile)			4.53	2.11

1/ 7- Deer Habitat; 8-General Forest; 9-Scenic Views; 11-Intensive Recreation; 17-Deschutes Wild and Scenic River corridor

Monitoring

Project monitoring focuses primarily on "implementation monitoring" to assure the selected alternative and mitigation measures are implemented on the ground as designed and achieve the desired results.

Wildlife Objective: To increase wildlife habitat effectiveness.

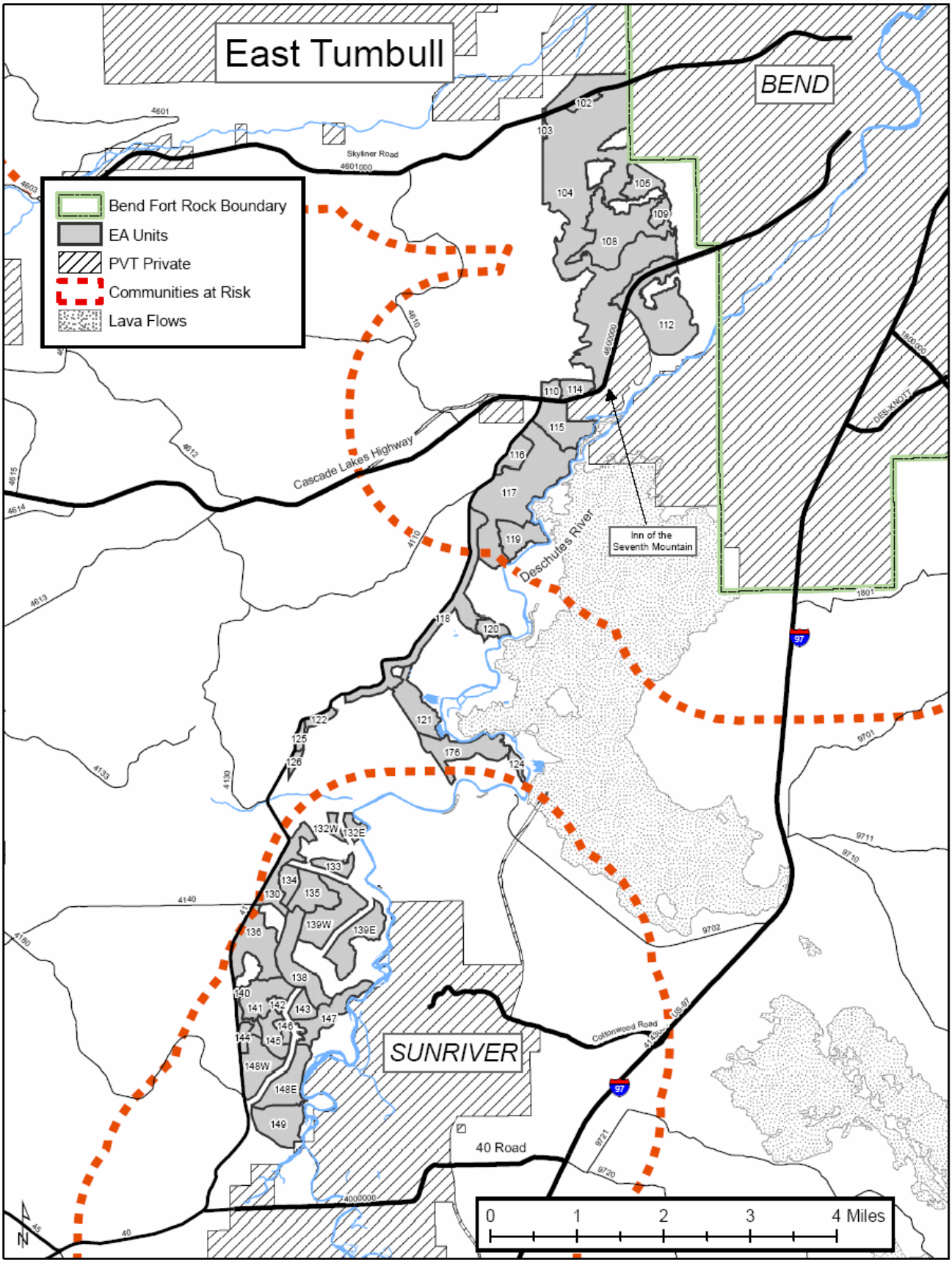
Monitor Elements: Determine if road closures and decommissioning were completed and effective.
Area of Consideration: Roads identified for closure and decommissioning
Suggested Methodology: Annual field review for 2 years.

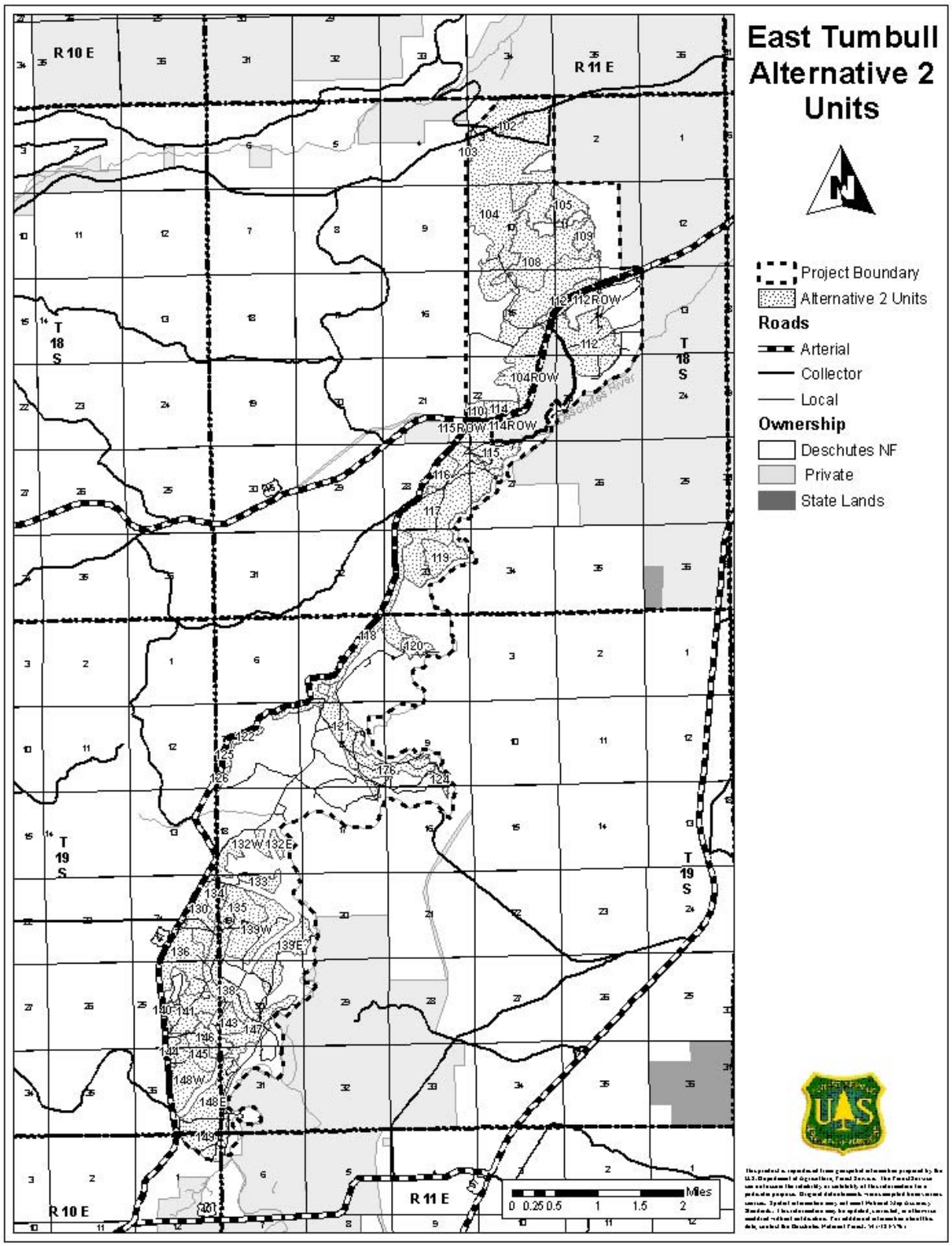
Soil Quality Objective: To determine if post-project subsoiling mitigation was effectively accomplished and reduced the extent of detrimentally compacted soil in specified in EA units.
Monitoring Elements: Surface area treated on specific roads and primary logging facilities.
Area of Consideration: EA units.
Suggested Methodology: Shovel probe, visual survey

Noxious Weeds Objective: To determine the introduction of new infestations or expansion of existing infestations of invasive plant species.
Monitoring Elements: Area covered by infestations and their locations.
Area of Consideration: EA units.
Suggested Methodology: Inspect travel routes annually during field season.

Sale Area Improvement Projects

The following mitigation, resource enhancement and restoration projects are actions connected with Alternative 2. Mitigation projects (M) must be completed followed by, if funding is available, resource enhancement (E) activities. 1) Decommission identified system roads (26.5 miles) (M/E); 2) Close 11.9 miles of identified system roads (M/E); 3) Convert road 4100250 to a trail and reestablish hiking trails damaged by vegetation management activities (E/M); 4) Noxious weed control monitoring (M); 5) Create 260 snags for wildlife from 20 to 26 inches dbh within EA units with a thin $\leq$21"dbh (E/M); 6) Remove timber sale flagging and tags along Century Drive, Skyliner, 41 and 4100250 (E/M); 7) Remove conifer encroachment within aspen stands (E).


East Tumbull
BEND
SUNRIVER
Bend Fort Rock Boundary
EA Units
PVT Private
Communities at Risk
Lava Flows
Skyliner Road
Cascade Lakes Highway
Deschutes River
Inn of the Seventh Mountain
Cottonwood Road
40 Road
DESCHUTES
0 1 2 3 4 Miles
N


East Tumbull
Alternative 2
Units
Project Boundary
Alternative 2 Units
Roads
Arterial
Collector
Local
Ownership
Deschutes NF
Private
State Lands
R 10 E
R 11 E
T 18 S
T 19 S
Miles
0 0.25 0.5 1 1.5 2

CHAPTER 3 ENVIRONMENTAL EFFECTS

Introduction

For ease in presentation and comparison, the discussions are separated into individual resource areas, such as fuels and fire hazard reduction, soil productivity and wildlife habitat management. Although the anticipated environmental effects of the two alternatives were analyzed for each resource, the analysis emphasizes those decisions that relate to the issues identified in Chapter1, Purpose and Need for Action. Estimated effects of the alternatives are discussed in terms of environmental changes from the current situation and include qualitative as well as quantitative assessments of direct, indirect and cumulative effects.

Environmental analysis in this document is consistent with the June 24, 2005 memorandum (Appendix G) regarding Guidance on the Consideration of Past Actions in Cumulative Effects Analysis. Thorough scoping and analysis was used to confirm that the environmental effects of Alternative 2 and the reasonably foreseeable Met CE, when combined with past, ongoing and other reasonably foreseeable actions, do not reach a point of significant environmental effects. The direct, indirect and cumulative effects of treating 482 acres with the Met CE were included throughout this section with Alternative 2.

Fuels and Fire Hazard Reduction Introduction

Fuels and fire hazard reduction was one of the issues used to design the specific activities of Alternative 2. The following measures were used in the analysis: Measure #1 Acres of prescribed burning and/or mowing; Measure #2 Percentage of project area rated as low for fire behavior potential; Measure #3- Roadside evacuation/access miles treated; Measure #4 Production of Particulate Matter.

Scope of the Analysis As an HFRA project, the scope of the analysis is focused on the western side of the WUIs identified in the Sunriver and Bend CWPPs that are overlain by the East Tumbull project area (map, page 11). Only fire and fuels reduction activities that occurred within the project area during the proceeding 15 years were considered in the analysis of cumulative effects for fuels and fire hazard reduction because district experience and field reviews have shown that mowing and prescribed fire have the beneficial effect of reducing fire intensity and fire behavior for an average of 15 years. Decomposition of small forest residues is also a 15 year process within the project area. All vegetation management activities that have occurred during the previous 15 years included removal of activity generated fuels and disposal of these activity generated fuels has been completed. Site visits of pre-1990 activities have verified that activity generated fuels have decomposed or were disposed of at the time of the activity. Therefore, activities that occurred before 1990 are not relevant and have no bearing on the decision to be made between the two alternatives regarding fuels and fire hazard reduction.

Affected Environment-Existing Stand and Fire Suppression History Fire was the major disturbance mechanism in shaping the historic forest of Central Oregon and it was one of the primary forces that sustained vast, contiguous stands of old growth ponderosa pine. It was an important determinant of stand structure, size, density arrangement, patch size, CWD and other organic matter. Fire intensities were usually low to moderate (Munger 1917) with fire return intervals of 7 to 38 years (Bork 1984). The frequency of an average (40 to 100 acre) stand replacing fire ranged from 80 to 300 years (Hopkins 1992).

In the 1920's over 8,000 acres of private land were clear-cut harvested by the Shevlin-Hixon Company in the project area. The Federal Government in the 1920's and 1940's traded the cutting rights for trees on adjacent government owned land to the Shevlin-Hixon Company in exchange for the over 8,000 acres of private land. The result is that almost all of the land within the project area was clear-cut harvested in the 1920 to 1949 time period. The dense, young stands of trees that have developed in the interim on these lands are unrecognizable from the historic, open old growth ponderosa pine that previously existed in the project area. Active fire suppression has exacerbated fuels and fire hazard by allowing shrubs, needle-cast, dead trees and other litter to accumulate for the last 60 to 80 years on lands that have a natural fire regime of frequent, low intensity fires on

a 7 to 38 year fire return interval. The exclusion of fire from the project area has allowed lodgepole pine to encroach on lands historically dominated by ponderosa pine. While fire intensity differs depending on fuel availability and time of year, additional factors such as site productivity must be taken into consideration. Currently, the below average site productivity in the East Tumbull project area is conducive to higher intensity fires due primarily to above average biomass production from overstocking and low summer time fuel moistures that allows organic matter to accumulate at a faster rate than it can decay (Debano et. al, 1998).

Table 3-1. Fire Behavior Potential

Fire Behavior Potential	Acres (Federal lands) Within Project Area
Extreme/High	5,975
Moderate	1,437
Low	2,753

In Table 3-1, acres within the project area at a level of extreme/high or moderate fire behavior are considered in need of restoration and are at risk of large stand replacing fires. These acres account for approximately 73 percent of the project area. More discussion on restoration acres will occur in the Affected Environment-Existing Condition Class section. The ponderosa pine associated stands within the project area have higher stand densities, less grass cover, and more shrub cover (bitterbrush, manzanita, and snowbrush) than seen historically. The mix of lodgepole and ponderosa pine sites also have high stand densities with a well developed understory shrub layer. Beetle killed lodgepole and ponderosa pine have made a significant contribution to fuel loadings in the southern portion of the project area. Dense stands of lodgepole pine reproduction also occur in areas of beetle activity adding to fire behavior potential due to ember production and rapid torching of crowns. These stands of reproduction also add to the ladder fuels already present in the shrub layer and dead lower tree limbs that allows rapid crown fire development. Dwarf mistletoe that has infected some of the overstory trees adds to crown fire susceptibility by collecting litter fall. In some areas, the lodgepole pine stands have pockets of dead, down material, as well as pockets of standing dead adding again to fire behavior potential. Fire suppression and the lack of vegetation management to treat hazardous fuels in this area has allowed naturally occurring fuels to continue to increase and stands to become more dense. This condition does not allow fires to burn with the low intensities that they historically had (Agee 1993), instead they burn with high intensities as evidenced in recent fires in the area (Inn Fire 1989, Awbrey Hall 1990, Pringle 1995 and the 18 Fire 2003).

The WUI boundary along Sunriver has lodgepole pine stands in flats along the river, transitioning to ponderosa pine with lodgepole pine encroachment elsewhere. The WUI with the city of Bend and Inn of the 7th Mountain is composed of a dense overstory of young ponderosa pine with an extremely well developed shrub layer (predominantly bitterbrush) with some encroaching juniper. Bitterbrush is capable of 15 foot flame heights under moist conditions in late spring and displays even more extreme fire behavior under summer conditions. These existing, varying conditions that all lead to moderate to extreme fire behavior would, under wildfire conditions, threaten private property adjacent to the project area and put recreational users at risk. The human influences of fire suppression, inactive fuels management (prescribed burning and other fuels treatment), and timber harvest activities that left other species as a component of the ponderosa pine stands are leading factors in converting large portions of the area from widely spaced ponderosa pine with little ground vegetation that were fire resistant to mixed lodgepole pine and ponderosa pine stands that are not fire resistant due to dense stand structure, shrub densities, disease and ground fuel accumulations.

The primary road system within the project area allows access to most areas for fire suppression. Fuel conditions adjacent to the primary road system do not provide defensible space (fuel breaks/ safety corridors) for suppression forces in the event of a high intensity wildfire. Secondary roads do not provide a safe escape route for suppression forces or the public, but are a major source of human-caused ignitions.

Affected Environment-Expected Fire Behavior by Fuel Model Fire behavior fuel models (Rothermel 1972,

Albini 1976) and their arrangement across the landscape interpret fire behavior potential. Fuel models 2 (short grass in open pine stands), 6 (dormant shrubs), 8 (compact conifer litter layer with little or no undergrowth), 9 (long needle litter), 10 (dead down woody fuels) are the predominant fuel models in the area. Fuel model 5 (low green shrubs) forms a small percentage of the project area. The slash fuel models 11 (light slash), 12 (medium slash) and 13 (heavy slash) are not present due to treatments in past harvest areas. Fuel model 6 (dormant shrubs) accounts for the majority of the extreme fire potential and is found in large blocks throughout the project area. This, in conjunction with the WUI, creates an extreme risk for the public and fire suppression forces in the area. Assuming average summer conditions of an 85 degree Fahrenheit day with a humidity between 12 and 15 percent and fuel moistures of three to four percent for the one hour fuels, five to six percent for ten hour fuels and six to seven percent for 100 hour fuels with a four to six mile per hour (mph) wind, the following fire behavior can be expected on flat terrain:

Fuel Model 2 (699 acres) has a rapid rate of spread similar to fuel model 6 (3,960 feet per hour) but has less fire intensity than a fuel model 6. Fireline intensity would limit direct attack by handline with mid-flame wind speeds above three mph. A mid-flame wind speed of six mph would produce seven foot flame lengths. As a reference, four foot flame lengths is the upper limit agency standard for direct attack by handline. Spotting would occur up to 1/3 of a mile from the main fire. Mortality can occur in ponderosa pine under 60 to 70 feet tall due to convective heating and scorch. Large open grown ponderosa pine should survive.

Fuel Model 6 (5,125 acres) with a six mph mid-flame wind speed would have flame lengths of over eight feet, making direct attack by handline not feasible. The forward rate of spread would be 3,960 feet per hour (60 chains), the spotting distance would be one mile from the main fire and the probability of ignition from embers would be 80 to 90 percent. Mortality would be high in ponderosa pine due to convective heat scorching live foliage 60 to 80 feet from the ground. When this fuel model has ponderosa pine overstory it will demonstrate more explosive fire behavior than described above due to needle drape in the shrub layer. Within the project area, the heavy needle accumulations of this fuel model make it extremely flammable even when the shrubs are not dormant. The Awbrey Hall fire, a stand replacement fire of 1990, took place just west of the city of Bend and is an example of the damage resulting from a wildfire in a fuel model 6 with a ponderosa pine overstory. This is the predominant fuel type within the project area and WUI.

Fuel Model 8 (2,572 acres) has low fire behavior characteristics. Rates of spread with a six mph mid-flame wind would be 198 feet (three chains) per hour. Spotting would be short range and scorch height would be less than four feet. Little mortality would occur in ponderosa pine and other less fire tolerant species. Flame lengths would be less than two feet with a six mph mid-flame wind allowing direct attack with ground forces.

Fuel Model 9 (841 acres) develops moderate fire behavior under the stated fuel moisture and light wind conditions. The rate of spread would be 1,056 feet per hour (16 chains) with four foot flame lengths. Overstory tree mortality would be low in fire tolerant species like ponderosa pine but high in intolerant species such as lodgepole pine and white fir. Direct attack, with the help of retardant, is effective on this fuel model.

Fuel model 10 (1,201 acres) under stated conditions, exhibits high fire behavior. The forward rate of spread of 792 feet per hour (11-13 chains) with over six foot flames and scorch height of 26 feet causes a high percentage of mortality in all tree species. Spotting over ¼ mile outside of the main fire would occur. Torching and crowning of trees is common. Suppression tactics are limited due to fire intensity, crown densities and heavy accumulations of dead, down fuels.

Affected Environment-Existing Condition Class A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but includes the influence of aboriginal burning (Agee 1993, Brown 1995). Course scale definitions for natural (historical) fire

regimes have been developed by Hardy et al. (2001) and Schmidt et al. (2002) and interpreted for fire and fuels management by Hann and Bunnell (2001). The five natural fire regimes are classified based on the average number of years between fires (fire frequency) combined with the severity (amount of replacement) of the fire on the dominant overstory vegetation. These five regimes include: I – 0-35 year frequency and low (surface fires most common) to mixed severity (< 75 percent of the dominant overstory vegetation replaced); II – 0-35 year frequency and high (stand replacement) severity (> 75 percent of the dominant overstory vegetation replaced); III – 35-100+ year frequency and mixed severity (< 75 percent of the dominant overstory vegetation replaced); IV – 35-100+ year frequency and high (stand replacement) severity (> 75 percent of the dominant overstory vegetation replaced); V – 200+ year frequency and high (stand replacement) severity.

A Fire Regime Condition Class (FRCC) is a classification of the amount of departure from the natural regime (Hann and Bunnell 2001). Coarse-scale FRCC classes have been defined and mapped by Hardy et al. and Schmidt et al. (2001). They include three Condition Classes for each Fire Regime. The classification is based on a relative measure describing the degree of departure from the natural fire regime. This departure results in changes to one (or more) of the following ecological components: vegetation characteristics (canopy closure, species composition, structural stages, stand age and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and associated disturbances (e.g. insect and diseased mortality, grazing, and drought). There are no wildland vegetation and fuel conditions or wildland fire situations that do not fit within one of the three classes.

The three classes are based on low (FRCC 1), moderate (FRCC 2), and high (FRCC 3) departure from the central tendency of the natural (historical) regime (Hann and Bunnell 2001, Hardy et al. 2001, Schmidt et al. 2002). The central tendency is a composite estimate of vegetation characteristics, fuel composition; fire frequency, severity and pattern; and other associated natural disturbances. Low departure is considered to be within the historical range of variability, while moderate and high departures are outside that natural regime. Characteristic vegetation and fuel conditions are considered to be those that occurred within the natural fire regime. Uncharacteristic conditions are those that did not occur within the natural fire regime. Determination of the amount of departure from the natural fire regime is based on comparison of a composite measure of fire regime attributes (vegetation characteristics; fuel composition; fire frequency, severity and pattern) to the central tendency of the natural fire regime. The amount of departure is then classified to determine the FRCC. A simplified description of FRCCs and associated potential risks follow.

Table 3-2. Description and Potential Risks of Fire Regime Condition Classes

Fire Regime Condition Class	Description	Potential Risks
Condition Class 1	Within the natural (historical) range of variability of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances	Fire behavior, effects, and other associated disturbances are similar to those that occurred prior to fire exclusion (suppression) and other types of management that do not mimic the natural fire regime and associated vegetation and fuel characteristics. Composition and structure of vegetation and fuels are similar to the natural (historical) regime.
Condition Class 2	Moderate departure from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances	Risk of loss of key ecosystem components (e.g. native species, large trees, and soil) are low. Composition and structure of vegetation and fuel are moderately altered. Uncharacteristic conditions range from low to moderate;
Condition Class 3	High departure from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances	Risk of loss of key ecosystem components are moderate fire behavior, effects, and other associated disturbances are highly departed (more or less severe). Composition and structure of vegetation and fuel are highly altered. Uncharacteristic conditions range from moderate to high. Risk of loss of key ecosystem components are high

Summary of Acres in Fire Regimes and Condition Class and Acres within Wildland/Urban Interface More detailed descriptions of the Fire Regime Condition Classes, associated attributes and EA unit by unit summaries of Condition Class are provided in Appendix E. To simplify the display of these rather complex concepts, the three classes were collapsed into two, with class 2 and class 3 into one category called restoration and class 1 into a maintenance category. The term restoration is not meant to imply that every acre in this category must be restored to a condition consistent with projected conditions that historically existed. It is recognized that there are other management objectives that require some of those restoration areas to remain in or near their current condition. However, the decision to manage fire adapted ecosystems for objectives other than sustainability or resiliency is also a decision to accept some risk of loss in the event of a wildland fire. The restoration category is applied to those areas in Condition Class 2 or 3 with an elevated risk of loss of components that define those systems as unique.

Areas in the maintenance category are assumed to be functioning within expected parameters in terms of potential fire behavior and effects. This does not mean that no treatment is needed. In fact, managing those maintenance areas currently functioning as desired through burning or other maintenance entries would be a high priority. Table 3-3 shows that within the project area, the East Tumbull units fall within Fire Regimes I, III, and IV. Within those Fire Regimes, only eight percent of the acres are considered maintenance condition. The remaining 92 percent are in restoration condition. The uncharacteristic conditions associated with these areas of restoration include those resulting from fire suppression, encroachment of fire intolerant lodgepole pine and non-historic forest composition and structure e.g. all of the trees over 12 to 14 inches in diameter were removed in a frequent surface fire regime.

Table 3-3. Existing Fire Regime/Condition Class Summary for East Tumbull EA Units*

Fire Regime	Description	Maintenance Condition Acres	% of Regime	Restoration Acres	%of Regime	Total Acres in Regime
I	0-35 yr return, low intensity (i.e. pine)	72	2.4	2909	97.6	2981
II	0-35 yr return, high intensity (i.e. i.e. shrub and juniper plant communities)	0	0	0	0	0
III	35-100+ yr return, mixed severity (i.e. mixed con)	248	49	258	51	506
IV	35-100+ yr return, lethal severity (i.e. dry range types and lodgepole)	0	0	403	100	403
V	>200 yr return, lethal severity (i.e. high elevation)	0	0	0	0	0
TOTAL		320	8	3570	92	3890

*****A total of 321 of the 4211 activity acres in Alternative 2 are unvegetated (235 acres of dirt and rocks) or unclassified (86 acres) and are not included in Table 3-3.*

Private lands within Sunriver, Inn of the 7th Mountain and the Highlands subdivision would best be described as Fire Regime I in the maintenance condition class.

LRMP and Other Management Direction Introduction Each resource section will have a brief discussion of pertinent management direction that is intended to give the reader an overview of information important to the design of Alternative 2. It is not intended as an all-inclusive list of all standards and guidelines that need to be evaluated to determine consistency with LRMP and other management direction. It will also frequently include a description of the LRMP and/or other management direction desired condition also sometimes called the target landscape or resource condition and used interchangeably throughout this document.

Fuels and Fire Hazard Reduction and Air Quality Management Direction The LRMP, as amended by the Upper Deschutes River Plan, specifies fuels and fire management activities to protect wildlife habitat, riparian habitat, air quality, public property, health and safety while reducing fuels and wildland fire risk. This is accomplished by following the Forest-wide (LRMP FF-1 to FF-11), Upper Deschutes River Plan and individual management area Standards and Guidelines that initiate long term actions to prevent wildfire and reintroduce the use of low intensity prescribed fire to move towards the desired future conditions (target landscape condition) for each management area.

The 1990 Clean Air Act (CAA) is an amended federal law first passed in 1970. Under this law, the Environmental Protection Agency (EPA) protects and enhances the quality of the nation's air resources by setting limits on how much of a pollutant (particulate matter) can be in the air based on scientific studies that have established a link between the particulate matter and public health. The Oregon Clean Air Act Implementation Plan considers local geography and industry to further define how the provisions of the CAA would be implemented through the Oregon Smoke Management Plan. This plan includes regional monitoring and regulation of pollutants less than 10 and 2.5 micrometers (PM 10 and PM 2.5) in size.

The Forest Service is required by law to follow the directions of the State Forester in conducting prescribed burning in order to achieve strict compliance with all aspects of the CAA by working in conjunction with the Oregon Department of Forestry (ODF) to adhere to the Oregon Smoke Management Plan. One of the requirements of the plan is to minimize smoke intrusions into designated areas (i.e. Bend) and Class 1 Airsheds to avoid adversely affecting air quality. The closest Class 1 airshed is the Three Sisters Wilderness approximately 10 to 20 air miles west and northwest of the project area.

Target Landscape (i.e. Desired)Condition and Related Strategies The landscape within which the project area falls should display a mosaic of strategically placed areas managed to reduce fire behavior potential, suppress wildfire, and provide protection to valuable resources on forest lands and adjacent to forest lands (i.e. WUI). Those areas managed for reduced fire behavior potential would include a number of associated desired conditions. The structure of stands should exist so that the canopy bulk density and the continuity of the forest canopy could not sustain a crown fire occurrence. Trees within the stands would have a height to live crown well enough above shrub and fuel cover in order to reduce potential for crown fire initiation. Shrub cover would also be maintained at a height that would reduce potential for crown fire initiation. In addition, shrub cover would be managed in order to keep flame lengths under the four foot agency standard for direct attack by handline. Surface fuels would be maintained much the same as shrub cover.

Defensible space, within these areas across the landscape and immediately along private property lines, access and evacuation roads, of at least 500 feet wide would be a working condition for suppression forces, and may also serve as fuel breaks. Fuel models eight and nine are the timbered fuel models that exemplify fuel characteristics conducive to low fire behavior and to fire suppression by direct attack of hand crews. These two fuel models are used to describe the desired condition of those areas. It is also a desired condition for these areas that the Fire Regime Condition Class is returned to a Condition Class 1, where there is a return to a natural, or historical, range of variability of vegetation characteristics.

Defensible space not only provides a better chance of stopping intense wildfires from entering private lands, it also aids in suppression of fires that start on private and burn on to public lands. By reducing crown densities through thinning and removing ground and ladder fuels through either mechanical shrub treatments (mowing), pruning, underburning, piling slash and burning the piles; fire behavior would be reduced to primarily a surface fire that suppression forces will have a better ability to control. The thinning of dense canopies allows retardant to become more effective by getting to the ground fuels and not being intercepted in the canopy. In order to be

effective, these treatments, in general, need to be at least 500 feet wide on both sides of the roads. In the WUI, the distance of treatment would vary depending on prevailing winds, resources at risk, fuel type, access and other resource objectives, but should be no less than those described above for roads.

Deschutes LRMP Standards and Guidelines prevent treating all of the project area for fire and fuels hazard reduction at one time. Defining a percentage of the project area that should be treated to reduce fire and fuels is problematic due to the shortcomings and variables involved with weather, stand condition, location of EA units, modeling and research. Taking expected fire behavior into account and the strategic placement of EA units, the ID team decided that the percentage of the project area in the low fire behavior category (FRCC 1) should be greater than 50 percent over both the short (5 to 10 years) and long term (10 to 20 years) timeframes. Fifty percent is certainly higher than historic conditions but with the shortcomings described above it can provide a gauge for measuring progress towards reduced fire and fuel hazard reduction within the project area.

Fuel and Large Fire Reduction Strategies Given the existing condition and the desired future condition contained in the management direction mentioned above; the following strategies were developed to move toward the desired future condition and to help direct treatment types and locations:

1) *Defensible space (fuel breaks and safety corridors)* Road systems allow ground suppression forces (engines, crews and equipment) to access wildfires. When fuel conditions allow surface fires to get into the canopies of the trees (ladder fuels) contributing to extreme fire behavior (torching, crowning and long range spotting), direct attack by ground forces becomes impossible. Wildfire under these conditions will cross any system road with such intensity that suppression forces have little chance of stopping the fire at the road. Retardant alone will only slow a wildfire for a short period of time. Suppression forces need to quickly utilize the effects of the retardant to contain a wildfire. Roads provide a good area for retardant to be utilized quickly by suppression forces. During recent fires on the forest, rural fire engines have responded to aid in the suppression efforts. These large low-ground clearance pieces of equipment cannot operate on most local forest roads due to narrow road widths and uneven road surface conditions. Use of the major roads in a fuel break and safety corridor strategy is recommended, especially in the WUI where public safety and evacuation is of high concern. Roads that provide fuel break safety corridors also provide safe escape routes for firefighters and the public.

2) *Restoration of historic fire regimes in ponderosa pine ecosystems* The absence of fire over the last 60 to 80 years combined with the development of shrubs and dense thickets of regeneration in the understory have placed the ponderosa pine stands at high risk of stand replacing wildfires. Although some of the timber stands in the WUI have been thinned in the past, the shrub layer within the stands remain capable of producing extreme fire behavior. Reintroduction of fire in these ponderosa pine type stands would be used as needed to achieve the desired condition. Prescriptions would be developed for low intensity prescribed fire to start a return to historic conditions, subsequent prescribed fire entries would be conducted through time to create a fire resistant stand condition that would help preserve the ponderosa pine. When prescribed fire is used every 8 to 15 years, depending on fuel accumulations, these areas should regenerate ponderosa pine slowly through time as they did historically (Agee 1993). Repeated prescribed burning should keep naturally regenerated lodgepole pine in low numbers through time. Mechanical shrub treatments may be used prior to or in lieu of burning if the shrub size and densities could cause severe scorch or mortality of the residual timber stand.

3) *Fuel reduction and discontinuous fuels* Areas with either existing dead and down material, dense stands of trees and shrubs, needlecast and activity created slash from illegal woodcutting can create extremely hazardous fuel conditions. When these conditions exist over a large area, such as East Tumbull, a wildfire can be extremely difficult to control. Under unfavorable weather conditions, the fire would burn until it reached an area where fuels were lighter and control tactics are more likely to be achieved. In 2001, Dr. Mark Finney published the paper *Design of Regular Landscape Fuel Treatment Patterns for Modifying Fire Growth and*

*Behavio*r in Forest Science magazine. The paper presents the theory that strategically-placed fuel treatments could achieve much greater results at minimizing large fire growth than randomly placed fuel treatments, especially when only a percentage of the area could be treated. Fire spread modeling theoretically shows that strategic placement could significantly reduce large fire growth while the same percentage of randomly placed treatments would have little or no effect. It suggests that when treating just a percentage of the landscape, the juxtaposition of fuel treatment areas in relation to one another was more important than the total amount of area treated. At this time, there is no scientific evidence supporting a conjecture that treating a minority of acres within a landscape, even when the treatments are strategically placed, would provide the same level of protection or restoration effects as treating a majority of the landscape. According to Finney, treating in a spatially strategic pattern would increase effectiveness in minimizing large fire spread and buy time to complete treatments on additional areas before they burn.

Through the use of wood fiber utilization, whole tree harvesting, mechanical shrub treatments, underburning, machine piling, handpilingiling and burning of piles, the continuity of large areas of these heavy fuels can be fragmented. Once isolated, these areas under extreme conditions could still be a problem for suppression forces due to long range spotting onto to both private and federal lands. Under less extreme conditions, the mosaic of treated and untreated areas can provide suppression forces with an area where control of a wildfire is possible and provide escape routes and safety zones during a wildfire.

4) *Thinning to reduce crown fire susceptibility and long range spotting* Crown fires are considered to be the most intense wildfires. They usually produce long range spotting that further hampers control efforts. Dense stands of timber support crown fires; allowing fires to burn through the canopies of the trees independent of the ground fire. Torching and crowning in conjunction with ground fire is also a common problem during wildfires in dense stands of trees. Breaking up the connectivity of the timber canopy through thinning greatly decreases the chance of independent crown fire. Thinning reduces the amount of torching and crowning that occurs with ground fire and thus reduces long range spotting potential.

Fire and Fuel Hazard Reduction Environmental Effects

Direct and Indirect Effects of Alternative 1 *Measures #1 and #2 - Acres of prescribed burning and/or mowing; Percentage of project area rated as low for fire behavior potential.* Under this alternative, no management activities would occur with the exception of fire suppression and already approved on-going projects. A listing of the recently completed and ongoing activities can be found in Appendix G (except for the Met CE there are no other reasonably foreseeable activities within the project area). In summary, a total of 413 acres (BB 90 unit 9, Kiwi Pine unit 18, BB 89 units 13-15) have been thinned and prescribed burned in the previous fifteen years to reduce natural fuels and an additional 411 acres (BB 90 units 1, 3, 4, 10; Pine 90 unit 2; BB 89 units 8, 10; Katalo units 17, 23) are approved to be prescribed burned and are ongoing within the project area. During the same time period, 478 acres (Awbrey Hall Fire) were mowed and an additional 26 acres (Katalo Units 8 and 10) of mowing is ongoing to reduce shrub flame heights.

Natural forest succession would continue under Alternative 1 and over time more acres would transition from low fire behavior potential towards high and extreme fire behavior potential. Currently an estimated 27 percent of the Federal land in the project area is in the low fire behavior category. Included in the 2,951 acres in this category is 56 acres of lava flows, 116 acres in rock pits and 853 acres in meadows, streams, terraces and the river channel. The remaining 1,926 acres includes the recently completed activities mentioned above, wildfires and other lightly vegetated areas.

Under Alternative 1, the area would remain highly susceptible to a large wildfire. During the short term (0 to 10 years), the percentage in the low fire behavior category would remain approximately 27 percent of the

project area as the 437 acres of on-going treatments cancel out an estimated 598 acres of low fire behavior potential that would naturally transition (due to tree and shrub growth) to either a moderate or high/extreme fire behavior category. Over the long term (10 to 20 years), the percentage in the low fire behavior class would fall to 10 percent as recently completed and ongoing fuel reduction activities become less effective due to shrub and tree growth and accumulation of dead and down material, needle cast, limb cast and bark slough. An estimated 90 percent of the project area would be moderate to extreme for fire behavior potential and associated with the heavy fuel loadings within this area would be increased rates of wildfire spread and burn severity. The impacts on forest health, wildlife habitat, soils, water quality, recreational values, public and firefighter safety would continue to increase. Fuels reduction would only occur during a wildfire that, under this alternative, would most likely be a large, very intense event that would be stand replacing over the majority of the fire area such as the Awbrey Hall Fire of 1990 and the Inn Fire of 1989.

Without a large wildife event the FRCC would continue to deviate further from the current condition with a steadily increasing vulnerability to a stand replacing fire. This continued change to an infrequent and intense fire regime would take place in the fire dependent ponderosa pine ecosystem (76 percent of project area) that historically had frequent low intensity fire regimes. Fire starts that escape initial suppression actions would cycle a high portion of the landscape to an early seral stage with high mortality (>90 percent) of the overstory trees regardless of tree size or species.

In the lodgepole pine plant association (9 percent of project area) located in the southern portion of the project area, fuels have continued to accumulate due to beetle mortality, woodcutting and natural regeneration. Fuels are at a level where if a wildfire occurs with low relative humidity and fuel moisture, it would be a intense stand-replacing event. Although the individual stands of lodgepole pine are relatively small (< 500 acres) these areas are contiguous with the thousands of acres of black bark ponderosa pine that are classified as FRCC 2 and 3. Any fire that started within the lodgepole pine stands could quickly move into the adjacent young ponderosa pine stands; setting the stage for a large wildfire that would put both structures and public safety at risk.

Measure #3- Roadside evacuation/access miles treated Suppression would continue to be extremely hazardous for firefighters and some suppression options would be eliminated due to lack of escape routes and safety zones. During the Awbrey Hall Fire of 1990, the main evacuation route (Road 46) was shut down for hours due to fire intensity. During the succeeding 15 years, there has been essentially no strategic fuels reduction activities along evacuation and access roads with the minor exceptions of road 4100-280 and the actual Awbrey Hall fire area itself. Fuel loads along the remaining main roads are higher than they were in 1990. The urban interface areas would continue to accumulate fuels over time under this alternative. The property line between Forest Service and private lands is composed of a mix of previously thinned and unthinned ponderosa pine and lodgepole pine stands that have not had any fuels reduction treatments, with two minor exceptions, for over 15 years. These exceptions are the thinning, chipping and handpiling of 11 acres adjacent to Sunriver in 2003 (Cardinal Bridge) and the mowing of the shrub layer in the Awbrey Hall Fire in the spring of 2005. Over the previous 10 years, Sunriver, Inn of the 7th Mountain and the Highlands subdivision have implemented ongoing cooperative fuels reduction activities on the 390 acres of private lands located within the project area as well as the 3,374 acres of Sunriver and 1,311 acres in the Highlands subdivision contiguous to the project area to provide for defensible space. The primary responsibility for assuring low home ignitability would continue to remain with the homeowner under either alternative (Cohen). Although structure protection has increased, much of the existing fuels component adjacent to the private property line is still capable of moderate to extreme fire behavior under summer wildfire conditions. Fuel breaks (defensible space) have been shown to be effective at saving structures when combined with suppression efforts. The lack of defensible space along access roads and escape routes could compromise suppression activities and endanger firefighters as discussed above. Without suppression activities, fire breaks often fail. These current conditions, associated with no action, could also

compromise public safety due to limited evacuation routes and a high probability of wildfire spotting into and near adjacent private subdivisions and residences.

Measure #4 - Production of Particulate Matter Under Alternative 1, the effects on air quality would occur when high quantities of PM 2.5 and PM 10 are released when inevitable wildfire comes through the project area. These quantities of PM 2.5 and PM 10 released are much higher than what would be released under prescribed fire conditions. This can be attributed to the fact that summer wildfire conditions are usually windier, hotter and drier and consume a greater amount of down woody material, litter, duff, bark and foliage components during both ground and crown fire events. During a high intensity wildfire, smoke emissions of particulate matter of PM 2.5 and PM 10 could range from 500 lbs. to 2,000 lbs or more per acre. This is at least 10 times the effects of mowing and prescribed underburning of the same acre. Where down woody fuels have accumulated and/or stands are dense; particulate matter production of PM 2.5 and 10 may exceed these estimates.

Smoke from wildfires within the project area would impact the communities of Sunriver, Bend, La Pine and Redmond because it would most likely occur under conditions not conducive to smoke dispersion. It is highly likely that air quality within the Three Sisters Wilderness, a Class 1 Airshed, would be adversely affected.

Dust from a denuded wildfire area within the WUI is also a major air quality concern, at least until grasses and forbs become reestablished over one to two growing seasons. As shown in the Skeleton Fire, which destroyed numerous homes on Bend's southeast side in 1996, this effect can last up to two years. Residents whose homes were not destroyed in the fire often awoke to find dust drifts up to18 inches high located inside their attached garage, even with the door closed.

Cumulative Effects of Alternative 1 Since there would be no new proposed activities there would be no cumulative effects. Regardless, there would be the direct and indirect effects noted above from the continued suppression of fire starts, ongoing vegetative growth and recreation use and summarized below.

Measures #1 and #2 - Acres of prescribed burning and/or mowing; Percentage of project area rated as low for fire behavior potential. As discussed previously, the percentage in the low fire behavior class would fall to ten percent as recently completed, ongoing and reasonably foreseeable fuels reduction activities become less effective due to vegetative growth and natural accumulation of fuels over the next 15 to 20 years. The FRCC would deviate further from current conditions with a steadily increasing vulnerability to a stand replacing fire. The trend of more frequent, intense fires that are larger in size and more difficult to control would continue as fuel loadings also continue to increase throughout the project area. Current fuel loads on 73 percent of the project area already exceed the desired fuel loading of five to ten tons per acre for ponderosa pine outside of the river corridor and ten to 15 tons per acre within the river corridor.

Measure #3 Roadside evacuation/access miles treated Only the portion of the Cascades Lakes Highway that is located within the Awbrey Hall Fire of 1990 and mowed in 2005 (AH-1, 478 acres) would be suitable as an access and evacuation route in the event of a wildfire. The remaining major roads within the project area would continue to be unavailable for either evacuation or access routes for direct attack in the event of a wildfire. The rapidly growing population of Central Oregon combined with ongoing fuels accumulation and high open road density means that the incidence of human caused ignition starts within the project area is likely to increase.

Measure #4 Production of Particulate Matter The cumulative effects on air quality would be to have much higher quantities of PM 2.5 and PM 10 released when wildfire occurs within the project area due to the higher burn intensity and increasing fuels accumulation that would occur over time. The amount of acres of vegetation management and fuels reduction activities accomplished within Central Oregon via timber harvest has steadily declined over the last 10 years. This trend has been partially offset by the increase of other fuels reduction

activities without fiber removal such as maintenance underburning and mowing over that same time interval. Much of this increase has occurred on the eastern side of the forest where the effects on human air quality from either wildfire or prescribed underburns is not a concern due to distance and smoke dispersion. The continued deferral of treatment within the WUI would only exacerbate the negative effects on air quality, when wildfire inevitably returns, for the Bend and Sunriver communities.

Direct and Indirect Effects of Alternative 2 *Measures #1 and #2 - Acres of prescribed burning and/or mowing; Percentage of project area rated as low for fire behavior potential.* Under Alternative 2, implementation of proposed treatments would be integrated to reduce the risk of wildfires to the landscape, recreation sites, administrative sites, and the WUI of Sunriver, Inn of the 7th Mountain and Bend. An estimated total of 4,211 acres would have fuels reduction treatments within the WUI of these communities. Fuel treatments in these alternatives include: mechanical shrub treatments (mowing), pruning, underburning, mechanical and handpiling of small trees, pile burning, mechanical slash treatment, thinning trees and whole tree yarding. More than one of these fuel treatments may be used in a given EA unit (Table 3-4) to move towards the desired condition and to ensure that there would be no short term increase in wildland fire risk. An example of multiple treatments would be to thin to remove competing trees and non fire-resistant species such as lodgepole pine, combined with whole tree yarding to eliminate any activity generated fuels. Follow-up treatment of the understory would typically include noncommercial thinning and perhaps mowing of the shrub layer prior to underburning to limit scorch and mortality of trees. The integrated treatment would ensure a reduction of both the crown fire and surface fire potential within the EA units and resultant long-range spotting onto private and other federal lands. These gross overlapping acres are included in Table 3-4. Implementation of treatments would be expected to begin in 2006. Completion of prescribed burning would likely require 5 to 7 years, based on district experience, due to the need to ensure compliance with air quality guidelines and a limited number of days to burn within prescription to meet the Oregon Smoke Management Plan.

Table 3-4 Fuel Treatment Acres

Fuel Reduction Activity	Alt. 2
Prescribed Underburning	1,587
Mowing	2,414
Thinning (burn piles)	3,631
Handpiling (burn handpiles)	1,041

The proposed treatments would help fragment continuous ground and aerial fuels to change these acres to low fire behavior. This, in turn, would make for a safer work environment for firefighters, lower resistance to control and average fire size, reduce spotting and the risk of wildfire entering private lands and aid in the suppression of fires that start on private lands and move toward federal ownership. The intensity of wildfire, within the EA units, under extreme conditions would be reduced and provide suppression forces an opportunity to control a wildfire near the WUI. The use of ladder fuels reduction, thinning, pruning, shrub treatment, and prescribed fire would also begin restoring the role of fire in ponderosa pine ecosystems.

In the first five to ten years, the percentage in the low fire behavior category would increase from 27 percent to approximately 65 percent of the project area as the 437 acres of on-going treatments, the 320 acres of maintenance and 3,570 acres of restoration treatments included with Alternative 2 cancel out the estimated 598 acres of low fire behavior potential that would naturally transition to another category. Over the long term (10 to 20 years), the percentage in the low fire behavior class would gradually fall to 53 percent as the Alternative 2 fuels reduction activities, recently completed, and ongoing fuel reduction activities become less effective due to shrub and tree growth. Depending on vegetative response, wildland fire risk reduction treatments would become less effective in 7 to 10 years for mowing areas and 10 to 15 years for prescribed burn areas. Most all areas would become ineffective in 15 to 20 years with an overall average considering mowing and underburning of 15 years. Not all areas would necessarily become ineffective in 15 to 20 years. For example, prescribed burning conducted west of Bend (Swede Ridge) and adjacent to the Inn of the 7th Mountain in the late1970s has

been shown to be effective at moderating crown fire potential, intensity and rate of spread some 25 years later. At the same time, other areas within the project area (Awbrey Hall Fire) have needed maintenance treatment as soon as ten years, due to the lack of an overstory to suppress shrub response. The strategic placement of the EA units combined with the percentage of the WUI being treated would reduce the overall risk of a large stand replacement wildfire within the project area to a low level. An analysis (Appendix J) was also done to ensure the effectiveness of these fuels reduction activities at reducing fire behavior potential.

Measure #3 Roadside evacuation/access miles treated Alternative 2 would create approximately 13 miles of defensible space along major roads in EA units 102 to 104, 110, 112, 114 to 118, 120 to 122, 124 to 126, 130, 136, 138, 140, 144, 148 and 176. Roads 46, 4100280, 41, 4601, 4600100, 4601220, 4100700, 4120, 4120100, 4100280, and 4100240 are considered public evacuation routes in the event of a fire. Defensible space along the above mentioned roads would be created through vegetation management treatments (mechanical shrub treatments, prescribed underburning, thinning, mechanical and handpiling). This alternative would generally treat areas of hazardous fuels within 300 to 500 feet of the roads to reduce flame heights to under four feet and provide access and evacuation routes for firefighters and the general public. Suppression actions would be considerably less hazardous for firefighters, the effectiveness of aerial delivered retardants would be enhanced and the detrimental effects on soils from an intense wildfire and the need to construct all mechanical firelines would be reduced. All suppression options including the ability to construct handlines would be improved with safe access and defensible space occuring both along the major roads and within the EA units.

Alternative 2 would close approximately 38.4 miles of road within the project area. Under some situations, proposed road density reductions would have the potential to increase response time of ground based suppression resources to fire starts, especially lightning starts, as most human caused fires are in close proximity to open roads. This potential increase in response time could under certain weather and fuel moisture conditions lead to larger fires. However, an increase in response time is not anticipated within the project area because administrative access for firefighting would still be available on 11.9 of the 38.4 miles of roads and the fuels reduction activities within the EA units would cancel out any potential increase in response time because: The roads being obliterated would not typically be used in initial attack due to the need for high clearance vehicles and their narrow road template that is not conducive to a high volume of two-way traffic. At the same time, a reduction in the number of human caused fires can be expected with the road closures.

Measure #4 Production of Particulate Matter Smoke emissions connected with Alternative 2 are of concern due to the project areas proximity to Bend, Sunriver, Inn of the 7th Mountain, surrounding communities and the Three Sisters Wilderness. As discussed before, underburning included with Alternative 2 is generally limited to stands within the southern portion of the project area where the burning window is more favorable. The one exception is EA unit 112 that was mowed in 2005. Through the use of mowing prior to burning, emissions would be reduced versus burning without mechanical shrub treatment. For example, 500 acres of mowing and underburning produce approximately six tons of PM 10 versus 16 tons when burning without mowing. Under Alternative 2, air quality would be affected primarily by smoke produced during prescribed underburning and pile burning activities. Table 3-5, below, displays the type of burning and an estimate of smoke emissions.

Table 3-5. Estimated Smoke Emissions (Measure)

	Total Tons <PM 10	Total Tons <PM 2.5
Landing Piles	6.8	5.9
Underburning	104	101
Hand/Machine Piles	8	7

Burning would be conducted in compliance with National Ambient Air Quality Standards and under the Oregon Smoke Management Plan regulations and restrictions to track smoke produced and monitor emissions. Burning would only be

conducted when prevailing and predicted wind patterns would result in negligible effects to the Bend Designated Area and the Three Sisters Wilderness Class 1 airshed. Implementation of the action alternative, based on the measures included to reduce emissions and to disperse smoke during favorable conditions, is expected to protect air quality in Bend, Sunriver and adjacent communities while having no visible effects to the Three Sisters Wilderness area.

Compared to Alternative 1, fuels treatments included with Alternative 2 would limit potential wildfire size per occurrence and emissions produced. Under extreme fire behavior conditions, the remaining dense stands and areas of high fuel loading could burn intensely and long range spotting may remain a problem. This concern is being addressed by the creation of defensible space under Alternative 2 and the collaborative ongoing fuels treatments on private lands that would allow staging of suppression forces to protect private property and structures during a wildfire.

There would be some dust created from the proposed mechanical operations in Alternative 2 mainly from log haul and the operation of machinery within the EA units. The amount of dust actually created would be near zero since the major log haul roads have paved or dust abated gravel surfacing and secondary native surface haul roads include watering for dust abatement. None of the vegetation management activities would create any cleared areas larger than 1/5 acre in size and dust created during actual operations would be short term and confined to the rare times when machinery was actually moving over bare native surface soils. Provisions that require mechanical operations to occur outside the dry June 1 to September 30 time period means that operations would be less likely to create any measurable dust from snow covered, frozen, or moist soils. Dust from prescribed underburns would not occur because burn prescriptions are designed to retain the duff layer.

Cumulative Effects of Alternative 2 *Measures #1 and #2 Acres of prescribed burning and/or mowing; Percentage of project area rated as low for fire behavior potential* All mechanical fuels reduction activities create measurable amounts of dead and down woody residue. All forest residues from previous vegetation management activities within the project area have been treated and reduction of natural fuels on an additional 411 acres of approved underburning and 26 acres of mowing is ongoing. Alternative 2 includes integrated fuel treatments which disposes of the residue created by vegetation management as well as natural accumulation of fuels. There would be no negative short term or long term cumulative effects on fuels loading from the combination of Alternative 2 and ongoing activities because all mechanical removal requires whole tree removal and hand thinning and piling is done concurrently. Mowing in itself does not reduce fuels. Its value is in rearranging fuels to make ground fuels less flammable while lowering flame heights and speeding decomposition of the forest residues, that is, otherwise, a ten to 15 year process in this project area.

Overall, there would be a substantial cumulative downward trend in the amount of fuel loading and wildland fire risk if Alternative 2 was implemented. Sunriver, Inn of the 7th Mountain and the Highlands subdivision have implemented ongoing cooperative fuels reduction activities on the 390 acres of private lands located within the project area as well as the 3,374 acres of Sunriver and 1,311 acres in the Highlands subdivision contiguous to the project area. For example, Sunriver maintains a six year fuels reduction cycle on common grounds within the community as well as a private residential fuels reduction program. Vegetative material is recycled by composting to improve both air and soil quality. Maintenance of private lands in the low fire behavior category would reduce the risk of a wildfire ignition occurring and moving onto federal lands and is also the main factor in helping to ensure home and structure protection during a wildfire event.

As discussed under the direct and indirect effects of Alternative 2; the percentage in the low fire behavior category (FRCC 1) on Federal lands would increase from 27 percent to approximately 65 percent and gradually fall to 53 percent over the next 15 to 20 years. Modeling of fire behavior by Finney has shown that with strategically designed fuels treatments that the greatest reduction in expected spread rate of a fire occurs with

the first 20 percent of a landscape treated followed by the next quartile. Alternative 2 when combined with existing and planned treatments on both federal and private lands would exceed 50 percent of the project area in the low fire behavior class for the next two decades; providing a high level of protection for private lands, present and future forest values. During that time the 5,075 acres of private land within Sunriver, Inn of the 7th Mountain and Highlands subdivision would be maintained in the low to moderate fire behavior (FRCC 1, 2) categories to continue providing the defensible space that is the primary responsibility of private landowners.

Measure #3 Roadside evacuation/access miles treated Alternative 2 would create approximately 13 miles of defensible space along roads within the project area and when combined with ongoing fuels reduction activities adjacent to road 41 (underburning of BB 90 unit 1, Pine 90 unit 2, Katalo Unit 23) a total of 14 miles of defensible roads would be created. Cumulatively, suppression, evacuation and access for both firefighters and the public would be less hazardous. As mentioned in the previous chapters, road 41 was chosen as the project area boundary to leverage fuels treatments previously completed on the westside of road 41 with defensible space treatments included with Alternative 2 along the eastside of road 41.

Measure #4 Production of Particulate Matter The cumulative effect on air quality from prescribed burning included with Alternative 2 is zero. A study of the cumulative effect of emissions in the Central Oregon area shows that slash burning contributes less than 0.5 percent (0.34 percent) of the PM 10 and less than 1 percent (0.64 percent) of the carbon monoxide in Central Oregon (CAC, 12/97). As stated before, burning would be conducted in compliance with National Ambient Air Quality Standards and Oregon Department of Environmental Quality regulations and restrictions to ensure that there would be no cumulative effects on air quality. In areas where restoration of historic fire regimes is planned, prescribed fire would likely need to occur every 8 to 15 years although the actual frequency is speculative and not foreseeable. The additional 411 acres of prescribed underburning within the project area is also subject to the same restrictions, requirements and regulations and would not have an additive negative effect to air quality within Central Oregon communities.

LRMP/Other Management Direction Consistency LRMP Forest-wide (FF-1 to FF-11) standards and guidelines give direction on wildfire prevention and suppression. Alternative 2 focuses on the prevention of human caused wildfires in and near high use and high risk (FF-1) recreation areas, roads, and beetle killed stands adjacent to private lands by closing roads and strategic placement of EA units to reduce wildland fire risk. Consistent with LRMP FF-9 and Upper Deschutes River Plan V-11, burn plans and silvicultural prescriptions are prepared in advance for all prescribed burning in order to ensure compliance with the Oregon Smoke Management Plan and LRMP. In addition to air quality monitoring of prescribed burns by the Oregon Department of Environmental Quality, Forest Service personnel are routinely posted as lookouts on burn days to track smoke plumes and suspend burning operations to ensure strict compliance with the CAA and to minimize smoke intrusions into designated areas and Class 1 Airsheds.

The *Vegetation Standards and Guidelines* of the Upper Deschutes River Plan includes a target level (LRMP, Amendment #12, V-15) of 10 to 15 tons per acre of standing dead trees, down logs and associated fuel loading for the ponderosa pine PAG and 12 to 24 tons per acre for the mixed conifer (EA unit 124) PAG. A total of 1230 acres within the river corridor (MA-17) would have fuels treatments. All EA unit prescriptions are designed to achieve the desirable range of fuel loading. For example, EA unit 124 is the only mixed conifer PAG. This EA unit would have noncommercial thinning of small live trees followed by handpiling on 13 acres. No dead standing or down trees would be removed in order to meet the target level of 12 to 24 tons per acre. Similarly, the remaining acres within MA-17 also focus on thinning the overstory to reduce crown density and ladder fuels while lowering natural fuels in the understory by mowing and prescribed burning. Consistency with other applicable Upper Deschutes River Plan standards and guidelines is discussed under the Forest Management and Health and Wild and Scenic River Values sections.

The Deschutes LRMP limits prescribed burning in Deer Habitat (MA 7) to an average of 2.5 percent (MA 7-26) of MA 7 annually. Alternative 2 would treat 905 of the 2012 acres of MA 7 within the project area. None of these acres would be prescribed underburned; instead mowing would be used to reduce ladder fuels and the arrangement of ground fuels while providing optimum habitat conditions on deer winter and transition ranges.

Prescribed fuels reduction activities in the EA units in the other management areas (MA 8, MA 9, MA 11) are designed to: retain 5 to 10 tons per acre of coarse woody debris for wildlife habitat and soils enhancement, reduce the risk of stand replacement wildfire, provide defensible space, prevent lodgepole pine encroachment, increase palatability and promote the desired visual condition in ponderosa pine stands (M 8-25, M 9-90, M 9-91, M 11-42). Alternate fuels treatment such as thinning followed by mowing or machine piling would be used as a low cost option to meet silvicultural, soils, fire and air quality objectives (M 8-26) in the portion of the project area north of the Benham Falls road (4100400). Handpiling would be used in scenic areas to meet visual quality objectives (M9-90).

Ecosystem Health Introduction (analysis issue) The terms "Healthy Forests," "Ecosystem Health," and "Forest Health" are often used interchangeably. Ecosystem Health for the East Tumbull project area is defined as a condition where size, structure and species composition are represented in a balanced distribution across the project area and adjacent landscape so that insect, disease and fire are operating within or close to historic conditions while meeting the current and future needs of people for desired levels of uses, values and products as determined by the Deschutes LRMP.

The following measures were used in the analysis: Measure #1 Acres of thinning to maintain or restore forest health and reduce fire, insect and disease related mortality; Measure #2 Acres of prescribed burning or mowing; Measure #3 Acres of treatment that maintain or accelerate the development of late or old structural stage ponderosa pine.

Scope of the Analysis The scope of the analysis is focused on the structural stages defined by the Eastside Screens in the project area. All previous vegetation management activities that included thinning or tree removal in the project area have been completed and there are no other ongoing, -planned or reasonably foreseeable projects that would affect structural stage. These past activities have been incorporated into the existing condition structural stage affected environment section below. A cataloguing of these previous vegetation management activities is not necessary because there are no ongoing negative effects on ecosystem health.

The beneficial effects of 411 acres (BB 90 units 1, 3, 4, 10; Pine 90 unit 2; BB 89 units 8, 10; Katalo units 17, 23) of ongoing and already approved prescribed burning and 26 acres (Katalo Units 8 and 10) of mowing was included in the effects discussion.

Affected Environment-Existing Plant Association Group (PAG) Plant community classification in the Pacific Northwest Region follows guidelines established in FSH 2090.11 (USDA Forest Service, 1991). It is founded on the concept of 'Potential Natural Communities' (PNC). Plant associations are designated as the lowest level of classification for vegetation (FSH 2090.11, 05, definitions). The terms 'plant association' and 'potential natural communities' are interchangeable.

Potential natural communities are composed of those species that are presumed to be most competitive over time (climax) and that will prevent establishment of less competitive (seral) species under present environmental conditions without additional human-caused disturbance. However, plant associations are classified based on vegetation that would occupy a site in the absence of fire. Thus, the historical effects of fire have been excluded from the classifications, even though ponderosa pine for example may have historically

dominated the site. Table 3-6 displays the current vegetative condition by PAG. The 390 acres of ponderosa pine located on private lands overlays the Inn of the 7th Mountain.

Table 3-6 Current Vegetation by PAG and Percent Project Area Acres

Broad PAG	Plant Associations	Approximate Acres	% of Project Area
Open*	Meadow, Cinder, Water	1,025	10%
Lodgepole Pine Dry & Wet	CL-S2-11, CL-S2-14, CL-M3-11, CL-S2-12	936	9%
Ponderosa Pine Dry (pvt)	CP-S2-11	390	4%
Ponderosa Pine Dry & Wet	CP-G2-12, CP-S2-11, CP-S2-12, CP-S2-13, CP-S2-17, CP-S3-11, CP-S3-14	7,570	72%
Mixed Conifer Dry & Wet	CW-S1-12, CW-S1-13 CW-S1-14, CW-S1-15	634	6%
Totals		10,555 ac	100%

* Composed of meadows, Deschutes River, lava flows, cinder and rock pits.

Lodgepole Pine Lodgepole pine is considered highly seral and climax in Central Oregon. Most of the lodgepole plant associations are classified as 'dry' with a few 'wet' associations found along the Deschutes River. Lodgepole is primarily located south of Benham Falls. All of the mature stands of lodgepole pine in the project area have been successfully attacked by successive waves of mountain pine beetles during the 1980's and 1990's killing up to 75 percent of the trees. Since then, lodgepole pine seedlings and saplings have regenerated in the beetle caused openings. Mountain pine beetles have continued to attack the remaining mature trees larger than 9 inches in diameter with endemic beetle mortality killing up to 10 percent of the residual mature trees annually.

Ponderosa Pine Ponderosa pine dominates the project area and is found throughout the lodgepole pine PAG where the small topographic relief of 5 to 10 feet elevation gain allows it to escape frost damage. Almost all the ponderosa pine stands were clear-cut harvested in the 1920 to 1940 time period. A combination of natural regeneration and planting successfully reestablished ponderosa pine on the logged sites. The success of reforestation has resulted in the dense stands of black bark ponderosa pine that cover the project area today. Fully 2/3 of these stands have current densities that exceed the long-term carrying capacity of the sites they occupy. These conditions make this project area susceptible to western pine beetle attacks and combined with a dense shrub component create fuel conditions conducive to large stand replacing fires and rapid fire spread.

Mixed Pine The mixed ponderosa and lodgepole pine stands found in the project area includes those stands where ponderosa pine dominated over lodgepole pine due to frequent, low intensity ground fires. These sites have 20 to 50 large ponderosa pine stumps per acre and were naturally regenerated with wind blown seed. Lodgepole pine often had the advantage on these sites due to seed that can remain dormant in the soil and to a lighter seed that can travel farther with the wind. The lodgepole pine in these stands has subsequently become susceptible to mountain pine beetle attack and heavy concentrations of dead and down trees exist in portions of this stand type. These stands are primarily classified as ponderosa pine dry plant associations, although they are currently transitioning through a lodgepole pine phase. Prevailing ecological thought is that these stands are readily adaptable to conversion to a more pure ponderosa pine composition over time.

Mixed Conifer Mixed conifer vegetation is generally confined to the Benham Falls overlook with a narrow stringer that extends back to the west. This plant association includes one of the few late/old structure (eg., "old growth") ponderosa pine stands (EA unit 124) within the project area. White fir typically forms a widely scattered understory with a ponderosa pine and lodgepole pine overstory that regenerated after clearcutting on the mixed conifer PAG sites.

Affected Environment-Structural Stages and Historic Range of Variability (HRV) Table 3-7 displays HRV by broad plant groups and percent of vegetation within each structure stage for the project area. The current and circa 1900 historic conditions were established by using survey notes, site visits, fire records, type maps, historic disturbance patterns and photos. For a definition of the structure stages used for Eastside Screen consistency see Appendix I. Lodgepole pine forms an exception to the structural stage definitions in that typically it does not reach structure stage VI & VII due to fire, insects and disease. Structure stage V generally can be considered to be a late structural stage stand for lodgepole pine, as it is a short-lived species.

Table 3-7 HRV Comparison to Current Conditions

Plant Association Group (PAG)	Species Composition in order of occurrence	Acres and Proportion of Area (%)	Structure Stage	Historic Percentages	Current Condition
Meadow, Water, Lava, Cinder, Rock	Water, grasses, lava rock flows, cinder, pits	1,025 ac (10%)	Open	1-10%	10%
Lodgepole Pine Dry & Wet	Lodgepole Pine Ponderosa Pine	936 ac (9%)	Early (I/II/III) Middle (IV/V) Late/Old(VI/VII)**	30-70% 20-60% 1-10%	4% 37% 59%
Ponderosa Pine Dry & Wet	Ponderosa Pine Lodgepole Pine	7,960 ac (75%)	Early (I/II/III) Middle (IV,V) Late/Old (VI/VII)	10-30% 10-30% 20-60%	5% 94% 1%
Mixed Conifer Dry & Wet	White Fir Lodgepole Pine Ponderosa Pine	634 ac (6%)	Early (I/II/III) Middle (IV/V) Late/Old (VI/VII)	1-20% 10-40% 30-80%	18% 80% 2%
Totals	All	10,555 ac (100%)	Open (O) Early (I/II/III) Middle (IV/V) Late/Old (VI/VII)	1-10% 10-30% 10-40% 20-60%	10% 6% 79% 5%

** Lodgepole pine Late/Old structural stages (VI/VII) are short-lived and quickly revert to middle structural stage (V) when mountain pine beetle attacks kill the larger trees (10-20 year timeframe).

Affected Environment-Historic Disturbance Regimes The following table documents the historic disturbance regimes that were dominant within the project area based on research done on similar dry pine natural fire regimes (Hopkins 1993, Agee 1990, 1993, Brown 1995, Hardy 2001, Schmidt 2002, Hann and Bunnell 2001).

Table 3-8 Historic Disturbance Regimes

Biophysical Environment	Dominant Disturbance Factors	Disturbance Regimes * (Agee, 1990)	Average Disturbance Patch Size Acres	Typical Landform Setting	Typical Elevation	Aspect
Non-Forest Meadow	na	na	na	na	na	Level
Lodgepole Pine	1) Fire 2) I & D	High Moderate	80 – 150 10 – 1,000	Level, Rolling	4,000	Flat, Various
Ponderosa Pine	1) Fire 2) I &D	Low Low	40 – 100 1 – 20	Elevated and dry Sites	4,500	Flat, Various
Mixed Conifer	1) Fire 2) I & D	High Moderate	100 – 500 100 – 500	Elevated sites & buttes	4,250	N-NE, Various

Low severity regimes: 0-35 yr return interval, 0-75percent trees kill, Moderate severity regimes: 35-100 yr return interval, 26-75% tree kill, High severity regimes: > 100yr return interval, 75% + tree kill

Ecosystem Health Management Direction The LRMP, as amended by the Upper Deschutes River Plan and Eastside Screens, specifies vegetation management activities to minimize fire, insect and disease mortality while providing for ecosystem health and diversity (LRMP FH-1 to FH-5, TM-1 to TM-7, TM-10, TM-55 to

57, 67, MA 7, MA 8, MA 9, MA 11). The Upper Deschutes River Plan explicitly states that "any silvicultural practices which provide long-term benefits to Outstandingly Remarkable Values may be allowed" (Upper Deschutes River Plan V-16). The Eastside Screens amended the LRMP in 1995 to provide additional guidance on commercial timber sales to ensure the conservation of open, park-like stands of ponderosa pine while specifying that thinning should be used to maintain or accelerate the development of these types of conditions (Eastside Screen EA, page 8). Appendix B of the Eastside Screens further prohibits the cutting of live trees greater than or equal to 21 inches in diameter (dbh). Vegetation management activities must meet the seven requirements of 36 CFR 219.27(b) as well as be consistent with direction on invasive plants and noxious weeds.

Target Landscape Condition The long term (50 to 100 years) target condition is move towards the historic conditions shown in Table 3-7. For the East Tumbull project it was defined by the ID team as having less than 50 percent of the project area in the high fire behavior category and less than 40 percent (i.e. 60 percent of the ponderosa pine stands resilient to insects and fire based on the Table 3-7 average of the middle and late/old historic percentage ranges) at risk of epidemic beetle attack for the coming two decades versus 20 percent (or less) long term. Thinning, prescribed fire and mowing would be used to maintain and restore ecosystem health where insect and disease mortality would remain at endemic levels while accelerating the development of open, large, single-stratum ponderosa pine that currently does not exist in a project area where it was historically the dominant stand condition.

Ecosystem Health Environmental Effects The discussion of effects on scenic views, ORVs , wildlife and other resources are included in the appropriate individual resource area.

Direct and Indirect Effects of Alternative 1 *Measure #1 Acres of thinning to maintain or restore forest health and reduce fire, insect and disease related mortality.* No thinning would occur within the project area. Ponderosa pine trees within the project area would remain in an unhealthy condition, within current structural stages, and would not be moving towards Late and Old Structural Stage (LOS) ponderosa pine. The black bark stands would probably not move towards a ponderosa pine LOS future condition due to the continuing mortality of the larger black bark ponderosa pine trees by bark beetles and stand replacing wildfires.

Over the short term (5 to 10 years) an estimated 68 percent of the ponderosa pine, lodgepole pine and mixed conifer stands would remain susceptible to accelerated bark beetle mortality. Current mortality in black bark stands within the subwatershed varies from 1 to 13 dead trees per acre per decade larger than 10 inches dbh. The higher mortality in these stands is indicative of stress and active pockets of beetle mortality can be found throughout the project area. Over the next 10 to 20 years the percentage that would be susceptible to epidemic bark beetle attack can be expected to increase to roughly 80 percent. An epidemic bark beetle outbreak in the susceptible black bark stands could result in up to 50 percent mortality of the ponderosa pine (Eglitis, Zone Entomologist, personal communication 2005) over the next 10 to 30 years. Unlike a thinning from below prescription that leaves the larger, healthier trees; bark beetles tend to "thin from above" by killing the larger trees. Although somewhat beneficial from a diversity standpoint in naturally developed stands this can be extremely negative in the East Tumbull project area where tens of thousands of acres of contiguous ponderosa pine were clear-cut harvested and regenerated to form a landscape that is not resilient to natural disturbances.

Current levels of mountain pine beetle within the lodgepole pine stands would decrease over time; returning to a more endemic level in the next 10 to years due to the lack of mature, live lodgepole pine within the project area that would be needed to sustain current beetle populations. The incidence of dwarf mistletoe within lodgepole and ponderosa pine would continue to slowly increase by an estimated 10 percent per decade.

Measures #2 and #3: Acres of prescribed burning or mowing; Acres of treatment that maintain or accelerate the development of late or old structural stage ponderosa pine. No management activities would occur with the

exception of fire suppression and already approved, on-going projects. On-going, already approved activities include a total of 411 acres (BB 90 units 1, 3, 4, 10; Pine 90 unit 2; BB 89 units 8, 10; Katalo units 17, 23) that would be prescribed burned and 26 acres (Katalo Units 8 and 10) that would be mowed within the project area.

Identical to the fuels and fire hazard reduction effects discussion the project area would remain highly susceptible to a large wildfire. During the short term (0 to 10 years) the percentage in the low fire behavior category would remain approximately 27 percent. Over the long term (10 to 20 years) the percentage in the low fire behavior class would fall to 10 percent as recently completed and ongoing fuel reduction activities become less effective due to increasing shrub and tree growth. In essence the only areas that would be rated as low for fire behavior would be semi-permanent meadows, lava flows, water and mineral pits. The trend of having large stand replacement fires would continue and the absence of integrated thinning, underburning or mowing means it's unlikely that the ponderosa pine within the project area would survive to grow into later structural stages with the exception of the 437 acres of already approved treatment mentioned above.

EA unit 124 is a remnant structure stage 6 (LOS, multi-story) ponderosa pine stand with a heavy white fir understory that is experiencing beetle mortality at rates above endemic levels due to insects and stand replacing wildfires. The 20 acre portion of this stand east of the Deschutes River was heavily killed during a lightning caused stand replacement wildfire in 1998. The heavy white fir understory that developed due to fire suppression is competing with the overstory ponderosa pine and within 20 years up to 20 percent of the residual large trees, within the remaining 13 acres outside the RHCA, could be expected to die. As a popular recreational area the chance of a human-caused fire at Benham Falls is elevated and any fire that started can be expected to kill the remaining old trees within EA unit 124.

Cumulative Effects of Alternative 1 Since there would be no new proposed activities under this alternative there would be no cumulative effects. Effects of already approved activities to underburn 411 acres (BB 90 units 1, 3, 4, 10; Pine 90 unit 2; BB 89 units 8, 10; Katalo units 17, 23) and mow 26 acres (Katalo Units 8 and 10) would be beneficial within the project area.

Measure #1 Acres of thinning to maintain or restore forest health and reduce fire, insect and disease related mortality. Over the next 10 to 20 years the percentage that would be susceptible to epidemic bark beetle attack would increase from 68 to about 80 percent with a steadily increasing level of dwarf mistletoe infection.

Measures #2 and #3: Acres of prescribed burning or mowing; Acres of treatment that maintain or accelerate the development of late or old structural stage ponderosa pine. Under this alternative no management activities would occur with the exception of fire suppression and already approved, on-going treatments consisting of prescribed burning of 413 acres and mowing of 26 acres. The FRCC would continue to deviate further from the current condition and the trend of more frequent, intense fires that are larger in size and more difficult to control would continue as fuel loadings also continue to increase throughout the project area. Currently, the Pilot Butte subwatershed is on a trend to be burned by stand replacing wildfires over the next 50 years. If this trend continues the result is that no LOS stage stands would develop within the project area for the next 200 years.

Direct and Indirect Effects of Alternative 2 *Measure #1 Acres of thinning to maintain or restore forest health and reduce fire, insect and disease related mortality.* A total of 2,627 acres (EA units 104, 109, 117, 120, 122, 130, 132E to 136, 138 to 140, 142, 144, 146 to 149, 176) of black bark stands < 21 inches dbh would be thinned to reduce tree density, ladder fuels and bark beetle risk. An additional 1,004 acres (EA units 102, 103, 105, 108, 110, 115, 116, 118, 119, 121, 124, 125, 141) < 12" dbh would be thinned to reduce ladder fuels and improve forest health by increasing residual growth rates. These stands with the exception of EA unit 124 are generally not at high risk for beetle attack and no live trees larger than 12 inches dbh would be removed.

A total of 6,265 acres within the project area are at high risk of mountain and western pine beetle mortality. Alternative 2 would treat 2,458 acres of the 6,265 acres and reduce overall beetle risk from 68 percent of the forested acres to 40 percent of the forested acres and 36 percent of the project area. Much of the remaining 3,807 acres at risk were not proposed for treatment because they were pure lodgepole pine stands or desirable for wildlife habitat, located on sensitive soils or are within the RHCA of the Deschutes River. Studies done in Central Oregon (Cochran, 1999) have shown that thinning of ponderosa pine trees is extremely effective in reducing susceptibility to beetle attack. It is expected that areas thinned at 60 to 80 square feet of basal area would average less than two beetle and disease killed trees per acre per decade over the next 25 years.

The integrated fuels reduction treatments would ensure that the ponderosa pine trees would continue to develop into later structural stages on more than 50 percent of the project area during both the short and long term. In all areas, no trees over 21" dbh would be removed. Areas treated would have stocking and density levels reduced to be within stand density guidelines developed for the Deschutes National Forest plant associations (Appendix I). Thinning would reduce competitive stress on residual vegetation and help accelerate residual stand growth. Stresses on the large trees in EA unit 124 would be reduced and it is probable that they could be retained for a longer period of time in the forest than if the stresses had not been removed. As important in EA unit 124 would be the elimination of ladder fuels under the large overstory ponderosa pine. Thinned stands of vegetation would be more resilient to fires and insect epidemics. Overall forest health would be greatly improved. Treatments would move the existing vegetative condition towards the desired condition associated with Forest Plan MAs 7, 8, 9, 11 and 17.

Alternative 2 would not remove any mistletoe infected trees larger than 21 inches dbh and the emphasis in the EA units where dwarf mistletoe occurs and thinning is proposed is to maintain the "best of the worst." In other words the larger ponderosa pines would be maintained regardless of mistletoe infection level by thinning to a wider spacing and prescribed underburning. The complete eradication of mistletoe is neither feasible or desirable from a biological and wildlife perspective. The majority of this project area would not have any thinning and some areas of heavily mistletoe infected trees would remain throughout the project area both within ponderosa pine and lodgepole pine stands.

As noted, Alternative 2 defers treatment of pure lodgepole pine stands and similar to Alternative 1 current levels of mountain pine beetle within the lodgepole pine stands would decrease due to the fact that most mature lodgepole pine over 9 inches in diameter would be successfully attacked and killed during the next 10 to 20 years. The incidence of dwarf mistletoe within lodgepole pine would continue to slowly increase.

Measure #2: Acres of prescribed burning or mowing All vegetation management activities included with Alternative 2 are integrated in that the trees cut during thinning would be removed by whole tree yarding or treated within the EA unit by hand or machine piling. Natural fuels within the thinning EA units would be addressed by either mowing or underburning in these stands. In total 4,211 acres would be prescribed underburned, mowed or piled to increase the low fire behavior category from 27 percent to approximately 65 percent of the project area over the next 5 to 10 years. At this level of treatment the potential for a large stand replacement wildfire greater than 500 acres within the project area is low; reversing the trend of having large stand replacement fires. It is likely that the ponderosa pine with low or no dwarf mistletoe infections within the project area would survive to grow into later structural stages that would be sustainable by periodic maintenance burns or mowing such as the 580 acres in EA units 112, 114, 126, 133, 143, 145.

Measure #3: Acres of treatment that maintain or accelerate the development of late or old structural stage ponderosa pine. Within the ponderosa pine plant association group (refer to Table 3-7), none of the forest structure types are within the historic range of variability including stage VI (single) and stage VII (multi-stratum with large trees. Alternatives 2 would thin approximately 3,618 acres of ponderosa pine in middle-aged

structural stages 4 and 5. Vegetative treatments would create a much healthier forest and accelerate the development of vegetation currently in earlier stages towards the later/older stages by two to five decades depending on vegetative response and the inherent site potential of the stand. No structural stage 6 or 7 stands would be thinned with the exception of the 13 acres in EA unit 124. Treatments within EA unit 124 are designed to maintain the current structural stage 6 stand while at the same time reducing ladder fuels and understory competition around individual large ponderosa pine. Reduction of wildland fire risk and competition would be done by hand cutting and piling understory trees less than 12 inches dbh within 25 feet of the large (>21" dbh) ponderosa pine. There would be no commerical timber harvest in this EA unit.

Cumulative Effects of Alternative 2 *Measure #1 Acres of thinning to maintain or restore forest health and reduce fire, insect and disease related mortality.* There are no cumulative effects because there are no ongoing or reasonably foreseeable other thinning projects within the area besides the 3,631 acres proposed with Alternative 2 (including Met CE) that would reduce overall beetle risk from 68 percent of the forested acres to 40 percent of the forested acres and 36 percent of the project area. The effect of this level of treatment would be to minimize the need for future mechanical treatment for the next 20 to 30 years in the EA units.

Measure #2: Acres of prescribed burning or mowing The cumulative effect of the 439 acres of ongoing prescribed underburning and mowing combined with the 4,211 acres of Alternative 2 would be to increase the low fire behavior category from 27 percent to approximately 65 percent of the project area over the next 5 to 10 years; falling to 53 percent over the next 10 to 20 years assuming no other activities would occur during this time period. The potential for a large stand replacement wildfire within the project area would be low; reversing the trend of having large stand replacement fires. During the past 10 years, the district has underburned thousands of acres of ponderosa pine without mechanical treatment to maintain or restore condition class 1 fire behavior identical to the 580 acres of maintenance treatment included with Alternative 2. It is likely during the next 20 to 30 years that maintenance burning of the 65 percent of the project area of low fire behavior potential would buy time to allow future projects to focus on restoration of the historic disturbance regime on the remaining 35 percent of the project area.

Fuels reduction treatments on the 390 acres of private lands located within the project area as well as the 3,374 acres of Sunriver and 1,311 acres in the Highlands subdivision contiguous to the project area would reduce the risk of a wildfire ignition occurring and moving onto federal lands

Measure #3: Acres of treatment that maintain or accelerate the development of late or old structural stage ponderosa pine. The combination of current, already approved and Alternative 2 integrated natural and activity generated fuels treatments would result in at least 60 percent of the ponderosa pine stands within the project area being resilient to insects, disease and wildfire disturbances during the next 20 years while maintaining current structural stages (Appendix I, Table I-8) and accelerating the development of LOS ponderosa pine.

Identical to the measure #1 and #2 discussions, all the past, ongoing and proposed treatments within ponderosa pine stands within the East Tumbull project area have been integrated in that both activity generated fuels and natural fuels have or will have been treated. Maintenance underburning and mowing with little or no mechanical treatment of these stands would allow future projects during the next 20 to 30 years to concentrate on restoration of the remaining ponderosa pine stands within the project area.

LRMP/Other Management Direction Consistency LRMP Forest-wide (FH-1 to FH-5) standards and guidelines give direction on forest health disease and insect prevention. Alternative 2 would be beneficial both short and long-term at preventing a major insect epidemic by proactively using thinning to improve forest health on a landscape basis while decreasing the percentage of forested stands still at risk of accelerated beetle mortality from 68 to 36 percent. The ID team prioritized high risk beetle stands within the project area based on

vicinity to the WUI, diversity, visual and wildlife considerations. Vegetation management is designed to decrease both insect and disease risk by thinning and selecting against diseased and low vigor trees.

A silvicultural prescription (Appendix I) was prepared for all vegetation management activities consistent with Forest-wide standards and guidelines TM-1 to TM-7, TM-10. The retention of 20 to 30 percent of the gross acres of each thinning EA unit and variable density spacing is designed to promote biological diversity (TM-55) and maintain and accelerate the development of structural diversity (TM-56) in an area of uniform stand conditions. The needs for long term stand health and vigor necessitate EA units larger than 40 acres in size. Requirements for wildlife clumps, shrub retention, variable spacing, retention of all trees larger than or equal to 21 inches dbh, and travel corridors complement the eventual development of horizontal diversity (TM-57) in a landscape where clearcut harvesting removed all of the mature ponderosa pine trees. As discussed, fire suppression has allowed lodgepole pine to encroach on areas where ponderosa pine was the dominant or only species historically present (TM-67). The retention of 20 to 30 percent of the gross acres for wildlife in ½ to 30 acre no treatment areas would maintain lodgepole pine and other minor species such as juniper (northern portion of the project area) and white fir for species diversity on the landscape. Pure lodgepole pine stands were excluded from consideration for vegetation management, generally for wildlife habitat retention.

This decision is consistent with the seven vegetative manipulation requirements of 36 CFR 219.27 (b). 1) All proposed vegetation treatments are suited to multiple-use goals as established by the Forest Plan. Vegetation treatments proposed under Alternative 2 would move vegetative conditions towards the desired condition associated with LRMP MA 7, 8, 9, 11 (Appendix I). There are no regeneration treatments proposed in this project although all planned vegetation treatment activities would occur on lands suited for timber production and capable of being adequately stocked within 5 years after the final harvest. 3) Vegetation treatments included an economic analysis; although the greatest dollar return or output of timber were not the primary factors considered in the development of Alternative 2. 4) Vegetation treatments were developed to enhance residual and adjacent stand health while moving towards the desired future condition of forest lands as outlined in the LRMP. 5) Best Management Practices and timber sale contract specifications that mitigate potential adverse effects would be implemented in all proposed vegetation treatments, thus avoiding permanent impairment of site productivity and ensuring conservation of soil and water resources (refer to soil productivity and maintenance and fisheries and hydrology sections). 6) All proposed vegetation treatments were designed to meet the desired condition as outlined in the LRMP; specific to MA 7, 8, 9, 11. Refer to appropriate resource section. 7) No new permanent roads would be constructed to implement activities proposed in Alternative 2. Temporary roads needed during harvest would be obliterated after vegetation management operations were completed. Designated skid roads would be used for logging system design and modern ground based harvest systems required for commercial fiber removal is available and consistent with other resource protection.

This EA is tiered to a broader scale analysis (the Pacific Northwest Region Final Environmental Impact Statement for the Invasive Plant Program, 2005, hereby referred to as the R6 2005 FEIS). The R6 2005 FEIS culminated in a Record of Decision (R6 2005 ROD) that amended the Deschutes National LRMP by adding management direction relative to invasive plants (see Vegetation Management and Noxious Weed section for consistency discussion.

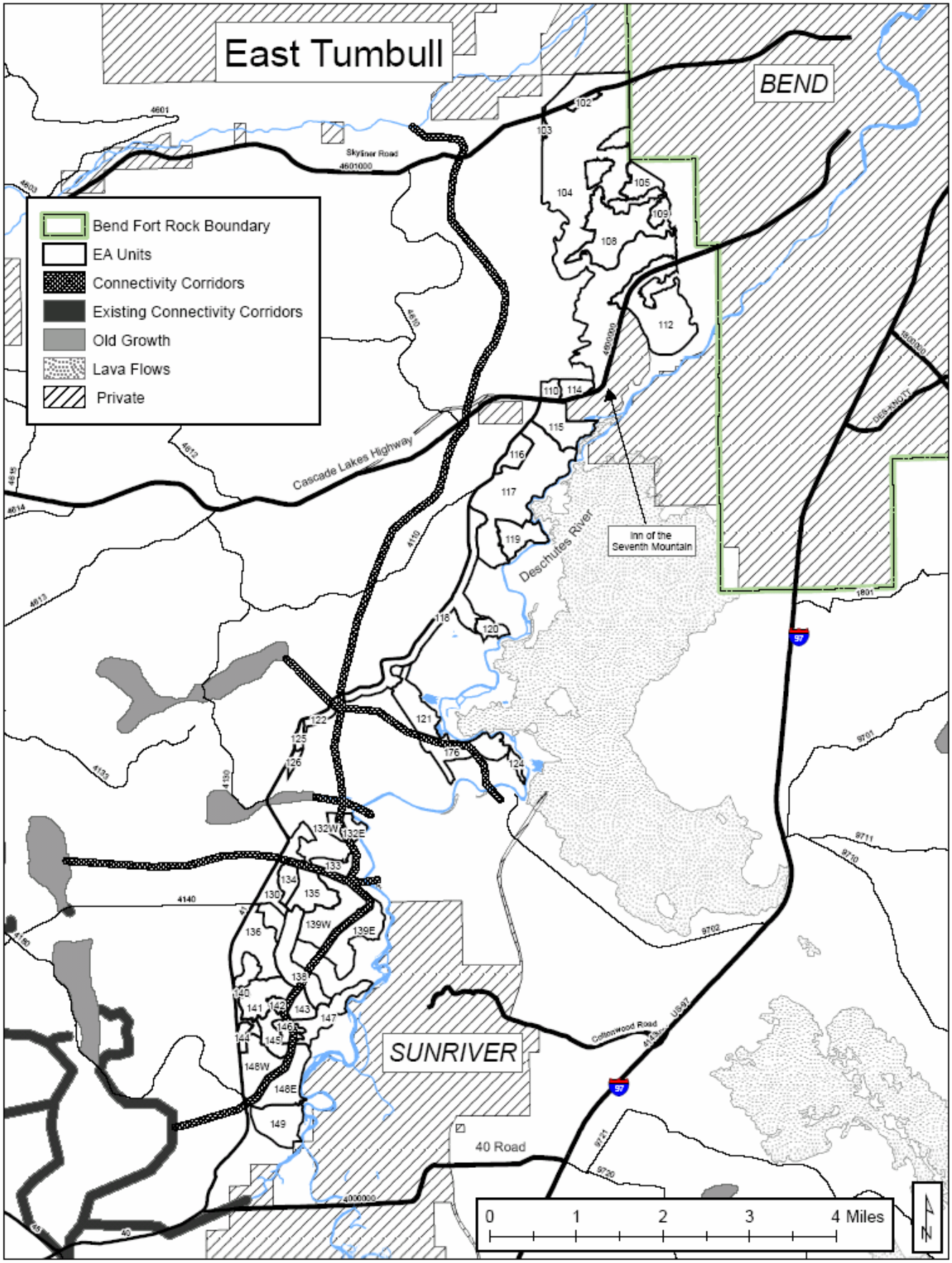
Although determined by a Federal Court decision to be out of date regarding invasive plants, vegetation management activities proposed with the action alternatives are consistent with the ROD for the FEIS for Managing Competing and Unwanted Vegetation and the subsequent Mediated Agreement of 1989. Vegetation management activities that treat competing and unwanted vegetation would not be needed as no evidence supports a prediction that competing and unwanted vegetation would exceed the damage threshold of the site.

Eastside screens consistency: Eastside screens only apply to timber sales. Scenario A is used whenever the ecosystem standard (Table 3-7) documents that any one type of LOS is below the HRV. The timber sale(s) proposed with project meet the interim wildlife direction under Scenario A.

Corridors in a thinned landscape, such as East Tumbull, do not have the same edge related effects as corridors in a clearcut landscape would have. Eastside Screens allows for thinning of corridors even though they would be excluded from vegetation management activity with this project. As noted below, corridors were designated to meet Eastside screen requirements even though LOS is nearly nonexistent within and adjacent to the project area.

NFISH replaced the Eastside Screens riparian standard and a consistency analysis (see Hydrology/Fisheries section) determined that this project meets INFISH direction.

Objective	Meets, Not Applicable	Rationale
Some timber sale activities can occur in LOS stages that are within or above HRV	N/A	Treatments in structural stage 6 EA unit 124 are noncommercial handthinning.
Maintain all live trees ≥21"dbh; manipulate vegetative structure to move towards LOS; maintain and manipulate vegetation in a manner to encourage open, parklike stand conditions	Meets	All live trees ≥ 21: dbh would be maintained. Thinning followed by underburning or mowing is designed to promote this condition in all harvest EA units.
Maintain connectivity and reduce fragmentation of LOS stands by maintaining and enhancing the current level of connectivity.	Meets	400 foot wide connectivity corridors were designated as directed (see map, next page) and excluded from harvest activities.
All sale activities will maintain snags and GTRs at 100% of the maximum population potential using the best available science. Leave 3-6 down log pieces per acre in ponderosa pine with a small end diameter of 12" > than 6 feet in length for a total of 20-40 lineal feet/acre.	Meets	No snags or CWD of any species would be removed. Sale activities would maintain GTRs, snags and CWD above Eastside Screen levels and move towards desired levels as determined by best available science (see *Snags, CWD and GTRs* consistency finding in wildlife section).
Protect every known active and historically used goshawk nest-site from disturbance.	N/A	No known active or historic goshawk sites are within the project area. If a goshawk nest is found the project will be modified to implement Eastside Screen goshawk direction.


East Tumbull
BEND
SUNRIVER
Bend Fort Rock Boundary
EA Units
Connectivity Corridors
Existing Connectivity Corridors
Old Growth
Lava Flows
Private
Skyliner Road
Cascade Lakes Highway
Deschutes River
Inn of the Seventh Mountain
Cottonwood Road
40 Road
DESHOTT
0 1 2 3 4 Miles
N

Soil Productivity Introduction

The long-term sustainability of forest ecosystems depends on the productivity and hydrologic functioning of soils. Ground-disturbing management activities directly affect soil properties, which may adversely change the natural capability of soils and their potential responses to use and management. A detrimental soil condition often occurs where heavy equipment or logs displace surface organic layers or reduce soil porosity through compaction. Detrimental disturbances reduce the soils ability to supply nutrients, moisture, and air that support soil microorganisms and the growth of vegetation. The biological productivity of soils relates to the amount of surface organic matter and coarse woody debris retained or removed from affected sites. Therefore, an evaluation of the potential effects on soil productivity is essential for integrated management of forest resources.

Scope of the Analysis The soil resource may be directly, indirectly, and cumulatively affected within each of the activity areas proposed within the project area. An activity area is defined as "the total area of ground impacted activity, and is a feasible unit for sampling and evaluating" (FSM 2520 and Forest Plan, page 4-71). For this project proposal, activity area boundaries are considered to be the smallest identified area where the potential effects of different management practices would occur. Thus, the discussion of soil effects and soil quality standards will be focused on the units proposed for silvicultural and fuel reduction treatments. The activity areas range in size from approximately 8 acres to 1,002 acres and the analysis considers both the effects of Alternative 2 and post 1970 vegetation management activities on the soil resource. Railroad logging activities before 1970 are not relevant because natural processes have gradually restored soil quality over the past 70 to 80 years. Where appropriate and relevant, the effects discussion is expanded to the project area to provide additional context and intensity.

Quantitative analyses and professional judgment were used to evaluate the issue measures by comparing existing conditions to the anticipated conditions which would result from implementing the proposed actions. The temporal scope of the analysis is defined as short-term effects being changes to soil properties that would generally revert to pre-existing conditions within 5 years or less, and long-term effects as those that would substantially remain for 5 years or longer. This analysis also considered the effectiveness and probable success of implementing the management requirements, mitigation measures, and Best Management Practices (BMPs) which are designed to avoid, minimize or reduce potentially adverse impacts to soil productivity.

Affected Environment-Landscape Characteristics The East Tumbull project area is located on the lower eastern flanks of the Cascade Range in Oregon, where essentially all landforms, rocks, and soil are products of volcanism, glaciation, and major earth movements. Approximately 50 percent of the project area is comprised of gentle to uneven lava plains, ridges and buttes that rise above glacial outwash plains and valley bottomland that comprise about 40 percent of the area. Slopes generally range from 0 to 30 percent with the exception of steeper side-slopes (30 to 70 percent) associated with ridge escarpments, buttes, and side slopes of glacial moraines that comprise the remaining 10 percent of the area. Elevation ranges from about 3,800 feet along the Deschutes River below Lava Island Falls near Meadow Camp to approximately 4,564 feet west of Benham Falls. Mean annual precipitation averages between 12 to 15 inches. The glacial outwash plains, floodplains, and stream terraces contain coarse-textured alluvium and glacial outwash materials that have been reworked by running water from the melting of historic mountain glaciers. Except for a few barren lava flows of minor extent, dominant overlaying soils have developed from volcanic ash and pumice deposits that vary from 10 to 40 inches thick and consist mainly of loose, sand-sized soil particles with little or no structural development.

The sandy textures of these ash-influenced soils have high infiltration and percolation rates that readily drain excess moisture over much of the project area. The underlying residual soils and bedrock materials have a moderate capacity to store water. Most of the water yielded from these lands is delivered to streams as deep seepage and subsurface flows. Segments of the Deschutes River and other perennial, intermittent and ephemeral stream channels occur within the project area (see Hydrology/Fisheries section).

The project area contains 28 landtype units based on similarities in landforms, geology, and climatic conditions that influence defined patterns of soil and vegetation (Soil Resource Inventory, Larsen, 1976). The biophysical characteristics of these landtype units can be interpreted to identify hazards, suitability, and productivity potentials for natural resource planning and management. The dominant ash-influenced soils are moderately deep (20 to 40 inches) to deep (greater than 40 inches) with loamy-sand textures and moderate productivity potential for the growth of vegetation. Soils formed in riparian areas are extremely variable in texture, depth, degree of wetness, and rock fragment content. Soils on terraces above floodplains have better drainage, but hazards associated with high water tables are common and many of these areas are subject to periodic flooding. Most soils in riparian areas are susceptible to soil puddling and compaction damage due to wet soils with low soil strength.

Soils derived from volcanic ash and pumice deposits tend to be non-cohesive (loose) and they have very little structural development due to the young geologic age of the volcanic parent materials. These soil types have naturally low bulk densities and low compaction potential. However, mechanical disturbances can still reduce soil porosity to levels that limit vegetative growth, especially where there is a lack of woody debris and surface organic matter to help cushion the weight distribution of ground-based equipment. Due to the absence of rock fragments on the surface and within soil profiles, these soils are well suited for tillage treatments (subsoiling) that loosen compacted soil layers and improve the soils ability to supply nutrients, moisture, and air that support vegetative growth and biotic habitat for soil organisms. The sandy-textured surface layers are also easily displaced by equipment operations, especially during dry moisture conditions. The maneuvering of equipment is most likely to cause soil displacement damage on the steeper landforms. Due to their lack of plasticity and cohesion, the dominant sandy-textured soils within the project area are not susceptible to soil puddling damage.

On undisturbed sites with gentle slopes, surface erosion occurs at naturally low rates because soils are protected by vegetation and organic litter layers. Surface erosion by water is generally not a concern because dominant landtypes have gentle slopes and low-to-moderate erosion hazard ratings. Accelerated surface erosion is usually associated with disturbances that reduce vegetative cover, displace organic surface layers, or reduce soil porosity through compaction. Soils derived from volcanic ash are easily eroded where water becomes channeled on disturbed sites such as road surfaces, recreation trails, and logging facilities.

Affected Environment-Land Suitability and Inherent Soil Productivity The suitable lands database for the Deschutes LRMP identifies areas of land which are considered to be suitable for timber production using criteria affecting reforestation potential (FSH 2409.13). This data was developed to designate a broad-scale timber base area for forest-wide planning purposes. Lands that do not meet these criteria are considered unsuitable or partially suitable for timber harvest due to regeneration difficulties or the potential for irreversible damage to resource values from management activities.

Dominant landtypes within the East Tumbull project area generally have moderate productivity ratings. All activity areas proposed for commercial and/or non-commercial thinning treatments meet the criteria for land suitability that would allow them to be regenerated or resist irreversible resource damage. The locations of the proposed activity areas exclude barren lava flows and other miscellaneous landtypes with site conditions and soil properties which are considered to be unsuitable for timber production.

Affected Environment-Sensitive Soil Types Based on criteria for identifying sensitive soils to management (Deschutes LRMP Appendix 14, Objective 5), sensitive soils within the East Tumbull project area include: 1) soils on slopes greater than 30 percent, 2) soils with variable depths on rocky lava flows, and 3) soils with seasonally high water tables. There are no landtypes that contain sensitive soils with high or severe ratings for surface erosion. Surface erosion is not a primary concern within the project area due to the dominance of gently

sloping to moderately steep landforms and the inherent porosity of representative soils.

Approximately 2,108 acres of the project area contain landtypes with localized areas of sensitive soils. It should be emphasized that only portions of these total landtype acres actually contain sensitive soils. Landtype delineations for Concern Type 3 (Table 3-9) contain localized areas with seasonally high water tables in swales and depressions only during certain months of the year. The sensitive portions of these landtypes are confined to specific segments of the dominant landform and they are generally too small to delineate on maps.

Table 3-9: Landtype Acres that contain localized areas of Sensitive Soils within the East Tumbull project area (Soil Resource Inventory, Deschutes National Forest, 1976)

SRI Map Unit Symbol	Geomorphology (Representative landforms)	Type of Concern**	Landtype Acres
10, 14, 21, 68, LA, LK	Steep slopes of buttes, lava ridges and glacial moraines	1	1,199
1	Barren, rocky lava flows	2	56
5, 8, 43, WE, WF	Wet meadows, stream terraces and floodplains	3	853

****Management Concerns:** 1) On slopes > 30 percent, loose sandy soils are susceptible to soil displacement. 2) Sensitive soils with variable depths on rocky, uneven lava flows. 3) Potentially wet soils with seasonally high water tables.

Sensitive soil areas that occur within activity areas are discussed under the direct and indirect effects of implementing the management activities proposed under Alternative 2.

Affected Environment-Existing Condition of the Soil Resource The current condition of soils is directly related to soil porosity and the quantity and quality of surface organic matter within the project area. Ground-disturbing management activities (i.e., timber harvest, road building, recreation use and livestock grazing) have caused some adverse changes to soil quality in previously managed areas, especially where mechanical disturbances removed vegetative cover, displaced organic surface layers, or compacted the soil. The following background information is relevant to issue measures developed for tracking the soil productivity issue.

Measure #1: Detrimental Soil Disturbance There is currently no evidence of detrimental soil conditions from natural disturbance events within the East Tumbull project area. Fire history data indicates that the 1990 Awbrey Hall Fire burned vegetation and natural fuels on approximately 700 acres in the northeastern corner of the project area. Although the fire caused high mortality of overstory trees, ground-level heating was generally not elevated to temperatures capable of altering soil properties that affect site productivity. The minor extent of severely burned soil was likely confined to small localized areas where individual logs or stumps were completely consumed by fire. Enough time has passed since the occurrence of this wildfire that existing vegetation and forest litter are providing adequate sources of ground cover to protect mineral soil from water and wind erosion. There are no natural or management-related landslides within the project area. Therefore, natural soil disturbances were not included as existing sources of detrimental soil conditions within any of the activity areas proposed for this project.

Affected Environment-Existing Condition of the Soil Resource (Timber Management) Ground-based railroad logging was used to harvest large-diameter ponderosa pine in portions of the project area during the 1920's and 1930's. Since volcanic ash-influenced soils have naturally low bulk densities and compaction potential, it is expected that natural processes have gradually restored soil quality over the past 70 to 80 years. Soils on previously compacted sites have likely returned to near-natural density levels through frost heaving, freeze-thaw and wetting-drying cycles. The establishment of native vegetation and accumulation of fine organic matter have been improving areas of past soil displacement. Visual evidence of old logging facilities is very difficult to observe due to the abundance of ground cover vegetation and forest litter. Based on more recent harvest history, various silvicultural treatments were implemented between 1970 and 1997. The primary

sources of detrimental soil conditions are associated with the transportation system and existing logging facilities which were used for timber harvest and yarding activities. Temporary roads, log landings, and primary skid trails were constructed and used to access individual harvest units of past timber sales. Most project-related impacts to soils occurred on and adjacent to these heavy-use areas where mechanical disturbances removed vegetative cover, displaced organic surface layers, or compacted soil surface layers. Research studies and local soil monitoring have shown that soil compaction and soil displacement account for the majority of detrimental soil conditions resulting from ground-based logging operations (Page-Dumroese, 1993; Geist, 1989; Powers, 1999; Deschutes Soil Monitoring Reports).

Soil condition assessments were conducted for a representative sample of past harvest treatments that included commercial thinning, intermediate and regeneration harvest prescriptions. Qualitative assessments of soil surface conditions were made by establishing line transects and recording visual evidence of soil disturbance at 5 foot intervals within previously harvested areas. Detrimental soil compaction was the primary disturbance category observed where equipment operations were intensive on main skid trail systems, log landings, and existing roads. Shovel probing was used to assess compaction using resistance to penetration as a measure. Soil displacement, as defined by FSM 2521.03, was more difficult to distinguish due to the establishment of native vegetation and the accumulation of forest litter. Observations suggested that equipment turns or movement generally caused more mixing of soil and organic matter than actual removal from a site. Based on the proportionate extent of overlap of sampled areas within the proposed EA units, these field assessment results are included in the percentages of existing detrimental soil conditions displayed in Tables 3-10 and 3-12.

The extent of detrimentally disturbed soil is dependent on a number of variables including the types of silvicultural prescriptions, the intensity of equipment use with each entry, and the spacing distances between main skid trails. Soil monitoring results on local landtypes and similar soils have shown that 15 to 30 percent of the unit area can be detrimentally disturbed by ground-based harvest systems depending on harvest prescriptions and soil conditions at the time of harvest (Deschutes Soil Monitoring Reports, 1995, 1996, 1997, and 1999). Since most of the past soil disturbances occurred prior to LRMP direction (1990), conservative estimates were used to predict how much surface area is currently impacted by existing roads and logging facilities for the remaining activity areas which were not measured in the field. A combination of harvest history and field investigations of previously managed areas on similar landtypes and soils was used to make conservative estimates of existing soil conditions within each of these activity areas.

The majority of past harvest treatments were intermediate (partial removal) and regeneration harvest prescriptions that typically cause more soil disturbance than thinning prescriptions because equipment use is more intensive throughout activity areas (Deschutes Soil Monitoring Reports 1996, 1997, and 1999). Activity areas which were managed with intermediate harvest prescriptions generally have about 23 percent detrimental soil conditions associated with existing roads and logging facilities. Past regeneration treatments (e.g., shelterwood, overstory removal) generally cause about 6 percent more detrimental soil impacts (29 percent) and commercial thinning treatments result in about 6 percent less soil impacts (17 percent) than disturbed area estimates based solely on the design of skid trail systems and log landings. Based on the proportionate extent of overlap of past treatments with the proposed activity areas, these percentages were used to calculate existing amounts of detrimental soil conditions within the activity areas planned for this project.

Ground-based equipment disturbed soils in portions of approximately 634 acres that occur within the project area. Based on the extent of overlap with the 36 activity areas (EA units) proposed for mechanical vegetation treatments, it was determined that about 278 acres of these previously managed areas occur within portions of nine (9) EA units. There was no overlap of past harvest areas with the other 27 activity areas proposed for mechanical vegetation treatments. Table 3-10 displays specific harvest history and the estimated extent of soil impacts associated with existing logging facilities.

Table 3-10 Past Harvest History within EA units proposed for Mechanical Vegetation Treatment

EA Unit Number	Unit Acres	Project Name and Year of Harvest	Past Harvest Prescription	Treated Acres	Percent of Unit	Existing Detrimental Soil Conditions (Log Facilities) Acres	Percent
130	81	Pitsua Fuelbreak 1977	Thinning	6	7 %	1.4	2 %
135	82	Camp Mistletoe 1970	Regeneration	64	78 %	13.0	16 %
135	82	Kiwi Pine CT 1993	Thinning	65	79 %	5.7	7 %
136	132	Green LP 1981	Intermediate	10	8 %	0.2	< 1 %
138	121	Green LP 1981	Intermediate	13	11 %	0.3	< 1 %
139W	127	Camp Mistletoe 1970	Regeneration	8	6 %	1.8	1 %
140	24	Green LP 1981	Intermediate	13	54 %	3.1	13 %
141	98	Green LP 1981	Intermediate	42	43 %	9.9	10 %
141	98	Green LP 1981	Regeneration	56	57 %	16.6	17 %
144	17	Green LP 1981	Intermediate	5	29 %	1.2	7 %
144	17	Green LP 1981	Regeneration	10	59 %	2.8	17 %
149	97	Camp Mistletoe 1970	Regeneration	50	52 %	14.5	15 %

There have been no restoration treatments, such as subsoiling, which have rehabilitated compacted soil on existing skid trails and log landings within these nine activity areas. The long-term effects of deep compaction still persist where multiple equipment passes were made in previously harvested areas. Impacted soils will remain in a detrimental condition until such time that reclamation treatments are implemented to improve the hydrologic function and productivity on disturbed sites.

Much of the random disturbance between main skid trails and away from landings has decreased naturally over time. Research has shown that the detrimental effects of soil compaction generally require more than 3 to 5 equipment passes over the same piece of ground (McNabb, Froehlich, 1983). Where logs were skidded with only 1 or 2 equipment passes, soil compaction was shallow (2 to 4 inches) and the bulk density increases did not qualify as a detrimental soil condition. Frost heaving and freeze-thaw cycles have restored soil porosity in areas with slight to moderately compacted layers near the ground surface. Other factors that have helped the recovery process include root penetration, rodent activity, wetting and drying cycles, and surface organic matter. The establishment of vegetative ground cover and the accumulation of litter and organic matter has also been improving areas of past soil displacement. There is no evidence that broadcast burn treatments caused any severely burned soil in random locations off designated logging facilities in previously managed areas.

Affected Environment-Existing Condition of the Soil Resource (Site Preparation and Reforestation Activities) Mechanical disturbances from site preparation and reforestation activities can also reduce site productivity through soil compaction and displacement of surface organic layers. During the late 1960's and early 1970's a dozer was commonly used, on areas that did not reforest naturally after the clear-cut harvests of the 1920's and 1930's, to clear brush and prepare sites for reforestation. Brush was often cleared in strips that were about 10 feet wide followed by a planting machine with a V-shaped blade that would clear debris from a space about 3 feet wide while planting tree seedlings down the center of the clearing. Some of these older plantations overlap portions of nine (9) proposed activity areas (EA units 102, 104, 108, 110, 112, 116, 118, 125, and 176). Based on the Regional definition (FSM 2520, R-6 Supplement) for detrimental soil displacement, it is expected that overlap portions of all nine activity areas originally sustained some impacts that exceeded the current standard because the disturbed width of cleared strips was wider than the defined criteria of 5 feet. Since the establishment of Regional and LRMP soil management objectives, this method of removing brush is no longer used as a site preparation practice. Due to the limited amount of equipment traffic (one or two passes) and the cushioning effect of forest litter, it is expected that soils in these areas sustained

only light soil compaction near the ground surface (2 to 4 inches). Frost heaving, freeze-thaw cycles and other natural processes generally offset the short-term effects of compaction near the soil surface.

It is expected that much of the original ground disturbance was likely grubbing of shrubs and roots that did not remove all of the organic surface layers in treatment areas. Some of the soil humus either remained in place or it was mixed with mineral soil during equipment operations. Smaller areas of gouging or the mixing of soil and organic matter does not constitute detrimental displacement because the organic materials were not removed off site. Visual evidence of past displacement damage is difficult to observe due to the abundance of ground cover vegetation and forest litter. Enough time has passed since the occurrence of these mechanical site-preparation treatments that litter from adjacent trees, coupled with the re-establishment of herbaceous grasses, forbs, shrubs, and planted conifers continue to provide fine organic matter for humus development and short-term nutrient supplies on these previously disturbed sites.

Dominant landtypes within all nine of the proposed activity areas have moderate productivity ratings with site index values that range from 60 to 85 for ponderosa pine. In order to determine whether site productivity was adversely affected by past topsoil displacement, site index measurements were taken by a qualified silviculturist on representative plantation trees within one of the proposed activity areas, Unit 118 (Brna, 2005). The site index results of 92 and 104 (average 98) are well above those listed in the plant association guide and soil interpretations for the dominant landtype found within this activity area (Volland, 1982; Larsen, 1976). This could indicate that the combined effects of mechanical site preparation and machine planting operations did not adversely affect soil productivity through displacement of surface organic layers. It could also indicate the effects of reduced plant competition through brush removal and the fact that more soil moisture was available to the planted trees. Regardless of the reason, it is expected that new accumulations of fine organic matter have been improving soil quality over the past 40 years and these sites still remain suitable for timber production. Therefore, the effects of these old soil disturbances were not included as existing sources of detrimental soil conditions within any of the nine (9) affected activity areas.

Affected Environment-Existing Condition of the Soil Resource (Roads and Rock Borrow Pits) Roads detrimentally disturb soil properties and convert the soil resource to a non-productive condition. Most of the precipitation that falls on compacted road surfaces is transmitted as surface runoff, and roads are primary sources of accelerated surface erosion. The project area contains approximately 69 miles of system roads. This equates to approximately 109 acres or 1.1 percent of the project area. Segments of these existing roads, ranging from less than 0.1 to 5.9 miles (0.2 to 8.9 acres), cross through portions of 29 activity areas proposed for mechanical treatments. Some local system roads are currently closed to public use, but segments of these roads may be re-opened to provide necessary access. These roads would be closed again following harvest activities. Road surveys would be conducted to identify where improvements may be necessary to correct drainage problems on existing system roads that would be used as haul routes for this project. The amount of detrimentally disturbed soil committed to existing system roads is included in the estimated percentages displayed in Tables 3-11 and 3-12.

The project area contains portions of eight cinder or rock borrow pits that range in size from six (6) to 45 acres. This equates to approximately 116 acres or one percent of the area. None of these disturbed sites are located within any of the activity areas proposed for mechanical vegetation treatments under the action alternatives.

Affected Environment-Existing Condition of the Soil Resource (Recreation Activities) The extent of detrimental soil conditions associated with recreation use is relatively minor in comparison to the transportation system and past logging disturbances. Soil disturbances are generally confined to relatively small sites where the concentration of human activity often reduces vegetative cover. Current recreational activities include picnicking, boating, hiking, mountain biking, and horseback riding. Developed facilities consist of eight day-

use picnic areas, six trailheads, a boat launch area, and about 46 miles of non-motorized system trails that preclude other uses of the soil for as long as they remain in use. The majority of these recreation facilities are located within and adjacent to streams and riparian areas. The Forest Service conducts annual maintenance of developed sites to prevent erosion problems and impacts to other resource values. It is estimated that approximately 54 acres or 0.5 percent of the project area is currently dedicated to developed recreation facilities. Most of these sites are excluded from planned activity areas and hazard trees are removed as needed. Short segments of non-motorized system trail cross through portions of 21 activity areas proposed for mechanical treatments under Alternative 2. A disturbed width of 6 feet was used to estimate the amount of disturbed soil associated with system trails. This equates to approximately 0.7 acres per mile of trail. The percentages of detrimental soil conditions ranged from 0.1 to 4.5 percent of the unit areas. The amount of disturbed soil committed to recreation trails within proposed activity areas is included in the estimated percentages of detrimental soil conditions displayed in Table 3-12.

Soil impacts from dispersed recreation activities are usually found along existing roads, trails and other management facilities where vegetation has been cleared and soils have been previously disturbed by other land uses. Conservative estimates were used to account for soil disturbances from existing roads and logging facilities. Incidental soil disturbances in other locations are not expected to have a measurable effect on site productivity within the individual activity areas proposed for this project. Detrimental soil disturbances from dispersed recreation use likely account for less than 0.1 percent of the project area. Therefore, the minor extent of detrimental soil conditions from dispersed recreation use is not expected to increase the estimated percentages of detrimental soil conditions for any of the proposed activity areas. Table 3-11 summarizes the current sources and total extent of existing detrimental-soil conditions within the East Tumbull project area.

Table 3-11. Current Sources and Extent of Existing Detrimental-Soil Conditions within the East Tumbull Project Area (10,165 acres)

Land Use Disturbed Acres				Existing Detrimental Soil Conditions	
Logging Facilities	Roads	Recreational Trails & Facilities	Cinder & Rock Pits	Total Acres	Percent of Project Area
130	109	54	116	409	4 %

Based on the extent of overlap with past activity areas, it was concluded that three (3) of the 36 activity areas proposed for mechanical treatments currently have detrimental soil conditions that exceed 20 percent of the unit area. Existing detrimental soil conditions range from 24 to 27 percent (25 percent average) within proposed EA units 135, 141, and 144. Most project-related impacts to soils occurred on and adjacent to heavy-use areas such as skid trail systems, log landings and roads that were used for access in past timber sale units. Within the remaining 33 activity areas, existing detrimental conditions range from 0 to 17 percent and average 3 percent.

Measure #2: Coarse Woody Debris (CWD) and Surface Organic Matter The effects of management activities on soil productivity also depend on the amount of coarse woody debris (CWD) and surface organic matter retained or removed on affected sites. Decaying wood on the forest floor is critical for maintaining the soils ability to retain moisture and provide both short and long-term nutrient supplies and biotic habitat for microorganism populations. Mycorrhizal fungi and other soil organisms depend upon the continuing input of woody debris and fine organic matter. A balance between fuel management objectives and ensuring adequate amounts of CWD is an important goal for maintaining long-term soil productivity. Using mycorrhizal fungi as a bio-indicator of productive forest soils, research studies were used to develop conservative recommendations for leaving sufficient CWD following management activities (Graham et al. 1994, Brown et al. 2003). A minimum of 5 to 10 tons per acre of coarse woody debris (greater than 3 inches in diameter) should be retained on dry, ponderosa pine sites and 10 to 15 tons of CWD per acre on mixed conifer sites to maintain soil productivity. A sufficient number of standing dead snags and/or live trees should also be retained for future

recruitment of organic matter.

Conserving surface litter (i.e., organic materials such as leaves, twigs and branches less than 3 inches in diameter) is also important for protecting mineral soil from erosion, buffering the effects of soil compaction, and supplying nutrients that support the growth of vegetation and native populations of soil organisms. Surface litter also provides on-site moisture retention.

It is expected that adequate amounts of coarse woody debris and surface organic matter currently exist to protect mineral soil from erosion and provide nutrients for maintaining soil productivity within the majority of activity areas. There are some older activity areas, prior to LRMP direction (1990), where management activities likely resulted in less than desired amounts of coarse woody debris (CWD) on the ground. In other portions of the project area, fire suppression has resulted in vegetation conditions that have fuel loadings in excess of historic pre-settlement conditions (Fuels/Smoke Management Section). It is expected that previously managed areas have been improving towards optimum conditions as additional woody materials have accumulated through natural mortality, windfall, and recruitment of fallen snags over time. Annual leaf and needle fall, small diameter branches, twigs and other forest litter have increased organic matter levels for short-term nutrient cycling.

Measure #3: Project Design and Mitigation Cumulative levels of existing and predicted amounts of new soil disturbance need to be considered to determine whether soil quality standards will be met following project implementation. For activity areas that have already been impacted by previous management, project plans need to include options for avoiding, reducing, and mitigating adverse impacts from project activities to meet soil quality standards (see Mitigation Measures and Project Design Criteria).

Soil Productivity Management Direction The Deschutes LRMP specifies that management activities are prescribed to promote maintenance or enhancement of soil productivity by leaving a minimum of 80 percent of an activity area, in a condition of acceptable productivity potential following land management activities (Deschutes LRMP page 4-70, SL-1 and SL-3). This is accomplished by following Forest-wide standards and guidelines to ensure that soils are managed to provide sustained yields of managed vegetation without impairment of the productivity of the land. Standard and Guideline (SL-4) directs the use of rehabilitation measures when the cumulative impacts of management activities are expected to cause damage exceeding soil quality standards and guidelines on more than 20 percent of an activity area. SL-5 limits the use of mechanical equipment in sensitive soil areas. Operations will be restricted to existing logging facilities (i.e., skid trails, landings) and roads, whenever feasible. LRMP Management Areas do not contain specific standards and guidelines for the soil resource. Forest-wide standards and guidelines apply to this project proposal.

The Pacific Northwest Region developed soil quality standards and guidelines that limit detrimental soil disturbances associated with management activities (FSM 2520, R-6 Supplement No. 2500-98-1). This Regional guidance supplements LRMP standards and guidelines, which are designed to protect or maintain soil productivity. Detrimental soil impacts are those that meet the criteria described in the Soil Quality Standards listed below.

Detrimental Compaction in volcanic ash/pumice soils is an increase in soil bulk density of 20 percent, or more, over the undisturbed level.
Detrimental Puddling occurs when the depth of ruts or imprints is six inches or more.
Detrimental Displacement is the removal of more than 50 percent of the A horizon from an area greater than 100 square feet, which is at least 5 feet in width.
Severely Burned soils are considered to be detrimentally disturbed when the mineral soil surface has been significantly changed in color, oxidized to a reddish color, and the next one-half inch blackened from organic

matter charring by heat conducted through the top layer.

The Regional supplement to the Forest service Manual (FSM 2520, R-6 Supplement No. 2500-98-1) provides policy for planning and implementing management practices which maintain or improve soil quality. This Regional guidance is consistent with LRMP interpretations for standards and guidelines SL-3 and SL-4 that limit the extent of detrimental soil conditions within activity areas. When initiating new activities: 1) Design new activities that do not exceed detrimental conditions on more than 20 percent of an activity area, including the permanent transportation system; 2) In activity areas where less than 20 percent detrimental soil impacts exist from prior activities, the cumulative amount of detrimentally disturbed soil must not exceed the 20 percent limit following project implementation and restoration; 3) In activity areas where more than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and should move conditions toward a net improvement in soil quality.

Target Landscape Condition The primary management goal is to maintain or enhance soil conditions at acceptable levels without impairment of the productivity of the land. The extent of detrimental soil disturbances is minimized through the application of management requirements and mitigation measures designed to minimize, avoid or eliminate potentially significant impacts, or rectifying impacts in site-specific areas by restoring the affected environment. The land effectively takes in and distributes water, and erosion rates are controlled to near-natural levels. The biological productivity of soils is ensured by management prescriptions that retain adequate supplies of surface organic matter and coarse woody debris without compromising fuel management objectives and the risk of soil damage from large-scale stand replacement wildfire.

Soil Productivity Environmental Effects

Introduction The best information about the proposed actions (EA, Alternative Descriptions) was used in conjunction with the location of activities to analyze the potential effects on the soil resource. The potential for detrimental changes to soil physical properties was quantitatively analyzed by the extent (surface area) of temporary roads, log landings, and designated skid-trail systems that would likely be used to facilitate yarding activities within each of the proposed activity areas. Professional judgment was used to evaluate changes in the amount and composition of coarse woody debris and surface organic matter. This analysis also considered the effectiveness and probable success of implementing the soil mitigation and resource protection measures which are designed to avoid, minimize or reduce potentially adverse impacts to soil productivity.

The following section, Important Interactions, provides a discussion of the potential effects on soil and biological conditions from implementing the various vegetation management treatments. After this discussion, the environmental effects are presented and tracked by the issue measures used to evaluate the estimated impacts on soil productivity.

Important Interactions The proposed management activities include commercial and non-commercial thinning of forest stands combined with fuel reduction treatments to reduce stand densities and hazardous fuels. Mechanically harvested trees would be whole-tree yarded using a track-mounted harvester and grapple skidders. Most of the slash generated from commercial harvest would be machine piled and burned at log landings. The thinning of non-commercial trees would either be accomplished manually using chainsaws or with the use of specialized machinery where dense stands occur within some treatment units. Low ground-pressure machinery, such as the ASV Posi-track equipped with special attachments, would only be allowed to make a limited number of equipment passes to transport some of the small-diameter material to existing roads or other disturbed sites for use as firewood or processing wood fiber. The handpile-and-burn method would be used in

localized areas where slash accumulations may not meet fuel management objectives. Management activities also include mechanical shrub/slash treatments (mowing) and the use of prescribed fire to reduce fuel loadings and treat the shrub layer.

There would be no new construction of roads that would remain as classified system roads. Approximately 5.8 miles (total) of temporary road would be established or re-established to allow access to 18 of the 36 activity areas proposed for mechanical vegetation treatments. Many of these spur roads would consist of reopening short segments (100 to 7200 feet) of old access roads from previous entries. All of these temporary road segments would be subsoiled (obliterated) upon completion of vegetation management activities. The proposed actions include closing approximately 12 miles of open system roads following project activities. An ID team review of the Upper Deschutes River Plan and East Tumbull project area also identified opportunities to decommission (obliterate) approximately 27 miles of local system roads within the project area because they are no longer needed for long-term access. Soil restoration treatments (subsoiling) would also be applied on some of the primary skid trails and log landings within five (5) of the proposed harvest units to comply with Regional policy and LRMP management direction by reducing the cumulative amount of detrimentally compacted soil.

The effects of ground-based logging disturbances on soil productivity vary based on the types of silvicultural treatments, the duration of activities, and the amount of ground disturbance with each entry. The cumulative amount of soil impacts also depends on existing conditions prior to entry, the ability to reuse previously established landings and skid trail systems, types of equipment, amount of material removed from treatment areas, operator experience, and contract administration. Soil productivity monitoring on the forest has shown that detrimental soil conditions increase each time a stand is treated with mechanical equipment (Deschutes Soil Monitoring Reports 1996, 1997, and 1999). Even with careful planning and implementation of project activities, the extent of detrimental soil conditions can be expected to increase by 5 to 10 percent with each successive entry into a stand (Craigg, 2000).

Soil condition assessments for similar soils and the same types of ground-based harvest systems, research references, local monitoring reports (including the effectiveness of subsoiling treatments), East Tumbull field surveys and observations, and personal communications with local, sale administration and soil scientist personnel were used to predict the potential extent of detrimental soil disturbance associated with this project proposal. Estimates for predicted amounts of detrimental soil conditions account for the expected amount of volume removal, the type of logging equipment, the spacing of skid trails, and the number of log landings that would be needed to deck accumulated materials. Since the same types of mechanical treatments are proposed on similar landtypes and ash-influenced soils, the nature of the effects to the soil resource is similar for project activities that use ground-based equipment to accomplish management objectives.

Mechanical harvest would likely be accomplished using a ground-based machine equipped with a felling head (harvester shear). Feller bunchers are one of the most common harvester machines used in this geographic area. It is expected that similar equipment would be used in proposed activity areas for this project. Felled trees would be whole-tree yarded to main skid trail networks and then transported to landings using grapple skidders. Skidding equipment would be restricted to designated skid trails at all times. It is estimated that skid trails would have an average disturbed width of 12 feet and the average spacing distance between main trails would be approximately 100 feet (11 percent of the activity area). The primary skid trails are not constructed trails when the terrain is gentle to moderately sloping as in the East Tumbull project area. Therefore, surface organic layers are not scraped away by equipment blades or removed off site. These organic materials are either retained near the top of the skid trail, or through operations fluffed to the edges of the trail. It is not mixed deeper into the soil profile, and these organic materials are easily redistributed onto the skid trails during rehabilitation. Based on personal communications with timber sale administrators, the Forest average for log landings is one landing (100 feet by 100 feet) for 10 acres of harvest (approximately 2 percent of the unit area).

The majority of soil impacts would consist of soil compaction on heavy use areas (i.e., roads, log landings, and main skid trails) in known locations that can be reclaimed when these facilities are no longer needed for future management. In unmanaged portions of the proposed activity areas, approximately 13 percent of the harvest unit areas would be dedicated to the development of new logging facilities (11 percent in skid trails plus 2 percent in log landings). This amount was used to analyze the proportionate extent of detrimental soil conditions which are expected to occur in unmanaged portions of some activity areas proposed for mechanical thinning treatments (Table 3-12).

Machine traffic off designated logging facilities would be limited in extent. Mechanical harvesters would only be allowed to make no more than two equipment passes on any site-specific area between main skid trails or away from log landings. Physical impacts to the soil resource incurred by off-trail machine traffic are generally considered to be detrimental where multiple passes are made by heavy equipment on moist or dry soils. Research has shown that the detrimental effects of soil compaction generally require more than 3 to 5 equipment passes over the same piece of ground (McNabb and Froehlich, 1983). Therefore, the effects of only two passes are not expected to qualify as a detrimental soil condition. On gentle to moderately sloping terrain, the maneuvering of equipment generally does not remove soil surface layers in areas that are at least 5 feet in width to qualify as detrimental soil displacement (FSM 2520, R-6 Supplement). Smaller areas of displacement or the mixing of soil and organic matter does not constitute a detrimental soil condition.

Past monitoring information was used to predict the extent of new soil disturbance in activity areas that overlap with previously managed areas. Even with careful planning and implementation of project activities, the extent of detrimental soil conditions can be expected to increase by 5 to 10 percent with each successive entry into a stand (Craigg, 2000). The estimates of detrimental soil conditions account for the expected amount of volume removal and the fact that not all existing logging facilities can be reutilized due to their orientation within units. For the mechanical thinning treatments (both commercial and non-commercial harvest) proposed for this entry, conservative estimates were used to predict how much surface area would likely be impacted by additional logging facilities that would be needed to accommodate the yarding of commercial material. Although existing skid trail networks and log landings would be used wherever possible, the creation of new logging facilities for this type of harvest system would likely cause an average increase of 7 percent detrimental soil conditions within activity areas. This amount was used to analyze the proportionate extent of overlap for previously managed areas that occur within the activity areas proposed for this entry. Table 3-12 displays the percentages of detrimental soil conditions for existing conditions and the predicted effects from project implementation, including soil restoration treatments, for each of the activity areas planned for mechanical vegetation treatments.

Non-commercial thinning by hand felling small-diameter trees would not cause cumulative increases in detrimental soil conditions because machinery would not be used for yarding activities. Prescribed fire or mowing treatments would be used to reduce fuel accumulations within portions of the 34 activity areas proposed for non-commercial thinning. Fuel reductions achieved through planned ignitions usually burn with low-to-moderate intensities that do not cause detrimental changes in soil properties. Mowing these small diameter trees and slash accumulations would not cause soil displacement or compaction damage that qualifies as a detrimental soil condition (Soil Monitoring Report, 1997). The primary factors that limit soil compaction are the low ground pressure of the machinery, the limited amount of traffic (one equipment pass), and the cushioning effect of surface organic matter. Some of these organic materials would remain on the ground to provide additional surface cover. This would have beneficial effects to site productivity as these woody materials gradually decompose and become fine organic matter for humus development in mineral soil.

Commercial harvest and whole-tree yarding can affect soil productivity through the removal of nutrients in the form of tree boles, limbs and branches. Although these forest practices remove potential sources of future CWD, ground-based harvest activities also recruit CWD to the forest floor through breakage of limbs and tops

and toppling of some trees during felling and skidding operations. This would accelerate the accumulation of woody debris where these materials may be currently deficient. These organic materials also provide additional soil cover that improves the soils ability to resist surface erosion. The proposed actions are expected to comply with recommended guidelines that ensure adequate retention of snags and coarse woody debris to meet soil productivity and wildlife objectives.

Fuel Reduction Activities A combination of fuel reduction treatments would be implemented to reduce the potential for intense wildfires and their rates of spread. Fuel treatments include thinning trees, grapple machine and handpile-and-burn methods, mechanical shrub/slash treatments (mowing), and the use of prescribed fire.

Most of the slash generated from commercial harvest would be machine piled and burned on log landings and/or main skid trails. Burning large concentrations of machine-piled logging slash would cause severely burned soil because heat is concentrated in a localized area. However, this slash disposal method would not result in a net increase in detrimental soil conditions because burning would occur on previously disturbed sites. Therefore, there would be no cumulative increase from the predicted amount of detrimentally disturbed soil associated with the mechanical harvest and yarding activities proposed with this project.

Machine piling on temporary roads or main skid trails would have a minimal effect on the overall extent of detrimentally disturbed soil because equipment would operate off the same logging facilities used during yarding operations. The same designated skid trail systems would be used as primary travel routes. The use of specialized equipment such as small backhoes with grapple arms, tracked excavators, and other low ground-pressure machines are capable of accumulating woody materials without moving appreciable amounts of topsoil into slash piles. This fuel reduction method would not cause additional soil impacts because the piling and burning would occur on previously disturbed sites that already have detrimental soil conditions.

Machine piling off designated logging facilities would add cumulatively to other soil disturbances caused during harvest. Post activity review would determine the need for machine piling operations in random locations of activity areas. This method would only be used where machine piling on previously disturbed sites could not be employed and it would not be used on steep slopes or sensitive soils with seasonally high water tables. Approximately 1,526 acres of the 3,631 total acres proposed for mechanical vegetation treatments are tentatively planned for machine piling and burning in portions of 19 activity areas. Based on the amount of slash that would likely be generated from non-commercial thinning activities, the fuel management specialist anticipates that an average of two piles per acre, 15 feet by 15 feet in size, would be required to reduce activity-created slash accumulations (Bisby, 2005). It is estimated that the surface area in slash piles off designated logging facilities would comprise about one (1) percent of the treated portions of these activity areas. These post-harvest activities would be accomplished using low ground-pressure machinery that minimizes the potential for soil impacts. The depth of compaction from only one or two equipment passes is not expected to cause deep, detrimental compaction that would inhibit the growth of vegetation. Natural processes (i.e., frost heaving, freeze-thaw and wetting-drying cycles) generally offset soil compaction near the soil surface. On gentle to moderately sloping terrain, equipment operations that cause small areas of ground disturbance or mixing of soil and organic matter generally do not qualify as a detrimental soil displacement. The dominant sandy-textured soils within the project area are not susceptible to soil puddling damage due to their lack of plasticity and cohesion.

The burning of slash piles can cause severe burning of the soil surface because heat is concentrated in a localized area. Although pile burning would be conducted when the soil surface layer is moist, it is expected that the surface area under machine piles would be severely burned and this would result in a detrimental soil condition. Therefore, one (1) percent of the activity area acreage that is tentatively planned for machine piling/burning was added to the estimates of detrimental soil conditions associated with the mechanical harvest

and yarding activities. Table 3-12 displays existing and predicted amounts of detrimental soil conditions for each of the individual activity areas planned for mechanical thinning and fuel reduction treatments.

The proposed activities also include hand treatments for reducing fuel accumulations in portions of some activity areas. The handpile and burn method would be used to burn small concentrations of woody materials that are well-distributed within activity areas. This non-mechanical fuels treatment does not cause soil displacement or compaction damage. Due to the smaller size of these slash piles, ground-level heating is usually not elevated long enough to detrimentally alter soil properties that affect long-term site productivity. These activities are conducted at times and under conditions that reduce the risk of resource damage, including impacts to soils and understory vegetation. Soil heating is reduced when the soil surface layer is moist, so piles are typically burned following periods of precipitation. Nutrient releases may actually benefit site productivity in these small localized areas. Conservative estimates were used in Table 3-12 to account for the cumulative amount of surface area that could be potentially impacted within activity areas. The cumulative effects to soils from this activity would be relatively minor in comparison to harvest and yarding activities. Therefore, the overall extent of detrimental soil conditions is not expected to increase above the predicted levels in any of the activity areas proposed for these handpile and burn treatments.

Brush mowing activities would not cause detrimental soil displacement and increases in soil bulk density are inconsequential. The primary factors that limit soil compaction are the low ground pressure of the tractor and mowing heads, the limited amount of traffic (one equipment pass), and the cushioning effect of surface organic matter. These activities have been monitored in the past, and results show that increases in soil displacement and compaction do not meet the criteria for detrimental soil conditions (Soil Monitoring Report, 1997).

Prescribed fire would be used to reduce fuel accumulations in some of the activity areas proposed for mechanical harvest and non-commercial thinning as well as other activity areas where prescribed burning would be used exclusively to treat the shrub layer and reduce natural fuels. Prescribed burning activities are conducted at times and under conditions that maximize benefits while reducing the risk of resource damage. The degree of soil heating depends upon fuel type (grass, brush, trees), fuel density, nature of the litter and duff layers (thickness, moisture content), and burn conditions at the time of ignition. For the treatment areas proposed with this project, natural fuel accumulations consist mainly of fine fuels (i.e., decadent brush, tree branches, and needle cast litter) that typically do not burn for long duration and cause excessive soil heating. Based on photo series guides such as *"Photo Series for Quantifying Natural Forest Residues in Common Vegetation Types of the Pacific Northwest" (Maxwell, Ward, 1980)*, the fuel management specialist anticipates that the average amount of coarse woody debris (greater than 3 inches in diameter) following tree thinning and slash pile burning would range from about 5 to 12 tons of per acre over most of the activity areas (Bisby, personal communication). High-to-extreme fire hazard and potential for excessive soil heating exists when downed woody debris exceeds 30 to 40 tons per acre (Brown et al., 2003). Therefore, it is expected that there would be no detrimental changes in soil properties from prescribed burning activities in timber stands because soil moisture guidelines would be included in burn plans to minimize the risk for intense ground-level heating.

Prescribed burn plans would comply with all applicable LRMP standards and guidelines and Best Management Practices (BMPs) prior to initiation of burn treatments. Soil heating during spring burns would be negligible because higher moisture levels at this time of year generally result in cooler burns with lower potential for causing severely burned soil. Fall burning would be conducted following brief periods of precipitation. Prescribed underburns in timber stands would be accomplished under carefully controlled conditions to minimize damage to standing trees. These activities are planned to meet fuel and visual management objectives without removing all of the protective surface cover. It is expected that adequate retention of coarse woody debris and fine organic matter (duff layer) would still exist for protecting mineral soil from erosion and supplying nutrients that support the growth of vegetation and populations of soil organisms. Fuel reductions

achieved through planned ignitions usually burn with low-to-moderate intensities that do not result in severely burned soils. The effects of low-intensity fire do not easily consume material much larger than 3 inches in diameter, and charring does not substantially interfere with the decomposition or function of coarse woody debris (Graham et al., 1994). The successful implementation of these proposed activities would likely result in beneficial effects by reducing fuel loadings and wildfire potential as well as increasing nutrient availability in burned areas.

It is anticipated that mechanical fuel breaks would be used in conjunction with existing roads and natural barriers to effectively control the spread of fire within treatment units. Handlines may also be used to create smaller blocks within the larger activity areas. The extent of disturbed soil would be limited to the minimum necessary to achieve fuel management objectives. In locations where mechanical fuel breaks are necessary, a low-ground pressure ATV machine would pull a small wedge-shaped plow to expose mineral soil in areas approximately 2.5 feet to 3 feet wide. Soil compaction is not a concern because this activity would be accomplished with a single equipment pass. Displaced topsoil and unburned woody debris would be redistributed over mechanical fire line following prescribed burning activities. The disturbed area of handlines would likely be less than 18 inches in width. Therefore, the extent of soil disturbance associated with these activities would not remove surface organic layers in large enough areas, at least 5 feet in width as defined in FSM 2520, to qualify as detrimental soil displacement. Litter from adjacent trees, coupled with the establishment of herbaceous grasses, forbs, shrubs, and tree seedlings will provide new sources of fine organic matter for humus development in the mineral soil.

Soil Restoration Treatments on Roads and Logging Facilities Under the proposed action (Alternative 2), soil restoration treatments would be applied with a self-drafting winged subsoiler to reclaim and stabilize detrimentally compacted soil on specific roads and some of the primary skid trails and log landings following post-harvest activities. Additional treatment options for improving soil quality on disturbed sites include redistributing topsoil in areas of soil displacement damage and pulling available logging slash and woody materials over the treated surface. Individual activity areas that would receive soil restoration treatments are identified by unit number in a site-specific mitigation measure (see Chapter 2).

Under Alternative 2, road decommissioning treatments would include subsoiling to rehabilitate approximately 27 miles of local system road within the project area. A total of approximately 19 miles of these existing roads occur within the proposed activity areas. Road segments, ranging in length from approximately 0.1 to 1.0 miles, cross through portions of 22 activity areas proposed for mechanical vegetation treatments. The soil restoration acres in Table 3-12 include road decommissioning treatments within these affected activity areas. These acres were deducted from the disturbed area estimates after harvest because subsoiled areas are expected to reach full recovery within the short-term.

Decommissioned road segments outside of activity areas would also help reduce the overall amount of detrimental soil conditions within the larger project area. However, the overall reduction would be minor (0.1 percent) due to the limited amount of surface area (approximately 12 acres) associated with these road segments.

As previously described under Affected Environment, extensive areas of the project area have been covered by loose, non-cohesive ash deposits that overlay buried soils that originally formed from basalt and andesite lava. These sandy-textured soils have little or no structural development within the principal root development zone (4 to 12 inches in depth) where changes in soil compaction (bulk density) are assessed according to Regional direction (FSM 2521.03). These are the soil properties which are typically affected by mechanical forces that either reduce or improve soil porosity in the compaction zone. Although equipment traffic during harvest operations can decrease soil porosity on these soil materials, compacted sites can be mitigated physically by

tillage with a winged subsoiler (Powers, 1999). Dominant soils within the project area are well suited for tillage treatments due to naturally low bulk densities and the absence of rock fragments within soil profiles.

The winged subsoiling equipment used on the Deschutes National Forest has been shown to lift and shatter compacted soil layers in greater than 90 percent of the compacted zone with one equipment pass (Craigg, 2000). Subsoiling treatments have been implemented with good success due to the absence of rock fragments on the surface and within soil profiles. Although rock fragments can limit subsoiling opportunities on some landtypes, hydraulic tripping mechanisms on this specialized equipment help reduce the amount of subsurface rock that could potentially be brought to the surface by other tillage implements. Most of the surface organic matter remains in place because the equipment is designed to allow adequate clearance between the tool bar and the surface of the ground for allowing smaller logging slash to pass through without building up. Any mixing of soil and organic matter does not cause detrimental soil displacement because these materials are not removed off site. Since the winged subsoiler produces nearly complete loosening of compacted soil layers without causing substantial displacement, subsoiled areas on this forest are expected to reach full recovery within the short-term (less than 5 years) through natural recovery processes.

Although the biological significance of subsoiling is less certain, these restoration treatments likely improve subsurface habitat by restoring the soils ability to supply nutrients, moisture, and air that support soil microorganisms. Research studies on the Deschutes National Forest have shown that the composition of soil biota populations and distributions rebound back toward pre-impact conditions following subsoiling treatments on compacted skid trails and log landings (Moldenke et al., 2000). The subsoiling specialist and trained crew members work with the equipment operator to identify locations of detrimentally compacted soil. Implementation and effectiveness monitoring is then conducted on treatment areas to assure that soil restoration objectives have been met.

Direct, Indirect and Cumulative Effects The magnitude and duration of potential effects, both physical and biological changes in soil productivity, depend on the intensity of site disturbance, the timing and location of activities, and the inherent properties of the volcanic ash-influenced soils within affected activity areas. Direct effects occur at essentially the same time and place as the actions that cause soil disturbance, such as soil displacement and compaction from equipment operations. Indirect effects occur sometime after or some distance away from the initial disturbance, such as increased runoff and surface erosion from previously compacted areas. Cumulative effects include all past, present, and reasonably foreseeable actions that cause soil disturbance within the same activity areas proposed with this project.

Direct and Indirect Effects of Alternative 1 *Measure #1: Detrimental Soil Disturbance* The effects of past and ongoing management activities were previously described under Affected Environment-Existing Condition of the Soil resource. Under Alternative 1 (No Action), the management activities proposed in this document would not take place. No additional land would be removed from production to build roads or logging facilities for harvest and yarding operations. This alternative would defer opportunities for road decommissioning treatments that would reclaim and stabilize detrimentally compacted soil on some local system roads which are no longer needed for long-term access. There would be no cumulative increase in detrimental soil conditions above existing levels. Although disturbed soils would continue to recover naturally from the effects of past management, the current extent of detrimental soil conditions would likely remain unchanged for an extended period of time.

Soil productivity would not change appreciably unless future stand-replacing wildfires cause intense ground-level heating that results in severely burned soils. Detrimental changes to soil properties typically result from extreme surface temperatures of long duration, such as the consumption of large diameter logs on the forest floor. Although hazardous fuels have been reduced in some previously managed areas, fire exclusion has

resulted in undesirable vegetation conditions and excessive fuel loadings in other portions of the project area (see Fire/Fuels Section). Alternative 1 would defer fuel reduction opportunities at this time.

If a large amount of fuel is present during a future wildfire, soil temperatures can remain high for an extended period of time and excessive soil heating would be expected to produce detrimental changes in soil chemical, physical, and biological properties. Severe burning may cause soils to repel water, thereby increasing surface runoff and subsequent erosion. The loss of protective ground cover would also increase the risk for accelerated wind erosion on the loose, sandy textured soils which are widespread throughout the project area.

Measure #2: Coarse Woody Debris (CWD) and Surface Organic Matter In the short term, the amount of coarse woody debris and surface litter would gradually increase or remain the same. In forested areas, coarse woody materials will continue to increase through natural mortality, windfall, and recruitment of fallen snags over time. Short-term nutrient sources will also increase through the accumulation of small woody material from shrub and tree branches, annual leaf and needle fall, and decomposition of grass and forb plant materials.

In the long term, the accumulation of CWD and forest litter would increase the potential for intense wild land fires which may completely consume heavy concentrations of fuel and ground cover vegetation. High-to-extreme fire hazard and potential for excessive soil heating exists when downed woody debris exceeds 30 to 40 tons per acre (Brown et al., 2003). Intense ground-level fire would likely create areas of severely burned soil and increase the potential for accelerated wind erosion. The loss of organic matter would adversely affect ground cover conditions and the nutrient supply of affected sites. Over time, burned areas would have increased levels of CWD as fire killed trees are recruited to the forest floor.

Measure #3: Project Design and Mitigation Under Alternative 1, there would be no cumulative increase in detrimental soil conditions from the proposed management activities. Implementation of project design criteria and mitigation measures would not be necessary.

Cumulative Effects of Alternative 1 *Measure #1: Detrimental Soil Disturbance* Under Alternative 1 (No Action), the extent of detrimental soil conditions would not increase above existing levels because no additional land would be removed from production to build temporary roads and logging facilities. The effects of past and current management activities were previously described under Existing Condition of the soil resource.

The primary sources of detrimental soil conditions from past management are associated with existing roads and ground-based logging facilities which were used for timber management activities between 1970 and 1997. Some previously managed areas that were treated with intermediate (partial removal) and regeneration harvest prescriptions currently have detrimental soil conditions that exceed 20 percent of an individual activity area. Soil disturbances from recreation use and other management facilities are relatively minor in comparison to existing roads and past logging disturbances. Under Alternative 1, the overall amount of detrimentally disturbed soil combined with soil resource commitments to management facilities would remain at approximately 409 acres or 4 percent of the project area. Disturbed area estimates for existing roads, logging facilities, and recreation trails are included in the percentages of existing detrimental soil conditions for the individual activity areas that contain these facilities (Table 3-12). Existing detrimental soil conditions range from 0 to 27 percent and average 5 percent for the activity areas proposed with this project.

Measure #2: Coarse Woody Debris (CWD) and Surface Organic Matter Under Alternative 1, the amount of coarse woody debris and surface organic matter will gradually increase over time. In the long term, the accumulation of CWD and forest litter would increase the risk for wild land fires.

Measure #3: Project Design and Mitigation Under Alternative 1, implementation of project design criteria and

mitigation of project-related soil disturbances would not be necessary.

Direct and Indirect Effects of Alternative 2 The proposed management activities are identified in the Alternative Descriptions (EA, Chapter 2). Alternative 2 is designed to reduce the potential for intense wildfires and their rates of spread by implementation of commercial and non-commercial tree thinning and a combination of various fuel reduction treatments. The nature of the effects to the soil resource has already been described under "Important Interactions" in the Environmental Effects section.

Measure #1: Detrimental Soil Disturbance The use of ground-based equipment for vegetation management treatments would increase the amount and distribution of soil impacts within the proposed activity areas. The development and use of temporary roads, log landings, and skid trail systems are the primary sources of new soil disturbance that would result in adverse changes to soil productivity. Most soil impacts would occur on and adjacent to these heavy-use areas where multiple equipment passes typically cause detrimental soil compaction. Mitigation and resource protection measures would be applied to avoid or minimize the extent of soil disturbance in random locations between main skid trails and away from log landings. Non-commercial thinning by hand felling small-diameter trees with chainsaws would not cause additional soil impacts because machinery would not be used for yarding activities.

Mechanical shrub and slash treatments would be accomplished using low ground-pressure machinery and soil disturbances from these activities are not expected to qualify as a detrimental soil condition. The depth of compaction from only one or two equipment passes would not reduce soil porosity to levels that would require subsoiling mitigation to restore soil physical properties. On gentle to moderately sloping terrain, the maneuvering of equipment generally does not remove soil surface layers in large enough areas to qualify as detrimental soil displacement (FSM 2520, R-6 Supplement). The dominant sandy-textured soils within the project area are not susceptible to soil puddling damage due to their lack of plasticity and cohesion. However, in activity areas proposed for machine piling/burning off designated logging facilities, one (1) percent of the activity area acreage was added to the estimates of detrimental soil conditions in Table 3-12 because the burned area under the piles is expected to result in a detrimental soil condition.

Prescribed underburns in timber stands are conducted under carefully controlled conditions that maximize benefits while reducing the risk of resource damage. Fuels reductions achieved through planned ignitions usually burn with low-to-moderate intensities that do not result in severely burned soils.

The amount of disturbed area associated with temporary roads and logging facilities would be limited to the minimum necessary to achieve management objectives. Approximately 5.8 miles (8.7 acres) of temporary road would be needed to allow access within 18 of the 36 activity areas proposed for mechanical vegetation treatments. None of the temporary road locations would require excavation of cut-and-fill slopes because they are located on nearly level to gentle slopes (less than 5 percent gradient). These temporary road segments would be decommissioned following their use, so the disturbed area estimates in Table 3-12 are balanced by subsoiling treatments that would reclaim and stabilize compacted road surfaces to improve soil quality.

Since there was only minor overlap with previously managed areas, opportunities to reuse existing skid trail networks and log landings would be limited. Conservative estimates indicate that a total of approximately 471 acres of soil would be removed from production to establish designated skid trail systems and log landings within portions of 36 activity areas proposed for mechanical vegetation treatments. Table 3-12 displays existing and predicted amounts of detrimental soil conditions in acres and percentages for each of these 36 activity areas.

Soil restoration treatments (subsoiling) would be implemented to reduce the cumulative amount of detrimentally compacted soil within five of the proposed activity areas that are expected to exceed the Regional

guidance provided in FSM 2520, R-6 Supplement No. 2500-98-1. Surface area calculations (acres) of designated areas such as roads, main skid trails, and log landings determine how much area needs to be reclaimed within individual activity areas of known size. In order to comply with LRMP management direction and Regional policy, it is predicted that approximately 34 acres of compacted soil on temporary roads and some of the primary skid trails and log landings would need to be reclaimed following their use. The five activity areas are identified by unit number in a site-specific mitigation measure (EA, Chapter 2). Following project implementation including soil restoration treatments (subsoiling), the analysis indicates that the extent of detrimental soil conditions relative to existing conditions would either: 1) remain the same, 2) increase, but remain within the LRMP standard of 20 percent, or 3) decrease levels below existing conditions (Tables 3-12 and 3-13).

Table 3-12. Alternative 2: Estimates of Detrimental Soil Conditions following Mechanical Harvest and Soil Restoration Treatments by Activity Areas.

EA Unit Number	Unit Acres	Existing Detrimental Soil Conditions		Estimated Detrimental Soil Conditions After Harvest		Estimated Detrimental Soil Conditions After Restoration	
		Acres	Percent of Unit	Acres	Percent of Unit	Subsoil Acres	Percent of Unit
102	18	0.6	3 %	2.9	16 %	0.0	16 %
103	8	0.2	3 %	1.3	16 %	0.0	16 %
104	1,002	21.1	2 %	150.3	15 %	0.4	15 %
105	60	0.9	2 %	9.6	16 %	0.0	16 %
108	237	1.4	1 %	35.6	15 %	0.3	15 %
109	24	0.1	< 1 %	3.1	13 %	0.0	13 %
110	25	1.4	6 %	5.0	20 %	0.0	20 %
115	114	2.5	2 %	17.1	15 %	1.0	14 %
116	50	0.5	1 %	7.5	15 %	0.7	14 %
117	326	12.0	4 %	58.7	18 %	4.7	17 %
118	197	4.1	2 %	31.5	16 %	0.4	16 %
119	69	1.5	2 %	10.4	15 %	0.0	15 %
120	25	1.0	4 %	4.3	17 %	0.0	17 %
121	101	3.8	4 %	17.2	17 %	0.1	17 %
122	17	0.3	2 %	2.6	15 %	0.0	15 %
124	13	0.7	5 %	2.3	18 %	0.3	15 %
125	14	0.3	2 %	2.2	16 %	0.0	16 %
130	81	3.3	4 %	13.8	17 %	0.9	16 %
132E	15	0.3	2 %	2.3	15 %	0.0	15 %
132W	15	0.5	3 %	2.6	17 %	0.0	17 %
134	36	0.6	2 %	5.4	15 %	0.0	15 %
135	82	19.7	24 %	26.2	32 %	9.8	20 %
136	132	1.1	< 1 %	18.5	14 %	0.5	14 %
138	121	2.7	2 %	18.2	15 %	1.2	14 %
139E	104	0.8	1 %	15.6	15 %	2.2	13 %
139W	127	4.4	3 %	21.6	17 %	0.0	17 %
140	24	3.6	15 %	6.0	25 %	1.2	20 %
141	98	26.5	27 %	33.3	34 %	13.7	20 %
142	10	0.0	0 %	1.4	14 %	0.0	14 %
144	17	4.2	25 %	5.4	32 %	2.0	20 %
146	15	0.0	0 %	2.1	14 %	0.1	13 %
147	75	1.5	2 %	12.0	16 %	0.7	15 %
148E	91	0.5	< 1 %	12.7	14 %	1.7	12 %
148W	92	0.3	< 1 %	12.9	14 %	0.3	14 %
149	97	16.3	17 %	26.2	27 %	6.8	20 %
176	99	2.2	2 %	14.9	15 %	2.2	13 %

The following conclusions summarize the potential increases in detrimental soil conditions associated with temporary roads and logging facilities that would be needed to facilitate mechanical thinning and yarding operations in each of the 36 activity areas.

Under Alternative 2, an estimated total of approximately 141 acres of soil is currently impacted by existing roads, logging facilities, and recreation trails within 34 of 36 proposed activity areas. It is predicted that the direct effects of the proposed harvest and yarding activities would result in a total increase of approximately 471 acres of additional soil impacts associated with skid trail systems and log landings. Soil compaction would account for the majority of these impacts and the total amount of detrimental soil conditions would be approximately 612 acres prior to soil restoration activities. Subsoiling treatments would be applied on approximately 51 acres of detrimentally compacted soil associated with specific roads and some of the logging facilities within portions of 22 activity areas. Only five (5) of the 22 activity areas would actually require soil restoration treatments to reduce the extent of detrimental soil conditions in order to comply with management direction. Subsoiling in the remaining 17 activity areas is associated with the proposed road decommissioning treatments.

Based on these disturbed area estimates, the percentages of detrimental soil conditions following implementation of project and restoration activities would increase above existing conditions by approximately 3 to 14 percent in 33 of the 36 activity areas proposed for mechanical vegetation treatments. Three (3) of the proposed activity areas would result in a 4 to 7 percent net improvement in soil quality following subsoiling treatments. None of the 36 activity areas would exceed the LRMP standard of 20 percent detrimental soil conditions after soil restoration activities. Therefore, the proposed actions comply with LRMP standards and guidelines SL-3 and SL-4 and Regional policy (FSM 2520, R-6 Supplement No. 2500-98-1) for maintaining or enhancing soil productivity.

Table 3-13 summarizes the predicted changes in detrimental soil conditions from current levels for the combined number of activity areas (units) proposed for mechanical harvest, fuel reduction and soil restoration treatments. This summarized information reflects the net change in detrimental soil conditions for the total area of soil impacts within the individual activity areas (units) as opposed to the entire project area as shown in Table 3-11.

Table 3-13. Summary[1] of Net Change in Detrimental Soil Conditions following Mechanical Harvest and Soil Restoration Treatments.

Net Change in Detrimental Soil Conditions from Existing Condition	Alternative 2 (Proposed Action)		
	Detrimental Soil Conditions		
	<=20%	>20%	Total
Existing Condition	33 units 91 acres	3 units 50 acres	36 units 141 acres
Following Harvest	31 units 515 acres	5 units 97 acres	36 units 612 acres
Post-Project Condition Following Susoiling Mitigation	36 units 561 acres	0 units 0 acres	36 units 561 acres

[1] Summarizes unit specific information found in Table 3-12 .

Sensitive Soils The majority of activity areas proposed for mechanical vegetation treatments do not occur on

landtypes that contain sensitive soils. Only a small percentage (about 3 percent) of the 3,631 acres proposed for mechanical treatment are located on landtypes that contain sensitive soils in localized areas. The sensitive portions of these landtypes are confined to areas with steep slopes (over 30 percent) or specific segments of the dominant landform, such as drainages, swales and depressions that contain potentially wet soils during certain times of the year. None of the proposed activity areas overlap landtypes that contain sensitive soils with high or severe ratings for surface erosion that would require special mitigation.

Total affected landtype acres and proposed units that contain small areas of sensitive soils are displayed by concern category in Table 3-14. Proper locations and design standards can mitigate potentially adverse effects to soils in sensitive areas. Activity areas proposed for mechanical treatment on landtypes that contain sensitive soils are identified by unit number in site-specific mitigation measures (Chapter 2).

Table 3-14: Activity Area (acres) proposed for Mechanical Vegetation Treatments on Landtypes that contain Localized Areas of Sensitive Soils in the East Tumbull project area.

Management Concern	Alternative 2
Slopes greater than 30 percent	34 acres (total) EA Units: 115, 117, 124, 132E, 139E, 142, 146, 147, 148E, 176
Potentially wet soils with seasonally high water tables	70 acres (total) EA Units: 117, 121, 147, 148E, 149

Soil displacement from harvest activities occurs when soil organic layers are scraped or pushed away by equipment or gouged by logs during skidding operations. This type of soil disturbance is most likely to occur on the steeper portions of harvest units. In order to avoid soil displacement damage, activity area boundaries would be adjusted to prohibit equipment operations in portions of activity areas that contain slopes steeper than 30 percent. It is expected that many of these sensitive areas will be included as untreated patches within and adjacent to the proposed units to meet wildlife objectives. On gentle to moderately sloping terrain, the maneuvering of equipment generally does not remove soil surface layers in areas that are at least 5 feet in width (FSM 2520). Smaller areas of soil displacement or the mixing of soil and organic matter would not constitute detrimental soil displacement.

The potential for soil puddling (rutting) and compaction damage is minimized by avoiding equipment operations in localized areas such as drainage bottoms, swales and depressions that contain potentially wet soils. Temporary roads and logging facilities would be located on well-drained sites, upslope from areas with concave shape that likely contain high water tables during certain times of the year. Appropriate buffers would be applied to ensure protection of wetlands, seeps, springs and riparian areas. Activity areas that contain potentially wet soils with seasonally high water tables are identified by unit number in a site-specific mitigation measure (Chapter 2).

The potential for successful regeneration is limited by properties such as soil depth and soil fertility on low productivity sites such as rocky lava flows. The locations of the proposed activity areas exclude barren lava flows and other miscellaneous landtypes with site conditions and soil properties which are considered to be unsuitable for timber production. Dominant landtypes generally have moderate productivity ratings. All proposed activity areas currently have adequate stocking levels and meet criteria for land suitability that would allow them to be regenerated or resist irreversible resource damage.

Measure #2: Coarse Woody Debris (CWD) and Surface Organic Matter The measure for CWD and surface organic matter was evaluated qualitatively based on the probable success of implementing appropriate Best

Management Practices and recommended guidelines that address adequate retention of these important landscape components to meet soil productivity and wildlife habitat objectives (see Wildlife Section and Chapter 2 Mitigation). A minimum amount of 5 to 10 tons per acre of CWD on ponderosa pine sites and 10 to 15 tons per acre on mixed conifer or lodgepole pine sites is recommended to ensure desirable biological benefits for maintaining soil productivity without creating an unacceptable fire hazard.

The proposed harvest activities would reduce potential sources of future CWD, especially where mechanized whole-tree yarding is used in activity areas. However, harvest activities also recruit CWD to the forest floor through breakage of limbs and tops during felling and skidding operations. Existing down woody debris, other than lodgepole pine, would be protected from disturbance and retained on site to the extent possible. Understory trees, damaged during harvest operations, would also contribute woody materials that provide ground cover protection and a source of nutrients on treated sites. It is expected that enough broken branches, unusable small-diameter trees, and other woody materials would likely be available after mechanical thinning activities to meet the recommended guidelines for CWD retention.

Fuel reduction treatments would potentially reduce CWD and some of the forest litter by burning logging slash and natural fuel accumulations. Most of the logging slash generated from commercial harvest would be machine piled and burned on log landings and/or main skid trails. Post-harvest review by fuel specialists would determine the need for prescribed underburn treatments, especially where fine fuel accumlations increase the risk of wildfire to unacceptable levels. If prescribed fire is recommended, burning would occur during moist conditions to help ensure adequate retention of CWD and surface organic matter following treatment. Fuel reductions achieved through planned ignitions usually burn with low-to-moderate intensities that increase nutrient availability in burned areas. Low intensity fire does not easily consume material much larger than 3 inches in diameter, and charring does not substantially interfere with the decomposition or function of coarse woody debris (Graham et al., 1994). Any dead trees killed from prescribed burn treatments will eventually fall to the ground and become additional sources of CWD. Depending on the rate of decay and local wind conditions, many of the small-diameter trees (less than 10 inches) would be expected to fall within the short-term (less than 5 years).

A cool-temperature prescribed burn would remove some of the surface litter and duff materials without exposing extensive areas of bare mineral soil. Some of the direct and indirect beneficial effects to the soil resource include: 1) a reduction of fuel loadings and wildfire potential; 2) increased nutrient availability in localized areas; and 3) maintenance of organic matter that supports biotic habitat for mycorrhizal fungi and microorganism populations.

Measure #3: Project Design Criteria and Mitigation The management requirements, mitigation measures, and project design elements built into Alternative 2 are all designed to avoid, minimize, or rectify potentally adverse impacts to the soil resource from ground-disturbing management activities. Operational guidelines for equipment use are included in project design elements to provide options for limiting the amount of surface area covered by logging facilities and controlling equipment operations to locations and ground conditions that are less susceptible to soil impacts in random locations of activity areas. Existing logging facilities would be reutilized to the extent possible. Grapple skidders would only be allowed to operate on designated skid trails spaced on average of 100 feet apart (11 percent of the unit area). The short-term effects of only two passes by specialized machinery off designated skid trails are not expected to qualify as a detrimental soil condition. Natural processes, such as frost heaving and freeze-taw cycles, can offset soil compaction near the soil surface. Equipment operations would be avoided in random locations of activity areas that contain sensitive soils on steep slopes over 30 percent and potentially wet soils with seasonally high water tables. On gentle to moderately sloping terrain, the maneuvering of equipment generally does not remove soil surface layers in large enough areas to qualify as detrimental soil displacement (FSM 2520, R-6 Supplement). Other examples include

avoiding equipment operations during periods of high soil moisture and operating equipment over frozen ground or a sufficient amount of compacted snow. The successful application of these management practices would help lower the estimated percentages of detrimental soil conditions displayed in Table 3-12.

The project area is located on the eastern flanks of the Cascade Mountain Range where ample snowfall accumulations typically provide favorable winter logging conditions. By skidding over frozen ground or compacted snow, the direct and indirect effects to soils is greatly reduced or eliminated. Soil displacement and compaction are not a major concern when equipment is operated under conditions and in locations which are suitable for winter logging activities. There is no potential for soil puddling damage because dominant soils lack plasticity and cohesion, and equipment operations are discontinued during wet weather conditions. Best results are achieved by skidding over frozen ground (at least 6 inches in depth) or on a compacted snow base (at least 12 inches in depth) if the soil is not frozen. Skidding over shallower snow packs should only be considered during snow accumulation periods and not during melt periods. If the compacted snow base begins to melt due to warmer temperatures or rain-on-snow events, skidding operations would be discontinued until freezing temperatures and/or additional snowfall allows operations to continue. If project implementation includes the use of winter logging operations, it is anticipated that there would be very little or no visual evidence of soil compaction, rutting, displacement, or loss of protective plant and litter cover within activity areas.

Soil restoration treatments (subsoiling) would be applied to reduce the cumulative amount of detrimentally compacted soil within 22 of the 36 proposed activity areas. This would include subsoiling all temporary roads and some of the primary skid trails and log landings in portions of five activity areas which are expected to exceed Regional and LRMP guidelines for detrimental soil conditions. Road decommissioning treatments would also include subsoiling to alleviate compacted road surfaces on about 19 miles of local system road which cross through portions of the 22 activity areas. The predicted amount of detrimental soil conditions was evaluated for each activity area proposed for mechanical vegetation treatments (Table 3-12). The majority of existing and new soil impacts would be confined to known locations in heavy use areas (i.e., roads, log landings and main skid trails) which facilitates where these restoration treatments need to be implemented on compacted sites. Individual activity areas that would receive subsoiling treatments are identified by unit number in a site-specific mitigation measure (EA, Chapter 2). The predicted amount of subsoiled acres within specific activity areas were used for deductions in the estimated percentages of detrimental soil conditions in Table 3-12.

Subsoiling treatments are expected to be highly effective in restoring detrimentally compacted soils. Dominant soils within the project area are well suited for tillage treatments due to naturally low bulk densities and the absence of rock fragments within soil profiles. Restoration treatments, such as subsoiling, are designed to promote maintenance or enhancement of soil quality, and they are consistent with Regional policy (FSM 2520, R-6 Supplement) and LRMP interpretations of standards and guidelines SL-3 and SL-4.

All reasonable Best Management Practices (BMPs) would be applied to minimize the effects of road systems and timber management activities on the soil resource. A variety of BMPs are available to control erosion on roads and logging facilities. The BMPs are tiered to the Soil and Water Conservation Practices Handbook (FSH 2509.22), which contains conservation practices that have proven effective in protecting and maintaining soil and water resource values. The Oregon Department of Forestry evaluated more than 3,000 individual practices and determined a 98 percent compliance rate for BMP implementation, with 5 percent of these practices exceeding forest practice rules (National Council for Air and Stream Improvement, 1999).

Soil moisture guidelines would be included in prescribed burn plans to minimize the potential for intense ground-level heating and adverse effects to soil properties. Under all action alternatives, guidelines for adequate retention of coarse woody debris and fine organic matter are included as management requirements to

assure both short-term and long-term nutrient cycling on treated sites.

If the Responsible Official selects an action alternative, the management requirements, project design elements and mitigation measures are to be implemented during and following project activities to meet the stated objectives for protecting and maintaining soil productivity.

Cumulative Effects of Alternative 2 *Measure #1: Detrimental Soil Disturbance* Alternative 2 would cause some new soil disturbances where ground-based equipment is used for mechanical harvest and yarding activities during this entry. The combined effects of current disturbances and those anticipated from implementing the project activities were previously addressed in the discussion of direct and indirect effects. The majority of project-related soil impacts would be confined to known locations in heavy use areas (such as roads, log landings, and main skid trails) that can be reclaimed through soil restoration treatments. Estimates of existing and predicted amounts of detrimental soil conditions were previously displayed in Table 3-12 and summarized in Table 3-13. Based on these disturbed area estimates, detrimental soil conditions within activity areas proposed for mechanical treatment (after harvest) were predicted to range from 13 to 34 percent with an average of 18 percent. None of the 36 activity areas proposed for mechanical treatments would exceed the LRMP standard of 20 percent detrimental soil conditions after soil restoration activities.

Fuel reductions would mainly be accomplished by whole tree yarding and most of the logging slash would be machine piled and burned on log landings. This management practice would not cause cumulative increases in soil impacts because burning would occur on previously disturbed soils that already have detrimental conditions. Mechanical shrub and slash treatments would be accomplished using low ground-pressure machinery and soil disturbances from these activities are not expected to qualify as detrimental soil compaction due to the low ground-pressure of the equipment, the limited amount of traffic, and the cushioning effect of surface organic matter. In activity areas proposed for machine piling/burning off designated logging facilities, one (1) percent of the activity area acreage was added to the estimates of detrimental soil conditions because the burned area under the piles is expected to result in a detrimental soil condition. Monitoring results have shown that brush mowing activities would not increase the cumulative amount of detrimental soil conditions within activity areas (Soil Monitoring Report, 1997). Slash disposal by the handpile and burn method would not cause a measurable increase in detrimental soil conditions because machinery would not be used and burning small concentrations of slash materials is not expected to cause severely burned soil. Fuel reductions achieved through prescribed underburning in timber stands are conducted at times and under conditions that result in low-to-moderate intensity burns that do not cause detrimental changes in soil properties.

Measure #2: Coarse Woody Debris (CWD) and Surface Organic Matter As previously described for the direct and indirect effects, it is expected that Alternative 2 would comply with the recommended management guidelines that ensure adequate retention of snags, coarse woody debris, and fine organic matter for surface cover, biological activity, and nutrient supplies for maintaining soil productivity on treated sites.

Measure #3: Project Design Criteria and Mitigation Under Alternative 2, project implementation includes the application of management requirements, project design elements and mitigation measures during and following project activities to meet stated objectives for protecting and maintaining soil productivity. Operational guidelines for equipment use provide options for limiting the amount of surface area covered by logging facilities and controlling equipment operations to locations and ground conditions that are less susceptible to detrimental soil impacts within activity areas.

All reasonable BMPs would be applied to minimize the effects of road systems, fuels and timber management activities on the soil resource. The BMPs are tiered to the Soil and Water Conservation Practices Handbook (FSH 2509.22), which contains conservation practices that have proven effective in protecting and maintaining

soil and water resource values.

Soil restoration treatments would be applied to rectify impacts by reclaiming and stabilizing detrimentally disturbed soils committed to roads and logging facilities. Restoration treatments, such as subsoiling, are designed to promote maintenance or enhancement of soil quality, and these conservation practices are consistent with both LRMP management direction and Regional policy.

Foreseeable Actions Common to All Alternatives Future management activities are assumed to occur as planned in the schedule of projects for the Deschutes National Forest. No outyear timber sales are currently scheduled within the East Tumbull project area. On-going fuel reduction activities currently planned within the project area boundaries include: approximately 26 acres of brush mowing and 57 acres of prescribed burning in the Katalo timber sale, approximately 68 acres of prescribed burning in the BB-89 timber sale, approximately 218 acres of prescribed burning in the BB-90 timber sale, and approximately 68 acres of prescribed burning in the Pine-90 timber sale. None of the activity areas associated with these four timber sales overlap with any of the activity areas proposed for treatment with the East Tumbull project. Consequently, there would be no cumulative increase in the extent of detrimental soil conditions beyond the predicted levels displayed for each of the proposed activity areas in Table 3-12. The successful implementation of these fuel reduction treatments would likely result in some beneficial effects to soils in different locations of the project area by reducing fuel loadings and wildfire potential as well as increasing nutrient availability in burned areas.

The proposed extensions of the Storm King Mountain Bike trail (about 2,200 feet) and the Kiwi Springs Mountain Bike trail (about 3,900 feet) would convert about 0.8 acres of soil to a non-productive condition within the East Tumbull project area. This constitutes less than 0.01 percent of the project area. The entire 2,200 feet (0.3 acre) of Storm King trail extension occurs within one proposed activity area; EA Unit 117. Only about 500 feet (0.1 acre) of the Kiwi Springs trail extension crosses through a portion of EA Unit 118. An average disturbed width of 6 feet (0.7 acres per mile) was used to estimate the cumulative increase of detrimentally disturbed soil within these two activity areas. Due to the size of the proposed activity areas, the minor amount of disturbed soil associated with these trail extensions does not increase the estimated percentages of detrimental soil conditions for either of these activity areas (Table 3-12).

Other foreseeable future activities include continued recreation use, standard road maintenance, and prescribed maintenance burning to reduce fuel densities and the risk for future wild land fires.

There are no site-specific mitigation measures or Sale Area Improvement activities recommended by other resource specialists that would cause additional soil impacts from ground disturbing activities.

The effects of recreation use would be similar to those described for Existing Condition of the Soil Resource. Future soil disturbances would be confined mainly to small concentration areas that would have a relatively minor effect on overall site productivity. With the exception of short segments of non-motorized system trails that cross through portions of 21 activity areas, the other developed recreation sites are excluded from the proposed activity areas. Impacts from dispersed recreation activities are usually found along existing roads and trails where vegetation has been cleared on or adjacent to old logging facilities in past harvest areas. Soil disturbances from future recreation use are expected to occur in similar locations. Incidental disturbances from hikers and mountain bikers are not expected to have a measurable effect on site productivity within the individual activity areas proposed for this project. There are no major soil-related concerns associated with the combined effects of these future activities.

Road maintenance activities would reduce accelerated erosion rates where improvements are necessary to correct drainage problems on specific segments of existing road. Surface erosion can usually be controlled by

implementing appropriate Best Management Practices (BMPs) that reduce the potential for indirect effects to soils in areas adjacent to roadways. There are no major soil-related concerns associated with the combined effects of these future activities.

The effects of prescribed maintenance burning would be similar to those described for the direct and indirect effects of Alternative 2. These complimentary activities would be conducted under carefully controlled conditions that maximize benefits while reducing the risk for resource damage. Prescribed burn plans would comply with all applicable LRMP standards and guidelines and BMPs prior to initiation of burn treatments. Soil moisture guidelines would be included in burn plans to minimize the risk of intense heating of the soil surface. The successful implementation of these proposed activities would likely result in beneficial effects by reducing fuel loadings and wildfire potential as well as increasing nutrient availability in burned areas.

Under Alternative 2, the cumulative effects from the proposed actions combined with all past, present, and reasonably foreseeable management activities is summarized for the entire project area in Table 3-15. The net change in detrimental soil conditions is associated with the developed recreation trail extensions (about one acre total) and additional logging facilities that would be retained following post-harvest soil restoration treatments.

Table 3-15. Current Sources and the Cumulative Extent of Detrimental Soil Conditions within the East Tumbull Project Area (10,165 acres)

Land Use Disturbed Acres				Cumulative Detrimental Soil Conditions	
Logging Facilities	Roads	Recreational Trails & Facilities	Cinder & Rock Pits	Total Acres	Percent of Project Area
561	68	55	116	800	8 %

LRMP/Other Management Direction Consistency Under Alternative 2, equipment operations would cause some new soil disturbances in portions of previously managed areas where ground-based logging is proposed for this entry. As previously discussed under direct and indirect effects, the project design elements, management requirements, and Best Management Practices (BMPs) built into this alternative are all designed to avoid or minimize potentially adverse impacts to the soil resource. The amount of disturbed soil associated with temporary roads and logging facilities would be limited to the minimum necessary to achieve management objectives. Compliance with LRMP standard and guideline SL-5 is addressed by excluding small portions of activity areas with sensitive soils on steep slopes (greater than 30 percent) or potentially wet soils with seasonally high water tables. All reasonable Best Management Practices for Timber Management and Road Systems would be applied to protect the soil surface and control erosion on and adjacent to roads and logging facilities that would be used during project implementation. These conservation practices are to be implemented during and following project activities to meet the stated objectives for protecting and maintaining soil productivity.

Soil restoration treatments would be applied to rectify impacts by reducing the amount of detrimentally compacted soil dedicated to existing roads and some of the primary logging facilities within specific activity areas. Restoration treatments, such as subsoiling, are designed to promote maintenance or enhancement of soil quality. These conservation practices comply with LRMP interpretations of Forest-wide standards and guidelines SL-3 and SL-4.

Subsoiling mitigation is also supported by the Forest Service Manual and Regional direction for planning and implementing management activities (FSM 2520, R-6 Supplement No. 2500-98-1). Management objectives for this project are as follows:

In activity areas where less than 20 percent detrimental soil impacts exist from prior activities, the cumulative amount of detrimentally disturbed soil must not exceed the 20 percent limit following project implementation and restoration.
In activity areas where more than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and should move conditions toward a net improvement in soil quality.

Based on disturbed area estimates for Alternative 2, the percentages of detrimental soil conditions following implementation of project and soil restoration activities would increase above existing conditions by approximately 3 to 14 percent in 33 of the 36 activity areas proposed for mechanical vegetation and fuel reduction treatments. The remaining three (3) activity areas would result in a 4 to 7 percent net improvement in soil quality following subsoiling treatments. None of the activity areas would exceed the LRMP standard of 20 percent following implementation of project and restoration treatments. The proposed actions are also expected to comply with recommended guidelines for snags and coarse woody debris retention following both harvest and fuel reduction treatments.

Irreversible and Irretrievable Commitments The action alternatives are not expected to create any impacts that would cause irreversible damage to soil productivity. There is low risk for mechanical disturbances to cause soil mass failures (landslides) due to the inherent stability of dominant landtypes and the lack of seasonally wet soils on steep slopes. Careful planning and the application of Best Management Practices and project design elements would be used to prevent irreversible losses of the soil resource.

The development and use of temporary roads and logging facilities is considered an irretrievable loss of soil productivity until their functions have been served and disturbed sites are returned back to productive capacity. Alternative 2 includes soil restoration activities (subsoiling) that would improve the hydrologic function and productivity on detrimentally disturbed soils. There would be no irretrievable losses of soil productivity associated with reclamation treatments that decommission unneeded roads and management facilities.

Short-Term Uses of the Human Environment and the Maintenance of Long-Term Productivity LRMP management requirements and mitigation measures built into the action alternative ensure that long-term productivity would not be impaired by the application of short-term management practices. The action alternatives would improve soil productivity in specific areas where soil restoration treatments (subsoiling) are implemented on soils committed to roads and logging facilities.

Wildlife Habitat Management Introduction

Similar to the other resource sections general descriptions of the affected environment, scope of the analysis, target (i.e. desired) landscape condition and management direction are followed by the effects analysis. Due to the length of this resource section; LRMP/Other Management Direction Consistency findings were made, where appropriate, under each of the direct, indirect and cumulative effects discussion. Also included under the effects analysis is additional management direction, affected environment information and measures appropriate to understanding the analysis.

Scope of the Analysis The Deschutes National Forest Land and Resource Management Plan (LRMP) (USDA 1990) identified a group of wildlife species as management indicator species (MIS). These species were selected because they represent other species with similar habitat requirements. Management indicator species can be used to assess the impacts of management activities for a wide range of wildlife species with similar habitat needs (FSM 2620.5). Those management indicator species selected for the Deschutes National Forest include the bald eagle, northern spotted owl, golden eagle, red-tail hawk, osprey, northern goshawk, Cooper's

hawk, sharp-shinned hawk, great gray owl, great blue heron, woodpeckers (cavity nesters), peregrine falcon, California wolverine, elk, mule deer, American marten, Townsend's big-eared bat, and waterfowl.

In addition to the above mentioned MIS species there have been a number of wildlife species deemed "species of concern" (Table 3-16) either by the United States Fish and Wildlife Service (USFWS) or through other directives (e.g., neotropical migrant (NTMB), see Birds of Conservation Concern section). The species analyzed in this section include those MIS species known or suspected to occur within the project area, focal species and selected ecological indicator species. Ecological indicator species were selected to represent habitat conditions and species requirements that were not covered by the MIS or focal species. Refer to Table 3-16 for a partial listing of species that have habitat present in the project area and that were analyzed in this resource section. For the reasons discussed above not all species are required to be analyzed. Proposed, endangered, threatened and sensitive (PETS) species have been addressed in the Biological Evaluations for those species which have habitat or the potential to be within the project area (see PETS species section).

The scope of the analysis varies based on the species and wildlife habitat component. For example, effects on elk focuses on the Ryan Ranch KEHA while effects on deer looks at both summer and winter range within the project area as well as effects on overall numbers of animals in the Upper Deschutes herd unit. Snag analysis uses black bark stands within the landscape, Pilot Butte 5th field watershed and the project area.

There are no other ongoing or reasonably foreseeable future activities within the project area that would effect cover. Activities that would effect cover within the Ryan Ranch KEHA, outside of the project area (i.e. Kelsey), were included. Also included is ongoing and reasonably foreseeable activities that could effect forage, snag levels and road density within the KEHA. A laundry list of previously completed activities in the project area and the Pilot Butte 5th field watershed were not included because these past activities have no on-going negative effects; are included in the affected environment and existing condition discussion and they have no bearing on the decision to be made. This analysis also considered the effectiveness of implementing the management requirements and mitigation measures which are designed to avoid, minimize or reduce potentially adverse impacts to wildlife.

Affected Environment-Landscape Characteristics The project area provides a moderate level of habitat diversity for wildlife. Dry, even-aged ponderosa pine forest dominates the area, but there are significant inclusions of lodgepole pine. The majority of the ponderosa pine stands are classified as "black bark" which are generally 50-60 years old with one canopy layer. The relatively low elevation and limited precipitation of the area likely limit the site capability to develop multi-stratum late and old structure (LOS) forest, except on the northern aspects and higher elevations within the project. The potential for single-story LOS is good. The Deschutes River is the eastern boundary of the project, which provides the richest diversity of habitat in the area. Seasonal ponds are adjacent to the river in old oxbows. There are a number of springs adjacent to the river as well. Other than the Deschutes River there are no natural streams, permanent ponds, lakes or man-made guzzlers in the project area. Minor lava outcrops and a few riverside cliffs are the only special or unique habitats. There are no talus slopes, caves, aspen, mountain mahogany, or extensive areas of forested lavas. However, significant stands of aspen occur across the river at the toe slope of a large lava field. Ryan meadow provides valuable habitat to a variety of species. It is near the river and was flooded historically by high spring flows, however diking has eliminated this event.

A total of 2,012 acres of the project area is allocated by the LRMP as big game winter range that is important to mule deer and Rocky Mountain elk. Additionally, another 5,463 acres of biological winter range is present, but higher priority LRMP allocations have superceded it. The Ryan Ranch KEHA, which is a LRMP designation, occupies 73 percent (7,660 ac.) of the project area. Other medium and large mammal species potentially inhabiting this area include black bear, mountain lion, American marten, badger, coyote, and bobcat.

A variety of small mammals and birds occur in the project area. Refer to the following table for a partial listing of species known or suspected to use the project area. Species and groups that have habitat within the project area will be evaluated to determine project activity effects and related recommendations for the project. Table 3-16 is designed to give the reader a landscape overview of the wide range of the diversity of species present within the project area and not an exhaustive listing of all species that were analyzed or utilize the project area.

Table 3-16: Selected Wildlife Species Summary

Species	Abundance*	MIS	USFWS Species of Concern	ODFW Sensitive Species	Ecological Indictor Species**
Northern goshawk (NTMB, MBTA)	S/G5	X	X	X	X (1)
Sharp-shinned hawk (NTMB, MBTA)	S/G5	X			(4)
Cooper's hawk (NTMB, MBTA)	S/G5	X			
Great gray owl	U/G5	X			(1, 2a, 4, 5, 7- LPP thickets, broken topped snags, pocket gophers)
Red-tailed hawk (NTMB, MBTA)	C/G5	X			(7-generalist)
Golden eagle	U/G5	X	BCC (BCR 9)		(6)
Lewis' woodpecker (NTMB, MBTA)	U/G4	X	BCC (BCR 9)		X (2a-large snags, 7-burns)
Pileated woodpecker	U/G5	X			X (1, 2a, 2b)
White-headed woodpecker (MBTA)	U/G4 (declining, BBS)	X	BCC (BCR 9)	X	X (1-PP, 2a, 2b, 7-sugar pine foraging, large LOS patches)
Hairy woodpecker (MBTA)	C/G5	X			X (2a, 2b, 7-burns)
Black-backed woodpecker (MBTA)	R/G5	X		X	X (1-LPP, 2a, 2b, 7-burns)
Williamson's sapsucker (NTMB, MBTA)	R/G5 (declining, BBS)	X	BCC (BCR 9)	X	X (2a-large snags, 2b, 7-higher elevations)
Mule deer	C	X			(7-shrubs winter range)
Rocky Mountain elk	C	X			(5, 7-shrubs winter range)
American marten	R	X		X	X (1-MC, LPP, 7-CWD concentrations)
Townsend's big-eared bat (Pacific western)	S	X	X	X	(3-foraging, 6-caves, lava tubes)
Flammulated owl (NTMB, MBTA)	U/G4		BCC (BCR 9)	X	X (1, 2a, 4, 5-interspersed grassy openings and thickets)
Pygmy nuthatch (migratory, MBTA)	U/G5			X	X (1-PP, 2a, 2b, 7-large trees)
Olive-sided flycatcher (NTMB, MBTA)	U-C/G4 (declining, BBS)		BCC (BCR 5)	X	X (1, 2a, 7-burns, clearings, edges w/ conifers)
Chipping sparrow (NTMB, MBTA)	U/? (declining, BBS)				X (7- open understory w/regenerating pines)
Mountain bluebird (NTMB, MBTA)	U-C/G5				X (2a, 7- burns, openings)

Species	Abundance*	MIS	USFWS Species of Concern	ODFW Sensitive Species	Ecological Indictor Species**
Yellow-pine chipmunk	C				X (2a, 2b)
Green-tailed towhee (NTMB, MBTA)	U/G5				X (3)
Western fence lizard	C				X(2b, 6-rocks)

***Note:** Relative abundance (East Tumbull area only) codes: **C** = common, **U** = uncommon, **R** = rare, **S** = suspected but not confirmed, i.e. potential habitat available/Global Conservation Status: **G4** Apparently Secure, **G5** Secure (source Nature Serve). ** Special habitat requirements codes: **1** = late and old successional forest (LOS), **2a** = snags, **2b** = logs, **3** = mature shrubs, **4** = dense conifers for nesting/foraging, **5** = meadows or grassy openings for foraging, **6** = special/unique habitats (rock, cliffs, caves, etc.), **7** = other, noted. Abbreviations: **LPP** = lodgepole pine, **PP** = ponderosa pine, **MIS** = management indicator species, **MC** = mixed conifer, **CWD** = coarse woody materials (logs and limbs > 3" in diameter), **NTMB** = neotropical migrant bird, **MBTA** = Migratory Bird Treaty Act listing. USFWS Species of Concern (SOC) includes species identified by the 2002 Birds of Conservation Concern (BCC) publication (USDI, 2000) with the applicable Bird Conservation Region (BCR; BCR5 is the Northern Pacific Forest, BCR9 is the Columbia Basin). Other references included: Guenther and Kucera, 1978, USDA, 1990 and 2000, ODFW, 1997, Csuti et al. 2001, Marshall et al. 2003, and USDI, 2001.*

Affected Environment-Historic Range of Conditions The historic structural stages and disturbance regimes were discussed earlier and summarized in Tables 3-7 and 3-8. Little information is known about the historic population levels of wildlife species endemic to the East Tumbull Project area. It is likely those species associated with relatively dry, open ponderosa pine forest with frequent, low intensity wildfire were more common. Fire suppression, timber harvest, road construction, and nearby development on private lands have impacted the wildlife populations of the local area. Species including the flammulated owl, white-headed woodpecker, pygmy nuthatch, Lewis' woodpecker, and olive-sided flycatcher are examples of species that were likely more common historically due to their association with open ponderosa pine forests.

The project area is dominated by relatively young (i.e. "black bark"), even-aged ponderosa pine stands typically less than 80 years old. There is a limited amount (496 ac. or ~5 percent) of classified late successional forest (LOS) in the area. The understory is also relatively simple with bitterbrush, green manzanita, ceanothus, and Idaho fescue being the dominate species. The forest is patchy with the openings allowing for greater shrub cover. Several, large plantations of ponderosa pine occur with the project area. Rocky outcrops with low tree stocking create some horizontal diversity. In general the area is very homogeneous, and the Deschutes River and associated meadows provide the greatest habitat richness.

In comparison to likely historical conditions, ponderosa pine stands were more open and had a greater component of grasses and forbs as compared to the present dominance by shrubs. The percentage of forest in LOS single-story stands was higher due to relatively frequent, low intensity wild fires. The river was unconstrained by an upstream dam and was more variable in its flows. The lack of human impacts along the river together with higher flows may have provided for a broader, richer riparian zone. Additionally, livestock grazing, which terminated in 1996 in the area, may have altered the historic riparian habitats.

Affected Environment-Existing Habitat Conditions, Big Game Both mule deer and elk are designated by the LRMP as MIS. Mule deer utilize the area year round, and due to its low elevation it is particularly important as winter range. The extensive stands of bitterbrush (*Purshia tridentata*) provide critical forage resources during the winter months for deer. There are an estimated 1,400 mule deer (63 percent of Management Objective; M.O.) and 500 elk (71 percent of M.O.) in the Upper Deschutes herd unit. The ODFW herd objectives for the unit are 2,200 mule deer and 700 elk, which has been agreed upon by the Forest Service in the LRMP. Historic survey data indicates a mule deer population from 1958 to 1968 that ranged from 1,900 to 2,500 animals. Actual elk estimates are unavailable as surveys were not done for them but the overall numbers of elk in the herd that utilizes the East Tumbull project area and the Ryan Ranch KEHA has been showing a slow upward trend (source Glen Ardt and Steve George, ODFW).

As previously noted, approximately 19 percent of the project area is classified as winter range (i.e. LRMP Management Area 7, Deer Habitat). However, the plan allocations for Scenic Views and Intensive Recreation are in essence overlaying biological winter range. Biological winter range delineates the biological potential of the area developed during the Integrated Fuels Strategy process (1998). It is not considered an official allocation in the Deschutes LRMP; however, it was recognized by ODFW as an important area for mule deer. The current Tumalo Cooperative Winter Range Closure Area (Appendix H) applies to the project area from its northern boundary to a point about 8 miles southwest of Bend in the vicinity of Benham Falls. This area in essence is biological winter range regardless of the LRMP management area allocations.

Hiding cover provides security for deer and elk during the hunting season, from poachers, and some predator species. It was classified using the basic definition of Thomas (1979), which requires vegetation capable of hiding from the view of a human 90 percent of a standing adult deer or elk at 200 feet or less. The following table summarizes the existing condition of deer hiding cover for the East Tumbull Project area. It stratifies the project area by winter range, summer range, and project-wide (i.e. all MAs) for each hiding cover class.

The LRMP objective for winter range is a 40:60 ratio of cover to forage. The cover should be comprised of 10 percent hiding cover and 30 percent thermal cover (LRMP 4-113). For summer range a minimum of 30 percent hiding cover is required (LRMP WL-54). The existing conditions meet the hiding cover objective for mule deer and elk on both winter and summer ranges.

Table 3-17: Existing East Tumbull Project Area Deer and Elk Hiding Cover (Acres)

LRMP Mgmt. Area	WRHU*	Deer Hiding Cover Classes			Non-Forest	Net/Gross Cover	Current Cover Percentage
		Acceptable	Marginal (gross/net)	Non-cover			
Winter Range (MA 7)	Kiwa (partial)	88	784/392	1074	53	480/1946	25
Summer Range (all but MA 7)	NA	1335	2572/1286	4013	234	2621/7920	33
Projectwide	NA	1423	3356/1678	5087	287	3101/9866	31

***Notes**: 1) Acceptable cover stands must have 75%+cover. If a patch was less than 400 feet across, it was less likely to be considered acceptable (but may meet marginal). 2) Marginal cover stands must have 50-74% cover and are calculated using 50% of the gross acerage for the actual acres of cover. The standard used in classifying marginal cover was that no more than 50% of a photo interpretation (PI) stand could be in non-cover types (e.g. shrubs). The patches meeting cover also had to be well distributed across the stand. 3) Non-cover are those stands with less than 50% cover. Non-cover includes forested habitats that have the potential to become cover. 4) Non-forest is incapable of becoming cover, e.g. meadows, cinder pits, rock, xeric shrublands, and semi-forest and is not used in the cover percentage calculations. 5) Net/Gross cover acres include only those categories capable of becoming cover. It is assumed that semi-forest (see definition following), shrub and non-veg categories are incapable of ever providing deer hiding cover, as formally defined in the literature. 6) Current cover percentage is calculated by dividing the acres currently classified as cover, i.e. acceptable + 50% of gross marginal by the gross acres (i.e. potential, forested). 7) Semi-forest is defined as those PI stands that are presently mapped with the proportion of the polygon with acreage < or = to 25% in forested habitat. The rationale being that tree cover must be more prominent within the stand in order to meet deer cover requirements. 8) All data used is filed in district files.*
**WRHU=winter range habitat unit*

Cover is used by big game to moderate cold weather conditions and to assist in maintaining a constant body temperature is referred to as thermal cover (Thomas 1979). Tree canopy cover conditions that provide optimal thermal cover are considered to be: 1) those with 75 percent canopy cover in seedlings and sapling stands greater than five feet tall; or 2) those with 60 percent canopy cover in pole sized (5-9 inches dbh) trees and larger (Thomas 1979). Crown cover greater than 40 percent with trees 30 feet tall cover are the minimum requirements for deer thermal cover (LRMP, MA 7-13). For elk, a minimum of 40 percent canopy cover of trees at least 40 feet tall in stands at least 10 acres in size is required. The LRMP has different standards for

black bark ponderosa pine stands. Stands may provide both thermal and hiding cover, which is considered under the effects discussion. In summary, existing thermal cover exceeds the LRMP objective of 30 percent.

Table 3-18: Existing Deer and Elk Thermal Cover (MA 7 only)

Thermal Cover Quality Categories* (acreages)			Non-forest/No canopy	Current Cover Percentage (forested)**
High	**Moderate**	**Low**		
850	665	94	406	53

***Note**: Based on 1995 PI data.*high = 25% +canopy cover, moderate = 15-20% canopy cover, low = 1-10% canopy cover, and non-cover = 0 (including non-forested habitat types). Canopy cover is increasing by an estimated 1% /year (Brna, 2005). The high category, for example, would be a minimum of 40% when project is halfway through implementation in 2010.** Acres of thermal cover include only the high category with the percentages based upon the forested areas (i.e. potential thermal cover habitats), which is 1,609 acres. Thus, 850 ac./1609 ac. = 53%.*

The LRMP has a Key Elk Habitat Area (KEHA) allocation (LRMP 4-56, Standard and Guideline WL-43 and Appendix 16) for areas across the Deschutes National Forest that provide critical elk habitat. The Ryan Ranch KEHA encompasses approximately 21,462 acres with about 36 percent (7,624 acres or 72 percent of the project area) of it within the East Tumbull project area.

Table 3-19: Existing Key Elk Hiding Cover Acres (Project Area)

Elk Hiding Cover Classes			Non-forest	Net/Gross Cover	Current Cover Percentage (forested)
Accept-able	Marginal (gross/net)	Non-Cover			
1363	2531/1266	3510	220	2629/7404	36

***Note**: the preceding definitions in 3-18 are applicable.*

The LRMP requires a minimum of 30 percent hiding cover in each key elk area (LRMP WL-47). However, "black bark" ponderosa pine stands have a different requirement, which is at least 30 percent of the key areas will provide clumps of visual screening (LRMP WL-51). Given that the project area ponderosa pine stands are presently black bark but nearly evolved to an older age class, and that a minor component is lodgepole pine habitat, the non-black bark standard of 30 percent is recommended for the future desired condition for the entire KEHA under the Target Landscape Condition.

Table 3-20: Existing Key Elk Thermal Cover Acres

Thermal Cover Quality Categories* (acreages)			Non-forest/No canopy	Current Cover Percentage (forested)**
High	**Moderate**	**Low**		
4327	2242	369	1057	62

***Note**: * the definitions in 3-18 are applicable. ** Acres of thermal cover include only the high category with the percentages based upon the forested areas (i.e. potential thermal cover habitat, 6,937 acres) of each sub-area.*

In summary, crown cover greater than 40 percent with trees 40 feet tall in stands at least 10 acres in size are the minimum requirements for elk thermal cover in KEHAs (LRMP, WL-50). The LRMP allows for the modification of the canopy cover minimums on low productivity sites (i.e. higher risk of insect/disease impacts), such as those found within the project area, however with ongoing growth this was not necessary for this project as noted under the definitions following Table 3-18. The existing condition of thermal cover in the KEHA is well above the minimum requirement, which may be having a localized detrimental effect on forage quality, i.e. shading of bitterbrush.

Affected Environment-Existing Habitat Conditions, Other MIS Species *Raptors:* There are no known raptor nest sites within the project area. Field surveys for northern goshawk, sharp-shinned hawk, Cooper's

hawk, golden eagle, red-tail hawk, osprey, and great gray owl were conducted in 2004 and 2005. The patchy black bark pine habitat should provide at least some limited nesting habitat for these species. Riverine and meadow habitats offer potential habitats for the great gray owl. They were detected calling in the area, however nest searches were unsuccessful. There are no known records of spotted owls in the area.

American marten: There are no known records of marten within the project area and no surveys were conducted. Existing conditions suggest there is a low probability of marten occupancy. The marten prefers extensive areas of lodgepole pine habitat at moderate to high elevations that is nonexistent within East Tumbull.

Other MIS*:* MIS including great blue heron, woodpeckers, waterfowl, Townsend's big-eared bat, species associated with logs and coarse woody materials (CWD), species associated with various plant communities and successional stages, and species with special or unique habitats have habitat within the project area, however there were no formal surveys conducted for these species.

Affected Environment-Existing Habitat Conditions, Shrub Habitat Shrubs, primarily bitterbrush, provide critical mule deer and elk winter forage. They also provide nesting and foraging habitat for shrub-associated species (e.g. yellow-pine chipmunk and golden-mantle ground squirrel), and neotropical migrant birds, such as green-tailed towhee (Paige and Ritter, 1999). Many of these species, particularly the seed-caching rodents, such as the yellow-pine chipmunk, serve an important ecological role in the regeneration of shrub species (Vander Wall, 1994). A current condition survey of bitterbrush age/structure class proportions was not done for the winter range area of the project. Field reconnaissance indicates that there is an abundance of mature bitterbrush available (i.e. greater than 18" in height) to wintering big game species. Refer to the section of the report on Indicator Species for more detailed information on species dependent upon shrub habitats.

Affected Environment-Existing Habitat Conditions, Roads and Trails Designated roads such as 46 and 4601 are open year-around to provide access to recreation (Mt. Bachelor) and home sites (Skyliners). The winter range portion of the project (MA 7) area has an overall existing road density of 3.5 miles per square mile that is reduced to 1.3 miles per square during the administrative Tumalo Cooperative Winter Range Area Closure period from December 1st through March 31st. For the KEHA portion of the project area the existing open road density is 6.0 miles per square mile and 4.6 miles per square mile for the entire KEHA. There is one hiking trail along the bank of the Deschutes River, which runs the full length of the project area. Existing effects to wildlife habitats from roads have been moderate to high depending on the class of road (i.e. width, level of use), its location, and the season of use. Additionally, increasing OHV/snowmobile use, outside the river closure areas, in the project area could have detrimental effects on big game due to disturbance, particularly near open roads during the winter period or by illegal cross country travel.

Affected Environment-Existing Habitat Conditions, LOS)/Old Growth Management Areas (OGMA) A portion (51 acres) of one designated OGMA (LRMP, MA 15) is located on the western border of the project at Coyote Spring. Four other OGMAs are west of the project boundary and range from 1.5 miles to four miles away. Most of these OGMA are composed of black bark stands. Project-wide there are approximately 447 acres (4 percent) classified as structural stage 6 (late multi-story) and 49 acres (<1 percent) of structural stage 7 (late single-story) forest. Given the uniform past timber harvest history of the area (i.e. private lands railroad logging about 60 years ago) these stands are typically older black bark ponderosa pine, as compared to true old growth forest of 150+ years of age. In fact, only 77 acres of ponderosa pine and 13 acres of mixed conifer (Appendix I, Tables I-4, I-6) meet the more restrictive LOS definition. The past timber harvest, however, has created a large area of black bark ponderosa pine that has the potential to provide LOS habitat in the future. There are an estimated 5,637 acres (53 percent) of the project area in the stage 5 forest type (young multi-story).

Affected Environment-Existing Habitat Conditions, Connectivity and Fragmentation The project area and

adjoining lands to the west have had past timber harvest. However, the unit prescriptions (thinning) retained forest overstory, which facilitates the movement of wildlife species across the area. Fragmentation therefore is largely a result of roads which create edge effects that may be negative for some species. There are large areas of lava east of the Deschutes River that likely inhibit the movement of some species across it. The city of Bend occupies the area north of the lava field and a large portion of the area to the south and east of the project boundary is within the Sunriver development. A movement corridor between Sunriver and the lava flow has been identified as critical to migrating deer and elk. Roads may inhibit the movement of some species (e.g. mollusks) or contribute to mortality by vehicles. However, most of the roads are surfaced with gravel and have relatively low vehicle speeds. Road 41 is the project's primary western boundary and it's paved. Deer and elk migrating to winter ranges must cross it, but vehicle collisions with animals are rare.

Affected Environment-Existing Habitat Conditions, Snags, Green Tree Replacements, and Coarse Woody Materials (CWD) Habitats A snag is defined as a dead or partly dead tree (or stump per Johnson and O'Neil, 2001) that is over 4 inches in diameter-at-breast-height (dbh) and taller than 6 feet (Thomas et al. 1979). Coarse woody material (CWD) or woody debris is the accumulation of dead woody material on the forest floor including limbs and logs (Thomas et al. 1979). Numerous species of animals use snags and CWD for foraging, nesting, denning, roosting and resting. The most notable of the wood-using wildlife species are the primary cavity nesters including woodpeckers and nuthatches that excavate nest cavities in decayed wood in standing dead and green trees. Vacated cavities are subsequently used by many other birds and small mammals (i.e. secondary cavity users). Selected wildlife species known or suspected to occur in the project area that utilize these habitats include the flammulated owl, pileated woodpecker, white-headed woodpecker, Williamson's sapsucker, pygmy nuthatch, white-breasted nuthatch and mountain bluebird. Refer to Table 3-16 for individual species' management status and occurrence within the project area.

Desired conditions of snag and CWD habitat are based in part on management recommendations and standards and guidelines provided by the Deschutes National Forest LRMP (USDA, 1990), Deschutes National Forest Wildlife Tree and Log (WLTL) Implementation Strategy (USDA, 1994), and Eastside Screens (USDA, 1995).

In 2003, a new tool, the DecAID Advisor (Mellen et al. 2003), "was developed as a planning tool intended to help specialists manage snag and log levels best suited for their management area and associated wildlife species. The DecAID advisor cautions against using the tool on a stand or project area basis although it does suggest that, "Planning areas (landscapes or watersheds) should be sufficiently large to encompass the range of variation in wildlife habitat types and structural conditions that occur in the area. It is impossible to specify a single minimum size planning area that is most appropriate to all ecoregions and geographic areas. However, as a general rule-of-thumb we suggest that planning areas be at least 20 square miles in size." The best available science, including DecAID, was used to determine the recommended desired conditions for snags and CWD, which are addressed in a following section.

Rationale for using the East Tumbull project area for Snag Analysis The East Tumbull project area encompasses 10,555 acres of which 390 acres are private. The project area is located within the 147,978 acre 5th field Pilot Butte watershed. As noted before over 8,000 acres were clear-cut harvested in the 1920 to 1950 time period within the project area and subsequently acquired by the Deschutes National Forest in exchange for the cutting rights on adjacent stands of ponderosa pine.

Although the area is now made up of a variety of land management allocations, most of the project area, Pilot Butte watershed and surrounding landscape have been clearcut harvested resulting in a dominance of 60 to 80 year old, "black-bark" ponderosa pine stands. The contiguous acreage of black-bark with a few small "islands" of lodgepole pine is estimated at over 200,000 acres.

Using a larger analysis area than the project area is not necessary because the project area encompasses a sufficiently large enough area to include the range of wildlife habitats and structural conditions within the Pilot Butte watershed; which is itself typified by the same homogenous stand conditions found within the project area. A comparison with the adjacent Kelsey project area, which evaluated over 130,000 acres before the 18 Fire of 2003 occurred, shows that the snag (1.9 snags/acre for Kelsey vs. 2.3 snags/acre for East Tumbull) levels within the ponderosa pine plant association group are remarkably consistent across the Pilot Butte watershed. As noted in the Hydrology section of the EA, the use of watersheds is highly arbitrary on the Bend/Fort Rock Ranger District due to the absence of overland flow and the fact that most of the subsurface or ground water originates in the Cascades. Regardless, the East Tumbull project area was deemed large enough to encompass the range of forested habitat conditions as verified by the consistency of snag levels on adjacent project areas.

The project area was segregated into five conditions: 5,815 acres of black bark and mixed conifer stands at high risk for beetles; 1,786 acres of black bark and mixed conifer stands at low risk for bark beetle attack; 603 acres of recent (<less than 20 years) black bark stand replacement fires (Inn and Awbey Hall Fires) within the project area; 936 acres of lodgepole pine stands (450 acres at high risk for beetles); and 1,025 acres of non-forest consisting of permanent meadows, lava flows and stream terraces. Inventory of snags and down wood for each of the four forested conditions described above was weighted to arrive at an overall project area average as shown in the table below.

Table 3-21a: East Tumbull Snag and CWD Project Area (weighted average)

DecAid Habitat Type	Avg. Snags/acre 10-19.9" dbh	Avg. Snags/acre ≥ 20" dbh	CWD percent cover
PP/DF Small/Medium trees (50% tolerance level (8,204 acres)	2.21	0.12	0.77
Lodgepole Pine (936 acres)	15	2.5	1.75 (444 lineal feet ≥ 8")

The following tables break down the number of snags by the ponderosa pine individual habitat conditions:

Table 3-21: East Tumbull Ponderosa Pine PAG Snag Levels for 5,815 Acres at High Risk of Beetle Attack

Snag Diameter Class (DBH)	10-11.9"	12-14.9"	15-19.9"	20"+
# Snags/acre (range)	0.31-8.80	0.23-3.80	0.06-1.28	0.00-0.28
Average # snags/acre	1.47	0.90	0.45	0.09

Range 0.69 to 13.20 snags/acre. Snag levels are generally applicable to EA units with a thin ≤ 21" dbh prescription (Table 2-1).

Table 3-22: East Tumbull Ponderosa Pine PAG Snag Levels for 1,786 Acres at Low Risk of Beetle Attack

Snag Diameter Class (DBH)	10-11.9"	12-14.9"	15-19.9"	20"+
# Snags/acre (range)	0.24-0.75	0.00-0.13	0.00-0.25	0.13-0.48
Average # snags/acre	0.57	0.08	0.16	0.25

Range 0.71 to 1.26 snags/acre. Snag levels are generally applicable to EA units with a thin ≤ 12" dbh prescription (Table 2-1).

Table 3-23 summarizes the findings on stands that were recently prescribed burned within the project area.

Table 3-23: East Tumbull Ponderosa Pine PAG Snag Levels for Completed Prescribed Burn Units

Snag DBH Diameter	8-9.9"	10-12.9"	13-15.9"	16-19.9"	20"+
# Snags/acre (range)	0.32-0.33	0.45-0.88	0.22-0.37	0.14-0.32	0.10-0.11
Average # snags/acre	0.33	0.69	0.30	0.24	0.10
Average # LP snags created /acre	0.11	0.31	0.06	0.03	0.00
Average # LP snags felled/acre	0.01	0.07	0.02	0.01	0.00
Average # PP snags created /acre	0.16	0.31	0.12	0.09	0.03
Average # PP snags felled/acre	0.01	0.04	0.01	0.01	0.01

Table 3-24: East Tumbull Ponderosa Pine PAG Snag Levels for Inn (1988) and Awbrey Hall (1990) Wildfires (603 acres)

Snag DBH Diameter	8-9.9"	10-13.9"	14-15.9"	16-17.9"	18-19.9"+	20"+
Average # snags/acre	0.05	0.02	0.17	0.17	0.07	0.05

Green tree replacements (GTRs) or the trees needed for future snag and log recruitment are presently abundant throughout the project area. Past timber harvest and wildfires have had minimal impact on the numbers of trees. The age classes of trees, however, have been affected. Presently the area is dominated by black bark ponderosa pine averaging 50-80 years of age. Snag recruitment is primarily dependent upon insect and disease mortality with some additions via lightening strikes. Snags recruited by wildfires often are case hardened and less valuable to many species. Dense stands generally have higher mortality rates, however the trees tend to be smaller. Larger snags provide habitat for a greater diversity of wildlife, which would result from tree density reduction. The current condition of the stands with densification and high catastrophic wildland fire risk are not conducive to the long-term recruitment of the larger snags.

Wildlife Habitat Management Direction The LRMP, as amended, specifies standards and guides to maintain, protect and enhance wildlife habitat. As noted under the Affected Environment discussion this is accomplished by following applicable Forest-wide (LRMP WL-1 to WL-75), Upper Deschutes River Plan, Eastside Screens, and individual management area Standards and Guidelines. In the East Tumbull project area, those Standards and Guidelines pertaining to management of black bark stands and roads in the Ryan Ranch KEHA and areas outside of MA 7 (LRMP, pages 4-56 to 4-59) are pertinent as well as MA 7 standards and guides. Wildlife direction from the Upper Deschutes River Plan is discussed under the Wild and Scenic River Values section.

Eastside screens specify snag and CWD debris guidelines for timber sales and the maintenance of connective corridors for wildlife habitat movement and dispersal. Snag density and CWD levels for small-medium habitat Ponderosa Pine/Douglas-Fir can be found in Table 3-27 (2.7 snags and 1.4 percent CWD coverage per acre). An estimated 40 trees (3"-8" minimum diameter range) should be retained for future recruitment or GTRs. at the 50 percent level for low productivity ponderosa pine habitats (small/medium tree category).

Target Landscape Condition The following section provides baseline information that will be utilized as appropriate in the analysis of effects of the project later in this section.

Indicator Species Table 3-25 displays habitat and information for selected Ecological and MIS species from Table 3-16. The selected species reflect the capability of the ponderosa pine dominated habitats within the project area. Both short-term and long-term habitat objectives are displayed in the Habitat Description section. The territory and/or home range sizes will be considered in the evaluation of the spatial arrangement of habitat components in the project area. Similar to Table 3-16, the purpose of this table is to give the reader a landscape

overview of habitat diversity objectives for various species that may use the East Tumbull project area.

Table 3-25: General Objectives for Management and Ecological Indicator Species

Species	Territory or Habitat Unit Size	Habitat Description
Mule deer	Patches 6+ acres of hiding/thermal cover	Coniferous trees for hiding and/or thermal cover in patches no greater than 1200' apart on 40% of the project area with a ratio of 10:30 hiding to thermal cover. Provide movement corridors of cover at least 600' wide no greater than ½ mile apart. Bitterbrush is an essential winter forage.
Rocky Mountain Elk	Patches 30+ acres of hiding/thermal cover	Similar to mule deer. Greater utilization of grasses than shrubs.
Great Gray Owl	Home range 30-60 sq. mi. Territory 100 ac.	Coniferous forest with openings or meadows. Forage in open areas with a preference for pocket gophers. Broken topped snags often used for nests.
*Flammulated owl	Home range 25 ac. Territory 15-30 acres.	Prefer open ponderosa pine or mixed conifer with limited understory and large trees. Forage in openings, meadows, along edges. Secondary cavity nester (22-28" dbh snags).
*Lewis' woodpecker	Territory 15 ac.	Open forests. Patches of burned forest. Target >50% of burns un-salvaged. Retain all snags >21" dbh and 50% of snags 12-21" in fire salvages. Overall, retain 25 snags per acre 9"+ dbh in burns. Usually secondary nester but may excavate (12"+ snags, with 26" mean).
Pileated woodpecker	Home range 1005 ac., very territorial.	Dense mixed conifer forests in the late successional stage and hardwoods in river bottoms. Large trees, snags and down logs are critical for nesting and foraging. Rare in pure stands of ponderosa pine. Ponderosa pine and grand fir are important for nesting but must be large snags at least 28" dbh or larger. Nest sites have high snag densities (30/ac. >10" dbh and 8/ac. > 20" dbh). Only more mesic pine/fir sites can attain these densities.
*Williamson's sapsucker	Territory 10-20 ac.	Prefer open ponderosa pine for nesting. Excavate soft, decayed wood (12" dbh minimum, with 21"+ preferred). 1.5 snags/ac.
Hairy woodpecker	Territory 25 ac.	Open forests along edges and in burned areas. Primary excavator (10" minimum, with 17"+ preferred). 1.3-1.9 snags/ac. (burns 41.8/ac.) Light to moderate decay usually.
*White-headed woodpecker	Home range 250-500 ac.; territory 20 ac.	Open old-growth ponderosa pine with large trees for foraging and snags for nesting. Pine seeds (ponderosa and sugar) are important forage in the winter. Will use short snags and tall stumps in open areas (averages 12% canopy cover). Target 10 trees per acre >21" dbh with >2 trees per acre >31" dbh; 10-40% canopy closure; 1.4 snags per acre >8" dbh with >50% >25" dbh, mean 18". Burns 51.4 snags/ac.
*Pygmy nuthatch	Territory 2-4 ac.	Prefer older, mature ponderosa stands but will forage in young stands. Target 10+ trees per acre of 21" dbh+, including 2 trees per acre >31" dbh. Secondary nester or primary excavator in snags or dead portions of live trees (8" dbh min, prefer 16"+ dbh). 1.4 snags/ac.
Green-tailed towhee	Territory 25 ac.	Open ponderosa pine forest with vigorous, diverse shrub understories. Clearcuts are used.
*Olive-sided flycatcher	Territory 35-100 ac.	Open forests with scattered tall trees and snags, along edges (especially high contrast with mature forest). Burned areas are important.
*Chipping sparrow	Territory 3-7 ac.	Open forest with patches of regenerating trees or shrubs. Openings with forbs and grasses are important for foraging. Edges and clearcuts are utilized. Target 10-30% canopy cover, 20-60% shrub cover with >20% sapling cover, especially pines.
Mountain bluebird	Territory 5-15 ac.	Open forests, clear-cuts, edges of meadows, and burned areas. Secondary cavity nester (minimum 9" dbh). Burns 29.7 snags/ac.
Yellow-pine chipmunk	Home range <2.5-25 ac.	Open forests with shrub understories. Coarse woody debris is important, including stumps and logs, for nests (rocky areas also used). Seeds from trees and other plants are required. An important agent in the establish-ment of bitterbrush by caching seeds for food (Vander Wall, 1994).
Western-fence lizard	Home range <2.5 ac.	Rocky rims, canyons & hillsides with boulders. Require elevated perches; use stumps, logs, rocks, fences, etc. Great Basin subspecies in our area.

***Note**: *Focal Species for the Central Oregon Sub-province (Altman 2000). Other principal references included Csuti et al.*

2001; Johnson and O'Neil, 2001; Marshall et al. 2003; Thomas et al. 1979; and Mellen et al. 2003.

The following sections describe the principal habitat elements that the selected Indicator Species will require.

Big Game Habitat Component: The most important elements for this habitat component are listed and rated for importance in the following table:

Table 3-26: Big Game Elements

Indicator Species	Element Ratings*				
	Hiding Cover (minimum % required)	Thermal Cover (minimum % required)	Travel Corridor	Forage	Solitude (Road/Trail Density maximums)
Mule deer (winter range)	1 (10%)	1 (30%)	1	1 (60%)	1 (1.0-2.5 mi./sq. mi.)
Mule deer (summer range)	1 (30%)	2	1	2	1 (2.5 mi./sq. mi.)
Elk (KEHA)	1 (30%)	1 (20%)	1	1	1 (0.5-1.5 mi./sq. mi.)

***Note**: * Rating codes— 1 = required by the LRMP, 2 = not required by the LRMP. Black bark ponderosa pine exception (i.e. 30% of un-thinned/harvest visual screening clumps; WL-51).*

In summary, the described elements are critical for the maintenance of the big game population in the area. The LRMP (page 4-58) and agreements with ODFW direct that habitat for mule deer, and winter range in particular, will be monitored and enhanced where possible to meet specific herd objectives.

Snags/Green Tree Replacements(GTRs)/CWD Direction The LRMP as amended by the Eastside Screens requires the retention of snags and GTRs of 21" dbh or greater at the 100 percent (2.25 snags/acre; 11.7 GTRs/acre) potential population level of primary cavity excavators . The snag and GTR size may be less if the representative dbh of the overstory layer is less than 21" dbh. Eastside screens also requires the retention of 20 to 40 lineal feet of down logs with a minimum piece size of 6 feet and 12 inch small end diameter. The Eastside Screens further directs that these levels should be determined using the best available science on species requirements as applied through current snag models or other documented procedures. The following information meets this direction, and provides a baseline for use in the analysis of project effects later in this report.

Table 3-27 was developed from the DecAID Advisor and shows both the desired future long term (70+ years) condition for large (i.e. 150 years+) ponderosa pine and the desired short term condition (2.7 snags and 1.4 percent CWD coverage per acre) for small-medium ponderosa pine (i.e. 40-150 years) structural stages. Plant association delineation resulted in two types: ponderosa pine (DecAID -Ponderosa Pine/Douglas-fir) and lodgepole pine. The mixed conifer plant association was incorporated into the Ponderosa Pine/Douglas-fir Habitat type because the amount of acres is small (6 percent of project area), the stands were fire climax to ponderosa pine and the current overstory is ponderosa pine with an understory of small (generally less than 10" dbh) white fir and lodgepole pine. All vegetation management activities associated with the East Tumbull project, with the exception of 13 acres of noncommercial hand thinning in a structure stage 6 ponderosa pine/mixed conifer stand, is located within 60 to 80 year old black bark stands.

The snag/CWD habitat component is critical to a significant majority of the Indicator Species. The individual species territories are subject to both intra- and inter-species competition. Therefore, the arrangement and numbers of snags are important when implementing post-harvest snag creation strategies. The recognition of the importance of providing future green trees to continue the cycle of snags and logs for dependent species is also critical. The site capability to produce trees of adequate size for dependent species is important as related to the stand density and subsequent ability to produce trees and future snags within a reasonable time period. The area is below 5,000 feet in elevation and has low precipitation. The ponderosa pine/bitterbrush-fescue plant

association (CP-S2-11), which is of low site productivity, dominates the area (Volland, 1988).

Since, the East Tumbull project area is predominantly ponderosa pine with small to medium sized trees (see EA Tables 3-6, 3-7) with a frequent (0-35 year) fire return interval, low moisture and flat topography; the DecAID Ponderosa Pine/Douglas-Fir (Small-Medium) habitat/structure type was chosen at the 50 percent (lower productivity) tolerance level for snags, CWD and GTRs (40 trees @ 3"-8" minimum diameter range) as the short term desired condition

Table 3-27: DecAID General Desired Conditions for Snags and Down Wood

Habitat Type/Structure	Tolerance Levels	Snag Density *	Snag Size (dbh)	Percent Cover Down Wood
Ponderosa Pine/Douglas-Fir (Large)	80% (north aspects, more productive sites)	13.3/ac. >10" dbh with 10.1/ac. >20" dbh. Increase numbers for pileated woodpecker	12-57 in.	3-4% (10-19.7" diameter range, 14" mean, with some to 45")
" "	50% (lower productivity areas)	6.5/ac. >10" dbh with 3.6 /ac. >20" dbh.	10-32 in.	1.8% (4.9-19.7" diameter range, 10" mean)
Ponderosa Pine/Douglas-Fir (Small-Medium)	50% (lower productivity areas)	2.7/ac. >10"dbh with 1.1/ac. >19.7" dbh. High density clumps in low wildland fire risk areas that average to the above #s.	9.8-43 in.	1.4% (10" diameter mean with some larger)

***Note**: * As determined by snag inventory and wildlife data cited in DecAID.*

Table 3-28 summarizes the individual elements for snags and coarse wood materials that can be reviewed for importance to individual indicator species.

Table 3-28: Snags/CWD Elements

Indicator Species* (territory size)	Element Ratings**			
	Snag Density (minimum #/ac./DecAID data @ 50% level)/DecAID data @ 50% Post-fire***	Snag Size (minimum/mean dbh)***	Snag Arrangement (clumped, individual or mix)	Log Cover (minimum DecAID data for 1.4% per acre)
Flammulated owl (15-30 ac.)	1 (?/?/?)	1 (22"/24")	2 (mix)	3
Pileated woodpecker	1 (?/8/?)	1 (26"/30") nesting	2 (mix)	1
Lewis' woodpecker (15 ac.)	1 (?/?/24.8 burns)	1 (12"/26")	1 (individual and small clumps)	2
Williamson's sapsucker (15 ac.)	1 (1.5/?/?)	1 (12"/21")	2 (mix)	2
Hairy woodpecker (25 ac.)	1 (1.6/?/41.8 burns	1 (10"/17")	2 (mix, edges)	2
Whiteheaded woodpecker (20 ac.)	1 (1.4/6.4/51.4 burns)	1 (8"/26")	2 (individual)	2
Pygmy nuthatch (3 ac.)	1 (1.4/?/?)	1 (8"/18")	2 (mix)	2
Mountain bluebird (5-15 ac.)	1 (?/?/29.7 burns	1 (9")	1 (individual)	NA

***Note**: ***Italicized/bolded** species are Focal Species (Altman, 2000). **Rating codes—1 = required, 2 = used (not a critical parameter), 3 = indirect benefit (e.g. prey base uses), NA = not applicable, ? = no information. ***DecAID data from the ponderosa pine/Douglas-fir Open Vegetation Condition The open condition type was selected because the area presently has an uneven tree distribution, i.e. patchy. Furthermore, the post-treatment condition will provide a much lower amount of canopy cover. The addition of data for burned areas is provided, because past prescribed burn units in the project area have killed a significant number of overstory trees that will provide future snags.*

The Desired Condition information should be considered in light of the observed distribution patterns of snags and logs cited in the DecAID Advisor. The data indicate that approximately 54 percent of the inventoried areas had no snags, while the balance had measurable snags >10" dbh. Thus, a significant portion of the inventoried landscapes provided no snags.

Log retention also provides some flexibility. As an example, the 1.4 percent retention level (610 square feet of coverage per acre) would provide 34 logs in the 10" diameter size class. Given that a 10" log covers 0.041 percent of the ground, a 15" log covers 0.086 percent, and a 20" covers 0.152 percent, there is an opportunity to meet the total minimum percentage (i.e. 1.4 percent) with fewer logs using larger sizes. For example, a 10" log covers ~18 square feet and it would require 33.8 of them to meet the 610 square foot minimum. Leaving logs of 15" diameter (@ 37 square feet of coverage each) would only require 16.5 logs per acre. Logs of 20" diameter (@ 66 square feet of coverage each) would only require 9.2 per acre. These percentages are based on a log length of 40 feet.

Forest Structure and Arrangement Habitat Component: Table 3-29 displays selected habitat elements for each Indicator Species that utilize them. The importance of each element is rated by species. The Indicator Species as a group require relatively open forest habitats and snags and several have a strong affinity to burned areas.

Table 3-29: Forest Structure and Arrangement Elements (long-term)

Selected Management & Ecological Indicator Species*	Element Ratings**						
	LOS Stage 6	LOS Stage 7	Large Trees/ Snags/ Logs	Open Canopy	Closed Canopy/ Dense conifers	Shrubs/ Herbaceous/ Openings	Edges/ Burns
Mule deer	3	2 (forage)	NA	2 (forage)	2 (cover)	1 (forage)	2/2
Rocky Mt. elk	2	2	NA	1 (forage)	2 (cover)	1 (forage)	2/2
Flammulated owl	2	1	1 (nests)	1	1 (nests, roosts)	1 (forage)	1/?
Great gray owl	1 (LPP)	3	1 (nests)	3	1 (nests)	1 (forage)	1/?
Pileated woodpecker	1	2	1 (nests/foraging)	2	1	2	2
Lewis' woodpecker	3	1	1 (nests)	1	3	2 (forage)	2/1
Pileated woodpecker	1	3	1 (nests and forage)	3	1	NA	3/3
Williamson's sapsucker	2	2	1 (nests)	1	3	NA	3/?
Hairy woodpecker	1 (winter)	1 (winter)	1 (nests)	1	3	NA	3/1
White-headed woodpecker	3	1	1 (nests, forage green)	1	3	2 (nests)	3/?
Pygmy nuthatch	1	1	1 (nests, forage)	2	2	NA	2/?
Green-tailed towhee	NA	2	NA	1	NA	1	1/?
Olive-sided flycatcher	2 (edge)	1 (edge)	1 (dead tops)	1	NA	2 (migration)	1/1
Chipping sparrow	3	2	NA	1	3	1 (grass preferred)	1 (grass edge)
Mountain bluebird	2 (juniper)	3	2	1	NA	1	1/1
Yellow-pine chipmunk	3	2	2 (logs)	2	3	1	1/?
Western fence lizard	3	3	2 (logs)	2	NA	2	1/?

***Notes: *Italicized/bolded** species are Focal Species for the Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains (Altman, 2000) for the ponderosa pine habitat type. **Rating codes—1 = primary, 2 = secondary, 3 = casual use, NA = not applicable or negative relationship, ? denotes unknown, no information found. Principal reference Marshall et al. 2003.*

Wildlife Habitat Environmental Effects

Direct and Indirect Effects of Alternative 1 Absent a large stand-replacing wildfire**,** there would be few short-term direct or indirect effects (less than 10-15 years) to wildlife species or their habitats, but there would be potentially significant effects in the mid- to long-term periods of time. Table 3-30 following the effects discussion summarizes the Alternative 1 effects on the wildlife measures (indicators).

Table 3-30: Effects on Wildlife and Habitats from the No Action Alternative

Wildlife Indicators/ Habitats	Direct Effects	Indirect Effects	Cumulative Effects
Big game populations & habitats	Potential forage decreases due to tree densification. Hiding cover likely static or possibly with some increases.	Effects upon population are relatively insignificant. High road densities contribute to harvest vulnerability & potential disturbance of wintering deer & elk.	Potential to lose large blocks of hiding cover and forage from catastrophic fire. The size, location and timing of wildfires are unpredictable.
LOS/OGMAs	Stand densities will increase. Positive for spp. preferring multi-story. Negative for those needing single-story or fire dependent.	Large tree mortality may increase with higher competition levels. LPP will increase on PP sites.	Insect epidemics, dwarf mistletoe suppression of growth and mortality of trees. Variable in extent, magnitude, location, timing. Potential for large fires.
Connectivity/ fragmentation	Increased connectivity and decreased fragmentation. Positive for LOS dependent spp & big game movement. Negative for spp. dependent upon edges.	Less stand diversity across the landscape	Large wildfire potential with negative effects on forest cover connectivity.
Raptor sites & habitat	Positive for multi-story spp. and negative for open stand/edge spp.	Increasing solitude with high stand densities. May affect positively or negatively the prey base species (i.e. diversity abundance)	Large wildfire potential with negative effects on nesting and foraging habitats for most species.
Snags, GTRs, & CWD	Positive for snags/logs from stress/insect mortality. Negative for fire mortality snags, unless a wildfire event occurs.	Smaller trees in the future due to competition that may affect snag size and those spp. needing large ones.	Increasing dead will contribute to wildland wildland fire risks.
Special/Unique habitats	None identified	Potential for tree invasion of dry meadows with the absence of fire.	Potential loss to catastrophic wildfire.
Ecological Indicators & SOC	Same as LOS	Same as LOS. Will favor LPP spp.	Same as LOS.

In summary, Alternative 1 would benefit some species and negatively affect others. However, there are significantly more SOC in the latter category, which depend upon an ecosystem with the natural disturbance regime of frequent, low intensity fires. Many depend upon large ponderosa pine, an open understory, natural regeneration clumps, and large snags that are created and maintained by a disturbance regime with frequent, low intensity fire. The current situation of dominance by young multi-storied stands with atypical understory densification places the entire system at significant risk to epidemic insect/disease vectors and/or catastrophic wildfire events. In this scenario, large areas of future LOS could be lost with substantial negative impacts to many wildlife species, including the more common, e.g. mule deer. Multi-storied LOS stands are indeed critical to many species and must be maintained in the landscape, but in a proportion and spatial arrangement that are relatively stable. Their location would be critical given the risk of catastrophic wildfire.

Big Game Introduction The following measures were used for big game: hiding cover, thermal cover, forage, and road density. Road density also applies to habitat effectiveness for other species and it is discussed separately under Roads and Trail within this resource section.

Direct and Indirect Effects of Alternative 1, *Big game* Big game hiding and thermal cover would be maintained or increase in quantities, qualities and distribution over the short-term. Over the long-term (> 15 years), hiding cover quality in some of the ponderosa pine stands would diminish as crowns "lift" and self-

prune, increasing sight distances. Reductions of hiding cover may be offset, however, by shrub growth and tree mortality caused by inter-tree competition and mortality from bark beetles or other pathogens. Dead and fallen trees would provide visual screening, maintaining or improving hiding cover. Shrubs in many of the stands that do not currently provide hiding cover are relatively young in age. Growth of green leaf manzanita (*Arctostaphylos patula*) and snowbrush (*Ceanothus velutinus*), shrub species that are capable of attaining heights of 5-6 feet, would provide hiding cover in some limited areas.

Thermal cover quality and quantity is expected to remain about the same over the long-term in ponderosa pine. Regeneration of lodgepole pine in some ponderosa pine stand types would provide visual screening for hiding cover and increased canopy cover for thermal cover. Indirect effects to big game hiding and thermal cover include an increasing risk of insect and/or disease outbreak, especially in densely stocked ponderosa pine stands, and a high risk of loss in the event of wildfire.

Shrub habitats would continue to age, with a greater proportion of shrubs moving into late seral. Mature shrubs that are above snow levels (i.e. 18"+ height) and accessible to deer would increase in abundance through time but as shrubs become decadent the nutritional quality would decline. Natural regeneration of bitterbrush would occur as well, recruiting new shrubs that would develop into winter forage.

Herbaceous species, grasses and forbs, which are high in nutritional quality during spring and early summer periods, would decrease in abundance and diversity with accumulation of litter, maturity of shrub habitats, and lack of disturbance. The risk of wildfire and potential for loss of critical mule deer winter forage would remain high and may increase through time. Alternative 1 would forgo the opportunity to reduce the risk of wildfire occurring in critical mule deer winter forage areas and the opportunity to improve the abundance of herbaceous forage by reducing tree canopy cover.

Cumulative Effects of Alternative 1 Since there would be no proposed activities under this alternative there would be no cumulative effects. Potential effects of large fires on wildlife species and habitats is summarized in Table 3-30. Cumulative effects of Alternative 1 will not be discussed further in this resource section.

Direct and Indirect Effects of Alternative 2, *Big game*

Table 3-31: East Tumbull Winter Range (MA7)-- Deer and Elk Hiding Cover Effects (acres)

EA Units (acres)	Hiding Cover Classes			Gross Cover Reduction	Net Post-Treatment Cover Reduction (less 20-30% retention)**
	Acceptable	Marginal (50% of gross)	Non-Cover (forested)	Acres	Acres
103 (9.9)	0	0	0	0	0
104 (1417.3)	0	547 (274)	287	274	192
105 (75)	0	12 (6)	63	6	4
108 (295.9)	31	25 (13)	236	44	31
109 (35.2)	30	0	7	30	21
110 (28.8)	2	2 (1)	0	3	2
114 (42.5) Mow	0	0	1	0	0 (20%)
Totals:	63	586 (293)	594	357	250 (acres eliminated)
Existing (entire MA7)	88	754 (392)	1074	--	--

Note: *Units without existing cover will still have 30% retention patches of the best potential cover. The retention patches will also meet requirements for retaining structural diversity and future raptor habitat. * Hiding cover classes: Acceptable = 75% or greater coverage of a unit, Marginal = 50-74% coverage (uses 50 % of acres as cover), Non-cover (forested) = <50% coverage. **20% retention in fuels units and 30% in thinning, harvest or combinations with fuels.*

The project would reduce existing hiding cover in winter range from 480 acres to 230 acres (i.e. 88+392=480,

480-250=230). There are 1,916 acres of potential hiding cover (i.e. Table 3-31 the sum of the existing acceptable, marginal, non-cover acres) in the MA 7 allocation; the post-treatment cover would be approximately 12 percent of this area. The LRMP minimum requirement (MA 7, General Theme and Objectives) is 10 percent.

Table 3-32: Summer Range (excluding MA 7)-- Deer and Elk Hiding Cover Effects (acres)

EA Units (acres)	Hiding Cover Classes			Gross Cover Reduction Acres	Net Post-Treatment Cover Reduction Acres (less 20-30% retention)*
	Acceptable	Marginal (50% of gross)	Non-Cover (forested)		
102 (22.6)	0	3 (2)	20	2	1
103 (9.9)	0	0	10	0	0
104 (1417.3)	1	225 (113)	356	114	80
104ROW (14.6)	0	0	0	0	0
108 (295.9)	0	0	3	0	0
110 (28.8)	0	24 (12)	0	12	8
110ROW (2)	0	0	0	0	0
112 (336.8) Burn	0	0	337	0	0 (20%)
114 (42.5) Mow	0	1 (.5)	41	.5	0 (20%)
114ROW (2.9)	0	0	0	0	0
115 (139.9)	0	47 (24)	93	24	17
115ROW (2.4)	0	0	0	0	0
116 (62.4)	0	1 (.5)	62	.5	0
117 (465.8)	0	231 (116)	234	116	81
118 (245.7)	8	33 (17)	205	25	18
119 (86)	0	59 (30)	27	30	21
120 (35.6)	0	0	35	0	0
121 (126.3)	6	46 (23)	74	29	20
122 (25.2)	0	5 (3)	20	3	2
124 (16.2)	16	0	0	16	11
125 (18.1)	15	2 (1)	1	16	11
126 (15.7) Burn	1	0	0	1	1 (20%)
130 (115.2)	49	62 (31)	4	80	56
132E (20.7)	9	11 (6)	1	15	11
132W (21.1)	12	3 (2)	6	14	10
133 (42.6) Burn	16	11 (6)	15	22	18 (20%)
134 (50.8)	0	1 (.5)	49	1	1
135 (116.7)	1	47 (24)	69	25	18
136 (189.4)	49	106 (53)	34	102	71
138 (172.7)	35	54 (27)	84	62	43
139E (148)	5	134 (67)	9	72	50
139W (180.6)	88	59 (30)	34	118	83
140 (34.4)	32	0	3	32	22
141 (122.4)	114	8 (4)	0	118	83
142 (15.4)	7	9 (5)	0	12	8
143 (47.6) Burn	1	7 (4)	40	5	4 (20%)
144 (24.4)	6	0	19	6	4
145 (71) Burn	20	0	50	20	16 (20%)
146 (21)	19	0	2	19	13
147 (106.8)	49	53 (27)	4	76	53
148E (129.6)	51	61 (31)	17	82	57
148W (132.1)	41	40 (20)	51	61	43
149 (138.9)	4	124 (62)	11	66	46
176 (142.5)	60	72 (36)	10	96	67
Totals: 5426.5	715	1539 (770)	2030	1485	1048 acres reduction
Existing (entire summer range)	1335	2572 (1286)	4013	--	--

Note: *EA Units without existing cover would have 20-30% retention patches of the best potential cover. The retention patches*

*will also meet requirements for retaining structural diversity and future raptor habitat. Approximately 1,917 ac. or 85% of the acceptable and marginal (gross) hiding cover (2,253 ac.) is also classified as thermal cover (high category) within the proposed units for all land allocations combined. *20% retention in fuels units and 30% in thinning, harvest or combinations with fuels.*

Alternative 2 would reduce the existing hiding cover in summer range from 2,621 acres to 1,573 acres, i.e. 1335 + 1286 =2621, 2621-1048=1573. There are 7,920 acres of potential (forested) hiding cover in the summer range portion of the project area. Post-treatment approximately 20 percent of the area would provide hiding cover. The LRMP minimum is 30 percent (WL-54), however there are different standards in those stands classified as "black bark" ponderosa pine. In black bark the minimum amount of screening cover in summer range is 10 percent within treated stands in well dispersed clumps (WL-59). The issue is further complicated by the overlap of the summer range with the KEHA allocation (i.e. 7,920 ac. of summer range vs. 7,624 ac. of key elk or @96 percent overlap). The minimum requirement for visual screening (WL-51) in black bark ponderosa pine is 30 percent of the KEHA in well-distributed stands larger than six acres and at least 40 feet tall that have not been thinned or harvested for 20 years. In non-black bark habitats both deer and elk minimums are 30 percent hiding cover, however these habitat types are very limited in the project area and ,with the exception of EA units 124 and 141, excluded from vegetation mangement. Table 3-33 summarizes the effects.

Table 3-33: Ryan Ranch Key Elk (including MA 7 overlap)-- Hiding Cover Effects (acres)

EA Units (acres)	Hiding Cover Classes			Gross Cover Reduction	Net Post-Treatment Cover Reduction Acres (less 20-30% retention)*
	Acceptable	Marginal (50% of gross)	Non-Cover (forested)		
104 (1417.3)	0	130 (65)	266	65	46
104ROW (14.6)	0	0	15	0	0
108 (295.9)	0	0	18	0	0
110 (28.8)	2	27 (14)	0	16	11
110ROW (2)	0	2 (1)	0	1	1
112 (336.8) Burn	0	0	195	0	0
114 (42.5) Mow	0	1 (.5)	42	.5	0
114ROW (2.9)	0	0	0	0	0
115 (139.9)	0	47 (24)	93	24	17
115ROW (2.4)	0	0	0	0	0
116 (62.4)	0	1 (.5)	62	.5	0
117 (465.8)	0	231 (116)	234	116	81
118 (245.7)	8	33 (17)	205	25	18
119 (86)	0	59 (30)	27	30	21
120 (35.6)	0	0	35	0	0
121 (126.3)	6	46 (23)	74	29	20
122 (25.2)	0	5 (3)	20	3	2
124 (16.2)	16	0	0	16	11
125 (18.1)	15	2 (1)	1	16	11
126 (15.7) Burn	1	0	0	1	1 (20%)
130 (115.2)	49	62 (31)	4	80	56
132E (20.7)	9	11 (6)	1	15	11
132W (21.1)	12	3 (2)	6	14	10
133 (42.6) Burn	16	11 (6)	15	22	18 (20%)
134 (50.8)	0	1 (.5)	49	1	1
135 (116.7)	1	47 (24)	69	25	18
136 (189.4)	49	106 (53)	34	102	71
138 (172.7)	35	54 (27)	84	62	43
139E (148)	5	134 (67)	9	72	50
139W (180.6)	88	59 (30)	34	118	83
140 (34.4)	32	0	3	32	22
141 (122.4)	114	8 (4)	0	118	83

142 (15.4)	7	9 (5)	0	12	8
143 (47.6) Burn	1	7 (4)	40	5	4 (20%)
144 (24.4)	6	0	19	6	4
145 (71) Burn	20	0	50	20	16 (20%)
146 (21)	19	0	2	19	13
147 (106.8)	49	53 (27)	4	76	53
148E (129.6)	51	61 (31)	17	82	57
148W (132.1)	41	40 (20)	51	61	43
149 (138.9)	4	124 (62)	11	66	46
176 (142.5)	60	72 (36)	10	96	67
Totals: 5426.5	716	1446(723)	1799	1439	1017 acres reduction
Existing (entire KEHA)	1363	2531 (1266)	3510	--	--

Note: *Units without existing cover would still have 20-30% retention patches of the best potential cover. The retention patches would also meet requirements for retaining structural diversity and future raptor habitat. *20% retention in fuels units and 30% in thinning, harvest or combinations with fuels.*

The project would reduce existing hiding cover in the KEHA from 2,629 acres to 1,612 acres, i.e. 1363+1266=2629, 2629-1017=1612. There are 7,704 acres of potential (forested) hiding cover outside of MA 7 in the project area. Post-treatment, there would be approximately 21 percent of the area providing hiding cover. The LRMP minimum requirement is 30 percent (WL-47), however for the black bark portions of the project area the minimum of 30 percent may be met by clumps of "visual screening" (WL-51). Screening cover is defined by the LRMP to be un-thinned/un-harvested stands at least 20 years old. The existing amount of unthinned areas older than 20 years within the KEHA would fall from 6,971 acres to 4982 acres or 65 percent screening cover (Appendix G), including areas without treatment units and the 20-30 percent retention patches within EA units. The overlapping summer range and KEHA would have both of their respective individual LRMP requirements met post-project.

Table 3-34: Winter Range (MA 7)-- Deer and Elk Thermal Cover Effects (acres)

EA Units (acres)	Thermal Cover Classes*			Gross Cover Reduction Acres	Net Post-Treatment Cover Reduction Acres (less 20-30% retention)**
	High	Moderate	Low (forested)		
103 (9.9)	0	0	0	0	0
104 (1417.3)	282	422	116	282	197
105 (75)	0	6	76	0	0
108 (295.9)	1	175	77	1	1
109 (35.2)	29	0	5	29	20
110 (28.8)	0	2	2	0	0
114 (42.5) Mow	0	0	0	0	0
Totals:	312	605	276	312	218 (acres eliminated)
Existing (entire MA7)	849	665	94	--	--

Note: *Units without existing cover will still have 20-30% retention patches of the best potential cover. The retention patches will also meet requirements for retaining structural diversity and future raptor habitat. * Thermal cover classes: High = 25% or > canopy cover, Moderate = 15-20%, Low (forested) = 1-10%. Only the High class is considered to meet big game requirements. **20% retention in fuels units and 30% in thinning, harvest or combinations with fuels.*

In summary, the analysis represents the maximum potential loss of thermal cover to vegetation treatments. For example, EA unit 104 has 1,417 acres. The retention of 30 percent of the unit in an untreated condition represents 425 acres. If all of the High class of thermal cover, i.e. 282 acres, were retained the impact on thermal cover would be totally eliminated. However, the present distribution of thermal cover in the unit may not lend itself to leaving all of it. Or some of the cover patches may be at imminent risk to bark beetles and need treatment. This analysis represents the "worse case" scenario. It is assumed that only 30 percent of the existing cover would be retained in this analysis. The project will reduce existing thermal cover from 849 acres

to 631 acres, i.e. 849-218=631. There are 1,608 acres of potential thermal cover (i.e. forested) in the MA 7 portion of the project area. The post-treatment cover would be approximately 39 percent of this area. The LRMP minimum requirement (MA 7, General Theme and Objectives) is 30 percent. Therefore, the project would be in compliance with the LRMP. There are no LRMP requirements for thermal cover on summer range.

Table 3-35: Ryan Ranch Key Elk (including MA 7 overlap)-- Thermal Cover Effects (acres)

EA Units (acres)	Thermal Cover Classes			Gross Cover Reduction	Net Post-Treatment Cover Reduction (less 20-30% retention)*
	High	Moderate	Low (forested)		
104 (1417.3)	38	92	5	38	27
104ROW (14.6)	0	11	0	0	0
108 (295.9)	0	17	0	0	0
110 (28.8)	0	27	2	0	0
110ROW (2)	0	2	0	0	0
112 (336.8) Burn	0	3	78	0	0
114 (42.5) Mow	0	4	0	0	0
114ROW (2.9)	0	1	0	0	0
115 (139.9)	55	49	31	55	39
115ROW (2.4)	0	0	0	0	0
116 (62.4)	1	42	20	1	1
117 (465.8)	207	199	60	207	145
118 (245.7)	101	70	60	101	71
119 (86)	22	35	28	22	15
120 (35.6)	18	16	2	18	13
121 (126.3)	41	47	30	41	29
122 (25.2)	18	7	0	18	13
124 (16.2)	16	0	0	16	11
125 (18.1)	15	3	0	15	11
126 (15.7) Burn	1	15	0	1	1
130 (115.2)	96	8	11	96	67
132E (20.7)	20	1	0	20	14
132W (21.1)	16	5	0	16	11
133 (42.6) Burn	29	0	13	29	23
134 (50.8)	32	19	0	32	22
135 (116.7)	94	6	18	94	66
136 (189.4)	134	30	25	134	94
138 (172.7)	85	7	81	85	60
139E (148)	130	9	9	130	91
139W (180.6)	140	10	30	140	98
140 (34.4)	31	2	2	31	22
141 (122.4)	8	0	114	8	6
142 (15.4)	16	0	0	16	11
143 (47.6) Burn	8	39	1	8	6
144 (24.4)	6	0	19	6	4
145 (71) Burn	20	34	16	20	16
146 (21)	19	2	0	19	13
147 (106.8)	86	5	13	86	60
148E (129.6)	84	37	9	84	59
148W (132.1)	81	36	15	81	57
149 (138.9)	88	51	0	88	62
176 (142.5)	115	21	5	115	81
Totals: 5426.5	1871	962	697	1871	1319 (acres reduction)
Existing (entire KEHA)	4327	2242	369	--	--

Note: *Units without existing cover will still have 20-30% retention patches of the best potential cover. The retention patches will also meet requirements for retaining structural diversity and future raptor habitat. *20% retention in fuels units and 30% in thinning, harvest or combinations with fuels.*

The project would reduce existing thermal over in the KEHA from 4,327 acres to 3,018 acres, i.e. 4327-1319=3018. There are 6,937 acres of potential (forested) thermal cover in the key elk portion of the project

area. Post-treatment, there would be approximately 44 percent of the area providing thermal cover. The LRMP minimum requirement is 20 percent (WL-50, 51) and would be met even when including black bark.

Forage Shrub habitats are important to wintering big game species. Mule deer in particular are very dependent upon bitterbrush for browse during periods of snow. Field reconnaissance verified that the area is dominated by mature and late bitterbrush. Table 3-36 summarizes treatment effects in MA 7 and in biological winter range.

Table 3-36: Bitterbrush Effects in Winter Range (acres treated)

Sub-Areas	Thin/Harvest Units (gross acres and treatment type)*	Fuel Units* acres	Existing Early Age/Structure Bitterbrush acres	Post-treatment mature/late brush (acres of early created)
MA 7 (2014 ac.)				
	104 (835 gross ac., w/mow; 30% retain)	--	0	251 (584) [835x.3=251 of late; 835-251=584 of early]
	105 (75, w/mow)	--	0	23 (52)
	108 (293, w/mow)	--	0	88 (205)
	109 (35, w/mow)	--	0	11 (24)
	110 (4, w/mow)	--	0	1 (3)
	--	114 (.5, w/mow)	0	0
Totals:	1242	.5	223 (wildfire)	374 (868)
Biological Winter Range (5463 ac.)				
	102 (23, w/mow)	--	0	7 (16)
	103 (10, w/mow)	--	0	3 (7)
	104 (582, w/mow)	--	0	175 (407)
	104ROW (15, w/mow)	--	0	5 (10)
	108 (3, w/mow)	--	0	1 (2)
	110 (24, w/mow)	--	0	7 (17)
	110ROW (2, w/mow)	--	0	1 (1)
	--	112 (337, burn)	0	67 (270)
	--	112ROW (20, burn)	0	4 (16)
	--	114 (.5, mow)	0	8 (34)
	--	114ROW (3, mow)	0	1 (2)
	115 (140 w/mow)	--	0	42 (98)
	115ROW (2 mow)	--	0	1 (1)
	116 (62, w/mow)	--	0	19 (43)
	117 (466, w/mow)	--	0	140 (326)
	118 (246, w/mow)	--	0	74 (172)
	119 (86, w/mow)	--	0	26 (60)
	120 (36)	--	0	30 (6)
	121 (126, w/mow)	--	0	38 (88)
	122 (25, w/burn)	--	0	5 (20)
	124 (16)	--	0	13 (3)
	125 (18, w/mow)	--	0	5 (13)
	--	126 (16, burn)	0	3 (13)
	176 (143, w/mow)	--	0	29 (114)
Totals:	2025	418	92 (fire) + 382 (activities x .25)= 188	704 (1739)

Note: *Conversion factor to early age/structure varies by treatment type with thin/harvest only at 18% (i.e. allowing for 30% retention and 25% conversion of treated ground to early; 100 ac = 30 ac. + 70 x .75 or 52 for a total of 82 ac. untreated or 18% total treatment); thin/mow or thin/burn at 70% (assuming only retention patches untreated); and fuels w/prescribed burns or mowing at 80% (assuming only retention patches untreated). The prescriptions (Table 2-1) are determined by the combination of the column, i.e. thin/harvest or fuels, and the parenthetical note for each unit.

In conclusion, the treatments would convert 868 acres in MA 7 to the early age/structure stage. The Awbrey Hall fire occurred in 1990 and given the 15 years of recovery and the relatively higher productivity sites in the area, these 223 acres are classified as the mid age/structure class. The pre-treatment (Alternative 1) shrub ratio is 0 percent early, 11 percent mid, and 89 percent late/decadent. Post-treatment (Alternative 2), the ratio of age/structure classes post-treatment of the East Tumbull units would then be 43 percent early, 11 percent mid, and 46 percent late/decadent in MA 7. The desired ratio is 1/3rd, 1/3rd, 1/3rd. However, this is not a specified

LRMP requirement but would be a consideration in the optimization of habitat on winter range as directed in the Theme and Objectives section of the LRMP for MA 7. The desired ratio was developed cooperatively with the ODFW (USDA 1998). The post-treatment wide ratio is acceptable given the need to maintain forage availability for deer and elk above average snow depths.

In the biological winter range portion, there are 188 acres that have evolved to the mid age/structure class from past wildfire and management activities impacts. Thus, the final ratio post-treatment of the East Tumbull units would be 32 percent early, 3 percent mid, and 65 percent late/decadent. Across the composite area of MA 7 and biological winter range the ratio would be 35 percent early, 5 percent mid, and 60 percent late, which is acceptable given the limitations of this first entry. However, the desired condition at the stand or EA unit level is to retain at least 40 to 50 percent of the shrubs in an untreated condition in a mosaic pattern. This would be accomplished at the EA unit level by excluding 20 to 30 percent of the EA unit for hiding cover and retaining 25 percent unmowed for a range of 40 to 55 percent. This is particularly important in EA units with multiple, overlapping treatments, e.g. thin/harvest followed by a mechanical mow.

The Key Elk Area was not analyzed for shrub forage conditions, because elk are not highly dependent upon shrub browse (i.e. preference for grasses and sedges) and primarily winter on adjacent private lands. The proposed prescriptions will provide a more open forest environment which will promote the growth of both shrubs and grasses in the mid to long-terms.

Cumulative Effects of Alternative 2 Effects of past and already approved activities to underburn 411 acres (BB 90 units 1, 3, 4, 10; Pine 90 unit 2; BB 89 units 8, 10; Katalo units 17, 23) and mow 26 acres (Katalo Units 8 and 10) have already been included incorporated into the existing and direct and indirect effects for hiding cover, thermal cover and shrub age/structure classes for MA 7 and the Ryan Ranch KEHA. There are no reasonably foreseeable activities within MA 7. Ongoing negotiations to acquire the 30,000 acre private Bull Springs Tree Farm, west of Bend, for public multiple use would ensure that this important winter range for deer remains intact. The elk herd in the East Tumbull project has been tracked with radio collars and was found to winter in either the Ryan Ranch KEHA on federal and private lands or to utilize winter range to the west in the Bend watershed (source Steve George, ODFW). There are no cumulative effects with treatments that effect thermal cover, either negatively or positively, in the Kelsey, Lava Cast, Lone Prairie and Opine projects because the elk that use the East Tumbull project area do not use the thermal cover habitat in those other project areas.

The East Tumbull (EA page 81, paragraph 4) project area is located in the Upper Deschutes herd unit for mule deer and the Kelsey, Lava Cast and Opine project areas are in the northern Paulina herd unit. The winter range for deer that use thermal cover in the Kelsey, Lava Cast, Opine and Lone Prairie projects is bounded on the west by Highway 97 (Kelsey Vegetation Management Project DEIS page 3-68) and there would be no cumulative or additive effects with East Tumbull because East Tumbull is in a separate herd unit and the East Tumbull project area is located outside the winter range for the deer that use these other project areas.

The cumulative effects on hiding and thermal cover in the Ryan Ranch KEHA from reasonably foreseeable activities is discussed below. Shrub forage conditions are not described because elk prefer grasses and sedges and the vegetation management activities discussed in the table below should prove to be beneficial from an elk nutritional standpoint.

Ryan Ranch KEHA Thermal and Hiding Cover 36 percent of the Ryan Ranch KEHA is within the boundary of the East Tumbull Project. The Katalo and Katalo West EAs of the 1990s, located immediately to the west of East Tumbull, cover an additional 43 percent (27 percent Katalo and 16 percent Katalo West) of the Ryan Ranch KEHA. The Kelsey EIS project area located on the eastside of the Deschutes River has an additional 21 percent of the acres in the Ryan Ranch KEHA. All vegetation management activities from the Katalo and

Katalo West EAs that would reduce cover have been completed and incorporated into Table 3-37. Table 3-37 used the preferred alternatives for the Kelsey EIS and the East Tumbull EA to derive final post-treatment cover.

Table 3-37: Ryan Ranch Key Elk Area Thermal and Hiding Cover Cumulative Effects

KEHA Sub-Area (21,462 ac. total)	Thermal Cover*	Hiding Cover*
Ryan Ranch KEHA (current condition; post-Katalo EAs)	37%	42%
East Tumbull EA 7,620 ac. (Alternative 2)	44%/65%**	21%/65%**
Kelsey Project (Alternative 3) 4,604 ac.	22%	33%
Ryan Ranch KEHA (post-Kelsey EIS/East Tumbull EA	30%	37%

Note: *post-treatments. **classified cover/black bark non-harvest/thin last 20 years. The overall current amount of cover in the KEHA is 9,104 acres of hiding cover and 8,020 acres of thermal cover (source Kelsey Project EIS Wildlife Report). These figures are the net amounts post Katalo and Katalo West Projects treatments. The future Kelsey Project (Alternative 3) would remove 97 acres of hiding cover and 224 acres of thermal cover. East Tumbull would remove 1,017 acres of hiding cover and 1,309 acres of thermal cover. Cumulatively the combined projects (i.e. E. Tumbull and Kelsey) would reduce hiding cover to 7,990 acres or 37% and thermal cover to 6,487 acres or 30%.

Sunriver (3,374 acres), Inn of the 7th Mountain (390 acres) and Highlands subdivision (1,311 acres) that are located within or immediately adjacent to the project area provide extensive foraging habitat for big game, especially elk that prefer grass. These private land areas also provide water and security for both deer and elk.

LRMP/Other Management Direction Consistency Thermal and hiding cover exceed the target landscape condition for the Kelsey KEHA and LRMP hiding cover (30 percent; WL-47, 51) and thermal cover (20 percent; WL-50, 51) standards and guides even when considering black bark in hiding and thermal calculations. Due to the length of the big game discussion LRMP consistency findings were made, where appropriate, above.

Northern Goshawk, Cooper's and sharp-shinned hawks Introduction The goshawk, Cooper's and sharp-shinned hawks are considered MIS species in the LRMP. They often use dense cover in which to hunt and nest. The goshawk is associated with mature and late-successional forests. All mature and late-successional habitats are considered potential nesting habitat and earlier forested seral stages are considered potential foraging habitat. Moist mixed conifer and moist ponderosa pine late-successional areas are preferred habitats, although forest structure appears to be the more limiting factor to goshawk habitat rather than stand composition (i.e. tree species). Preferred nest stands have a minimum of 40 percent canopy closure; and the nest sites within these stands typically have >60 percent canopy closure. Cooper's hawks tend to select nest sites in dense second growth of mixed conifer or ponderosa pine stands while sharp-shinned hawks utilize thickets in mixed conifer and deciduous woods.

No nest sites for any of these species were found in field surveys and there are no historic sites within the project area. The project area, however, does provide nesting and foraging habitat for these species. A total of 6,265 acres of black bark ponderosa pine and lodgepole pine within the project area is at high risk of bark beetle attack with a canopy closure that averages 40 percent. All of the species prefer canopy closure greater than 60 percent for nest sites although they do nest in stands that are less dense. The amount of potential nesting habitat treated, as defined by beetle risk (i.e. small to medium structure trees, average tree dbh 9"+), will be used as the measure for Alternative 2 effects.

Direct and Indirect Effects of Alternative 1, *Northern Goshawk, Cooper's and sharp-shinned hawks*. In the short-term, there would be no effect to goshawks, Cooper's and sharp-shinned hawks. Potential habitat would remain, with a majority of the potential nesting habitat for these species remaining in areas of high risk to beetle-induced mortality and wildfire.

Over the long-term, there would be increasing risk for the potential loss of nesting habitat from both beetle-induced and stand replacement wildfire mortality. Loss of nesting habitat from either of these events would displace these species from the project area, except for foraging, for a minimum of four to five decades. It is likely that there would be a declining trend in populations as a result of habitat loss due to natural disturbances.

Direct and Indirect Effects of Alternative 2, *Northern Goshawk, Cooper's and sharp-shinned hawks*. There would be no direct or indirect effects to raptors or nesting sites because none are known to exist within the project area. If nesting birds are found the appropriate LRMP no-treatment buffers and seasonal restrictions would be implemented.

Potential nesting habitat of the Cooper's hawk, northern goshawk and sharp-shinned hawk would be affected. The types of forested stands in which these species prefer to nest in are usually those stands that pose the highest risk for insect epidemics and uncharacteristic, stand replacement wildfire and in which many of the proposed activities would occur. Treated stands would reduce stand density and simplify stand structure to the extent that these stands would not provide the characteristics of optimum nesting habitat for the next two to three decades. The retention of 20 to 30 percent of each EA unit in wildlife cover clumps from 2 to 30 acres in size would continue to provide nest sites for these species in the interim in a well distributed pattern across the landscape. In total 2,458 of the 6,265 acres would be thinned.

The proposed activities would improve foraging habitat of the northern goshawk, Cooper's hawk, and sharp-shinned hawk. The commercial harvest and non-commercial thinning would create more open stand conditions. This would allow greater maneuverability, visibility, and access to prey and would promote habitat for the wide variety of birds that form the primary prey of the northern goshawk and Cooper's and sharp-shinned hawks. Reducing the risk of beetle mortality and wildfire would help develop and maintain potential habitat and populations of these species in the project area.

C**umulative Effects for Alternative 2** Activities identified in Appendix G were reviewed to assess whether, in combination with the likely effects of the East Tumbull Project, there would be any cumulative effects to northern goshawks, Cooper's and sharp-shinned hawks. These past and ongoing actions are either no longer having effects that would overlap the effects of the proposed action in time and space, or if their effects are ongoing, these effects have been incorporated into the existing habitat conditions and it is not useful nor relevant to the decision making process to analyze them separately. Other past and ongoing projects in the Pilot Butte watershed and adjacent landscape that overlap in time and space with the proposed actions may contribute effects that are additive to the proposed actions and may be useful and relevant to the decision-making process. Based on that review, the potential cumulative effects are those discussed below.

There is a short term downward trend in the amount of dense stands that have potential for nesting use by the northern goshawk, Cooper's hawk, and sharp-shinned hawk in the landscape and Pilot Butte watershed due to the combination of private land development, stand replacing fires and vegetation management activities. Approximately 36,000 acres of the 133,000 acres within Kelsey, Lava Cast, and Fuzzy project areas have or likely will have vegetation management treatments during the 2000 to 2015 time period. In the East Tumbull and the adjacent Katalo project area 5,077 of the combined 37, 745 acres within these project areas have or likely will have thinning treatments within nesting habitats preferred by these species. Suitable nesting sites no longer exist within the Bend, Sunriver, and Inn of the 7th Mountain communities for these species; although they continue to provide some foraging and dispersal habitat. All known nest sites within these project areas are protected from disturbance with nest core areas designated and deferred from treatment.

The ongoing trend of stand replacement wildfires within this landscape poses the greatest risk to these species. Over the long term the effects, of the combination of projects, on nesting habitat would be a decreased risk of stand replacement fire and epidemic beetle mortality while providing higher quality nesting habitat because of increased diameter growth due to thinning. All of these projects were designed to meet current management objectives to develop more LOS habitat (often the best potential nesting habitat) and restore a landscape this is more resilient to natural disturbances. The result would be more stable populations throughout the landscape,

and little risk of species displacement due to a large stand replacing wildfire or beetle mortality event. Cumulatively, the action alternative and other ongoing projects would not lead to a trend toward Federal listing for these species.

LRMP/Other Management Direction Consistency The Eastside Screens provides direction for goshawk habitat management on the Deschutes National Forest. In summary it states that all active and historic goshawk nest will be protected from disturbance, with a 30 acre no harvest buffer around the nest tree and designation of a 400 acre post-fledging area (PFA) that will retain LOS stands and enhance younger stands to become LOS (Interim wildlife standard Scenario A). There are no historic goshawk, Cooper's hawk or sharp-shinned hawk nest sites within the project area but should one or more be found no harvest buffers (WL-9, 11, 17, 19, 25, 28) and, in the case of goshawk a PFA would be established to protect them from disturbing activities.

Consistent with LRMP WL-6, 13, 16, 21, 26 prospective nesting habitat of up to 30 acres would be maintained within and adjacent to the EA units. Alternative 2 complies with all management direction for these species.

Great Gray Owl Introduction The great gray owl is a MIS species that is typically associated with mature and old stands due partially to the fact that they do not build their own nests and are dependent on broken top snags or structures made by other species such as ravens and red-tailed hawks. This species prefers lodgepole pine forest habitat in proximity to meadows and other forest openings with good pocket gopher populations (Marshall et al. 2003). Forsman and Bryan (1984) found that meadows where snow persisted beyond mid-April were not occupied. Snow conditions may not allow successful foraging due to the formation of a thick icy crust during this period. This finding, along with the lack of the preferred habitat for this species may suggest that great gray owl habitat is marginal within the project area.

Potential nesting habitat within the project area occurs primarily near the Ryan Ranch area. Foraging habitat is widespread. Great gray owl surveys were conducted in the project area in 2004 and 2005 with six protocol visits completed each year within suitable habitat. One response was detected during surveys located along the Deschutes River. No known nests are located within the project area.

Direct and Indirect Effects of Alternative 1, *Great gray owl* In the short-term, there would be no effect to great gray owls. Potential habitat would remain, with a majority of the potential nesting habitat for these species remaining in areas of high risk to beetle mortality and wildfire.

Direct and Indirect Effects of Alternative 2, *Great gray owl* There would be no direct or indirect effects to great gray owls because Alternative 2 has avoided pure lodgepole pine stands and it would not affect the meadow/forest interface or riparian habitats If nesting birds are found the appropriate LRMP no-treatment buffers and seasonal restrictions would be implemented. Reducing the risk of beetle mortality and wildfire on adjacent stands would be beneficial by helping to protect and maintain current habitat in the project area.

C**umulative Effects for Alternative 2** There are no past or ongoing activities within the project area that would affect great gray owl nesting or foraging habitat..

LRMP/Other Management Direction Consistency There are no historic great gray owl nest sites within the project area but should one or more be found no harvest buffers (WL-30 to 34) would be established to protect them from disturbing activities.

Great blue heron (MIS) introduction The great blue heron is one of the most wide-ranging water birds in Oregon (Marshall et al. 2003 p. 62). Highly adaptable, it is found along estuaries, streams, marshes and lakes throughout the state. The Deschutes River provides foraging habitat and nesting habitat although there are no

known colonies/rookeries in the East Tumbull project area.

Direct and Indirect Effects of Alternative 1, ***Great blue heron*** In the short-term, there would be no effect to great blue herons. Potential habitat would remain within the RHCAs, with the potential nesting and foraging habitat for this species remaining in areas of high risk to beetle mortality and wildfire.

Direct and Indirect Effects of Alternative 2, *Great blue heron* There would be no vegetation management activity within the 300 foot wide RHCA under Alternative 2; protecting the river, its banks and any foraging or nesting habitat from any project effects. If nesting birds are found the appropriate LRMP no-treatment buffers and seasonal restrictions would be implemented. Road closures and reducing the risk of beetle mortality and wildfire on adjacent stands would be beneficial by helping to protect and maintain current habitat in the RHCAs.

C**umulative Effects for Alternative 2** The Bend Fort Rock Ranger District RHCAs adjacent to perennial water bodies within the project area was used as the scope of analysis for the great blue heron. There are no past or ongoing vegetation management activities within the project area's RHCAs that would affect great blue heron nesting or foraging habitat. Based on that review, and the fact that there are no planned vegetation management activities within the RHCAs proposed with Alternative 2 there would be no cumulative effects.

LRMP/Other Management Direction Consistency There are no known nest sites within the project area but should one or more be found no harvest buffers (WL-35) and seasonal restriction would be established to protect them from disturbing activities. No large, mature and over-mature ponderosa pine favored for nest trees would be harvested anywhere within the project area (WL-36). The project is consistent with the Deschutes LRMP.

Waterfowl (MIS) introduction The Deschutes River provides habitat for waterfowl. Some species utilize large snags for nesting, while others utilize open grassy areas near the water's edge. It is unknown if there is any nesting on the river banks, but it is unlikely except in areas of well developed riparian vegetation. Twelve waterfowl species, in addition to those mentioned elsewhere in this resource section, have been documented in the project area (mallard, common merganser, hooded merganser, wood duck, green-winged teal, blue-winged teal, ring-necked duck, Barrow's goldeneye, common goldeneye, common loon, western grebe, and Canada goose).

Direct and Indirect Effects of Alternative 1, *Waterfowl* There would be no effect to waterfowl. Potential habitat would remain within the RHCAs, with a majority of the potential nesting habitat for these species remaining in areas of high risk to beetle mortality and wildfire.

Direct and Indirect Effects of Alternative 2, *Waterfowl* There would be no vegetation management activity within the 300 foot wide RHCA under Alternative 2; protecting the river, its banks and any foraging or nesting habitat from any project effects. Road closures and reducing the risk of beetle mortality and wildfire on adjacent stands would be beneficial by helping to protect and maintain current habitat in the RHCAs.

C**umulative Effects for Alternative 2** The Bend Fort Rock Ranger District RHCAs adjacent to perennial water bodies within the project area was used as the scope of analysis for waterfowl. Since there are no past, ongoing, planned or proposed vegetation management activities within the project area's RHCAs that would affect waterfowl nesting or foraging habitat there would be no cumulative effects. Artificial water features developed in association with Sunriver, Inn of the 7th Mountain and Highlands subdivision such as ponds and wetlands provides additional nesting, roosting and foraging habitat for these species

LRMP/Other Management Direction Consistency This project does not specifically implement habitat enhancement projects for waterfowl (WL-39); however it is consistent with the LRMP because there are no negative direct, indirect or cumulative effects.

***Red-tailed hawk (MIS introduction)*:** The red-tailed hawk is found throughout the state in every habitat and at every elevation, although scarce in dense forests (Marshall et al. 2003 p. 156). They are perch hunters (trees, utility poles, etc.) and inhabit mixed country of open areas interspersed with woods (agricultural areas, grasslands, woodlands, meadows). They roost and nest in large conifers often in the tallest tree on the edge of the timber. Past clearcutting harvest activities and wildfires have produced habitat conditions favorable for red-tailed hawks. Numerous sightings have occurred throughout the project area, however no known nests have been documented within or adjacent to any of the EA units.

Direct and Indirect Effects of Alternative 1, *Red-tailed hawk* There would be no effect to Red-tailed hawks. The increased potential for stand replacing wildfires could create additional foraging and nesting (snags) habitat for this species.

Direct and Indirect Effects of Alternative 2, *Red-tailed hawk* Development of open canopied forest structure and large trees in the long-term may provide potential nesting habitat (Marshall et al. 2003). Alternative 2 would potentially have a positive effect by accelerating the development of larger trees on 3,631 acres of thinning. Larger snags sometimes used as perch or nest trees would not be removed.

C**umulative Effects for Alternative 2** Cumulatively, red-tailed hawk populations are expected to remain stable across the district due to their generalist behavior. Distribution of red-tailed hawks across the district may become more patchy, focusing on low-severity burn areas and the open forest habitat preferred by this species. The cumulative combination of all the fuels treatments within the project area should have a beneficial effect on improving and protecting both short term and long term habitat on the 437 acres of approved mowing and burning and the 4,211 acres of proposed and reasonably foreseeable vegetation management activities.

Sunriver (3,374 acres), Inn of the 7th Mountain (390 acres) and Highlands subdivision (1,311 acres) that are located within or immediately adjacent to the project area provide extensive foraging and to a lesser extent nesting habitat for this species on maintained golf courses, irrigated open spaces and open canopied forested common ground. Red tails, if habituated to human presence, can use these type of private land areas to successfully nest.

LRMP/Other Management Direction Consistency There are no known nest sites within the project area but should one or more be found the forested character would be maintained for 300 feet (WL-2) around the nest and seasonal restrictions (WL-3, 4) implemented to protect them from disturbing activities. The project is consistent with the Deschutes LRMP.

Osprey (MIS) introduction: The Deschutes River provides potential foraging habitat for osprey. Osprey are specialized for catching fish. They nest near lakes and rivers in the tops of large snags or they may use artificial platforms if available. There are no known osprey nests within the project area at this time.

Direct and Indirect Effects of Alternative 1, *Osprey* There would be no effect to osprey. Potential nesting and foraging habitat for this species would remain at risk to stand replacement wildfire.

Direct and Indirect Effects of Alternative 2, *Osprey* There would be no vegetation management activity within the 300 foot wide RHCA under Alternative 2; protecting the river, its banks and any foraging or nesting

habitat from any project effects. If nesting birds are found the appropriate LRMP no-treatment buffers and seasonal restrictions would be implemented. Although some nesting osprey can be habituated to human disturbance the reduction in vehicle traffic from road closures could make the area more attractive for nesting.

C**umulative Effects for Alternative 2** The Bend Fort Rock Ranger District RHCAs adjacent to perennial water bodies within the project area was used as the scope of analysis for osprey. There are no past or ongoing vegetation management activities within the project area's RHCAs that would affect osprey nesting or foraging habitat and there are no identified cumulative effects.

LRMP/Other Management Direction Consistency There are no known nest sites within the project area but should one or more be found the forested character would be maintained for 300 feet (WL-2) around the nest and seasonal restrictions (WL-3, 4) implemented to protect them from disturbing activities. The project is consistent with the Deschutes LRMP.

Pine (American) Marten (MIS) Introduction The American marten is associated with mixed conifer and high elevation hemlock/lodgepole pine late-successional habitats, and is a focal species for climax habitats. There are no known records of marten within the project area and no surveys were conducted. Existing conditions suggest that there is a low probability of marten occupancy. Marten generally use higher elevation lodgepole pine and mixed conifer habitat types with a preference for mesic, late successional forests that is nonexistent within the East Tumbull project area. Heavy canopy cover and abundant coarse woody materials are also important in marten habitat (Ruggiero et al. 1994). Even though the project area does not have quality habitat for marten it could provide dispersal habitat for marten. A minor portion of the project area is comprised of plant associations considered marginally suitable for marten habitat (e.g., mixed conifer – 634 acres, lodgepole pine – 936 acres) due to their tendency to be dry without adequate levels of CWD and canopy cover.

Direct and Indirect Effects of Alternative 1, *Pine marten* There would be no effects to dispersal habitat for pine marten. Dispersal habitat would remain susceptible to loss from a stand replacement wildfire.

Direct and Indirect Effects of Alternative 2, *Pine marten* There would be no net loss of snags and CWD that are important for marten dispersal within the project area. As noted before there would be no vegetation management treatment within the lodgepole pine and mixed conifer plant associations preferred by this species with the exception of 13 acres of hand thinning and piling in EA unit 124 and there would be no loss of mature forest habitat. Alternative 2 would reduce the shrub layer and crown densities that may be important for dispersal but the retention of wildlife cover patches, wildlife travel corridors, slash pile retention and thinned and unthinned stand mosaic would continue to provide habitat for any marten dispersing through the project area.

C**umulative Effects for Alternative 2** The Bend Fort Rock Ranger District lodgepole pine, mountain hemlock and mixed conifer plant associations above 4,200 feet in elevation is being used as the scope of analysis for marten denning habitat. Since there are no ongoing, planned or reasonably foreseeable activities within or adjacent to the project area that would affect marten dinning habitat there are no cumulative effects. Interconnected travel corridors would continue to provide dispersal habitat, in the event that any individual marten disperse through the project area. There are no identified cumulative effects that would lead to a trend toward Federal listing for the American marten.

LRMP/Other Management Direction Consistency Wildlife standard and guideline WL-61 and WL-63 were assessed below. The project is consistent with the Deschutes LRMP.

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-61 – Marten prefer extensive stands of dense lodgepole, mixed conifer, or mountain hemlock forest containing abundant dead woody material as habitat for rodent prey.	Meets	There is no vegetation management activities within preferred habitat.
WL-63 – In preferred forest types, concentrations of down woody material will be left at an average of approx. one per acre after any timber harvest.	Not Applicable	Slash piles would be left at an average of one per acre in **nonpreferred** forest types where logs of the recommended size and density are not available for wildlife prey and dispersal.

Management and Ecological Indicator Species Introduction The following effects analysis includes LRMP designated Management Indicator Species (MIS), Focal Species (Altman 2000) and selected ecological indicator species that could be affected by Alternative 2 but haven't been addressed encyclopedically because the effects are either minor or nonexistent. They have been grouped in this section for brevity. Those species that would not be expected to utilize the types of habitats within the project area were not evaluated. References utilized for the biological information by species are noted at the bottom of Table 3-25 unless otherwise noted.

Direct and Indirect effects of Alternative 2

Green-tailed towhee: Open forest conditions with a vigorous shrub layer are preferred by this bird. Alternative 2 would likely reduce the amount of shrub cover in the short-term (refer to the big game forage discussion) within EA units. A significant amount of mature and late/decadent shrub habitat would be maintained across the project area. Further, the mitigation measures for big game species and the creation of more open forest conditions should enhance shrub habitats in the mid to long-term.

Mountain bluebird: Open forests, clear-cuts, edges of meadows, and burned areas are preferred habitats of this species. The project area would continue to meet these requirements after implementation of Alternative 2.

Yellow-pine chipmunk: Open forests with shrub under stories and an abundance of coarse woody debris or rocks for cover are important to this small rodent. Alternative 2 would maintain these characteristics well distributed across the project area for both short and long-term.

Western fence lizard: Rocky rims, canyons and hillsides with boulders are important. Alternative 2 would have no effect on these habitats.

Golden eagle (MIS): Development of open canopied forest structure and large trees in the long-term may provide potential nesting habitat (Marshall et al. 2003). Alternative 2 would potentially have a positive effect.

Bald eagle (MIS): Refer to the Proposed Endangered, Threatened and Sensitive Species section for details.

Peregrine falcon (MIS): Refer to the Proposed Endangered, Threatened, Sensitive Species section for details.

Wolverine (MIS): Refer to the Proposed Endangered, Threatened and Sensitive Species section for details.

Townsend's big-eared bat (MIS): Alternative 2 would have no effect on this species as there is no roosting or

maternity habitat (i.e. caves or lava tubes) in the project area. The nearest occupied site is Skeleton cave about 11 miles east of the project area.

Woodpeckers (MIS): The following species were not utilized as indicators, but are included in the LRMP MIS category:

Pileated woodpecker: The pileated woodpecker is closely associated with higher elevation, dense, mesic mixed conifer stands and requires large diameter logs and snags (Marshall et al. 2003). Evidence of the presence of this species has been documented within the project area, (i.e. one foraging site). Alternative 2 would have little potential impact on this woodpecker. An estimated 40 percent of the project area would be retained in heavier canopied forest; including areas of north slope with higher productivity and tree diversity (i.e. mixed conifer sites on north side of buttes) that is the preferred stand condition for any potential use by this species. The area where pileated use was documented would not be treated. Finally, it is known that the species rarely uses pure ponderosa pine habitats, which dominate the project area and which is the focus of Alternative 2 vegetation management treatments.

Lewis' woodpecker (Focal Species): This species is strongly associated with areas composed of burned and unburned LOS ponderosa pine forests with a preference for LOS ponderosa pine stand replacement fires. This habitat is all but absent within and adjacent to the project area and there have been no observations of this species in the project area. Alternative 2 treatments that create a more open canopied forest and accelerate the development of LOS and snags on 4,211 acres may provide more suitable habitat in the future.

Hairy woodpecker: Another open canopied forest species that would benefit by the proposed actions. They require snags which would show a slight increase under Alternative 2 while thinning would accelerate the development of future, larger diameter GTRs.

Black-backed woodpecker (Focal Species)*:* This woodpecker is an opportunist and seeks out burned areas. Its normal habitat is closely associated with lodgepole pine with a preference for LOS stands. Alternative 2 would have no effects on the population viability of this species, because pure stands of lodgepole would not be treated. Ponderosa pine is not their preferred habitat type (Marshall et al. 2003; Altman, 2000) but may be utilized after a stand replacement fire. They require snags which would show a slight increase under Alternative 2 while thinning would accelerate the development of future, larger diameter GTRs.

Northern three-toed woodpecker*:* The three-toed species is associated with higher elevation (over 4500' on the DNF) mixed conifer and lodgepole pine stands. It is closely associated with bark beetles (Marshall et al. 2003). Alternative 2 would have no effect on this species, because it is normally absent from the area. Any future occupancy would likely be incidental and short-term in the pursuit of insects attracted to the area. They require snags which would show a slight increase under Alternative 2 while thinning would accelerate the development of future, larger diameter GTRs.

Northern flicker*:* This species is a generalist that utilizes a wide variety of habitat types with a preference for open canopied forest and edges (Marshall et al. 2003). They require snags which would show a slight increase under Alternative 2 while thinning would accelerate the development of future, larger diameter GTRs.

Cumulative Effects for Alternative 2, LRMP/Other Management Direction Consistency There were no identified negative cumulative effects identified for any of the above species. The incremental effects from the past have been incorporated and assessed relative to the requirements of the described management and ecological indicator species. There are no BLM administered lands adjacent to the project area that would have a significant contribution to the cumulative effects of this project. One parcel of private land (81 acres) within

the project boundary and has been heavily developed. Significant acreages of private lands are adjacent to the project on the extreme northeast (i.e. City of Bend) and southeast (i.e. Sunriver development) that have also been significantly altered and are providing lower levels of habitat except for maybe species such as waterfowl and big game where the golf courses, water features, and landscaping associated with development may have improved habitat. There is no current active livestock grazing in the project area that would contribute to cumulative effects.

The other assessments of indicator species concluded that all the requirements for them would be met by the project. Further, the relative small scale of the project in comparison to the large ranges of the species is an important consideration. Future and past vegetation manipulation projects within the potential home ranges of affected species include the Kelsey (planning stage) and Katalo (completed) Projects. Each has thoroughly assessed potential effects and proposed or implemented mitigation measures as needed to reduce or eliminate local negative effects on indicator species. For example, three previous contiguous project areas to the southwest covering 61,086 acres within Upper Deschutes herd unit would maintain 40 percent hiding cover while having the beneficial effects of reducing wildland fire risk and reducing overall open road density by 1.2 miles per square mile. Therefore, given neutral or positive effects at the population level on indicator species, there is no cumulative effect issue relating to incremental increases due to the East Tumbull Project. In conclusion, all of the indicator species discussed in the EA and potentially associated with habitat in the project area would maintain populations at the local scale, are demonstrably widespread, abundant, and secure or apparently secure and no cumulative effects were identified that would contribute to potential range-wide factors depressing populations or a trend toward listing of any of the species analyzed (Reference the PETS section for additional information relating to species that were assessed that have potential population viability issues (i.e. declining trends) at the regional and/or national scales).

There are no known nest sites for golden eagles within the project area but should one or more be found the forested character would be maintained for 300 feet (WL-2) around the nest and seasonal restrictions (WL-3, 4) implemented to protect them from disturbing activities. The project is consistent with the Deschutes LRMP.

Riparian Species and Species with Special or Unique Habitats (MIS) introduction: Riparian species were addressed by the previous indicator species that disclosed that there would be no negative direct, indirect or cumulative effects to the riparian zone or aquatic habitats. Also addressed elsewhere is the effect on habitat and species associated with snags, CWD, GTRs and various plants communities and successional stages. This section looks at other unique habitats such as cliffs, shrubs and old growth management areas (OGMA).

Direct and Indirect Effects of Alternative 1, *Unique habitats* There would be no effects on unique habits. The greatest risk to these habitats is associated with the risk of a large stand replacement wildfire that would remain under Alternative 1. LOS forest habitats and the OGMA would continue to age and mature, developing LOS characteristics (large diameter trees, large lateral limbs, snags, CWD). High tree densities in many of the ponderosa pine stands (structural stages 1 through 5) would retard tree growth, increasing the amount of time to attain large diameter trees, and also place these stands at risk to insects, disease, and wildfire and may result in loss of LOS and OGMA habitats. Unlike a thinning from below prescription that leaves the larger, healthier trees; bark beetles tend to “thin from above” by killing the larger trees and delaying or even preventing the development of LOS. The current levels of shrubs, fragmentation and connectivity would be maintained given that no large stand replacing wildfires occur within or adjacent to the project area..

Direct and Indirect Effects of Alternative 2, *Unique habitats* There would be no direct or indirect effects on special or unique habitats such as cliffs, springs, small meadows within the project area because these areas would be excluded from the EA units.

Shrub Habitat As noted in the previous discussion on big game forage, approximately 60 percent of the area within winter range would be retained in mature and late/decadent bitterbrush habitats post-treatments. Non-winter range areas would have a similar retention level. The 20 to 30 percent retention patches within EA units would provide well distributed habitat for species dependent upon shrub habitats. These patches would be particularly valuable for birds and other wildlife that utilize edges or ecotones between different habitat types. Refer to the species specific discussions for additional information (e.g. green-tailed towhee, chipping sparrow).

In summary for Alternative 2, the project would enhance the habitat conditions for the majority of the indicator species by creating a more open forest that produces larger trees and a more diverse understory of shrubs and herbaceous plants. The project would retain adequate amounts of close canopied forest to meet the needs of species dependent upon this habitat type, e.g. pileated woodpecker, northern goshawk.

Late and Old Structure Habitat/Old Growth Management Areas Only a small portion (51 acres) of one designated OGMA is within the project area. There would be no effect on this OGMA or the connective corridors with adjacent LOS because they were excluded from vegetation management treatment under Alternative 2.

Proposed treatment within EA unit 124 would affect 13 acres or less than three percent of the 496 acres classified as LOS (including black bark) in the project area. The prescriptions to be employed in the LOS areas would enhance the productivity of the remaining trees by reducing competition by hand thinning and piling while maintaining the stand in its current structural stage 6.

Over the long-term, the forest would provide larger trees and the open forest environment preferred by the majority of management indicator species described earlier would be promoted. The retention of large areas of untreated young multi-story forest for elk thermal cover and vegetative diversity (LRMP TM-55, 56, 62, 64) would provide adequate habitat for those species requiring more complex forest structure (e.g. goshawk, pileated woodpecker).

Connectivity/Fragmentation As noted in the existing condition section of this report the project has relatively low fragmentation at the present. The types of treatment included with Alternative 2 such as thinning, prescribed burning, mechanical mowing of shrubs and road closures would have the overall effect of reducing fragmentation further and enhancing long term connectivity by reducing road related fragmentation and accelerating the development of LOS ponderosa pine.

The residual stands of trees after thinning would, on average, provide full stocking for the dry sites they occupy within the project area. Historically wildfire was common to ponderosa pine habitats and reduced tree and shrub densities. The management indicator species common to these habitats have a strong preference for these more open forest types.

Movement corridors for deer, elk and other species needing more security have been mapped (District files) and would be retained intact by Alternative 2 activities. Three minor portions of the corridors are overlapped by EA units, but they would be excluded by incorporating them into the 20 to 30 percent cover retention areas.

C**umulative Effects for Alternative 2** The cumulative effects on LOS and shrub habitat were covered under the ecosystem health section and the wildlife section respectively. The cumulative effects of road closures and vegetation management activities such as thinning and underburning within and adjacent to the project area would be beneficial on connectivity, fragmentation and other unique habitats as well as the species that utilize them because the risk of a large stand replacement fire would be much reduced. At the same time, small stand replacement wildfires that are beneficial to those species that prefer this type of habitat would likely continue to

occur within the project area. The overall cumulative effect of the treatments is to restore and move towards the historic size and frequency of disturbances within this dry, ponderosa pine landscape.

LRMP/Other Management Direction Consistency The retention of large areas of untreated young multi-story forest for elk thermal cover and vegetative diversity (LRMP TM-55, 56, 62, 64) would provide adequate habitat for those species requiring more complex forest structure (e.g. goshawk, pileated woodpecker) while unique habitats such as cliffs, , springs and small meadows would be excluded from vegetation management activities. In conclusion, the project would meet the LRMP direction for maintaining and promoting vegetative diversity (WL-74, WL-75).

The design of the corridors achieve the direction of the LRMP (WL- 48, 56) and the Eastside Screens, including connectivity for OGMAs and LOS habitats both within and outside of the project area, watershed and landscape.

Roads and Trails Introduction The following measures were used for wildlife habitat effectiveness: open road density miles per square mile for the Ryan Ranch KEHA, MA 7 and the project area

Direct and Indirect Effects of Alternative 1, *Roads and trails* Alternative 1 would maintain current road and user created OHV trail density. This would maintain or increase the levels of disturbance to wildlife and vulnerability of big game to hunting and poaching. OHV use, outside the river closure area, within the project area would likely increase through time, causing increased levels of resource damage and disturbance to wildlife species. Alternative 1 would preclude the option of closing unneeded system and non-system roads, which would likely have indirect and direct negative effects on achieving big game herd objectives.

Table 3-38: Road Density Effects

Sub-Areas	Existing Project Area Density (mi./sq. mi.)	Post-Project Area Density (mi./sq. mi.)
MA 7	3.5	3.3 (1.3 with winter closure)
Key Elk	6.0	2.8 (1.5 with winter closure)
Summer Range	Not calculated*	Not calculated*
Project Wide	4.5	2.2 (1.7 with winter closure)

Note: *given a 97% overlap with the Key Elk area outside of winter range this calculation would not have served a purpose.

Direct and Indirect Effects of Alternative 2, *Roads and Trails* The table above displays the effects of road decommissioning and closing within the project area. The third column parentheses reflects the Tumalo Cooperative Winter Range Area Closure period

C**umulative Effects for Alternative 2** Table 3-39 summarizes the effects of 26.1 miles of road closures and decommissioning within the Ryan Ranch KEHA included with the ongoing Katalo project and the proposed Kelsey EIS. Also included is the 38.4 miles of closures included in the East Tumbull EA and the proposed expansion of the Tumalo Cooperative Winter Range Closure Area under the Kelsey EIS.

Table 3-39: Ryan Ranch KEHA Road Density Cumulative Effects

Area	Existing KEHA Density (mi./sq. mi.)	Post Katalo EA (ongoing) & Proposed Kelsey EIS Road closures (mi./sq. mi.)	Post East Tumbull Road Closures (mi./sq. mi.)	Tumalo Winter Range closure
Ryan Ranch KEHA	4.6	3.8	2.7	1.2

LRMP/Other Management Direction Consistency It is concluded that although the road densities cumulatively exceed the LRMP KEHA guidelines (WL-46, 0.5-1.5 miles per square mile) and the maximum

densities recommended in the literature for winter range (i.e.1 mi./sq. mi. density; Thomas et al., 1979), that the East Tumbull Project is not an additive factor. The reasons being: 1) no new roads will be built; 2) 38 miles of existing roads would be closed or decommissioned; 3) both hiding and thermal cover retention meets or exceeds the LRMP guidelines at both the project and KEHA wide scales; 4) the Tumalo Cooperative Winter Range Closure (i.e. MA 7, biological winter range areas, and KEHA, see Table 3-39) Area mitigates the potential conflicts that could affect big game population viability at the local scale; 5) the maximum legal closures (i.e. reference the LRMP Amendment #12 for the Wild and Scenic River Plan) would be implemented; and 6) it is not anticipated that the KEHA road density post-treatments would reduce the achievement of herd management objectives set by the Oregon Department of Wildlife and specified in the LRMP (i.e. Upper Deschutes Management Unit, 950 summer and 150 winter elk population, WL-42; note ODFW M.O. of 700). The current estimated number of elk in the management unit is 500. The herd management area is much greater than the KEHA. Impacts to wintering habitats beyond the project area on private lands have had significant negative effects on deer and elk. The East Tumbull project will not incrementally add to these effects.

KEHA Open Road Density Evaluation (TS-12 to TS-14) In summary, the post-project road densities are in compliance with the LRMP standard and guideline (S&G) for MA 7 (MA 7-22) but not the entire KEHA (WL-46, 0.5-1.5 mi./sq. mi.). The LRMP directs that procedures described in the LRMP's Transportation S&Gs will be implemented in those cases where the threshold is exceeded. This section (LRMP 4-73, Open Road Density, TS-12, 13, and 14) specifies that the guideline densities will be used as thresholds for a "further evaluation" by a wildlife biologist. The evaluation follows: The KEHA occupies a critical location on the landscape for elk. It has high quality habitats for all the seasons and provides an important migration corridor for both deer and elk. The proximity of the KEHA to the communities of Bend and Sunriver and the presence of the Deschutes River attracts significant numbers of recreationists. Further, the river corridor has numerous recreational facilities for the public and the LRMP (4-56, WL-44) encourages this use in the Ryan Ranch KEHA by stating that "public use will not be restricted…during the calving season (May 1 to July 31)."

Many of the roads closed in the past (e.g. Wild and Scenic River plan) are presently very popular with hikers and mountain bike enthusiasts. In fact, the use is occurring year-round. During the Tumalo Cooperative Winter Range Area Closure period (motorized vehicles) there are people accessing the area on foot, snowshoes and skis. Outfitter-guides and others heavily use the river from spring to fall for rafting. The fact that the area is close to communities attracts off-road drivers, wood cutters, etc. in much higher numbers than other similar areas. The LRMP states "Where public use is heavy, the low end of the range (i.e. 0.5 mi./sq. mi-1.5 mi./sq. mi..) should be the objective (WL-46)." It should be noted that the Upper Deschutes River Plan has amended the LRMP (Amendment #12) to provide specified open roads for the public to designated recreational sites.

There are no natural mitigating circumstances (e.g. terrain, roadless areas, etc.) associated with the KEHA that would justify the maintenance of excessive road density given the direction in the LRMP. However, the scope of the East Tumbull project only encompasses approximately 36 percent of the total KEHA area, which significantly limits the project's ability to meet the overall average density guideline. Further, the requirements imposed by the Upper Deschutes River Plan prevent any additional road closures beyond those already planned (i.e. 11.9 mi. of closures and 26.5 mi. of decommissioned roads). The Wild and Scenic River corridor totals 4,051 acres of the project's area. The LRMP amendment affects roads outside of the corridor that cross areas of the KEHA. The amendment cannot be used as the reason to not achieve the LRMP density guidelines for the entire KEHA but does prevent additional road closures within the project area. Therefore, Alternative 2 is consistent with LRMP guidelines for road density within the portion of the KEHA located within the East Tumbull project area and the road closures significantly enhance conformance with wildlife objectives (TS-13).

Cumulative Ryan Ranch KEHA and MA 7 Road Density LRMP Consistency Open road effects may be mitigated by several variables including seasonal closures, terrain, road class or use level, and associated cover.

A higher density of roads through an area with good cover and rough, steep terrain would be less impacting than the opposite scenario. Big game population viability (i.e. huntable population level) at the management area scale (i.e. Upper Deschutes Unit) is generally not dependent upon road density effects. However, it can have significant local impacts. Roads can also greatly influence the quality aspects of hunting. Roads can also aggravate poaching and hunting season survival of local populations. Road access is primarily a social issue outside of the winter period. The Tumalo Cooperative Winter Range Area Closure (see map, Appendix H) has effectively mitigated the latter consideration at least for vehicle disturbance at the present to MA 7.

As noted earlier, disturbance by humans on foot and illegal motorized vehicle disturbance are on the increase in the project area. To reduce motor vehicle and foot traffic effects both the East Tumbull EA and Kelsey EIS would close a substantial amount of roads within their respective project areas, in addition to ongoing road closures occurring west of the East Tumbull project area (Katalo EA project area). The Kelsey EIS also implements a winter range closure for big game in the 4,604 acre portion of the Ryan Ranch KEHA that is located on the eastside of the Deschutes River. This area is contiguous with the Tumalo Cooperative Winter Range Closure Area and the dates of closure would be the same (i.e. December 1 to March 31). The cumulative reduction during the winter closure period to 1.2 miles per square mile also significantly enhances conformance with wildlife objectives within the KEHA.

Snags, Coarse Woody Debris (CWD) and Green Tree Replacements (GTRs) Introduction Snags, CWD and GTRs are important forest structures to many Management Indicator Species (Table 3-29). The average numbers of snags and GTRs per acre by PAG and lineal feet and percent cover of CWD are the measures tracked for these important habitat components.

Direct and Indirect Effects of Alternative 1, *Snags, CWD and GTRs* Alternative 1 would maintain current snags, CWD and GTRs. On average, snag and CWD habitat would continue to meet desired levels within the lodgepole pine dry plant association groups (PAGs), and likely remain below the desired levels in the ponderosa pine dry PAG during the short-term (less than 10 years). This is due to mortality in lodgepole pine stands being higher than in ponderosa pine and the fact that the lodgepole pine stands were not harvested in the 1920 to 1950 time period. The resulting stands of ponderosa pine that have developed after clear-cut harvesting are simply not old enough to provide the overall desired levels of CWD or number of larger snags. The number of smaller diameter snags in the 10 to 20 inch dbh category would continue to meet the desired levels.

Natural disturbances such as wildfire, wind events, insect and disease pathogens, and lightning would recruit snag and CWD habitat through time, increasing the amount of these habitats. High tree density in some of the ponderosa pine stands may hasten the development of snag and CWD habitat as a result of mortality from bark beetles or fire. While density of these habitats is expected to increase through time, the size (diameter) of the trees in densely stocked stands would, on average, be less than if Alternative 2 were implemented to increase tree growth. High tree density in many of the ponderosa pine stands would retard the development of large diameter (>20") ponderosa pine trees and future snags as discussed under the ecosystem health section. This could adversely affect some Indicator Species (Table 3-25). Alternative 1 would also forgo creating snags in areas presently deficient of large diameter wildlife trees.

GTRs would remain at risk within the landscape and project area from large stand replacing wildfires.

Cumulative Effects of Alternative 1*, Snags, CWD and GTRs*. Although there would not be any cumulative effects, since there would be no activity, the trend of stand replacing wildfires would continue within the Pilot Butte watershed. At current rates all of the forested land could have stand replacement wildfire during the next 50 years, preventing the attainment of large diameter snags, CWD, GTRs and habitat conditions preferred by many wildlife species.

Direct and Indirect Effects of Alternative 2, *Snags, CWD and GTRs* This alternative would have direct and indirect effects on snags and CWD even though Alternative 2 does not include the salvage of any standing, dead trees or any dead, down trees. Some snags on the 2,627 acres of commercial thinning could be potentially transitioned to CWD (i.e. knocked down and left) due to worker safety related issues, however the use of mechanized harvest equipment greatly reduces, if not eliminates (Personal Communication-2006, Loren Sessa, Deschutes National Forest, FSR), that possibility.

Thinning has the direct effect of reducing stand densities and competition between trees for the available resources of water and nutrients. This would result in an increase in size of the trees and accelerate the development of larger diameter trees that meet the habitat needs of a broader range of snag and log dependent species. However, the reduction in competition would also decrease the mortality rate of trees from insects and disease in the EA thinning units. Generally, the small size classes of trees are the most susceptible to this type of mortality but bark beetles, as an example, commonly kill the larger trees that are stressed as well.

As noted under the Ecosystem Health section, mortality is expected to average less than two beetle and disease killed trees per acre per decade over the next 25 years in EA units (2,627 acres) thinned at 60 to 80 square feet of basal area per acre. On-going levels of mortality are currently averaging approximately one to two trees per acre per decade in EA units that would have thinning up to 21 inches dbh. The current and predicted future rates of mortality after thinning are similar because current beetle populations are acting at generally endemic levels within the project area. As beetles become more active in ponderosa pine stands, at risk of epidemic beetle attack, one can assume that ongoing mortality and snag creation would probably be less in the thinned stands over the next 20 to 25 years. This is perhaps best illustrated by the fact that the number of dead snags in dense, unthinned ponderosa pine stands varies from approximately 1 to 13 snags per acre depending on the level of beetle activity. As these unthinned stands continue to develop their susceptibility to beetle attack would continue to increase with the result that up to 50 percent of the stand may be killed.

The use of prescribed fire would have direct and indirect effects on snags and CWD within the 1,587 acres included for underburning. Underburning would burn down some existing snags as well as consume some of the existing CWD while also killing some of the existing overstory trees. Based on monitoring of prescribed fall burns within the project area (reference Table 3-23) on average approximately 1.1 standing green trees were killed versus the loss of 0.2 snags. The snags lost (i.e. burned over) replaced the existing CWD that was consumed during under burning operations. Prescribed burning prescriptions, as well as lining snags and large CWD, was shown to be very effective in not only mitigating the loss of any snags and consumption of CWD but also in actually increasing the number of snags per acre.

The creation of 260 new snags between 20 and 26 inches dbh for future habitat would be a high priority for potential Sale Area Improvement funding (reference Chapter 2). These snags would be long-term wildlife trees that would be created by chain sawing the top off of selected trees while leaving some live limbs to extend the effective life of these trees. The 20 inch and over size class was chosen because (Tables 3-21 to 3-24) snags of this size class are below the desired levels of 1.1 snags per acre (Table 3-27) due to the history of clearcut logging in the project area. Over time, as prescribed fire treatments are applied the snag numbers should increase in those EA units.

Thinning of 1,004 acres with a silvicultural prescription up to 12 inches dbh is not expected to effect existing snags or CWD levels in these (non commercial) EA units. The reasons for this are that the majority of the work would be done by hand and none of the areas would be under burned. Snag surveys have shown that the majority of the standing dead trees are within clumps that approximate 20 percent of the gross area of these stands. These clumps would be retained for wildlife cover and as areas where snags would continue to be

created at accelerated levels when compared with the overall landscape. Other agents of snag and CWD creation that are not affected by density reduction treatments would continue on that portion of the EA units actually thinned.

GTRs for future wildlife trees would benefit from thinning and wildfire risk reduction by increasing residual stand diameters and accelerating diameter growth to lesson the time period to develop larger trees for future wildlife snags and CWD that is preferred by some wildlife species and that is more persistent on the landscape due to its resistance to natural and human caused disturbances.

There would be no direct or indirect effects on snags, CWD and GTRs within the lodgepole pine plant association group because there would be no vegetation management treatment.

Cumulative Effects of Alternative 2*, **Snags, CWD and GTRs***. If underburning results are similar to the results documented in Table 3-23, a net of approximately one (0.9) additional snag/acre would be created on the 1,587 acres of underburning included with Alternative 2 and the 411 acres of underburning (BB 90 units 1, 3, 4, 10; Pine 90 unit 2; BB 89 units 8, 10; Katalo units 17, 23) that is on-going in the project area. The cumulative result of this underburning would be to increase the current overall average number of snags per acre on the 8,204 acres of ponderosa pine from 2.33 snags per acre to 2.57 snags per acre.

The Sale Area Improvement Plan for Alternative 2 includes the creation of 260 wildlife tree larger than 20 inches dbh. Approximately 50 of the 200 wildlife trees created with the Katalo Sale Area Improvement Plan are located within the project area. The addition of these 310 snags would further increase the average number of snag per acre from 2.57 snags per acre to 2.61 snags per acre. More importantly, while these larger snags have a small additive effect to overall snag levels, these wildlife trees would be created in the diameter class (i.e. >20" dbh) this is below desired levels within the landscape.

The overall trend in the project area under Alternative 2 would be a cumulative increase in the amount of snags and CWD within the project area over the next 10 years. The current snag levels of 15.0 dead trees per acre in the lodgepole pine PAG would continue to increase, as well, over the longer term. As noted, there is the potential for some decreased recruitment over the next two to three decades on the 2,627 acres of commercial black bark thinning EA units (i.e. thin <21" dbh); however at the level of proposed activity only 2,458 acres of the 6, 265 acres of high and 698 of 1,973 acres of moderate beetle risk would be treated (Appendix I, Table I-9). The remaining 3,807 acres (40 percent of the forested area within the project area) of high and 1,275 acres of moderate beetle risk stands can be expected to have greatly accelerated beetle mortality over the next two to three decades for the reasons stated before. Over the short term (< 10 years) the untreated portions of the project area would likely recruit snags at current rates as determined by endemic insect, disease, and competition related mortality but at a higher rate than natural background rates because of the small average diameter of the stands that exceed the carrying potential of the sites they occupy.

Reducing the risk of future stand replacing wildfire by the thinning of stands and by the reduction of fuel continuity, would be a positive long-term effect for snag dependent wildlife species and GTRs.

There would be no cumulative effect on snags, CWD and GTRs within the lodgepole pine PAG because there are no proposed or ongoing treatments within this habitat type. However, the same risk reduction benefits from fuels reduction would be beneficial in maintaining this area on the landscape which is important for species associated with snags, CWD and lodgepole pine as well as big game.

Private land development effects would generally be expected to be negative on most snags and CWD associated species. While the number of snags can be expected to be less in residential neighborhoods this can

be offset, at least for some species, by the extensive use of nest boxes and bird houses. At the same time, Sunriver, Inn of the 7th Mountain and Highlands all have extensive common areas were snags and CWD exist.

LRMP/Other Management Direction Consistency All treatments would retain snags (2.25/acre) and CWD (20-40 lineal feet >12"dbh) above the levels specified in the Eastside Screens standards for timber sales for ponderosa pine. As noted no snags or CWD would be removed and snags and CWD would continue to increase over the short and long term to move towards the desired levels determined by using the best available science.

The DecAID advisor cautions against using the tool on a stand or project area basis. It was developed as a planning tool intended to help specialists manage snag and log levels best suited for their management area and associated wildlife species on a landscape level. The synthesis of the various scientific references in DecAID indicate that approximately 54 percent of the inventoried areas had no snags while the balance had measurable snags >10" dbh at varying levels. In other words, historically the dry ponderosa pine forests within this area had a wide diversity of snag levels in a clumpy pattern where large portions of the landscape had no snags at all. The range on the rest of the landscape varied from low to high levels of snags and CWD.

The ID team used DecAid and other sources to determine how to best to design Alternative 2 to move back towards the historic distribution level of snags and CWD on the landscape. The mosaic of wildlife hiding cover areas associated with each thinning EA unit (20 to 30 percent) helps promote and move towards this historic diversity pattern across the landscape. The strategy of retaining and promoting the development of snags and CWD within the EA units along with designating 2 to 30 acre cover clumps scattered throughout the EA units where high levels of mortality can develop is consistent with the best available science by replicating on the landscape a wide variety of snag and CWD levels. As noted before, areas of lodgepole pine where high levels of current snags and CWD exist were deferred from vegetation management activity.

As discussed above, prescribed burning would remove some CWD but burning prescriptions are designed to ensure that consumption will not exceed 1.5 inches of diameter reduction of the featured large log sizes in the Eastside Screens by conducting burning operations when there is sufficient moisture to reduce consumption and by lining of individual large snags and pieces of desirable CWD. Where existing CWD is absent, an average of 1 slash pile or concentration per acre would be retained (WL-73).

Green tree replacements, post-thinning, would be adequate for the future recruitment of snags and logs. The EA units proposed for thinning up to 21 inches dbh would retain a minimum of 60 square feet of basal area which is equivalent to approximately 40 to 120 trees per acre (i.e. depending upon average tree diameter). Thinning of EA units with a prescription up to 12 inches would retain from 70 to 110 trees per acre. Using the reference for snag habitats at the 50 percent level for low productivity ponderosa pine habitats (small/medium tree category), 40 trees (3"-8" minimum diameter range) should be retained for future recruitment. The residual trees retained by the prescriptions would average 10 to 14 inches dbh, exceeding the minimum diameter requirements. The Deschutes National Forest Wildlife Tree and Log Implementation Strategy (WLTL, 1994) recommends 11.7 trees per acre (10"-20"+ size classes with 0 existing snags) at the 100 percent Maximum Population Potential (MPP) level (Eastside Screens). Some studies (Rose et al 2001) suggest that MPP levels are too low. Alternative 2 is consistent with LRMP direction, Eastside Screen levels and the best available science.

Birds of Conservation Concern Introduction The "Birds of Conservation Concern 2002" (BCC) identifies species, subspecies, and populations of all migratory non-game birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973. Bird species considered for inclusion on lists in this report include non-game birds, game birds without hunting seasons, subsistence-hunted non-game species in Alaska, and Endangered Species Act candidate, proposed endangered or threatened, and recently delisted species. While all of the bird species included in BCC are

priorities for conservation action, the list makes no finding with regard to whether they warrant consideration for ESA listing. The goal is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservations actions (USFWS 2002). The U.S. Shorebird Conservation Plan (USFWS 2004) revised the 2001 Plan with new information and developed a list of U.S. and Canadian shorebirds considered highly imperiled or of high conservation concern. Conservation measures were not included but these lists should be consulted to determine reasons for conservation concern.

Bird Conservation Regions (BCRs) were developed based on similar geographic parameters. One BCR encompasses the East Tumbull Project Area – BCR 9, Great Basin. See below for a list of the bird species of concern for the area, the preferred habitat for each species, and whether there is potential habitat for each species within the East Tumbull project area. Species appearing in **bold** are those considered highly imperiled or high conservation concern by the U.S. Shorebird Conservation Plan as of August 2004.

Table 3-40 BCR 9 (Great Basin) BCC 2002 list.

Bird Species	Preferred Habitat	Habitat within the East Tumbull Project Area (Y or N)
Swainson's Hawk	Open lands with scattered trees	N
Ferruginous Hawk	Elevated Nest Sites in Open Country	N
Golden Eagle	Elevated Nest Sites in Open Country	Y
Peregrine Falcon	Cliffs	Y
Prairie Falcon	Cliffs in open country	N
Greater Sage Grouse	Sagebrush dominated Rangelands	N
Yellow Rail	Dense Marsh Habitat	N
American Golden-Plover	Burned Meadows/Mudflats	N
Snowy Plover	Dry Sandy Beaches	N
American Avocet	Wet Meadows	N
Solitary Sandpiper	**Meadow/Marsh**	**Y**
Whimbrel	**Marsh/Mudflats**	**N**
Long-billed Curlew	**Meadow/Marsh**	**Y**
Marbled Godwit	Marsh/Wet Meadows	N
Sanderling	Sandbars and beaches	N
Wilson's Phalarope	**Meadow/Marsh**	**Y**
Yellow-billed Cuckoo	Dense riparian/cottonwoods	N
Flammulated Owl	Ponderosa pine forests	Y
Burrowing Owl	Non-forested Grasslands	N
Black Swift	Cliffs associated with waterfalls	N
Lewis's Woodpecker	Ponderosa pine forests	Y
Williamson's Sapsucker	Ponderosa pine forests	Y
White-headed Woodpecker	Ponderosa pine forests	Y
Loggerhead Shrike	Open country with scattered trees or shrubs	N
Gray Vireo	Arid scrub habitat	N
Virginia's Warbler	Scrubby vegetation within arid montane woodlands	N
Brewer's Sparrow	Sagebrush clearings in coniferous forests/bitterbrush	N
Sage Sparrow	Sagebrush	N
Tricolored Blackbird	Cattails or Tules	N

Landbird Strategic Plan Direction The Forest Service has prepared a Landbird Strategic Plan (January 2000) to maintain, restore, and protect habitats necessary to sustain healthy migratory and resident bird populations to achieve biological objectives. The primary purpose of the strategic plan is to provide guidance for the Landbird Conservation Program and to focus efforts in a common direction. On a more local level, individuals from multiple agencies and organizations with the Oregon-Washington Chapter of Partners in Flight participated in

developing a publication for conserving landbirds in this region. A Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington was published in June 2000 (Altman 2000). This document outlines conservation measures, goals and objectives for specific habitat types found on the east-slope of the Cascades and the focal species associated with each habitat type. This document provides recommendations for habitat management within the Central Oregon subprovince. See the table below for specific habitat types highlighted in that document, the habitat features needing conservation focus and the focal bird species for each.

Table 3-41 Priority habitat features and associated focal species for Central Oregon.

Habitat	Habitat Feature	Focal Species for Central Oregon (Habitat Y or N in East Tumbull)
Ponderosa Pine	Large patches of old forest with large snags	White-headed woodpecker-Y
	Large trees	Pygmy nuthatch-Y
	Open understory with regenerating pines	Chipping sparrow-Y
	Patches of burned old forest	Lewis' woodpecker-Y
Mixed Conifer (Late-Successional)	Large trees	Brown creeper-Y
	Large snags	Williamson's sapsucker-Y
	Interspersion grassy openings and dense thickets	Flammulated owl-Y
	Multi-layered/dense canopy	Hermit thrush-Y
	Edges and openings created by wildfire	Olive-sided flycatcher-Y
Lodgepole Pine	Old growth	Black-backed woodpecker-Y
Meadows	Wet/dry	Sandhill Crane-Y
Aspen	Large trees with regeneration	Red-naped sapsucker-N
Subalpine fir	Patchy presence	Blue Grouse-N

Ponderosa pine forests have incurred the largest and most widespread declines among the habitat types for terrestrial vertebrates in the Interior Columbia Basin (Wisdom et al. in press). Single, overstory ponderosa pine has declined by 55 percent and 18 percent within the Southern Cascades and Klamath Ecological Reporting Units. The desired condition for ponderosa pine is a large tree, single layered canopy with an open, park-like understory dominated by herbaceous cover with scattered shrub cover and pine regeneration.

Sixteen species are identified from these lists with the potential to be found within the East Tumbull Project Area. The golden eagle, peregrine falcon, Lewis's woodpecker, and black-backed woodpecker were covered in other sections of this document both as an individual species and as representing a group of species. The solitary sandpiper, long-billed curlew, Wilson's phalarope and sandhill crane are associated with meadows that are located within the RHCAs of the project area. Since there is no vegetation management activity within the RHCAs and there are no direct, indirect or cumulative effects to any of these species or their habitats they will not be discussed further.

The eight remaining focal species (brown creeper, hermit thrush, olive-sided flycatcher, chipping sparrow, Williamson's sapsucker, white-headed woodpecker, pygmy nuthatch, flammulated owl) are addressed below because they relate to specific habitat features within ponderosa pine and mixed conifer stands that have not been addressed before and which may have the potential for effects to individual focal or associated species and their habitat.

Focal species associated with the remaining habitat types have not been addressed below because the habitat or species are either absent (i.e. subalpine fir; ponderosa pine- patches of burned old forest) from the project area

or the action alternative would have no negative direct, indirect or cumulative effects on focal and associated species because the habitat (meadows; lodgepole pine) has been excluded from vegetation management activity.

Ponderosa Pine, Large Patches of Old Forest with Large Snags/Large Trees – White-headed woodpecker and Pygmy nuthatch introduction Both species are dependent upon ponderosa pine LOS, although the pygmy nuthatch will utilize younger age class forest habitats. Bate (1995) found that the abundance of white-headed woodpeckers in the central Oregon Cascades increased with increasing densities of large trees and snags greater than 20" dbh.

Wisdom et al found mixed trends for both species. Reasons for declines are extensive loss of large diameter ponderosa pine to timber harvesting, lack of recruitment of young ponderosa pine due to fire suppression that has allowed the encroachment of firs and lodgepole pine and predisposes the area to stand replacement fires, grazing which can suppress development of young ponderosa pine, fragmented habitat that increases energy expenditure and risk of predation to secure resources. In the case of the white-headed woodpecker they are dependent on large pine seeds during the non-breeding season and almost all ponderosa pine seed production is by large, dominant trees in open pine forests.

Current habitat for these species is limited with a total of 496 acres of LOS within the project area.

Mixed Conifer, Large Snags/Interspersion grassy opening and dense thickets – Williamson's sapsucker and Flammulated owl introduction Both species are associated with the mixed conifer PAG but do use ponderosa pine LOS, hence their grouping with the white-headed woodpecker and the pygmy nuthatch. Wisdom et al found mixed trends for both species with the declines generally associated with the Northern Cascades. As noted under the discussion for the white-headed woodpecker, pygmy nuthatch and brown creeper, mixed conifer and ponderosa pine LOS, large trees and large snags are almost non existent within the project area. The flammulated owl is associated with relatively open LOS ponderosa pine and mixed conifer forests interspersed with patches of higher density trees.

Factors that can contribute to a decline of these two species is the loss of large old trees and snags that these two species are dependent on for nesting, roosting and foraging (Williamson's sapsucker only). Fire suppression that leads to a loss of open understory and that inhibits tree growth and prevents or delays the development of large diameter trees are also contributing factors.

The development/maintenance of open understory ponderosa pine stands with a shrub or grass component will be used as the measure to evaluate the effects of the two alternatives on these four species.

Direct and Indirect Effects of Alternative 1, *White-headed woodpecked, Pygmy nuthatch, Williamson's sapsucker and flammulated owl* Under Alternative 1, the percentage of open understory pine would remain at approximately 17 percent of the project area as the 437 acres of on-going treatments cancel out an estimated 598 acres of open ponderosa pine stands that would naturally transition (due to tree and shrub growth) to a more dense understory habitat that would not be favorable for these species. Over the long term (10 to 20 years), the percentage of the project area with open understory pine would fall to near zero as recently completed and ongoing fuel reduction activities naturally transition to dense tree and shrub under stories less favorable for these four species.

As discussed in the Ecosystem Health section, beetle mortality often "thins from above" by removing the largest diameter trees. Beetle mortality under this alternative would likely increase both mortality of the larger diameter pines and add to the fuel loading and risk of stand replacement fires. Some species would benefit over the short-term from the tree mortality but the larger trees in these black bark stands generally are below the

desired sizes preferred by many of these focal species and the combination of beetle mortality and wildfire could prevent or delay by many decades the development of LOS within the project area and larger landscape.

Direct and Indirect Effects of Alternative 2, *White-headed woodpecked, Pygmy nuthatch, Williamson's sapsucker and Flammulated owl* Alternative 2 would thin approximately 3,618 acres of ponderosa pine in middle-aged structural stages 4 and 5 followed by underburning or mowing; providing habitat preferred by these species. The proposed thinning treatments that focus on black bark ponderosa pine would improve tree growth and health, which would in the long-term accelerate and provide LOS habitat conditions. All four species require snags (especially large snags) which would show a slight increase under Alternative 2. Thinning would accelerate the development of future, larger diameter GTRs and fuller crowns and seed production benefiting the white-headed woodpeckers and other seed eaters. A sale area improvement project that would create larger wildlife trees over the short-term would be beneficial for the white-headed woodpecker, Williamson's sapsucker and flammulated owl. Retention of 20 to 30 percent cover clumps associated with each EA unit would be beneficial for the flammulated owl.

Vegetation management activity within EA unit 124 that is designed to extend the life of large LOS ponderosa pine on 13 of the 496 acres of LOS within the project area may be beneficial, however vegetation management activity within EA unit 124 would not treat either the trees > 12" dbh or the shrub layer and the stand would remain a multi-stratum structure stage 6 stand that is not the preferred habitat for these species with the exception of the Williamson's sapsucker that prefers large snags.

Cumulative Effects of Alternative 2 The black bark ponderosa pine stands within the project area is being used as the scale for analysis for this species. The cumulative effect of the 439 acres of ongoing prescribed underburning and mowing combined with the 4,211 acres of thinning, mowing and underburning included with Alternative 2 would be to increase the percent of open pine stands from 17 percent of the project area to 55 percent over the next 5 to 10 years falling to 43 percent over the 10 to 20 year time period. The ongoing restoration and planned thinning, mowing and underburning of black bark stands adjacent to the project area and within the larger landscape would also be beneficial for these species.

Landbird Strategy Consistency Biological objectives for the White-headed woodpecker and Pygmy nuthatch in ponderosa pine LOS is addressed below followed by the objectives for the Williamson's sapsucker and flammulated owl. The project meets objectives outlined in the Conservation Strategy for Landbirds on the East-Slope of the Cascade Mountains in Oregon and Washington.

Objective	Do Not Meet, Meets, Not Applicable	Rationale
White-headed woodpecker and Pgymy nuthatch- Where ecologically appropriate initiate action in ponderosa pine stands to provide the following LOS conditions: 10 trees/acre > 21" dbh and at least 2 > 31" dbh. 1.4 snags/acre > 8" dbh with ½ of the snags > 25" dbh	Meets	Vegetation management activities would accelerate or maintain LOS conditions while also maintaining snag levels above the desired level. The project would also increase the number of larger snags and diameter growth of the residual stand for larger GTRs.
White-headed woodpecker- Where ecologically appropriate provide the conditions described above in predominantly LOS > 350 acres.	Meets	EA units were designed to meet species requirements for larger blocks of LOS ponderosa pine and diversity.

Objective	Do Not Meet, Meets, Not Applicable	Rationale
Williamson's sapsucker- Where ecologically appropriate initiate action in mixed conifer LOS forest to maintain or provide the following conditions: 1 snag/acre > 18" dbh (ponderosa pine) and mean canopy cover of 25-70%	Meets	Vegetation management activities would accelerate or maintain LOS conditions while also increasing the number of larger snags. Silviculture RX would retain on average a minimum 25-30% canopy cover
Flammulated owl- Where ecologically appropriate, initiate actions to maintain or provide LOS mixed conifer forest habitat with the following conditions: >10 snags/100 acres > 12" dbh and 6 feet tall; 8 trees/acr >21" dbh for GTRs; at least one large or two smaller dense, brushy thickets of sapling/pole trees for roosting habitat; one or two smaller grassy openings, provide conditions described above in patches of suitable habitat > 350 acres…	Meets	Vegetation management activities would maintain all trees currently > 21" dbh (Eastside Screens) and all snags while increasing the total number of snags within the EA units. Wildlife clumps from 2 to 30 acres and 20 to 30 % of the gross acres would be maintained with each EA unit while underburning and mowing would provide grassy openings. EA units were designed to meet species requirements for larger blocks of LOS ponderosa pine and diversity.

Ponderosa Pine, Open Habitats/Open Understories with Regenerating Pines – Chipping Sparrow introduction Chipping sparrows prefer open coniferous forests or stands of trees interspersed with grassy openings or low foliage (Marshall et al. 2003 pp. 538-542). Small forest openings with grasses and forbs are also important for foraging. Declines in populations of 3.9 percent per year have been noted from Breeding Bird Survey (BBS) results for the chipping sparrow. Some reasons for these declines include habitat changes due to fire suppression, grazing, invasion of exotic species and fragmentation. The development/maintenance of open understory ponderosa pine stands with a shrub or grass component will be used as the measure to evaluate the effects of the two alternatives.

Direct and Indirect Effects of Alternative 1, *chipping sparrow* Under Alternative 1, the percentage of open understory pine would remain at approximately 17 percent of the project area as the 437 acres of on-going treatments cancel out an estimated 598 acres of open ponderosa pine stands that would naturally transition (due to tree and shrub growth) to a more dense understory habitat that would not be favorable for this species. Over the long term (10 to 20 years), the percentage of the project area with open understory pine would fall to near zero as recently completed and ongoing fuel reduction activities naturally transition to dense tree and shrub under stories less favorable for this species.

Direct and Indirect Effects of Alternative 2, *chipping sparrow* Alternative 2 would thin approximately 3,618 acres of ponderosa pine in middle-aged structural stages 4 and 5 followed by underburning or mowing; providing habitat preferred by this species.

Cumulative Effects of Alternative 2 Similar to the white-headed woodpecker and pygmy nuthatch, the black bark ponderosa pine stands within the project area is being used as the scale for analysis for this species. The cumulative effect of the 439 acres of ongoing prescribed underburning and mowing combined with the 4,211 acres of thinning, mowing and underburning included with Alternative 2 would be to increase the percent of open pine stands from 17 percent of the project area to 55 percent over the next 5 to 10 years falling to 43

percent over the 10 to 20 year time period. As discussed previously, recently completed, ongoing and planned thinning, mowing and underburning of black bark stands adjacent to the project area and with the Pilot Butte watershed would also be beneficial for the chipping sparrow. Private land development, especially on the common areas of Sunriver, Inn of the 7th Mountain and Highlands would also provide habitat.

Landbird Strategy Consistency Biological objectives for chipping sparrow habitat in open understory ponderosa pine with regenerating pines will be assessed. The project meets objectives outlined in the Conservation Strategy for Landbirds on the East-Slope of the Cascade Mountains in Oregon and Washington.

Objective	Do Not Meet, Meets, Not Applicable	Rationale
Where ecologically appropriate initiate action in ponderosa pine forests to maintain or provide: interspersion of herbaceous ground cover with shrub and regenerating pine patches	Meets	Removal of lodgepole pine from black bark stands followed by mowing and underburning would provide these conditions
Where ecologically appropriate… maintain or provide: 20-60% cover in the shrub layer	Meets	As noted under the shrub discussion the percentage in the shrub layer would be maintained within this range within the project area and EA units.
Where ecologically appropriate… maintain or provide: >20% of shrub layer in regenerating sapling conifers especially pines	Meets	Lodgepole pine removal, natural patchiness of the stands and cover clumps would maintain @ 20%+.
Where ecologically appropriate… maintain or provide: 10-30% mean canopy cover	Meets	Silviculture RX would retain on average 25-30% canopy cover
Where ecologically appropriate at the landscape level maintain or provide: a mix of understory conditions such that 10-30% of the landscape meets site-level conditions mentioned above	Meets	An estimated 43% of the project area would have open forest conditions over the next 10-20 years, however not every acre would meet all conditions.

Mixed Conifer, Edges and Openings Created by Wildfire – Olive-sided Flycatcher Introduction The olive-sided flycatcher is a summer resident that breeds in low densities throughout coniferous forests of Oregon. The olive-sided flycatcher, an aerial insectivore, prefers forest openings or edge habitats where forest meets meadows, harvest units, rivers, bogs, marshes etc. (Marshall et al. 2003). Nesting success was highest within forest burns where snags and scattered tall, live trees remain (Marshall et al. 2003). This species forages from high prominent perches at the tops of snags or from the uppermost branches of live trees and needs unobstructed air space to forage. It preys on flying insects and in particular, bees and wasps. (Marshall et al. 2003).

Population trends based on BBS data show highly significant declines with an Oregon statewide decline of 5.1% per year from 1966-1996. Factors potentially contributing to population declines on breeding grounds include habitat loss through alteration of habitat through management activities (e.g., clearcutting, fire suppression), and lack of food resources. (Marshall et al. 2003 p. 376). Wisdom et al. (2000 p. 218) also noted that where altered fire regimes result in fewer but larger fire, the juxtaposition of early and late seral habitats becomes less favorable. However, within the Columbia Basin our area (Southern Cascades) shows increases of >60% for the olive-sided flycatcher compared to other areas.

The best habitat for this species is the 603 acres in the Awbrey Hall and Inn wildfires. There is some limited habitat along older wildfires such as Skyliners and edges between portions of the historic logging activities that had varying levels of reforestation success during the subsequent decades of natural regeneration.

Direct and Indirect Effects of Alternative 1, *Olive-sided Flycatcher* Habitat for this species would not be effected. Over time as the stands of black bark and recent wildfires mature, habitat for this species, barring a stand replacement event, would become less suitable. The potential for larger wildfires within the project area under Alternative 1 would also provide less favorable habitat conditions than desired.

Direct and Indirect Effects of Alternative 2, *Olive-sided Flycatcher* Alternative 2 does not include the creation of any high contrast edges (e.g. regeneration harvests), but the treatments will create a more open forested habitat as described under the chipping sparrow discussion. Another effect beneficial to this species is the decrease in large stand replacement wildfire potential. Smaller fires that would be more likely to occur within the project area would be nearer the historic disturbance size and intensity providing for a potentially more favorable juxtaposition of habitat conditions.

Cumulative Effects of Alternative 2 Activities were reviewed to assess whether, in combination with the likely impacts of the East Tumbull Project, there would be any cumulative impacts to the olive-sided flycatcher. The Bend Fort Rock Ranger District (mixed conifer stands within ¼ mile of grass, forb, or meadow habitat) is being used as the scale for analysis for this species. A total of 13 acres (EA unit 124) within mixed conifer stands would be hand thinned, however considering that the silvicultural prescription for this EA unit only includes removal of trees less than 12" dbh around individual, large ponderosa pine there would likely be no effect on this species.

Within the non-favored habitat of ponderosa pine, the potential cumulative effects are that Olive-sided flycatcher populations will likely remain stable or slightly increase in the short term due to the amount of open forest habitat restored. Cumulatively, less than an additive 1 percent increase in suitable habitat is expected with the implementation of this project.

Landbird Strategy Consistency The biological objectives for olive-sided flycatcher habitat in mixed conifer stands with edges and openings are not applicable because they relate to post-fire salvage harvest and prescribed underburning in mixed conifer forest. Alternative 2 is consistent with the biological objective assumption that actions would improve habitat throughout the project area for the olive-sided flycatcher.

Mixed Conifer, Large Trees/Multi-layered/Dense Canopy – Brown Creeper and Hermit Thrush introduction The brown creeper is a bark-gleaning insectivore that prefers large diameter Douglas-fir in mixed conifer LOS conditions. Habitat for this species is extremely limited as Douglas-fir trees do not exist within or adjacent to the project area, large trees of any species are largely absent on the landscape and LOS totals only approximately 2 percent of the 634 acres in the mixed conifer PAG (Table 3-7). Declines in populations of 5.6 percent per year have been noted from BBS results for the brown creeper.

The hermit thrush prefers a multi-layered canopy with a dense understory of small trees and shrubs. Declines in populations of 0.8 percent per year have been noted from BBS; although there is a short-term non-significant increase in both species. Although habitat in mixed conifer is extremely limited, the project area does has dense black bark stands that provide some habitat.

Factors contributing to the general decline of these species is the reduction of large trees and loss of understory and structural complexity across the landscape from timber harvest, fire grazing and winter recreational activities. Treatments within mixed conifer LOS and dense black bark stands will be used as the measures.

Indirect Effects of Alternative 1, *brown creeper and hermit thrush* There would be no effects to either of these species over the short term. The increasing potential for accelerated or epidemic beetle mortality and

large stand replacement wildfires could eliminate or delay the development of LOS mixed conifer and ponderosa pine habitat within the project area. There would be no effects from motorized winter recreational activity because the Tumalo Cooperative Winter Range Closure would remain in effect and, as noted before, there is no grazing within the project area.

Direct and Indirect Effects of Alternative 2, ***brown creeper and hermit thrush*** Alternative 2 would hand thin 13 acres (EA unit 124) of mixed conifer LOS. Weikel (1997) found that there was no change in abundance of the brown creeper with moderate thinning. The silvicultural prescription for this EA unit is a light thinning of trees less than 12" dbh located within the crown width of individual, large ponderosa pine. The stand would remain structural stage 6 (multi-strata with large trees) and have no effects on either species.

A total of 6,265 acres within the project area that are at high risk of mountain and western pine beetle mortality may provide some habitat for the hermit thrush. Alternative 2 would treat 2,458 acres of the 6,265 acres to reduce beetle risk and crown fire potential while at the same time reducing structural complexity preferred and potential use by this species.

Cumulative Effects of Alternative 2 The 496 acres of LOS mixed conifer and ponderosa pine stands within the project area is being used as the scale for analysis for these species. There are no mixed conifer LOS stands adjacent to the project area. Alternative 2 would treat less than 3 percent of the LOS stands. As noted above, there are no expected effects on either species from this treatment. There are no other ongoing or reasonably foreseeable treatments within these LOS stands. The long-term cumulative effect of the 439 acres of ongoing prescribed underburning and mowing combined with the 4,211 acres of thinning, mowing and underburning included with Alternative 2 would be to accelerate the development of LOS ponderosa pine stands that may provide some limited habitat for these species in the future. Brown creeper and hermit thrush populations are not expected to be effected by this project because there is almost a complete absence of mixed conifer habitat preferred by the brown creeper and an estimated 3,807 acres of primarily black bark ponderosa stands that has some attributes preferred by the hermit thrush would remain unthinned in a well-distributed pattern across the project area and landscape.

Landbird Strategy Consistency Biological objectives for brown creeper large tree habitat and hermit thrush multi-layered and dense canopy habitat are assessed below.

Objective	Do Not Meet, Meets, Not Applicable	Rationale
Brown Creeper-Where ecologically appropriate initiate action in mixed conifer forest to maintain or provide the following conditions: blocks of LOS>75 acres; >4 trees/acre > 18" dbh with at least 2 trees >24" dbh.	Meets	Treatments in EA unit 124 would help maintain a structural stage 6 stand while treatments throughout the landscape would accelerate the development of LOS ponderosa pine.
Hermit Thrush-Where ecologically appropriate initiate actions in mixed conifer LOS forest to maintain or provide the following conditions: patches of forest with multi-layered structure and a dense understory.	Meets	Light thinning in EA unit 124 well as no management within the remaining mixed conifer and ponderosa pine LOS, and retention of wildlife cover clumps associated with each EA unit would meet objectives for the hermit thrush.

Mixed Conifer, Large Snags/Interspersion grassy opening and dense thickets – Williamson's sapsucker and Flammulated owl introduction Both species are associated with the mixed conifer PAG but do use ponderosa

pine LOS. Wisdom et al found mixed trends for both species with the declines generally associated with the Northern Cascades. As noted under the discussion for the brown creeper mixed conifer and ponderosa pine LOS, large trees and large snags are almost non existent within the project area.

Factors that can contribute to a decline is the loss of large old trees and snags that these two species are dependent on for nesting, roosting and foraging (Williamson's sapsucker only). Fire suppression that leads to a loss of open understory and that inhibits tree growth and prevents or delays the development of large diameter trees are also contributing factors.

Indirect Effects of Alternative 1, *brown creeper and hermit thrush* There would be no effects to either of these species over the short term. The increasing potential for accelerated or epidemic beetle mortality and large stand replacement wildfires could eliminate or delay the development of LOS mixed conifer and ponderosa pine habitat within the project area. There would be no effects from motorized winter recreational activity because the Tumalo Cooperative Winter Range Closure would remain in effect and, as noted before, there is no grazing within the project area.

Direct and Indirect Effects of Alternative 2, *brown creeper and hermit thrush* Alternative 2 would hand thin 13 acres (EA unit 124) of mixed conifer LOS. Weikel (1997) found that there was no change in abundance of the brown creeper with moderate thinning. The silvicultural prescription for this EA unit is a light thinning of trees less than 12" dbh located within the crown width of individual, large ponderosa pine. The stand would remain structural stage 6 (multi-strata with large trees) and have no effects on either species.

A total of 6,265 acres within the project area that are at high risk of mountain and western pine beetle mortality may provide some habitat for the hermit thrush. Alternative 2 would treat 2,458 acres of the 6,265 acres to reduce beetle risk and crown fire potential while at the same time reducing structural complexity preferred and potential use by this species.

Cumulative Effects of Alternative 2 The 496 acres of LOS mixed conifer and ponderosa pine stands within the project area is being used as the scale for analysis for these species. There are no mixed conifer LOS stands adjacent to the project area. Alternative 2 would treat less than 3 percent of the LOS stands. As noted above, there are no expected effects on either species from this treatment. There are no other ongoing or reasonably foreseeable treatments within these LOS stands.

The long-term cumulative effect of the 439 acres of ongoing prescribed underburning and mowing, within structure 4 and 5 stage stands, combined with the 4,211 acres of thinning, mowing and underburning included with Alternative 2 would be to accelerate the development of LOS ponderosa pine stands that may provide some limited habitat for these species in the future.

Brown creeper and hermit thrush populations are not expected to be effected by this project because there is almost a complete absence of mixed conifer habitat preferred by the brown creeper and an estimated 3,807 acres of primarily black bark ponderosa stands that has some attributes preferred by the hermit thrush would remain unthinned in a well-distributed pattern across the project area and landscape by retaining large blocks untreated and by the retention of 20 to 30 percent wildlife clumps associated with the individual EA units.

Landbird Strategy Consistency Biological objectives for brown creeper large tree habitat and hermit thrush multi-layered and dense canopy habitat are assessed below.

Objective	Do Not Meet, Meets, Not Applicable	Rationale
Brown Creeper-Where ecologically appropriate initiate action in mixed conifer forest to maintain or provide the following conditions: blocks of LOS>75 acres; >4 trees/acre > 18" dbh with at least 2 trees >24" dbh.	Meets	Treatments in EA unit 124 would help maintain a structural stage 6 stand while treatments throughout the landscape would accelerate the development of LOS ponderosa pine.
Hermit Thrush-Where ecologically appropriate initiate actions in mixed conifer LOS forest to maintain or provide the following conditions: patches of forest with multi-layered structure and a dense understory.	Meets	Light thinning in EA unit 124 well as no management within the remaining mixed conifer and ponderosa pine LOS, and retention of wildlife cover clumps associated with each EA unit would meet objectives for the hermit thrush.

As discussed under environmental effects, over the long-term, Alternative 2 is designed to maintain or accelerate the development of large blocks of historic, ponderosa pine forest type conditions, favoring those focal species, which prefer those conditions and which have the highest risk for a downward population trend. The largest potential for negative effects generated by the action alternatives may be logging disturbance, fuels treatments and timing. Spring and summer logging of green trees, as well as prescribed burning and mowing, may reduce local NTMB numbers by inadvertently destroying nests and broods. The time period of concern in the East Tumbull project area is after lifting of the Tumalo Cooperative Winter Range Closure from April 1 to July 31. EA units 103, 104, 108, 109, 110, 115, 117, 119, 139E, and 147 have an operating restriction on all vegetation management activities involving mechanized tree removal, machine piling, mowing and prescribed underburning to eliminate recreational conflicts from May 15 to September 1. This is 47 percent of the 4211 acres of treatment. In addition, based on previous sales on the district, 50 percent or more of the fiber removal on the remaining EA units would typically occur outside this time period. This is due to summer fire restrictions and the low elevation of the project area that makes it ideal area for winter logging operations. Mechanical mowing and prescribed burning, when feasible, would be completed outside of the April 1 to July 31 time period on the remaining EA units to protect NTMBs and for many of the reasons stated above. Therefore this project is not expected to compromise population viability at the landscape level or have a cumulative additive effect and is in agreement with the biological objectives and conservation strategies for landbirds on the east-slope of the Cascades.

Proposed, Endangered, Threatened and Sensitive (PETS) Species

Scope of the Analysis Effects of the project are evaluated for those PETS plant and wildlife species that are documented or suspected to occur within the East Tumbull Project area.

Affected Environment-Landscape Overview The project area provides a moderate level of habitat diversity for wildlife. Dry, even-aged ponderosa pine forest dominates the area, but there are significant inclusions of lodgepole pine. The majority of the stands are classified as "black bark" which are generally 50-60 years old with one canopy layer. The relatively low elevation and limited precipitation of the area likely limit the site capability to develop multi-stratum LOS forest, except on the northern aspects and higher elevations within the project. The potential for single-story LOS is good. The Deschutes River is the eastern boundary of the project, which provides the richest habitat in the area. Seasonal ponds are adjacent to the river in old oxbows. There are a number of springs adjacent to the river as well. Other than the Deschutes River there are no natural streams, permanent ponds, lakes or man-made guzzlers in the project area. Minor lava outcrops and a few riverside cliffs are the only special or unique habitats. There are no talus slopes, caves, mountain mahogany, or

extensive areas of aspen or forested lavas. Ryan meadow provides valuable habitat to a variety of species. It is near the river and was flooded historically by high spring flows, however diking has eliminated this event.

Affected Environment-Species and Habitats Evaluated The following species and their habitats were considered in the preparation of this document. Those with bolded type are known, suspected or have some potential to occur within the project boundaries. There are no known current sites occupied, no known historic sites, and no current or potential habitats for those species that have not been designated (**bolded**). A more indepth discussion of habitat can be found under the affected environment discussion of the various resource sections.

SPECIES		**CLASSIFICATION**
Haliaeetus leucocephalus	**Northern bald eagle**	**T, OR/T, MIS**
Strix occidentalis caurina	Northern spotted owl	T, OR/T, MIS
Lynx canadensis	Canada lynx	T
Rana pretiosa	**Oregon Spotted frog**	**C, OR/S**
Martes pennanti pacifica	Pacific fisher	C, SOC, OR/S
Falco peregrinus anatum	**American peregrine falcon**	**S, SOC, OR/E, MIS**
Histrionicus histrionicus	Harlequin duck	S, SOC
Podiceps auritus	Horned grebe	S, OR/S
Podiceps grisegena	Red-necked grebe	S, OR/S
Bucephala albeola	Bufflehead	S, OR/S
Cotumicops noveboracensis	Yellow rail	S, OR/S
Agelaius tricolor	Tricolored blackbird	S, OR/S
Centrocercus urophasianus	Greater or Western sage-grouse	S, SOC, OR/S*
Gulo gulo luteus	California wolverine	S, SOC, OR/T, MIS
Sylvilagus idahoensis	Pygmy rabbit	S, SOC, OR/S
Prisiloma arcticum crateris	Crater lake tightcoil	S
Oncorhyncus mykiss gairdneri	**Redband Trout**	**S**
Castilleja chlorotica	**Green-tinged paintbrush**	**S**
Artemesiaia ludoviciana	**Estes wormwood**	**S**

Note: *E=Endangered, T=Threatened, C=Candidate for Federal listing, P=Proposed for Federal listing, SOC=USFWS Species of Concern, S=USFS Region 6 Sensitive, OR/T,E,S = State of Oregon status. *Petitioned for listing but found to not be warranted by the USFWS (USDI 2003).*

There are six species with potential habitat and occupancy within the project's boundaries including the northern bald eagle, Oregon spotted frog, American peregrine falcon, Redband trout, Green-tinged paintbrush and Estes wormwood. Bald eagles use the river corridor for foraging but none are known to nest or use winter roosts within the project's area. The nearest known nest site is 5 miles south of the project. There have been documented sightings of Oregon spotted frogs in the Deschutes River at and upstream of Sunriver within the project's boundary (USDA 2005 and Bowerman 2000). There is a historic peregrine nest site located on the cliff near Benham Falls, but it has not been occupied for many years. The nearest Green-tinged paintbrush plant populations are located one mile to the north and south of the project area. Estes wormwood is found at three known sites within the RHCA in the East Tumbull project area.

No habitat for the California wolverine, Canada lynx (threatened) or any other unbolded wildlife species exists within the project area (Biological Evaluation, Appendix D.). The Forest Wildlife Biologists for the Deschutes National Forest (DNF), the Ochoco National Forest (ONF), and the Crooked River National Grassland (CRNG)

have made a determination based on the best available science and guidance, that no lynx habitat or self-maintaining lynx populations are present on the three administrative units.

There are no known threatened, endangered, proposed, or candidate fish species within the project area. The proposed project area was evaluated to determine which species might occur based on the presence of required habitats and known locations. Bull trout once occupied the Deschutes River upstream of Bend, but have not been documented since 1954 (ODFW 1996). The nearest current population is at Lake Billy Chinook, approximately 45 miles downriver.

PETS Management Direction It is Forest Service policy to avoid all adverse impacts on threatened and endangered species and their habitats except when it is possible to compensate adverse effects totally through alternatives identified in a biological opinion rendered by the Fish and Wildlife Service. Measures are to be identified and prescribed to prevent adverse modification or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened, and proposed species (Forest Service Manual, FSM 2670.31). Through the biological evaluation process (FSM 2672.4), actions and programs authorized, funded, or carried out by the Forest Service are to be reviewed to determine their potential for effect on threatened and endangered species and species proposed for listing (FSM 2670.31). Species classified as sensitive by the Forest Service are to be considered through the National Environmental Policy Act process by conducting biological evaluations to determine the potential effect of all programs and activities on these species (FSM 2670.32). No impacts may be allowed on sensitive species that would result in loss of population viability or create significant trends toward Federal listing.

Existing management direction is found in the Deschutes LRMP which primarily discusses the procedures for determining essential habitat for plants (TE-1 to TE-7), bald eagle (WL-41) and peregrine falcon (WL-40, 41).

Target Landscape Condition The desired condition is the same as Ecosystem Health and Water Quality, namely maintaining or enhancing water quality and accelerating long-term development of LOS, single-stratum ponderosa pine that currently does not exist in a project area where it was historically the dominant stand condition while reducing short-term wildfire, beetle and disease risk to vegetation and water quality.

PETS Environmental Effects Introduction The biological evaluation(s) (BE, Fisheries BE - Appendix B; Plants BE – Appendix C; Wildlife BE – Appendix D) evaluate the effects of the East Tumbull Project on PETS species along with supporting information and rationale for effect determinations. The BEs are summarized below for brevity with supporting information in the appropriate appendices. A Biological Assessment (BA) will not be prepared because 1) it is not a major federal construction project that requires an environmental impact statement; 2) the effects on federal threatened, endangered and proposed species are not significant (i.e. adverse or jeopardy); and 3) it meets the Project Design Criteria (PDC) for the Joint Aquatic and Terrestrial Programmatic BA for Fiscal Years 2003-06 (USDA et al. 2003), referred to as Programmatic BA. Projects proposed in occupied or potential habitat of any PET species on the Forest must be consistent with specified PDCs for that wildlife species or additional consultation is required with USFWS.

Effects of the project are evaluated for those PETS species that are documented or suspected to occur within the East Tumbull Project area.

Direct, Indirect and Cumulative Effects of Alternative 1 Alternative 1 would have no direct effects on potential habitats of the bald eagle, spotted frog, peregrine falcon, redband trout, Green-tinged paintbrush or Estes wormwood.

There would be a potential adverse effect to habitats if wildfire were to occur within the project due to the

retention of presently overstocked forest stands as well as potential adverse effects to the three Estes wormwood plant population sites and redband trout; especially in the event of a stand replacing wildfire within the RHCAs.

Research has shown that fire can result in direct mortality to fish (Gresswell, 1999). Responses of fish populations to fire and fire-related disturbance have been documented in a limited number of studies, mostly for salmonid fishes. The influence of fire on persistence of native salmonid populations is highly variable. In some cases, local extinctions have been observed in response to fire, particularly in areas where populations of fishes have been isolated in small headwater streams. In larger interconnected systems, fish populations appear to be more resilient to the effects of fire (Dunham, 2003).

Indirect effects from stand replacing wildfire could reduce water quality (short and long term) by decreasing dissolved oxygen and increasing water temperatures, sediment inputs, and nutrient loading. Increased water temperatures and decreased dissolved oxygen can affect redband trout by increasing mortality, promoting disease, decreasing growth, and decreasing embryo survival. Suspended sediment can be abrasive to redband trout gills and reduce foraging ability. Fine sediments accumulated in riverbed substrates can limit survival of developing fish embryos and limit the production of aquatic macroinvertebrates, which provide forage for fish (Bjornn and Reiser, 1991, in Meehan, 1991). Fine sediments in the streambed were shown to impair growth and survival of steelhead juveniles (Suttle, 2004). Increased nutrient loading can reduce dissolved oxygen.

A decrease in bank stability and riparian vegetation would decrease overhead cover for redband. There would be a benefit to redband habitat from an increase in large woody material from fire-toppled trees and increased windfalls for several years after the fire. Instream large wood provides hiding cover for fish, reduces velocities to provide microhabitats, and provides habitat and a food source for aquatic macroinvertebrates. However, there would be a reduction in future recruitment of large woody material until the stands recover to maturity. An increase in primary productivity as a result of fire-introduced nutrients could increase the abundance of macroinvertebrates, thus increasing the food base for redband. Increases in macroinvertebrate abundance and diversity would likely be short term. Minshall (2003) summarized changes to macroinvertebrate communities are generally restricted to the first 5-10 years, but research was done on small order streams. The large size of the Deschutes River would likely temper any effects to the macroinvertebrate community as a result of the fire.

The use of fire retardants and foaming agents pose a risk to redband trout during fire-fighting operations. Fire retardant can persist in soils and produce toxic effects for weeks, especially in sandy soils (Luce, 2005). During August of 2002, fire retardant was inadvertently dropped in nearby Fall River while attempting to extinguish a small fire (<5 acres). A large fish kill was observed, estimated at 21,000 fish by the Oregon Department of Fish and Wildlife (ODFW). Aquatic invertebrates were also adversely affected. Recovery of the fish population was anticipated by ODFW to take up to 9 years.

There would be a short-term benefit to redband habitat of increased large wood recruitment to the river in the event of a fire adjacent to the river. Instream large wood provides hiding cover for fish, reduces velocities to provide microhabitats, and provides habitat and a food source for aquatic macroinvertebrates.

There is potential for indirect effects to redband habitat in the long term by not taking action to close roads and campsites. Dispersed sites and roads would continue to increase in abundance and area impacted, possibly leading to degraded riparian conditions and increased potential for sediment delivery to the river. Nutrient and bacteria inputs to watercourses as a result of dispersed camping practices would increase, but the changes would be difficult to attribute to activities along the river because of variables influencing water quality upriver in the watershed, primarily Wickiup Reservoir. Reservoirs and lakes are dynamic, and concentrations of ions and nutrients vary annually and seasonally.

Due to the potential for adverse indirect effects, this alternative May Effect Individuals and Habitat of redband trout, but would not lead a loss of population viability or create a significant trend toward federal listing. There would be No Effect to downriver bull trout populations.

There would be no cumulative effects because no vegetation management or other activites would occur.

Direct, Indirect and Cumulative Effects of Alternative 2 Alternative 2 would have no direct, indirect or cumulative effects on either the bald eagle, Oregon spotted frog, or peregrine falcon. The entire river corridor would have a 300 foot RHCA buffer with no vegetation or fuels treatments. The river corridor is the most likely foraging area for both the bald eagle and peregrine falcon. There are no proposed units near the cliffs at Benham Falls. In the long-term the promotion of larger trees by reducing competition could potentially provide nesting sites for bald eagles. The reduction in risk of catastrophic wildfire by the proposed actions would benefit habitats for all three species.

There would be no direct, indirect or cumulative effects on PETS plant species because no plants are located within the EA units and all populations of Estes wormwood are located in the RHCA of the Deschutes River which has no planned treatments.

Since actions proposed under this alternative would have immeasurable effects to both water quality and water quantity, there would be no direct or indirect effects to redband habitat or populations as a result of implementing these actions. Effects to redband habitat or populations would be from natural causes, fish management actions, or other causes. Potential for stand replacing wildfire is reduced, protecting riverbank stability, shade, future large wood recruitment to channels, and spawning gravels. The potential for short term gain in large wood recruitment as a result of wildfire is reduced.

Closure of dispersed campsites and roads leading to RHCAs would protect redband habitat by maintaining and restoring riparian conditions to reduce impacts to shade, overhead cover, large woody material recruitment, and decrease potential for sediment and nutrient delivery to the river, although measurable changes in water temperature, turbidity, nutrients, chlorophyll a, and sedimentation due to these activities would be difficult to determine. This alternative reduces the risk of wildfire and the potential cumulative effects to water quality and quantity that could occur thereof, which would in turn affect redband populations and habitat

Since there are no vegetation management treatments within the RHCAs, the potential for stand replacement fire effects to habitat, water quality and populations within the RHCAs would be similar to but less than Alternative 1 because upland stands would still be treated and the potential for a large, damaging, intense wildfire would be less. This is because evacuation and access routes would be available to fire suppression crews and fire behavior in areas adjacent to the RHCAs would be less intense allowing for direct attack of any ignition starts within the 300 foot wide RHCAs or upland areas adjacent to the RHCAs.

LRMP/Other Management Direction Consistency All applicable PDCs from the Programmatic BA will be met by the proposed action alternative for the East Tumbull Project. The following findings are located in the animal, plant and fisheries BE in the appendices.

Conclusions and Applicable PDCs Northern bald eagle: No Effect, provided that the following PDCs are met where needed: If an active bald nest is discovered-"Do not approve human disturbance in excess of base levels occurring in 2001… within 1/4th. mile non line-of-sight or ½ mile line-of-sight (1.0 mile for blasting) of known bald eagle nests between January 1 and August 31. This condition may be waived in a particular year if nesting or reproductive success surveys reveal that bald eagles are non-nesting or that no young are present that year. "If an active bald eagle roost is discovered-"Project activities that have potential to disturb bald eagle winter

roosts, shall be restricted within 400 m of the roosting area… from November 1 to April 30th…."

Oregon spotted frog: No Effect. American peregrine falcon: No Impact

PETS plant species: No Effect

Although the East Tumbull Project area is located a significant distance upriver of bull trout populations, the proposed activities under the action alternative was evaluated for consistency with the Project Design Criteria of the 2003- 2006 Programmatic BA. The proposed activities are consistent with the exceptions of Criteria E.1. The Equivalent Clearcut Area (similar to Equivalent Harvest Area) already exceeds 25 percent in the 5th field watershed the project is located within. Despite the inconsistency with this criteria, there are no anticipated effects to the bull trout for the following listed reasons: Due to the distance to the nearest bull trout population, the groundwater-dominated nature of the basin, the impoundment of the river at Bend that settles suspended sediment, and mitigation measures protecting water quality and riparian conditions within the project area, there will be no effect to bull trout from either alternative.

Overland flow of sediments is not expected because of very gentle slopes, porous soils, mitigation measures, and project design criteria, including the restriction of management activities within RHCAs. The proposed activities do not prevent attainment of the Riparian Management Objectives listed in the Inland Native Fish Strategy (INFISH).

Redband trout**:** No Effect. Downriver bull trout populations: No Effect.

Consistent with TE-1 to TE-4, 6 current and past field surveys were completed and reviewed for PETS plant species and documented in a BE (Appendix C).

Recreation Management Introduction

The Deschutes River, a high use recreation area, runs along the eastern boundary the East Tumbull planning project. Use of developed recreation day use facilities is very high in the summer months. Dispersed recreation activities are limited due primarily to the proximity of the area to town. Mountain biking, rock climbing (bouldering) are the most popular dispersed activities. This area has seen a dramatic increase in use due to the increased population of Bend, and Central Oregon being a very popular recreation destination area. The East Tumbull area is visited heavily during the summer months. During the fall the area still receives some use, primarily from mountain bikers, day hikers and horseback riding.

The area does provide some opportunities for dispersed camping. However, there is an area closure in the Wild & Scenic River corridor for overnight camping and OHV use. Outfitters and Guides under special use authority provide various recreation opportunities for the public. River rafting services is by far the most popular along the Deschutes River. For this activity alone there are approximately 25,000 users annually that float this stretch of the river. With the other permitted uses, the combined total use is likely over 30,000 annually.

Scope of the Analysis Recreation effects focus on the segments of the Upper Deschutes Wild and Scenic River that occur within the project area, implementation of road closures included in the Upper Deschutes River Plan and to a lesser extent dispersed recreation outside of the river corridor. Information regarding past actions, either vegetation or recreation management are incorporated into the existing condition discussion, below.

Affected Environment-Developed Recreation There are 6 day use facilities in the project area, all of which are adjacent to the Deschutes River, provide access to the river trail, and have a recreation fee pass requirement. From closest to Bend and upstream they are: Meadow (picnic area), Lava Island (boat ramp and interpretive

site), Dillon Falls (picnic area), Slough Camp (picnic area and boat ramp), Benham Falls West (scenic overlook) and Besson Camp (picnic area and boat ramp). In the northern area of the project, off of Skyliners Road is Phil's Trailhead. This is primarily a trailhead for mountain bike trail access to a variety of trails that head west from this point.

The facilities are somewhat dated and in need of a variety of backlog maintenance work. An example of which are: new toilet facilities, picnic tables, portal signs, vegetation enhancement, site definition, and boat ramp improvements. Some improvements were made in the mid- and late-90s that resulted in new toilets, vegetation management and interpretive sign installation. Use levels are high in the East Tumbull project area. Day use visitation is much higher in this area of the forest due to the proximity of the Bend, Sunriver and LaPine communities.

Most of the sites are in a Ponderosa pine plant association group, in various degrees of size, vigor and health. Some of these stands are in poor health and are in need of management to reduce risk to private property and facilities.

Affected Environment-Dispersed Recreation Long-time users of the area are generally made up of Bend and La Pine area residents. A majority of the non Central Oregon visitors are on summer vacations and seeking outdoor recreation experiences.

Dispersed recreation use impacts result in a loss or degradation of vegetation, soil compaction, sanitation problems (litter, water pollutants, etc.), and a change in site character (ex. crowding, scenic quality). This is caused primarily by: user-made roads and trails, pit toilet development too close to the river, use of vegetation for firewood and other camp use (construction of "camp furniture", lean-tos, etc.), and the increase in use of the area by recreationists.

Dispersed recreation use "hot spots" ("resider camps" and/or party spots) occur close to town. As discussed above, the Wild and Scenic River corridor is closed to overnight dispersed camping, as called for in the Deschutes Wild and Scenic River Plan. However, some overnight use does occur at the hot spot areas. These include areas just downstream of Meadow day use area, on the bluff overlooking the Deschutes River, access to a "closed area" near Benham West, fishing and access north of Besson Camp along the 4100-280 road, and various roads that connect the Cascade Lakes Highway to Shevlin Park road. Some campers reside in these areas for as long as possible, at times over the 30 day stay limit. Some come to camp legally during the summer months, though the area can remain accessible year-round in low snow years. Others congregate to party or dump trash illegally. This has resulted in the loss of vegetation and a safety hazard with certain types of garbage. It also reduces the scenic integrity of some areas.

Over the years, the popularity of this area has increased, resulting in vegetation and soil resources being heavily impacted, especially those in the riparian areas. Recreational use has resulted in trampled vegetation along the shoreline associated with dispersed campsites, boat launching and pull out areas, and user trails.

Affected Environment-Special Uses Dispersed recreation activities make up the majority of use in the East Tumbull project area. Rafting is by far the largest use on the Wild and Scenic Deschutes River, however, other uses occur as well, such as fishing, canoeing, shooting (there is a no shooting corridor in the Sunriver area) and kayaking. Use figures for rafting for 2001 through 2004 follow in the table below.

Table 3-42: Outfitter guide rafting use (# of people) on the Deschutes River by year

2001	2002	2003	2004
24,891	24,739	27,188	26,423

Other permitted uses occur, such as canoeing, fishing and outdoor classes. Public uses of these types also occur. There are no inventoried roadless areas, areas with roadless characteristics or Wilderness areas within the project area nor any associated special uses.

Affected Environment-Roads and Trails There are numerous trails in the area, all officially non-motorized, even though there is some illegal OHV use on low-standard roads. The Deschutes River has hiker, horse and mountain bike trails along it within the Wild and Scenic River corridor. There is a dog on leash only restriction for the river trails. There are also numerous primary mountain bike trails in the area between Road 46 and Skyliners Road.

There are a number of user trails and roads within the East Tumbull project area. These are captured and documented in the Transportation System Access section. Roads within the project area provide access for a variety of activities: driving for pleasure, four-wheel driving, big game hunting, forest product gathering, and wildlife viewing, to name a few. There are numerous roads and trails adjacent to the urban area on the Forest which are used as hiking, jogging, biking, horseback riding and OHV routes.

Maintaining open roads is a strong desire with many of the publics contacted in the field. Road construction and development (planned and user-created) over the years has made access easier to the river and some upland areas. This resulted in degraded soil and vegetative resources to varying degrees. Impacts are generally in the form of trampled vegetation, sprawling campsites and roads, and compacted soils that contribute to overland flow in concentrated recreation sites/areas. Many of the roads are used as trails for all types of users, both motorized and non-motorized.

Recreation Management Environmental Effects

Direct and Indirect Effects of Alternative 1- This alternative would put at risk the outstandingly remarkable values that were identified by the United States Congress when the Deschutes River was designated as a Wild and Scenic River. The effects of the two alternatives on those Wild and Scenic River Values immediately follows this section.

Developed Recreation Participation in day use activities would continue to increase as described previously. The current levels of effects within developed sites would remain relatively the same under this alternative, with some increase to lesser-used sites due to an increase in use levels. Negative effects such as compacted sites and denuded areas may increase in the surrounding forest environment and on the infrastructure of the day use areas that begin to receive more use.

Compacted and denuded sites located on both upland and riparian soils would continue to be used and would have little chance of recovery to a more natural state. This is especially true at less defined sites or areas. The risk of sediment contribution and continued degradation of soil quality in these areas would be highest under this alternative. Day use infrastructure and facilities would continue to decline and/or fail as many facilities are at or near the end of their service life (e.g. some of the older toilets). They would be replaced as part of the routine maintenance as fee collection dollars and appropriated budget are available. With occupancy rates expected to climb, the character of some of the day use areas may change, especially the lower use sites (Besson Camp). Crowding may likely become more of a factor in determining visitor satisfaction.

There would not be any vegetation management in or near developed facilities. There would not be an opportunity to manage stands for improvement of scenic views or integrity or to reduce wildland fire risk.

Dispersed Recreation The No Action alternative would maintain current areas of dispersed camping adjacent to the Deschutes River and in the upland areas described under Affected Environment. Imposing no limitations or alterations to dispersed camping would retain these areas in a denuded and/or compacted state. These areas would continue to contribute to an increased risk from escaped campfires and overland flow, with a continued risk of moving sediment into the river.

The risk of new sites being created throughout this stretch of the river is likely to rise as population pressures and the desire for waterfront dispersed campsites increase over time. This would raise the amount of the soil resource in a compacted and denuded state. Expansion in the number of sites would also increase the negative effects to vegetation from both increased wildland fire risk and as new sites or areas are accessed for day and overnight activities. Furthermore, the spread of new sites to new or lesser-used areas would result in an increase in the amount of "seen" area from the river.

A greater risk to the soil resource and the Deschutes River would be the increase in haphazard disposal of human waste in these areas. This risk is highest under this alternative due to the unrestricted overnight use adjacent to the river within the project area.

An increase in the creation of trails and play areas by OHVs, outside the river closure area, and other 4 x 4 enthusiasts would continue. User-created roads would be used and created, with use increasing with the trends of increased population and popularity of the area. Alternative 1 would not close any of the user created routes. They would continue to be used increasingly as more people discover them. They would not be signed. Any impacts occurring from them on other resources would continue. More trails and roads would be created over time.

Special Uses There would be no change to the Special Uses in the project area.

Cumulative Effects of Alternative 1 Since there would be no new proposed activities under this alternative there would be no cumulative effects.

Direct and Indirect Effects of Alternative 2

Developed Recreation Participation in day use activities would continue to increase as described previously. This may be compounded by the decrease in the amount and availability of dispersed campsites. In general, the developed sites are within the Wild and Scenic River corridor and the 300 foot RHCA along the river, so little vegetative manipulation would occur immediately adjacent to the sites. There are various treatments planned near most of the sites. In the case of the river sites, there is lava on the east side of the river; therefore a fire would be the biggest threat from the west. Vegetation treatments (thinning, mowing and burning) would have little to no effect on the recreation experience. Though treated areas are outside of developed sites, some would be seen by visitors as they pass through to reach their destination. The treatments would be a long term benefit to the developed sites by reducing the risk of fire starts and the rate of spread.

Identical to Alternative 1, there would be no changes proposed to the developed facilities at the day use sites in the project area under this alternative. Therefore, conditions of the sites and site character of the developed sites would not change in the short term. Without replacement of some of the older facilities, they would continue to decline. Recreation sites that do not function well (due to their age, design, and inability to meet visitor needs) would not be improved.

Over time, the projected increase in recreation use would continue to alter the recreation/riparian interface, site character, and developed recreation facilities. In effect, increased recreation use could cause the following to

occur: overcrowded conditions or competition for picnic sites or boat ramp parking, further vegetation trampling as sites become more used, and/or the failure of some recreation facilities (ex. picnic tables, toilets, etc.). These components would continue to deteriorate to the point where it would reduce their ability to function properly and/or reduce the quality of the recreation experience. This would occur due to lack of controls or facility design to control use impacts, lack of facilities to meet use demands, and/or lack of improvements to existing facilities to handle increasing recreation use.

Dispersed Recreation Alternative 2 would change the amount and type of use along the Deschutes River within the project area. This would be accomplished through road closures. Some roads are proposed to be closed and one (4100200) converted to a non-motorized trail north of Besson Camp. These areas are to be closed to address issues and concerns related to: wildland fire risk, water quality, soil compaction, litter, sanitation, rutting, negative effects to vegetation, wildlife habitat (including fisheries and amphibian habitat), and dispersed camping opportunities and experiences as it relates to the Upper Deschutes River Plan.

Road closures are an effective way to eliminate or minimize negative effects associated with motor vehicle traffic, as well as maintain the values described in the Wild and Scenic River Plan. Fire starts in the project area, as stated previously, have a very strong correlation with open roads.

Alternative 2 would have minor effects on the dispersed recreation situation in the project area. Effects from vegetation removal and fuels treatments may change the aesthetic value of the area in the short term. Treatments could displace some dispersed campsites by using them as landings. In general, dispersed use would be temporarily disrupted, but mostly only during treatment operations. Short term visual or physical effects would be short lived (see Scenic Views). In general, the amount of road closures being proposed reduces driving opportunities for sight-seeing and other activities. The area that would affect the public the most is the proposed closure and conversion to non-motorized trail for Road 4100280, north of Besson Camp to the terminus near Cardinal Bridge.

Road closures are proposed in a way to still provide many driving opportunities to motorists and to provide for fire crews. Access to each section within the project area would still be available via another open road. Even so, proposed closures would eliminate motor vehicle access to areas that were once available to the public. This is likely to result in dissatisfaction of many visitors that once used the closed roads for dispersed camping, sight-seeing, big game hunting, gathering forest products and other recreational activities. In general, the proposed road closures would be disregarded by some campers and recreationists who are accustomed to few or no use restrictions, or want to continue to access areas they have used in the past. This short term effect would likely persist until remedial action (warning notices and violation tickets) changes use habits.

The dispersed campsites in association with proposed road closures would be rehabilitated through natural processes, subsoiling and removal of user-made facilities that impact vegetation, as needed. This would return a small area (estimate 3 acres)of the soil and vegetative resources to a more natural state.

Trails would be affected by the treatment operations by disturbance of the trails themselves. A number of trails are within planned EA units. Use of these trails would be unsafe and restricted during treatment operations. Clean up of these trails in the form of maintenance and reconstruction would be completed after the treatments through contracts or force account crews and the actual time period trail segments would be closed would likely be less than four weeks. Mountain bike, horse or foot traffic would be diverted or detoured to other trails or roads to bypass the vegetation management activity until completion of the fuels reduction treatment.

Roads which serve as trails for recreation users would be closed or obliterated as a result of post sale improvements. Closing these roads reduces the options for local users. These roads get used by hikers, bikers,

walkers, dog walkers and motorized users. The result of closing roads near the urban interface is the displacement of these users to different nearby roads and trails. It is likely that some of the closed roads would get reopened, especially by motorized users, until remedial actions as discussed above take hold. Some roads should be closed versus obliterated to maintain them as hiking trails.

Cumulative Effects of Alternative 2 There would be no short or long term direct, indirect or cumulative effects from the treatments to the special uses in the project area. Road closures from other projects in the surrounding areas would reduce the amount of recreational motorized use. The overall effect to the public is that there are fewer roads to drive than there were previously. Motorized road access would still be maintained to every section within the Pilot Butte subwatershed while the opportunity for nonmotorized dispersed use such as hiking and mountain biking would increase consistent with the Upper Deschutes River Plan.

LRMP/Other Management Direction Consistency Under Alternative 2, vegetation management activities would cause some temporary closing of trails for safety reasons. As noted there would be no activity within the RHCA of the Deschutes River to avoid conflicts with existing trails. Where disturbance cannot be avoided; cleanup operations would be concurrent (TR-3). Compliance with the Upper Deschutes River Plan is addressed by implementing all road closures and road to trail conversions included in the plan while maintaining motorized vehicle access to all developed sites, dispersed sites and ingress/egress routes specified in the Upper Deschutes River Plan LRMP Amendment #12 (Upper Deschutes River Plan page 37:R-4, R-5; page 42: A-4; LRMP, WL-45).

Wild and Scenic River Values Introduction

The Deschutes River that forms much of the eastern boundary of the project area was included in the Federal Wild and Scenic River system in 1988. The federal act that established the Wild and Scenic River system mandates that the administering agency "protect and enhance" the Outstandingly Remarkable values (ORVs) for which the river was designated. The Upper Deschutes River Plan guides all development, management and restoration activities within the river corridor to protect these values which are used for the analysis of effects.

Scope of the Analysis The scope of the analysis is confined to those federal lands located within Segment 4 and that portion of Segment 3 north of the Harper Bridge Road (Forest Road 40). Cumulative effects include Alternative 2 and the reasonably foreseeable thinning of 87 acres (Kelsey EIS units 78, 87, 201, 202, 203, 204, 206) on the eastside of the river followed by the prescribed underburning of 60 of the 87 acres and mowing of the remaining 27 acres (Kelsey EIS units 78, 206). No other ongoing vegetation management activities on Federal lands are occurring within these segments. There is approximately 954 acres of private land adjacent to the project area that is within Segments 3 and 4. Approximately 819 of the 954 acres are in Sunriver with the remainder in the city of Bend. Infrastructure, recreational and residential housing development has largely been completed on these lands. Private land use and development were not included because these uses are governed by state and local land use regulations that are designed to protect river values (Upper Deschutes River Plan, page 45). There would be no additive effects on ORVs because the effects of completed WUI treatments on private lands have protected the ORVs and there would be no treatments within the RHCAs on Federal land.

Vegetation management has been deferred from the river corridor for most of the prior 15 years while the Upper Deschutes River Plan was completed. Because none of the prior completed activities have any identified ongoing negative effects these activities were incorporated into the existing condition.

Affected Environment-Wild and Scenic River Values The East Tumbull project area incorporates a portion of Segment 3 (southern boundary of the project area to northern boundary of Sunriver) and all of Segment 4 of the Upper Deschutes River Plan. The following outstandingly remarkable values (ORV) are found within the project area: Geologic, Fishery, Cultural, Vegetation and Recreation. Hydrologic was classified as significant

for the portion of segment 3 and all of segment 4 within the project area. Scenic and Wildlife is classified as significant for segment 3 and ORV for segment 4.

***Geologic*:** This value refers to the lava flows which have pushed the river west of earlier channels north of Benham Falls and created the stair-step falls and rapids popular with river runners. The river channel shape, size and rate of change is not classified as an ORV because the dynamics are so affected by water releases from upstream dams.

***Fishery/Hydrologic*:** The brown trout fishery in segment 3 and redband rainbow fishery in segment 4 are an ORV. The hydrological portion of the river was rated as significant. As discussed in Chapter 1, the dam regulated irrigation flow is the primary contributor to listing of the Deschutes River under section 303 (d) of the Clean Water Act. Even though the Deschutes is a listed river the clear, clean water is a major component of the Fishery ORV as well as the Scenic and Recreation ORVs.

***Cultural/historical*:** The Upper Deschutes River Plan encompasses more than 100 historic and prehistoric sites which are eligible for inclusion in the National Register of Historic Places.

***Vegetation*:** Vegetation in segments 3 and 4 is an ORV because of the presence of Artemis ludoviciana ssp. Estesii (Estes Mugwort or wormwood) a federal Category 2 Candidate for protection under the Endangered Species Act.

***Recreation*:** Recreation is an ORV because of the range of activities such as fishing, hiking, horseback riding, rafting, biking and hunting and the attraction of the river for vacationers from outside of the region due to proximity of Sunriver and Inn of the 7th Mountain.

Scenic: The mix of geologic, hydrologic, vegetative and wildlife along segment 4 is an ORV. The inclusion of private development (Sunriver) in segment 3 lowers the scenic value to significant, however it is still a major element of the recreation ORV for this segment of the river.

Wildlife: Segment 3 is classified as significant because it provides important nesting habitat for birds and travel corridors and habitat for elk and other big game. The diversity of the bird population in segment 4 is an ORV.

Wild and Scenic River Values Environmental Effects

Direct and Indirect Effects of Alternative 1- Neither of the two alternatives would affect the lava flows (*Geologic*) that created the stair-step falls and rapids downstream of Benham Falls; however Alternative 1 would put at risk the other ORV and significant values associated with the Deschutes River.

***Fishery/Hydrologic*:** Under Alternative 1, the largest potential for effects to water resources and fish habitat would come from a large-scale fire. The trend of forest health deterioration and fuels build-up that could inevitably lead to a large scale fire would not be addressed under this alternative. Effects could include a loss of shade, loss of future large wood recruitment and increased sediment input to the watercourse. Due to its proximity to the urban interface, even small wildfires would be aggressively suppressed with the potential for future fish kills caused by fire retardant reaching aquatic systems as occurred in the summer of 2002 along Fall River, a Deschutes River tributary.

Although the overwhelming majority of river bank erosion in this section is caused by the fluctuating flows caused by upstream water releases existing dispersed recreation use is also contributing sedimentation and river

bank degradation and erosion (Upper Deschutes River Plan, Appendix C-11, C-25) as discussed above under the recreation section.

Cultural/historical: There would be an effect to eligible or potentially eligible cultural properties if underburn treatments are not implemented. The result would be a heavier fuel load which would result in a high intensity fire. Fire effects on cultural properties state that temperatures above 650 degrees F can affect stone artifacts. (1998, BLM Protocol). In addition, wildfire could reveal new cultural properties with the added potential of loss to artifact hunters.

Not conducting road closures would continue motor vehicle access to cultural properties and maintain the potential for loss or degradation of cultural properties to other factors such as erosion and inadvertent recreational visitor collection.

***Vegetation*:** Under Alternative 1 no vegetation or fuel treatments would occur. The current and increasing risk of a stand replacement wildfire would not be addressed putting the populations of Estes Mugwort, a federal Category 2 Candidate for protection under the Endangered Species Act, at risk.

Deferring thinning and other fuels reduction activities means that the upland vegetative condition would remain as is and over time stand densities would continue to increase. Insect and disease problems would show a corresponding increase resulting in accelerated tree mortality and increased fuel loading. Mortality of larger ponderosa pine trees would exceed natural mortality rates putting current and future bald eagle and osprey-nesting habitat at risk Lodgepole pine would regenerate in naturally created openings more readily than ponderosa pine in the southern portion of the project area and slowly change the species composition to a lodgepole pine dominated stand on sites historically dominated by ponderosa pine.

Current conditions would remain with a high risk of a stand replacing fire event or insect event that could destroy existing vegetation and create a landscape similar to what occurred in the Pringle Fire of 1995 or Awbrey Hall Fires of 1990 (The Pringle Fire was a stand replacing wildfire event that killed all of the overstory trees as well as numerous bald eagle and osprey nest trees along a 3.5 mile stretch of the Deschutes River). A stand replacing fire would drastically change the structural stage composition of the forest, result in a major loss of future LOS conditions, create unsightly scenic views and set-back the development of a mosaic of different stand structures and ages on lands that were clear-cut harvested in the 1920 to 1940 time period.

***Recreation*:** Under Alternative 1 the trend of making the area less attractive for vacationers, weekday and weekend recreationists would continue. Unrestricted dispersed camping would continue. Enforcement of dispersed camping stays to less than 14 days would remain ineffective because the current open road density and lack of defined dispersed camping sites allows violators to easily move upstream or downstream. Likewise enforcement of fire precautions concerning open campfires would also remain difficult. The maze of open roads has led to a trend of increasing dumping of household garbage and abandonment of motor vehicles that not only makes the area less attractive for recreationists but also in the event of illegal drug lab dumping or a wildfire a substantial health risk through exposure to chemicals of confusion over evacuation routes.

Scenic: Under Alternative 1, scenic values over the short term would not change. Currently, some elements such as the lava flows, rapids and wildlife are attractive but the surrounding upland landscapes have only moderate diversity due to the prior, extensive clear-cutting of ponderosa pine and the development of large areas of immature “black bark” ponderosa pine. Encroachment of lodgepole pine in the southern portion (segment 3) of the project area on areas historically dominated by ponderosa pine has also obscured views. The risk of losing extensive areas of ponderosa pine that is just now starting to form desirable characteristics such as large diameters and yellow bark and the minor amount of large old ponderosa pine remaining within the project

area would continue to increase. Based on the fire history, stand densities, fuel loading and the number of annual fire starts, loss of the overwhelming majority of the forested lands to a stand replacing wildfire would be inevitable. At the present annual average rate of loss this would occur within the next five decades. In actuality, there is a high potential for this to occur within a single fire season as demonstrated by the recent Davis and B and B complex fires of 2003.

Road associated dispersed recreation use as discussed above would also continue and combined with illegal dumping, illegal firewood cutting, escaped campfires and arson the scenic values would continue to degrade.

Wildlife: Under alternative 1, nothing would change for the short term. Current high levels of motorized access to the portion of the Ryan Ranch KEHA (segment 3) west of the Deschutes River would remain the same, allowing disturbance and poaching from motorized vehicles to continue. The risk of loss of nesting, riparian, and upland habitat by wildfire would continue to increase with a corresponding risk of loss of potential nesting, roosting, hiding and calving habitat for species as diverse as elk, mule deer, osprey and bald eagles.

Bird diversity (segment 4 ORV) that is dependent on the mosaic of meadows and riparian areas interspersed with the variable density upland stands would be lost in the event of a large stand replacement fire. This would eliminate bird diversity and favor habitat generalists such as red tail hawks, bluebirds and other species that utilize open areas.

Under Alternative 1 the eventual loss of upland vegetation to wildfire would necessitate a road closure order. Road closures are routinely issued for fire areas to provide for public safety (roadside hazard trees) and to allow riparian and upland vegetation to recover. Road closures would be difficult to enforce on any stand replacement wildfire in the project area due to the gently sloping lands and nearness to town. Unrestricted motor vehicle access has a high risk for spreading noxious weeds and reducing future vegetative and wildlife habitat diversity.

Cumulative Effects of Alternative 1 Under Alternative 1 (No Action), there would be no cumulative effects to ORVs because no activity would take place within the project area. The reasonably foreseeable actions included in the Kelsey EIS, on the eastside of the river corridor within segments 3 and 4, would have some minor beneficial effects on ORVs.

***Fishery/Hydrologic*:** The thinning of 87 acres (Kelsey EIS units 78, 87, 201, 202, 203, 204, 206) followed by the prescribed underburning of 60 of the 87 acres and mowing of the remaining 27 acres (Kelsey EIS units 78, 206) of segments 3 and 4 would have a minor beneficial effect on reducing the potential for a large scale fire in the watershed with a subsequent decrease in the potential for fire related effects to the river. There would be no direct and indirect effects to the river from the proposed vegetation management and fuels management activities because the treatments are on gentle slopes with permeable volcanic soils, with no potential of overland flow carrying sediments to streams.

***Cultural/historical**:* There would be no cumulative effects because no activity would occur under this alternative and all sites would be avoided in other ongoing and reasonably foreseesable activities.

***Vegetation*:** Similar to the effect on the Fishery/Hydrologic ORVs there might be a minor beneficial effect on the vegetation ORV. The level of planned treatments within the Kelsey project and the ongoing major wildland fire risk posed by the vegetation on the westside of the river would make this effect meaningless in the overall context of protecting either Estes Mugwort or the upland vegetation within the river corridor.

Recreation/Scenic: The effects of road closures and vegetation management within the Kelsey EIS would have a minor effect on making the area more attractive for hiking, mountain bike, and horseback riding.

Wildlife: The risk of loss of nesting, riparian, and upland habitat by wildfire would decrease on 108 acres.

Direct and Indirect Effects of Alternative 2-*Fishery/Hydrologic*: The action alternative would decrease the potential for a large scale fire in the watershed with a subsequent decrease in the potential for fire related effects to the river. There would be no direct and indirect effects to the river from the proposed vegetation management and fuels management activities because the treatments outside of the RHCA of the Deschutes River are on gentle slopes with permeable volcanic soils, with no potential of overland flow carrying sediments to streams. The implementation of BMPs and mitigation measures would eliminate the potential for any sediment delivery into the Deschutes River caused by road closure activities. Although the overwhelming majority of river bank erosion in this section is caused by the fluctuating flows caused by upstream water releases; road closures and the reduction of existing dispersed recreation sites would restore an estimated 5 acres within the RHCA of the Deschutes River. Revegetation of these sites would restore water infiltration but more importantly it would prevent the enlargement of these sites by overuse and prevent potential future problems from developing such overland flow into the river. Alternatives 2 would not result in any changes to the flow regimes of the Deschutes river due to vegetation management activities such as thinning, based on a review of the hydrogeology of the basin.

Cultural/historical: Alternative 2 does not have the potential to impact eligible or potentially eligible cultural properties because all sites would be avoided or completed with the use of hand tools or over snow to avoid ground disturbance.

Indirect effects are not expected but the potential does exist. Unevaluated and significant cultural sites avoided by project implementation could have more people working during the short-term (5-7 years) in the vicinity with the potential to have surface artifacts observed and collected. Pile burning can potentially escape the planned burn location although the potential for surface temperatures to exceed 650 degrees F is highly unlikely because pile burning is prescribed to take place under high moisture conditions or snow cover. Changing the vegetation patterns through thinning and the transportation system by road closures and obliterations would change how subsequent forest users over the long term (seven plus years) recreate in the area; moving dispersed recreation use such as camping and hiking to adjacent locations avoided by this project area. This would be a beneficial effect as it would tend to direct users away from the immediate river corridor where the bulk of the historic and prehistoric sites are located.

***Vegetation*:** Under Alternative 2, the risk of losing the populations of Estes Mugwort to a stand replacement wildfire would be much less than Alternative 1 because of the upland treatments described below that reduces the possibility for a large stand replacement fire that could threaten these populations.

A total of 1230 acres of upland vegetation, outside of the RHCA, within the Deschutes River Wild and Scenic River Corridor would be thinned, prescribed burned and mowed to maintain ponderosa pine, mimic low intensity fires, perpetuate a mosaic of stand structures and ages, and reduce the risk of high intensity fires (Upper Deschutes River Plan, page 29, 62). The treatments are designed to reduce tree stress and create a healthier forest condition. Ponderosa pine would be favored in all thinning treatments to reduce the amount of lodgepole pine in areas historically dominated by ponderosa pine. Large ponderosa pine trees would be retained for a longer amount of time within the 13 acres of EA unit 124 to maintain osprey and potential eagle nesting habitat while also accelerating the development of LOS stage stands on the remainder of the treatment acres. Insect and disease problems would be reduced to ensure that desirable levels of endemic mortality continue while lowering the risk of an undesirable epidemic outbreak in the uniform, immature “black bark” ponderosa pine stands. Fuel treatments, including thinning, would reduce fuel ladders, crown density and the risk of a stand replacing wildfire. Natural and human-caused disturbances would mostly likely not be large

stand-replacing events greater than 10 acres within the EA units and a mosaic of stand structures and ages would still be prevalent if a fire event occurred. Wildlife cover and dispersal habitat would be decreased in the short term, but would increase over the long term as tree crowns increase and other growing space becomes occupied.

***Recreation*:** Alternative 2 would implement the final transportation system contained in the Upper Deschutes River Plan and reverse the trend of making the area less attractive for vacationers, weekday and weekend recreationists. Motorized dispersed camping at designated desirable and acceptable sites and motorized public and administrative access to all existing developed recreation would continue. Road closures and thinning activities would reduce the areas and opportunities for unobserved dumping of household garbage, dangerous substances and abandoned vehicles. At the same time, the opportunity and attractiveness of the area for hiking, mountain bike, and horseback riding would increase.

Dispersed motorized recreational opportunities would decrease due to the road closures however there would be no decrease in camping or OHV opportunities because none is allowed within the river corridor (see maps in Appendix G for closure areas).

Scenic: Scenic integrity would be improved under Alternative 2. Limiting motorized access would improve site conditions by preventing damage to riparian and upland vegetation within the river corridor while lowering unsightly, illegal dumping and firewood cutting. Thinning and fuels reduction would perpetuate the desired landscape and accelerate the development of large diameter yellow-barked ponderosa pine while lowering the risk of large wildfires. Encroachment of lodgepole pine in the southern portion (segment 3) of the project area on areas historically dominated by ponderosa pine would be reduced on an estimated 703 acres. The effects on Scenic Views throughout the project area are covered in depth under the Scenic Views resource section.

Wildlife: Under Alternative 2, nesting habitat would be maintained, enhanced or protected on 30 percent of the river corridor (1230 of 4051 acres). There would be no treatment within the RHCAs and no effect on the meadow and riparian mosaic that makes bird diversity in Segment 4 an ORV. Implementation of the Upper Deschutes River Plan transportation system would substantially lower motor vehicle disturbance to elk within the Ryan Ranch KEHA. The Tumalo Cooperative Winter Range Closure Area (Appendix H) that overlays the northern portion of the KEHA would further reduce harassment of big game and in turn should reduce poaching. There would be no effect on travel corridors because they were excluded from management activity.

The risk of loss of nesting, riparian, and upland habitat by wildfire would decrease due to the areas treated within and adjacent to the corridor and the strategic juxtaposition of the EA units that are designed to maximize the effectiveness of fuels reduction activities. Vegetation management and road closure activities would decrease human-caused ignitions, resistance to control and noxious weed spread while maintaining, improving and accelerating wildlife habitat diversity, wildlife habitat effectiveness, nesting and calving habitat.

Cumulative Effects of Alternative 2 The combined effects of planned, ongoing and those activities included in Alternative 2 would have a beneficial effect on ORVs.

***Fishery/Hydrologic*:** A total of 1,317 acres of upland vegetation would be treated between the Kelsey and East Tumbull projects to reduce the potential for a large scale fire in the river corridor with a subsequent decrease in the potential for fire related effects to the river. There would be no direct, indirect or cumulative negative effects to the river from the proposed vegetation management and fuels management activities because the treatments are on gentle slopes with permeable volcanic soils, with no potential of overland flow carrying sediments to streams.

Cultural/historical: There would be no cumulative effects because all sites would be avoided in all current, planned and reasonably foreseeable activities.

***Vegetation*:** The risk of losing the populations of Estes Mugwort to a stand replacement wildfire would be substantially less than Alternative 1. Cumulatively a total of 1,317 acres would have thinning and or other fuels reduction treatments to maintain ponderosa pine, mimic low intensity fires, perpetuate a mosaic of stand structures and ages, and reduce the risk of high intensity fires. Under Alternative 2 areas immediately adjacent to the river corridor would be thinned and prescribed burned or mowed; providing additional protection to Estes Mugwort and the upland vegetation within the corridor.

***Recreation/Scenic*:** Alternative 2 and the Kelsey EIS would complete the implementation of the final transportation system within the river corridor and reverse the trend of making the area less attractive for vacationers, weekday and weekend recreationists. Scenic view enhancements of 1,317 acres would be completed on an estimated 30 percent of the river corridor within this subwatershed. The beneficial effect of this planned activity would accelerate the development of large yellow-barked trees by two to three decades and reduce lodgepole pine encroachment on these acres to a level where periodic maintenance burns in the future could maintain the ponderosa pine stands without additional mechanical treatment.

Wildlife: Implementation of the Upper Deschutes River Plan transportation system would substantially lower motor vehicle disturbance to elk within the Ryan Ranch KEHA within the river corridor. The risk of loss of nesting, riparian, and upland habitat by wildfire would be negligible throughout segment 4 and that portion of segment 3 north of Forest Service Road 40.

LRMP/Other Management Direction Consistency The Upper Deschutes River Plan identifies actions needed to achieve the goals or Standards and Guidelines of the plan. The table below lists the pertinent categories of actions needed to achieve those Standards and Guidelines in order to maintain, enhance and protect ORVs.

Table 3-43

ORV to Maintain, Protect, Enhance	Category of Action	Action Examples
Hydrologic and Geologic	Actions which eliminate stream sedimentation or improve streambank stability	Close roads
Vegetation, Wildlife And Recreation	Actions that protect wildlife and riparian habitat, public health and safety and reduces wildlife disturbance	Reduce the amount and distribution of natural fuel loads Reduce lodgepole pine component within historic ponderosa pine fores Remove vegetation to reduce competition to ponderosa pine
	Long term actions to prevent wildfire, insect epidemics, and disease.	
	Actions that inhibit or prevent non-native species from enter or expanding their range in the river corridor.	No example actions described in Upper Deschutes River Plan
Scenic	Action which reduce visibility of human impacts	No example actions described in Upper Deschutes River Plan
	Actions which perpetuate desired long-term scenic quality	
Cultural	Actions which ensure protection of Cultural Resources associated with other project activities	Avoidance

Table 3-44 displays the proposed Alternative 2 EA unit treatments and consistency with the category of actions from the Upper Deschutes River Plan. All EA units include mitigation measures in project design and implementation to prevent or inhibit non-native species from entering or expanding their range in the river corridor.

Table 3-44

East Tumbull EA Units	Treatment 1// Category of Action 2/	Acres
EA Unit 115, 119, 121	Thin ≤ 12"dbh, HP, Mow/ #1, 2, 4, 6, 7, 8, 9	235
EA Unit 116, 118	Thin ≤ 12"dbh,HP, GR, Mow/ #1, 2, 4, 6, 7, 8, 9	105
EA Unit 124	Thin ≤ 12"dbh, HP/ #1, 2, 4, 5, 6, 7, 8, 9	13
EA Unit 112, 133, 143, 145	PB/ #1, 2, 4, 6, 7, 8, 9	116
EA Unit 117	Thin ≤ 21"dbh,HP, GR, Mow/ #1, 2, 4-9	243
EA Unit 120, 176	Thin ≤ 21"dbh,HP, Mow/ #1, 2, 4-9	124
EA Unit 132E, 138, 149	Thin ≤ 21"dbh,HP, PB/ #1, 2, 4-9	71
EA Unit 132W, 139W, 146	Thin ≤ 21"dbh,GR, PB/ #1, 2, 4-9	65
EA Unit 135	Thin ≤ 21"dbh/ #4, 6, 7, 8, 9	4
EA Unit 139E, 147, 148E, 148W	Thin ≤ 21"dbh,HP, GR, PB/ #1, 2, 4-9	254

1/HP-Handpile; GR-grapple pile; PB-prescribe burn 2/ Category of Action from Table 3-41: #1 Actions which eliminate stream sedimentation or improve streambank stability; #2 Actions that protect wildlife and riparian habitat public health and safety; #3 Actions that reduce wildlife disturbance; #4 Long term actions to prevent wildfire, #5 insect epidemics, and disease; #6 Actions that inhibit or prevent non-native species from entering or expanding their range in the river corridor; #7 Actions which reduce visibility of human impacts; #8 Actions which perpetuate desired long-term scenic quality; #9 Actions which ensure protection of Cultural Resources associated with other project activities.

Vegetation Standards and Guidelines Alternative 2 would protect populations of Estes Mugwort by strategically designed fuels treatment (LRMP, Amendment #12, V-1).

All EA units have noxious weed control provisions to prevent non-native species from entering or expanding their range in the river corridor (LRMP, Amendment #12, V-7). In addition, the 11.9 miles of road closure and 26.5 miles of road obliteration addresses short-term and long-term reduction of wildlife disturbance while the thinning and other fuels reduction activities also addresses long-term wildlife disturbance reduction. At the same time these road closures are designed to reduce human caused ignitions and noxious weed introduction and spread (Category #3, #6, Table 3-44).

The use of prescribe fire to mimic historic events would be used on a total of 506 acres and be conducted in compliance with Oregon State Smoke Management Plans (LRMP, Amendment #12, V-9, V-10, V-12). An additional 724 acres would have handpiling, thinning and mechanical shrub treatment to assist in the safe use of fire and to reduce the threat to the WUI. The proposed thinning of 1114 of the 1230 acres would enhance the potential for current and future nesting, roosting habitat for eagles and osprey (LRMP, Amendment #12, V-16).

All thinning included in Alternative 2 would retain trees of the best vigor. Ponderosa pine would be favored over lodgepole pine and have variable spacing to mimic natural stand developments. Mowing and underburning would reduce understory vegetation, including grasses, shrubs and small trees to move towards the more open ponderosa pine stands that historically dominated this area. On the 506 acres of underburning the tree boles and lower needles of trees would be scorched. The appearance of vegetation following treatments including variable spaced trees, clumps of shrubs and or bole scorch would mimic the historic, frequent, low intensity ground fires (LRMP, Amendment #12, V-17)

Wildlife, Scenery, Recreation, Administrative, Geology and Hydrology Standards and Guidelines Consistent with Eastside Screen direction wildlife dispersal and connectivity travel routes were designated throughout the area, all roads not specifically mentioned to remain open in the Upper Deschutes River Plan would be closed,

and the seasonal closure of the Tumalo Cooperative Winter Range Closure Area would remain in effect under Alternative 2 (LRMP, Amendment #12, G-5, A-4, R-5, W-1 to W-3).

Vegetation management within the river corridor defers treatment within 300 feet of the river to maintain partial retention in segment 3 and retention and partial retention in segment 4 as seen from the river and corridor. Upland thinning of 1114 acres includes whole tree yarding and concurrent handpiling along travel corridors to mitigate effects on visual quality. Mechanical operations involving tree removal would not occur between May 15 and September 1 to further reduce effects on visual quality. Mowing would be conducted, where needed on the 506 acres of prescribed underburning to reduce scorch heights (LRMP, Amendment #12, S-1). See scenic quality effects section immediately following for additional scenery analysis and consistency findings.

Scenic Quality Introduction "Sense of place" is a commonly used term that suggests that the identity of the people, both visitor and resident, who live or recreate in an area is largely defined by the natural features of that area. The East Tumbull project areas scenic attributes are dominated by the young "black bark" ponderosa pine stands that surround the river, roads, trails and residences. Currently, these high density stands of trees block views of areas with high natural scenic quality, including distant views, geological features of lava flows and rock outcroppings, the Upper Deschutes Wild & Scenic River, and designated scenic corridors and recreation sites. Measures used in the effects analysis are: Measure #1 Acres (or percentage) of improved or enhanced scenery*;* Measure #2 Acres (or percentage) of short-term scenic quality effects within the foreground and middleground landscape as viewed from a travel corridor or a viewpoint.

Scope of the Analysis Scenic view analysis is confined to the project area and the transportation corridors that access it with an emphasis on the maintenance and enhancement of those features that give the project area its sense of place. Vegetation management activities that have taken place during the last 15 years including thinning, underburning and mowing have been beneficial at maintaining and enhancing scenic quality. Cataloguing these activities is not necessary because they have been included in the existing condition. The effects of 411 acres (BB 90 units 1, 3, 4, 10; Pine 90 unit 2; BB 89 units 8, 10; Katalo units 17, 23) of ongoing and already approved prescribed burning and 26 acres (Katalo Units 8 and 10) of mowing was included in the effects discussion because these activities have the potential for a minor short-term negative effect on scenic quality. There are no other on-going or reasonably foreseeable activities within the project area that would change scenic quality.

Affected Environment-Existing Scenic Condition In general, the project area may seem as a "natural appearing landscape" to the casual forest visitors. However, the current condition is far from being natural. Decades of historic timber harvest and fire suppression have led to current condition of a unnatural mostly high density forested landscape. The area consist of mostly second growth, black bark ponderosa pine stands of various age and size classes with occasional stands of old-yellow bark trees existing along the scenic travel corridors. The mixed pine forests dominate along the Deschutes River near Sunriver, where densely stocked lodgepole pine forests mix in with ponderosa pine stands.

The development of larger trees is being suppressed by the densely stocked new regeneration stands and the changes in the fire regime and other natural disturbances throughout the project area. The densely stocked forests with a high canopy closure percent has led to the exclusion of the open park-like stands historically found within the area. Overstocking and high density stands in part of the project area have led to serious wildland fire risk and degraded scenic quality along scenic and travel corridors, in particular along the Upper Deschutes Wild and Scenic River corridor. The depth-of-field view into the forest is restricted to mostly within the immediate foreground area of the landscape (0 to 300 feet) due to the high level of vegetation density.

Affected Environment-Existing Landscape Character There are four (4) distinctive scenic and recreation

corridors or areas within the East Tumbull project area. These areas lend themselves to the opportunity for scenic view enhancement and an improvement in the recreation experience level through vegetation management and manipulation to reduce stand density and improve views and vistas into the landscape.

Area 1-The Skyliners Road Scenic Corridor: Forest Road 4601 to Project Western Boundary This segment, from the Bend Urban Growth Boundary west to the project boundary, consists of primarily second growth (black bark) ponderosa pine stands from early to mid seral stage. Bitterbrush components found in the landscape in this corridor are the dominant ground cover species. This is a disturbed landscape where urban development, such as recreational and destination resorts, along with past and present management activities exist on private lands and are apparent throughout the landscape. Large ponderosa pine is lacking and visual diversity is limited to black bark pine forests and low shrub components within the landscape. The landscape here is mostly flat with gentle slopes, dips, and swales. Views into this landscape is restricted to the immediate foreground area due to high density through this corridor.

Area 2-The Cascade Lakes National Scenic Byway Corridor: Highway 46 to Project Western Boundary This segment, from the Bend Urban Growth Boundary to the western project boundary, consists of primarily black bark stands with early to mid seral stage. Bitterbrush components are found in the lower elevation, along with manzanita and snowbrush in higher elevations. This is a disturbed landscape where past and present management activities exist and are apparent throughout the landscape. Large ponderosa pine component is lacking and visual diversity is limited to black bark pine forest and shrub components within the landscape. The landscape along this scenic corridor is mostly flat in terrain. Views into this landscape is of varying degrees, from past open wildfires to a developed green golf course with associated powerline corridors. In some areas, views are restricted to the immediate foreground area due to high density black bark ponderosa pine stands along the corridor.

Area 3-Road 41 Recreation and Scenic Corridor: Highway 46 to Road 40 This segment is a popular access route to some of the area's most popular recreation sites along the Upper Deschutes Wild and Scenic River corridor. The corridor consists of ponderosa pine of various age and size classes and changes into mixed pine forest at the lower elevation near Sunriver. Machine planted ponderosa pine plantations from the 1960's are a common sight, intermingled with older and mostly mixed pine forests with black bark ponderosa pine as the dominant species. Large ponderosa pines along this corridor are few and far between and visual diversity is limited to mixed pine forest and bitterbrush components in the landscape. The landscape here is mostly flat with gentle slope. Views into this landscape are restricted to the immediate foreground of the corridor due to the high density stands of various age and size classes.

Area 4—Upper Deschutes Wild and Scenic River Corridor This is a highly popular segment of the Upper Deschutes Wild and Scenic River corridor with numerous recreation sites, trails, and trailheads. High density stands of various age and size classes categorize this area's landscape character. It currently consists of large ponderosa pine stands of mid seral stage, mixed in with a varying degree of younger and less mature ponderosa pine and lodgepole pine stands. Bitterbrush and native grass species are the primary undergrowth components found throughout the landscape. The landscape is mostly flat with gentle slopes that drain toward the Deschutes River. Views into this landscape are restricted to the immediate foreground of the river corridor from the two primary scenic and travel corridors.

Scenic Quality Management Direction The USDA Forest Service established a Handbook for Scenery Management System (SMS--USDA FS 1995) use to protect and enhance scenic resources which may be diminished by human activities, such as vegetation management, recreation and/or administrative facility development. The analysis will take into consideration the balance between Social (human) and Ecological (natural) needs within the analysis area. This Scenery Management System (SMS) will be used in conjunction

with the Deschutes LRMP 1990).

The Forest Service implementing regulations, currently establish a variety of Scenic Quality Standards (SQO's for Scenic Views—MA 9). These standards include:

Natural Appearing Landscape with High Scenic Integrity Level (formerly Retention, MA 9, SV-1),
Slightly Altered Landscape with Medium Scenic Integrity Level (formerly Partial Retention, MA 9, SV-2),
Altered Landscape with Low Scenic Integrity Level (formerly Modification or General Forest, MA 8, GFO) within the Foreground as well as in the Middleground landscape.

Please refer to the LRMP, MA 9, Scenic Views Allocation and the Scenery Management System (SMS--USDA FS 1995) handbook for more detail.

Scenic View Allocations within the East Tumbull project area There are a total of 2,178 acres (20.6 percent of 10,555 acres) within Scenic Views (LRMP, MA 9) allocation areas, a total of 1,617 acres (15.3 percent) within the Intensive Recreation Area (LRMP, MA 11), and a total of 4,051 acres (38.4 percent of 10,555 acres) are within the Upper Deschutes Wild and Scenic River (MA 17-Upper Deschutes River Plan pages 33-34).

Highway 46 (Cascade Lakes), Highway 41, Highway 40 (Three Trappers Road), Forest Road 4601 (Skyliners Road) and the Upper Deschutes Wild and Scenic River are the primarily scenic view corridors and travel routes through this project area. The Highway 46 corridor has been allocated as Natural Appearing Landscape with High Scenic Integrity Level (Retention Foreground Scenic View, LRMP, MA-9, SV-1). Highway 41, 40, and Forest Road 4601 have been allocated as Slightly Altered Landscape with Medium Scenic Integrity Level (Partial Retention Foreground Scenic View, LRMP, MA 9, SV-2).

Target Landscape condition The Desired Scenic Condition is to achieve and maintain visual and species diversity in the landscape through variations of vegetation or stand densities, age and size classes (LRMP, MA 9, M 11, MA 17). The landscape character goal for the East Tumbull project area is to achieve a natural appearing landscape that represents the natural character of Central Oregon, such as open park-like stands with large yellow-barked ponderosa pine trees, where management directions, the desired future conditions, social and ecological framework of the Management Areas are met. In general, the historic structural stage percentages of the various species types displayed in Table 3-7 would represent the desired long-term trend.

The scenic integrity objective for East Tumbull would be a natural appearing landscape character where various line, form, color, and texture elements can be found within the landscape. Human alterations, in general, would be subordinate and conform to natural appearing landscape characteristics. Character trees, snags, rock formations and small openings to highlight special features within the landscape are desirable and encouraged. Where biologically feasible, diversity in vegetation species, age and size classes would be encouraged.

Ponderosa pine in foreground views (MA 9-4, MA11-17, Upper Deschutes River Plan S-1) would be managed to maintain or create a visual mosaic of numerous, large diameter, yellow-barked trees with stands of younger trees offering scenic diversity as seen from sensitive viewer locations, such as from a travel corridor. Ponderosa pine viewed as middlegrounds (M9-15) will be managed so that they provide a strong textural element. The present of a few individual large trees with full crowns is an important part of this landscape element. Immature stands are also an essential component in the landscape because they help provided a strong color contrasts, and they eventually become the replacements for the larger, old growth trees that perpetuate the desired coarsely-textured character. Visible openings are desirable where the natural landscape contains similar openings, or where natural-appearing openings can provide additional diversity in the landscape where lacking.

Mixed Conifer-Foregrounds Mixed conifer stands (EA unit 124) in the foreground landscape areas would be managed to perpetuate or enhance the characteristic (or natural) landscape. The characteristic landscape normally contains stands that are visually dense, though not necessary continuous. Diversity in tree and shrub species, various age and size classes produce the desired scenic character in the landscape.

Scenic Quality Environmental Effects

Important Interactions The proposed activities were designed to create an altered and different forest character that would increase forest health, enhance long-term scenery and improve the recreational experience. The effect on scenic resources from the two alternatives, specifically on landscape character, scenic quality, and scenic integrity level, can be classified into two specific categories. The first is short-term effects (0 to 5 years), and the other is long-term effects (from 5 years and beyond). The effect from the proposed management activities would be most evident to the visiting public within the foreground landscape (0 to 1/2 mile corridor) and some part of the middleground landscape (1/2 to 5 miles). This effect analysis takes into account short, long-term effect and cumulative effects.

Direct and Indirect Effects of Alternative 1 *Measure #1 Acres (or percentage) of improved or enhanced scenery* Under this alternative, an estimated 10,555 acres, (100% of the project area), including 2,178 acres (or 20.6% of total 10,555 acres) within Scenic Views (LRMP, MA 9), 1,617 acres (or 15.3% of total 10,555 acres) within the Intensive Recreation Area (LRMP, MA 7), and 4,051 acres (or 38.4% of total 10,555 acres) within the Upper Deschutes Wild and Scenic River (LRMP, MA 17), of the existing vegetation community within the East Tumbull project area would not be managed or altered by any proposed active vegetation management activity. Natural and ecological processes, such as insects and diseases, wind and snow damage, dead and down tree accumulations, would be allowed to continue unmanaged, exacerbated by continuing fire suppression.

Current management direction would continue as is (e.g. management of recreation use and services, fire suppression, hazard trees, standard road maintenance and re-closure of breached roads, etc.). No action would be taken to reduce risk at a landscape scale under this alternative. No action would be taken to thin the forest to reduce vegetation density and increase forest stand health and vigor. Vegetation health, growth, and vigor would continue to decline on those dense stands at high risk of beetle attack.

Measure #2 Acres (or percentage) of short-term scenic quality effects within the foreground and middleground landscape as viewed from a travel corridor or a viewpoint. Absent a large stand replacement wildfire, the area's landscape character, scenic quality, and scenic integrity level would remain essentially the same during the short-term period. The long-term landscape character, scenic quality, and scenic integrity level would be expected to be altered through time as vegetation aging processes naturally alter the project area's scenery.

The Deschutes National Forest LRMP objectives and the Desired Future Condition for Scenic Views (LRMP, MA 9, MA 11, MA 17) are not expected to be met as originally intended. An analysis of stand replacement wildfires within the subwatershed suggests that if current trends continue,the entire project area would revert back to early seral stage stands over the next five decades.

Cumulative Effects of Alternative 1 *Measure #1 Acres (or percentage) of improved or enhanced scenery. Measure #2 Acres (or percentage) of short-term scenic quality effects within the foreground landscape as viewed from a travel corridor or a viewpoint*. There would be no cumulative effects with this alternative because there would be no vegetation management activities that could affect scenic quality. Scenic quality within the project area would continue to trend down as fuels levels, stand density, and negative vegetation effects continue to increase from on-going fire suppression and motorized access.

Direct and Indirect Effects of Alternative 2 *Measure #1 Acres (or percentage) of improved or enhanced scenery.* Under Alternative 2, the management of existing vegetation to reduce fuel loading and to highlight individual large ponderosa pine trees would take effect. Mechanical shrub treatments (mowing), prescribed fire (underburn), tree thinning (commercial and noncommercial thinning), hand and machine piling of noncommercial thinning would be utilized to complete management activities as proposed. As a result, "filtered views" deep into the forest landscape, torward the Upper Deschutes Wild and Scenic River area, would be enhanced at places. In addition, upland fuel reduction treatments, specifically within the ponderosa pine and mixed pine stands, would reduce the overall wildland fire risk of a stand replacing wildfire that could severly affect both short and long-term scenic resources (i.e. scenic quality, scenic integrity level, and landscape character). This alternative is expected to enhance a late seral ponderosa pine stands (EA unit 124) by removing dense ladder fuels beneath old growth ponderosa pine. Fuel treatments would create a mosaic of shrub and grass communities with scattered regeneration within the understory. Within the lodgepole pine or mixed pine EA units, stand health is the primary focus of commercial and non-commercial thinning. Vegetation management would reduce the risk of a reoccurring mountain pine beetle epidemic, which would accelerate the development of larger more contiguous blocks of mature lodgepole pine forest.

Measure #2 Acres (or percentage) of short-term scenic quality effects within the foreground landscape as viewed from a travel corridor or a viewpoint. The largest potential for negative effect on scenery generated by the proposed management activities may be from logging disturbance, fuels treatment activities, and timing of such management activities. Logging of green trees, as well as prescribed burning and mowing, may reduce scenic quality and recreation experience during the short-term period. The time period of concern is during the summer peak recreation season, between the month of June and August. Summer logging activities may reduce or impede recreation access and experience level to the highly popular Upper Deschutes Wild and Scenic River and the associated recreation sites. The low elevation of the project area combined with soils that are well drained and hold up well during late fall and winter make it an ideal area for winter logging operations, which could help reduce recreation/logging conflict as well as reducing impact on the landscape. To eliminate recreational and visual conflicts, vegetation management activities involving mechanized tree removal, machine piling, mowing and prescribed underburning that overlay trails within EA units 103, 104, 108, 109, 110, 115, 117, 119, 139E and 147 would occur outside of the normal recreation season of May 15 to September 1. To further eliminate or minimize short-term effects on scenic views the following highly effective mitigation measures (see also Chapter 2) would be used:

- Minimize the use of paint where feasible, especially within the immiediate Foreground landscape. Where paint is needed along scenic routes, utilize backside tree marking to minimize visibility.
- Flush cut stump (8 inches or less) within immediate Foreground landscape (0 to 300 feet).
- Where possible, design and locate skid trails and landings at least 300 feet away from Forest Road 4601 (Skyliners Road), 46 (Cascade Lakes Highway), 41 and 4100280.
- Slash treatment within scenic corridor to be completed within one and two years period, respectively, for SV-1 and SV-2 scenic views allocation area.
- Keep scorching of tree crowns during prescribed burning to approximately 1/3 of live crown ratio.
- Removal of all boundary flagging as part of the post treatment activities, within one and two years period, respectively, for SV-1 and SV-2 along scenic corridors.

Prescribed burning and/or natural fuels mowing (treatment) activities are proposed under this alternative. Compared to Alternative 1, both treatment types would reduce fuel loading, improve and enhance naturally appearing landscape characteristics, scenic quality, and scenic integrity level. Prescribed fire has the potential to scorch tree crowns more than is visually acceptable. Treatment options include both pruning or tree removal. Tree removal would be confined to trees less than 12 inches dbh that are the most susceptible to crown scorch.

Mowing of shrub components in the landscape has the potential to have a direct affect on short-term scenic quality within the project area. Retaining clumps and small islands of the existing shrub layer distributed throughout the mowing unit (mosaic pattern) is designed to mitigate this visual effect as well as provide visual diversity in the post treatment landscape.

Approximately 1,012 acres (or 46.5% of total 2,178 acres within Scenic Views allocation areas, both SV-1 and SV-2) would be treated under this alternative. Additionally, a total of 863 acres (or 53.4% of total 1,617 acres within Intensive Recreation allocation areas) and 1230 acres (or 30.4% of total 4,051 acres within the Upper Deschutes River corridor) would be thinned and treated to accelerate the development of large-yellow bark ponderosa pine, a key scenic component within the Central Oregon landscape.

Under this alternative, the Deschutes National Forest LRMP directions, the Desired Future Condition for Scenic Views (LRMP, MA 9) is expected to move a step closer toward the desired conditions as originally intended. Over all, the long-term enhancement of landscape character, scenic quality, and scenic integrity level are expected as result of the proposed management activities. With effective implementation of mitigation measures, effect(s) on scenic resources are expected to meet all LRMP scenic quality standards and guidelines.

Table 3-45 Alternatives Comparison: Scenic Landscape Character, Scenic Quality, Scenic Integrity Level

DESCHUTES NF LRMP MANAGEMENT AREA	**ALTERNATIVE 1 NO ACTION**	**ALTERNATIVE 2 PROPOSED ACTION**	
Scenic Views (MA 9) SV-1 (Retention Foreground)	Generally follow natural and ecological processes No management activity other than the routine and normal function of resources management No short-term effect on Scenic Resources.	Proposed treatment of approx. 584 acres (27% of 2,178 acres) resulting in beneficial short-term and long-term alteration of the landscape character that is expected to be noticeable to a casual forest visitor along travel and scenic corridors.	
Scenic Views (MA 9) SV-2 (Partial Retention Foreground)	Generally follow natural and ecological processes No management activity other than the routine and normal function of resources management No short-term effect on Scenic Resources.	Proposed treatment of approx. 428 acres (20% of 2,178 acres) resulting in beneficial short-term and long-term alteration of the landscape character that is expected to be noticeable to a casual forest visitor along travel and scenic corridors.	
Intensive Recreation (MA 11) Total 1,617 Acres	Generally follow natural and ecological processes Proposed no management activity other than the routine and normal function of resources management No short-term effect on Scenic Resources.	Proposed treatment of approx. 863 acres (or 53% of total 1,617 acres) resulting in beneficial short-term and long-term alteration of the landscape character that is expected to be noticeable to casual forest recreationists to the project area	
Upper Deschutes W&SR (MA 17) Total 4,051 Acres	Generally follow natural and ecological processes Proposed no management activity other than the routine and normal function of resources management No short-term effect on Scenic Resources.	Proposed treatment of approx.1,230 acres (or 30% of total 4,051 acres) resulting in beneficial short-term and long-term alteration of the landscape character that is expected to be noticeable to casual forest recreationists to the project area	
Total: 7,846 Acres (or 73.3% of Total 10,555 Acres)	**Does not expect to meet LRMP Desired Future Scenic Condition (Open Park-Like Stands)**	**Expect to meet LRMP Standard and Guideline for Scenic Views and Enhance Long-Term Scenery**	

Cumulative Effects of Alternative 2 Central Oregon has always been a very dynamic landscape characterized as always evolving. Whether this evolution is by way of natural or man-made processes, they all have cumulative and altering effects on landscape character, scenic quality, and scenic integrity level at a varying degree. Individually and cumulatively, these man made and natural processes have created a landscape characterized as "distinctive" or "unique" (in accordance with the USDA Forest Service Manual 2380, Landscape Management). These man made and natural disturbances have, in effect, deviated from the previous "natural appearing" character of Central Oregon's characteristic landscape. Over the past decade, countless projects on the Deschutes National Forest have been implemented in black bark stands and throughout the forest to reduce fire, insect and disease prone forests to be more resilient to insects, decay and wildfire. As a result, the cumulative effect on scenery can be classified as altering landscape from an existing densely stocked forest character to a more open park-like stand of healthy green forest that help meet the Desired Future Scenic Condition as specified in the Deschutes LRMP for Scenic Views (MA 9).

Measure #1 Acres (or percentage) of improved or enhanced scenery. The combination of Alternative 2 and the past projects in the area, as reflected by the existing condition, contribute toward a more desired forest conditions that meet both short and long-term scenic views.

Measure #2 Acres (or percentage) of short-term scenic quality effects within the foreground landscape as viewed from a travel corridor or a viewpoint. Alternative 2 would prescribe underburn 1,587 acres in addition to 411 acres (BB 90 units 1, 3, 4, 10; Pine 90 unit 2; BB 89 units 8, 10; Katalo units 17, 23) of on-going burning activities. Prescribed fire has the potential to scorch tree crowns more than is visually acceptable. To date, none of the previous underburns has been determined to be visually unacceptable within the project area. Based on the provisions for conducting underburns under prescribed conditions there would be no negative cumulative effects on scenic quality from underburning.

Mowing of shrub components in the landscape has the potential to have a direct affect on short-term scenic quality within the project area. As noted under the direct and indirect effects discussion the retention, 25 percent of the net treatment acres in the EA units would not be mowed in addition to wildlife cover patches from 2 to 30 acres in size. Katalo units 8 and 10 (26 acres of mowing) also would retain clumps and small islands of the existing shrub layer distributed throughout the mowing unit to mitigate this visual effect. There would be no negative cumulative effects on scenic quality from mowing within the project area.

LRMP/Other Management Direction Consistency The landscape character goal for the East Tumbull project area is to move towards the historic ponderosa pine condition that was dominated by open, park-like stands with large yellow bark ponderosa pine greater then 30 inches in diameter. Vegetative management within MA 9, 11 and 17 is designed to perpetuate the desired visual condition by accelerating the development of LOS stage ponderosa pine (MA 9-11 to 9-17). This would be achieved by thinning from below with variable spacing to control insects and disease (MA 9-96) and highlighting rock outcrops (MA 9-16, MA 11-20) and individually scattered large yellow barked trees (MA 9-6, MA 11-18) in an interdisciplinary integrated (MA 9-7, 17, 26) silvicultural prescription (Appendix I) for each EA unit.

EA unit 124 would have hand thinning and handpiling to reduce the stress on a structure stage 7 stand and all large-diameter yellow-barked trees would be retained. The black bark stands in the remaining EA units would have variable density thinning, interspersed with 2 to 30 acre no treatment clumps to gradually introduce both horizontal and vertical diversity. Whole tree removal and concurrent handpiling of thinning slash would ensure that cleanup activities would be completed after the work has been completed in a timely manner to meet visual quality standards (M9-8, LRMP, Amendment #12, S-1).

To eliminate recreational and visual conflicts, vegetation management activities involving mechanized tree

removal, machine piling, mowing and prescribed underburning that overlay trails within EA units 103, 104, 108, 109, 110, 115, 117, 119, 139E and 147 would occur outside of the normal recreation season of May 15 to September 1 (MA 11-43, LRMP, Amendment #12, S-1). of May 15 to September 1.

Transportation System Access (Roads Analysis)
Scope of the Analysis The scope of the analysis is focused on the transportation system within the project area and the main roads that connect this system with areas outside of the project area. For all practical purposes this is the transportation system that overlays the Upper Deschutes River Plan. The project area instead of implementation units were used to evaluate road density because at over 16 square miles it is large enough to assess the average open road density. The cumulative effect on road density within the Ryan Ranch KEHA is discussed under the wildlife habitat section as well as road densities within appropriate management areas. There are no ongoing or reasonably foreseeable road closures or road construction within the project area.

Affected Environment-Existing Road Density The existing open road density is 4.5 miles of open road per square mile within the project area. This figure is skewed slightly higher due to the fact that the western boundary of the WUI is defined by Road 41. Boundary roads use half of the miles for road density calculations.

Transportation System Access Management Direction The LRMP, as amended by the Upper Deschutes River Plan, specifies threshold road density guidelines for key elk areas (WL-46), big game summer range (WL-53) and deer habitat (winter range, MA 7-22). These guidelines are analyzed in depth under the wildlife habitat management direction.

The Upper Deschutes River Plan conducted an analysis to identify the existing roads needed for a safe and responsive road system taking into account public needs and desires that would also be consistent with protecting and enhancing the Wild and Scenic River Values in this portion of the project area. Roads to remain open include those roads that access developed recreation sites (LRMP, Amendment #12, R-5) and roads to be maintained for administrative and emergency evacuation and access routes (LRMP, Amendment #12, RA-4). Additional roads analysis at the project scale is not automatically required but may be undertaken at the discretion of the responsible official. The basis for not conducting additional analysis must be documented.

The ID team reviewed the Upper Deschutes River Plan transportation system (Appendix H) for the East Tumbull project area with the additional provisions that the seasonal closure of the Tumalo Cooperative Winter Range Closure Area would continue (LRMP, Amendment #12, W-3) and road densities would be managed to improve habitat effectiveness (LRMP, Amendment #12, W-2).

Target Landscape Condition The Upper Deschutes River Plan (LRMP, amendment #12) specifies the roads that are to remain open in the East Tumbull project area. These roads include all of the following: Century Drive or Road 46 (also referred to as the Cascade Lakes Highway); Skyliners Road (4601); Conklin Road (41); Meadow Camp Road (4600100); Phil's Trailhead Road (4601220); Lava Camp Road (4100700); Ryan Ranch Road (4120); Benham Falls Road 4120100); Cardinal Bridge Road (4100280); and Besson Camp Road (4100240). Notwithstanding the provision that these roads must remain open, the upper limit on target open road density guidelines are 2.5 miles (WL-53), 1.5 miles (WL-46), and 2.5 miles per square mile for deer summer range, key elk and deer habitat, respectively.

Transportation System Access Environmental Effects Environmental effects of road densities, closures and temporary roads on recreation, fuels and fire hazard reduction, wildlife habitat, fisheries and hydrology, Wild and Scenic River Values are included in the approriate resource section.

Direct and Indirect Effects of Alternative 1 Roads superfluous to administrative, recreational, private and commercial use would remain open. The opportunity to implement the Upper Deschutes River Plan transportation system would be deferred. Negative effects on river values, wildlife habitat, fire and fuels hazard, etc from redundant and unneeded roads would continue as discussed elsewhere in this chapter. Roads required for recreational access would receive routine, periodic maintenance such as brushing and blading.

Direct and Indirect Effects of Alternative 2 Alternative 2 would require an estimated 5.8 miles of temporary roads to access firm wood fiber removal EA units (Appendix H). Approximately 50 percent of the temporary roads are existing old roads from previous entries that would be reopened Effects on road density are limited because the roads are not open to the public and contract provisions require their closure by the purchaser when fiber removal operations are completed. At the most it is anticipated that at any given time during fiber removal, a maximum of 1 mile of temporary road would be open. If none of the planned 11.9 miles of road closures and 26.5 miles of road obliterations are completed (map page 152) before the beginning of fiber removal operations, a maximum increase of 0.06 miles per square mile for the project area would occur due to temporary road construction. This would increase the current road density of 4.53 miles per square mile within the project area to 4.59 miles per square mile before being reduced to 2.11 miles per square mile when all activities have been completed.

None of the temporary road locations would require any earthwork such as cuts, fills, or drainage structures because they are located on flat ground (less than 5 percent) and do not cross any perennial, intermittent or ephemeral water courses. No permanent specified roads would be constructed. The effects of subsoiling temporary and permanent roads is discussed under the wildlife and soils resource sections.

Utilities such as powerlines, water pipelines and water storage tanks would still be accessible for administrative access by closed, currently gated roads. The chances for power outages or drinking water degradation due to a wildfire within the project area damaging lines and infrastructure would be lower than Alternative 1 after the vegetation management activies included with Alternative 2 are completed.

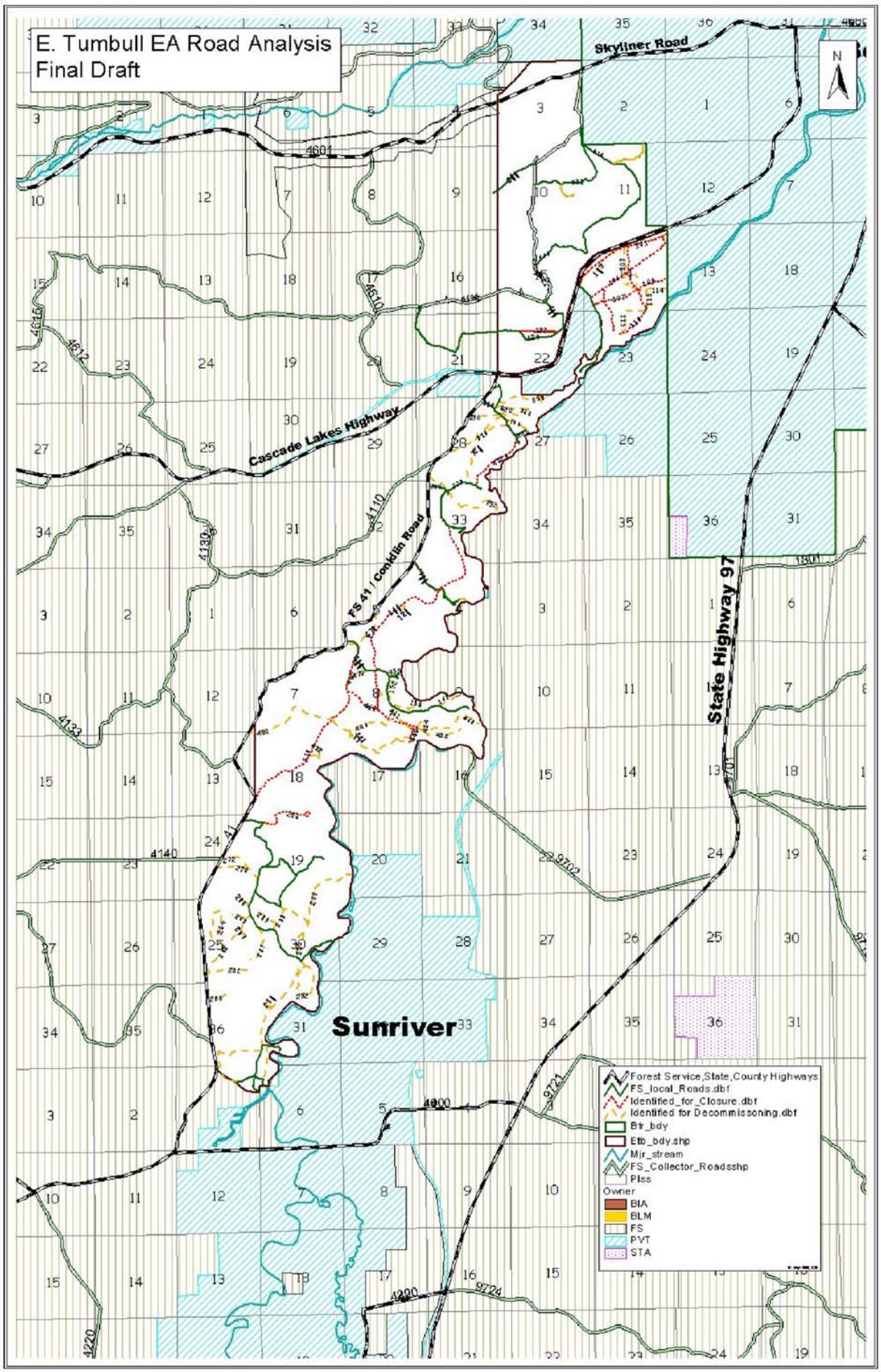
Vegetation management activities would include normal maintenance activities such as dust abatement to prevent dust, road grading to maintain surfacing and water drainage, spot rocking and brushing.

Cumulative Effects of Alternatives 1 and 2 There are no identified cumulative effects because under Alternative 1 there would be no activities and under Alternative 2 there are no other ongoing or planned transportation system changes. Cumulative effects on road densities within the Ryan Ranch KEHA is discussed under the wildlife habitat resource section.

LRMP/Other Management Direction Consistency Wildlife habitat management direction (WL-46, L-53, MA 7-22) is addressed by closing all roads that are not required by the LRMP (LRMP, Amendment #12, R-5, RA-4) to remain open. Only those roads that Amendment #12 to the LRMP require to remain open within the project area would be available for administrative or public access after Alternative 2 has been implemented.

Consistent with management direction (FSM 7712.13c), the decision to not undertake additional roads analysis for this project and the basis for the decision is documented in Appendix H (File Code 7710-2/1950-1, Subject**:** East Tumbull Environmental Assessment).

Overall road density within the project area would fall to 2.2 miles per square mile during the summer and 1.7 miles per square mile during the winter range closure area, consistent with LRMP direction.


E. Tumbull EA Road Analysis
Final Draft
Skyliner Road
Cascade Lakes Highway
FS 41 / Conklin Road
State Highway 97
Sunriver
N
Forest Service,State,County Highways
FS_local_Roads.dbf
Identified_for_Closure.dbf
Identified for Decommissoning.dbf
Bir_bdy
Etb_bdy.shp
Mjr_stream
FS_Collector_Roadsshp
Plss
Owner
BIA
BLM
FS
PVT
STA

Hydrology (Water Quality) and Fisheries Management Introduction

Water Quality and Fisheries Management are closely related. In this resource section the scope of the analysis and affected environment are discussed separately; followed by a combined effects analysis for the following measures: Measure #1 Timing and Volume of Peak/Base Flows and Water Yield; Measure #2 Water Quality ODEQ 303(d) Parameters; Measure #3 Fish Habitat and Populations, Measure #4 Project Design Criteria and Mitigation. Quantitative analyses and professional judgment were used to evaluate the issue measures by comparing existing conditions to the anticipated conditions from implementing the two alternatives. This analysis also considered the effectiveness and probable success of implementing the management requirements, mitigation measures, and Best Management Practices (BMPs), which are designed to avoid, minimize or reduce potentially adverse impacts to habitat conditions, water quantity and water quality.

Scope of the Analysis The hydrology resource may be directly or indirectly affected within the project area. The Deschutes River is the major waterbody within the project area; therefore it will be the focus of the hydrologic analysis. The Equivalent Clearcut Area (ECA) methodology was used to determine where cumulative watershed effects might occur at the 5th field watershed scale. Past, Present, and Reasonably Foreseeable Actions were considered in this analysis. Past actions included development in the City of Bend and outlying areas. Past actions on Forest Service lands included vegetation management activities (dating back approximately 40 years), fire history, and road density. Present actions included on-going vegetation management activities. Reasonably Foreseeable Actions included the Kelsey Vegetation Management Project area, Lava Cast and U.S. Hwy 97 construction but did not include private lands, such as the City of Bend and Sunriver because there is not an additive effect from East Tumbull and these other federal actions.

Affected Environment-Landscape Setting The East Tumbull Project area is east of the owl line, and lies within the management area of the Inland Native Fish Strategy (INFISH), which amended the Deschutes National Forest Land and Resource Management Plan in 1995. The project area also includes land (4,051 acres) within the corridor of the Upper Deschutes Wild and Scenic River, for which an EIS and Comprehensive Management Plan (Upper Deschutes River Plan, 1996) were completed. Wild and Scenic River Segments included in the project area are 3D, 4A, 4B, 4C, 4D, 4E, and 4F. Segment 3D includes the area from Harper Bridge (river mile 192) downriver to the northern boundary of Sunriver (river mile 185.4), and the Segment 4 sub-segments includes the area from the northern boundary of Sunriver downriver to the Bend Urban Growth Boundary (river mile 172). Wild and Scenic Rivers are included under Management Area 17 of the 1990 Deschutes National Forest Land and Resource Management Plan. The Federal Wild and Scenic River and State Scenic Waterway Acts established an overriding goal to protect and enhance the ORVs..

The 10,555 acre project area is within the 147, 978 acre Pilot Butte 5th field watershed, which is located on the eastern slope of the Cascade Mountain Range, and encompasses the city of Bend. This 5th field watershed is sub-divided into (7) 6th field sub-watersheds (Coyote Springs, Benham Falls, Lava Island Falls, Mokst Butte West, Green Mountain, Bessie Butte, and Lockit Butte). The East Tumbull project area lies within 3 of these 6th field sub-watersheds; Coyote Springs, Benham Falls, and Lava Island Falls.

Table 3-46. Sub-watersheds in the Pilot Butte 5th Field Watershed

6th Field Sub-watershed	Acres	Acres within Project Area	% of Sub-watershed in Project Area
Coyote Springs	15,538	3,728	24
Benham Falls	22,901	2,329	10
Lava Island Falls	29,268	4,112	14
Mokst Butte West	11,223	0	0
Green Mountain	12,912	0	0
Bessie Butte	47,958	0	0
Lockit Butte	8,178	0	0

Past impacts to the landscape have occurred from road construction, timber harvest, recreational activities, private land development, and wildfire. Roads and trails currently provide access to much of the area and urban development is present along the north, south, and east boundary of the project. Land in private ownership comprises 3,969 acres of the 16,995 acres within the Upper Deschutes Wild and Scenic River corridor (23 percent). There is no evidence of past mass wasting or debris flows within the watershed.

Riparian conditions along the Deschutes River within and adjacent to the project area vary from good to poor depending upon the degree of conifer encroachment, recreational use (dispersed and developed), private land development, and road density. Some riparian areas have a high degree of conifer encroachment and compaction (dispersed campsites), while others are functioning well. The controlled flow regime upriver at Wickiup Dam is the predominate source of hydrologic disturbance. During the summer months, algae blooms that form in the reservoir are then passed downriver. Additional information about existing conditions can be found in the Upper Deschutes River Plan.

Affected Environment-Upper Deschutes River Hydrologic Characteristics Vegetation management activities (harvesting, skidding, landings, road building, underburning) have potential for causing hydrological effects in a watershed. The pathways by which water moves to stream channels is affected by vegetation management through its influences on snow accumulation and melt rates, influences on evapotranspiration and soil water, and influences on soil structure that affect infiltration and water transmission rates (Meehan, 1991). This in turn can lead to changes in the timing, duration, and volume of peak flows in a stream, which influences changes in bank erosion and channel forming processes within the stream. Vegetation management also has the potential to modify stream processes by mass movements of sediment, bank destabilization from vegetation removal, and loss of instream large wood from direct removal or debris torrents. Effects from vegetation management activities are influenced by the proximity of treatments to streams and slope. Changes in water quality (suspended sediment, temperature, dissolved oxygen, nutrients) have potential to be affected by vegetation management activities (Meehan, 1991). Hydrologic and stream morphology changes ultimately influence fish habitat and fish populations. Mowing of underbrush generally has minor hydrologic effects to a watershed, as ground cover is retained.

Reducing net evapotranspiration by harvest of vegetation, in areas with soils that have high infiltrations rates, can also lead to increased water yield in ground water systems (Manga, 1997). The increased yield in groundwater generally takes days to months to "surface" in springs or stream systems, if not stored subsurface. Water yield increase due to groundwater flow generally is not a concern as some water is either or both stored and redistributed subsurface.

Hydrological effects from vegetation management activities as described above do not typically occur in the Upper Deschutes River basin, which includes the East Tumbull Project area. Surface runoff is a relatively small component of the total water budget in the basin due to the high infiltration rates of the highly permeable volcanic soils (Gannett, 2001). Surface water drainages are uncommon in the basin, and are primarily spring-driven. Groundwater that has moved through the highly permeable Cascade Range comes in contact with the low permeability sedimentary deposits of the La Pine sub-basin, forcing discharge to the surface (Gannett, 2001).

A large proportion of the precipitation in the Upper Deschutes Basin falls in the Cascade Range along the western fringe of the basin, making it the principal groundwater recharge area for the basin. East of the Cascade Range, there is little or no recharge from precipitation within the basin (Gannett, 2001). Precipitation in the East Tumbull project area is approximately 15-20 inches annually, while in the Cascade Range recharge area, annual precipitation may exceed 200 inches. Evapotranspiration of groundwater is rare in the basin. Groundwater level fluctuations in the basin are driven primarily by decadal climatic cycles (Gannett, 2001).

Affected Environment-Water Quantity The Pilot Butte watershed and the East Tumbull Project area are within the 4th field Upper Deschutes River basin, which encompasses 1759 square miles measured at Benham Falls (river mile 181.6). The Deschutes River within the project area loses flow to the surrounding strata, recharging the groundwater. Comparison of gaging station flow data indicates significant water loss from the Sunriver area down to Bend. Analysis of past flow data for the reach between the old Camp Abbott Bridge near Besson Camp and Benham Falls gaging station (10 miles downriver) demonstrated an average loss of nearly 24 cubic feet/second (cfs), and the reach between Benham Falls and Lava Island (7.5 miles downriver) averaged 83 cfs loss (Gannett, 2001).

Surface water drainages are uncommon in the Pilot Butte watershed and the East Tumbull Project area. The Pilot Butte watershed contains less than 40 miles of perennial stream channel, of which approximately 20 miles is within the East Tumbull Project area. The Deschutes River from river mile 172 to 190.8 and a small stream formed by Coyote Springs are the only perennial fish-bearing streams included in the project area. An occasional small perennial spring dots the landscape. There are an additional 18.4 miles of intermittent and ephemeral stream channels mapped in the project area that are tributaries to the Deschutes River. Field reconnaissance has noted that most of these do not exist and few, if any, ever have any surface flow.

The flow of the Deschutes River is regulated at Wickiup Dam. The flow regime was historically very stable, with a mean flow of about 1190cfs and an annual range from approximately 1000 to 1600 cfs measured at Benham Falls (Deschutes NF, 1996). Bankfull discharge, historic and present, are significantly less than would be expected for a basin this size (Rosgen, 1998), indicating significant infiltration to groundwater. Large flood events were uncommon, even prior to regulation. The river now experiences a large swing in flow with storage practices for irrigation needs. Flow is reduced in the winter, as low as 20 cfs released upriver at Wickiup Reservoir during low precipitation years, and then is elevated in the summer, with releases at Wickiup as high as 1800 to 2000 cfs to meet irrigation demands. This results in a range of flows from approximately 700 cfs to 2500 cfs measured at Benham Falls. (See Appendix L for hydrograph). The altered flow regime has led to increased riverbank erosion, widening of the channel, and reduced water quality and fish habitat (Deschutes NF, 1996). These effects are most evident in the river upstream of the confluence with Fall River, which is approximately 13 miles upriver of the southern end of the project area. The additional discharge provided by Fall River, Spring River, Little Deschutes River, and several small springs tempers the effects of the modified flow regime in downriver reaches.

As described previously, the Upper Deschutes River basin is primarily a groundwater driven system due to high infiltration rates of volcanic soils. Groundwater constitutes virtually the entire flow of several tributaries to the Deschutes River upriver of the project area, including Fall River (Gannett, 2001), the majority of which discharges from springs near the headwaters. The source of the discharge is thought to be from snowmelt that originated from the Cascade Range to the west (Gannett, et al 2001). Aquifers in the Cascade Range consist primarily of quatenary basaltic andesites, and are probably composed of many interbedded flows (Manga, 1999). A comparison of the groundwater discharge variations in the Cascade Range with precipitation levels at Crater Lake (over 100 miles south of the project area) showed that periods of high groundwater discharge generally corresponds with periods of high precipitation (Gannett, 2001).

Manga (1999) studied discharge on Upper Deschutes Basin spring-fed streams at 3 different timescales. The hydraulic timescale related long term changes in discharge to long term changes in recharge. This describes the effect of, and the recovery from, droughts. The hydraulic time scale for Fall River was calculated at 6.3 years. The time lag, which measures the time lag between groundwater recharge (springtime snowmelt) and the time of peak discharge at the spring, was calculated at 112 days. Lastly, Manga estimated that the age of groundwater discharged in the Upper Deschutes Basin springs to be approximately 10 to 30 years. In summary,

groundwater movement from the Cascade recharge area to surface systems is gradual.

Groundwater flow direction in the Upper Deschutes basin is influenced by complex, underlying geology, and is not closely associated with the surface topography in some areas. Generally, groundwater flow direction in the project area is in a eastern to southeastern direction from the Cascade Range toward the Deschutes River (Lite, 2002).

Road density in the East Tumbull Project area is 4.53 miles/square mile, and 1.19 miles/square mile within the RHCA of the Deschutes River. There are few stream crossings; the Deschutes River within the project area has no road crossings but does have two footbridge crossings. The road network has had minimal effects on increasing the drainage network within the project area.

The regulated flows at Wickiup Dam is the largest influence on water quality of the Deschutes River, and has likely led to the status as a water quality impaired waterbody under the Clean Water Act . Other factors that may contribute to water quality impairment are private land development and associated septic drainfields, which are considered to be a source of oxygen demanding bacteria (Deschutes NF, 1996), developed and dispersed recreational sites, and recreational activities including motorized boating. These activities have resulted in elimination or reduction in shade, large wood recruitment, riparian vegetation, riverbank stability, and increase in nutrient and sediment loading, all which can influence water quality and fish habitat. Impacts from recreational sites are generally at a localized scale. Agricultural land use is rare along the Upper Deschutes River.

The objective of the Clean Water Act (CWA) of 1972 is to restore and maintain the chemical, physical, and biological integrity of all waters. Under Section 319 of the 1987 CWA Amendments, states are required to determine those waters that will not meet the goals of the CWA, determine those non-point source activities that are contributing pollution, and develop a process on how to reduce such pollution to the "maximum extent practicable". Section 303(d) of the CWA requires that a list be developed of all impaired or threatened waters within each state. The Oregon Department of Environmental Quality (ODEQ) is responsible for compiling the 303(d) list, assessing data, and submitting the 303(d) list to the Environmental Protection Agency (EPA) for federal approval. Management direction for federal land management agencies regarding 303(d) listed rivers is that project activities should protect and not further degrade the parameters for which it is listed. In addition, Water Quality Restoration Plans (WQRP) are to be developed that address impaired waters (USFS, BLM, 1999). A draft WQRP has been developed for the Upper and Little Deschutes River 4th field watersheds.

The 2002 Oregon Department of Environmental Quality (ODEQ) list of water quality impaired water bodies (303(d) list) includes the Deschutes River within the East Tumbull Project area. The ODEQ river reach that most closely fits the project area is river mile 168.2 – 189.4. The parameters within this reach for which standards are not met are dissolved oxygen all year, turbidity spring and summer, Chlorophyll *a* from June 1 to September 30, high water temperatures September 1 to June 30, and sedimentation, undefined season. The draft 2004 ODEQ 303(d) list, currently under review, is identical to the 2002 list for this river reach with the exception of extending the violation of the water temperature standard to year-round.

Water temperature: ODEQ data collected in 1994-95 revealed 15 days with 7 Daily Moving Averages > than the standard of 12.8^{o} C.

Dissolved oxygen: ODEQ data for dissolved oxygen from water years 1985 through 1995, for the months of October through July, have shown that 39 percent of the samples did not meet the spawning dissolved oxygen standard (>11mg/l or 95 percent saturation). Sampling at another site revealed 56% of samples did not meet the standard. Also, for July and August, 25% of the samples did not meet the standard of >8 mg/l or 90% saturation.

Turbidity: U.S. Forest Service data from the spring and summer of 1995 showed that turbidity is increased as much as 30 fold when irrigation water is released in early spring and remains twice background until late July, exceeding the standard of 10% or more increase in Nephelometric Turbidity Units (NTUs). The water quality criteria for turbidity are being revised to better address effects to beneficial uses. The draft change is to apply a criteria of maximum (5 NTUs), monthly average (3 NTUs), and a visual contrast criteria for increases above background.

Sedimentation: U.S. Forest Service data showed that spawning gravels in the Deschutes River contained a high percent of fines (sedimentation) that limit embryo survival rates for trout (Deschutes NF, 1994).

Chlorophyll a: The chlorophyll a standard of 0.015 mg/l was exceeded in 17 percent of samples taken in 1995. Some samples taken since then have also exceeded the standard (Lamb 2005, personal communication).

The presence of Wickiup Dam, located approximately 35-50 miles upstream of the project area, and the modification of natural flow provides some explanation for these 303(d) listings. Beneficial uses affected by these listings are aesthetics, resident fish life and aquatic life, water supply, salmonid fish spawning, and salmonid fish rearing.

Beneficial uses are documented according to criteria in the Oregon Department of Environmental Quality, (ODEQ, 1998a). A beneficial use is a resource or activity that would be directly affected by a change in water quality or quantity. Water quality for beneficial uses is maintained and protected through the implementation of the Deschutes National LRMP (1990) Standards and Guidelines including (BMPs, INFISH (1995), the Upper Deschutes River Plan (1996), and the Newberry National Volcanic Monument Comprehensive Management Plan (1994). All proposed management activities under the East Tumbull Project would meet the required Standards and Guidelines and selected BMPs in both the short and long term.

Fisheries Management Introduction

The long-term sustainability of fisheries populations depends largely on habitat conditions and water quality, both are which are influenced by activities that occur instream, on the floodplain, and within the uplands of the watershed. Land use activities, such as vegetation management, road construction, private land development, and recreation have potential to adversely affect fish populations and fish habitat by reducing shade, overhead cover, and future instream recruitment of large woody material, introducing fine sediments, pollutants, and nutrients, and altering the timing and volume of streamflows.

Scope of the Analysis The fisheries resource may be directly, indirectly affected within the project area or cumulatively within the Pilot Butte watershed. The Deschutes River is the major waterbody within the project area, therefore it will be the focus of the fisheries resource analysis. As mentioned above, the long-term sustainability of fisheries populations depends largely on habitat conditions and water quality, which the analysis will be based on. Changes in fisheries management such as fish stocking and angling regulations and the effects they may have on the fisheries resource is beyond the scope of this analysis because these decisions are made by the ODFW and they have no effect on the decision to be made.

Affected Environment-Fisheries Populations and Habitat The Pilot Butte watershed includes two subwatersheds (Benham Falls and Coyote Spring) that are identified as being important for native Columbia River redband trout (Oncorhynchus mykiss gairdneri) viability. Redband trout are included on the Regional Foresters Sensitive Species List (R6).

There are no known threatened, endangered, proposed, or candidate fish species within the East Tumbull project area. Historic fish populations in the Deschutes River within the project area included redband trout, bull trout

(Salvelinus confluentus), mountain whitefish (Prosopium williamsoni), and sculpin (Cottus sp.). There are no records of anadromous species in the project area, as upriver migratory fish passage is considered to be restricted to below Big Falls on the Deschutes River downriver of Bend (ODFW, 1996). Over the last 100 years, several other fish species have been introduced into the basin, considerably altering the fish community. In addition, the bull trout is considered to be extirpated from the Deschutes River above Bend (ODFW, 1996).

Fish species that have either been introduced into the Deschutes River or move into the river through the unscreened outlet at Wickiup Dam include rainbow trout (Onchorhyncus mykiss), kokanee salmon (Oncorhyncus nerka kennerlyi), largemouth bass (Micropterus salmoides), eastern brook trout (Salvelinus fontinalis), three-spined stickleback (Gasterosteus aculeatus), tui chub (Gila bicolor), brown bullhead (Ictalurus nebulosus), coho salmon (Oncorhyncus kisutch), and brown trout (Salmo trutta). Fisheries is regarded as an ORV (see Wild and Scenic River Values) of the Upper Deschutes Wild and Scenic River in Segment 3 because of the trophy brown trout fishery. Determination of the value of redband trout in Segment 4 has been deferred until a review of the genetic status has been completed. Until that time, the redband population is to be treated as an ORV (Deschutes NF, 1996). The Federal Wild and Scenic River and State Scenic Waterway Acts established an overriding goal to protect and enhance the ORVs for which the river was designated (Deschutes NF, 1996). Species considered to be resident fish are the redband trout, rainbow trout, mountain whitefish, sculpin, brook trout, and brown trout.

The native redband trout have interbred with various introduced hatchery stocks of rainbow trout over the last several decades. The genetic make-up of the rainbow in the project area was studied a decade ago. Samples collected downriver of Benham Falls revealed 7.2 percent hatchery rainbow genetic contribution, i.e., on average, the fish were 92.8 percent pure redband (Phelps, 1996). Introduced brook trout are the only species inhabiting the perennial stream formed by Coyote Springs.

The altered flow regime below Wickiup Dam has affected fish habitat. Analysis of aerial photographs and channel morphology data indicates the channel is becoming wider and shallower, reducing maximum and average depths. The effects to fish habitat within the project area are reduced from that observed in upriver reaches because of the flow contribution of the tributary streams previously mentioned above. The channel width has increased approximately 20 percent since the inception of Wickiup Dam (Deschutes NF, 1996). Aggradation in pools has reduced their effectiveness as fish habitat. River bottom substrates have high volumes of sand and silt. These fine sediments plug the interspaces of substrate gravels, reducing the survival rates of developing fish embryos buried within, and limiting habitat for aquatic invertebrates (Meehan, 1991).

Log drives down the river in the 1930's damaged riverbanks and reduced instream large wood that fish depend on for cover from predators and as velocity breaks for resting. The endpoint for the river log drives was near the Benham Falls footbridge, where logs were loaded onto railroad cars and delivered to the mills in Bend. There is excellent fish hiding cover at this site due to the large accumulation of instream wood. The Sunriver Fish Habitat Restoration Project (1998) and the Kelsey Fish Habitat Project (2003) restored over 450 trees to the Deschutes River within the project area. Recent projects upriver of the project area have also re-introduced large wood. Due to limitations of equipment, large wood introductions are limited primarily to trees less than 20" diameter at breast height. Historically, abundant large ponderosa pines up to 4 feet in diameter were likely found within the channel to provide fish habitat. Private land development, primarily in segment 3, has reduced riparian vegetation and overhead hiding cover. Riverbank protection measures such as wooden planks and concrete retaining walls have reduced fish and aquatic invertebrate habitat.

Habitat type of the Deschutes River within the project area is dominated by long pools. Although there are only between 2.9 to 3.9 pools/mile by reach, the pool habitat percentage ranges from 44.3 percent to 79.9 percent. Side channel habitat is nearly non-existent. The channel is generally wide and shallow, with

width/depth ratios ranging from 20.9 to 64.4. Residual pool depths range from 3.4 to 6.3 feet. Large woody material (min. 12" diameter & 35' length) is uncommon, ranging from 7.6 to 21.9 pieces/mile (Dachtler, 2005).

Essential Fish Habitat Although the Upper Deschutes 4th field watershed (17070301) is mapped by the National Marine Fisheries Service as Essential Fish Habitat for chinook salmon, there are no present or historical records of chinook populations above Big Falls on the Deschutes River, over 50 miles downriver from the project area.

Water Quality and Fisheries Management Direction The LRMP, as amended by the Upper Deschutes River Plan, specifies management activities to protect water quality, riparian and fish habitat. The most site-specific potential negative effects to the watershed from the proposed activities are from the introduction of sediment into channels as a result of harvest, burning, road maintenance, and/or restoration activities. In order to minimize or eliminate effects, all appropriate BMPs would be implemented in conjunction with the standards and guidelines from the LRMP, INFISH, and the Upper Deschutes River Plan.

This is accomplished by the following pertinent BMPs T-10, T-21,F-3; LRMP standards and guidelines R-3, R-22 to 24 and Upper Deschutes River Plan V-9, V-11, V- 12 and V-17.

The Deschutes River within the project area is listed as having impaired water under Section 303(d) of the CWA. Management direction for federal land management agencies regarding 303(d) listed rivers is that project activities should protect and not further degrade the parameters for which it is listed.

Target Landscape condition The desired condition is to maintain or enhance riparian dependent resources such as water quality and quantity, fish habitat and riparian associated wildlife and vegetation

Hydrology (Water Quality) and Fisheries Management Environmental Effects

Direct and Indirect Effects of Alternative 1. The ongoing management activities that would continue under the no action alternative are identified in the Alternative Descriptions (EA, Chapter 2 and Chapter 3). None of the management actions identified under the proposed action would take place.

Measure #1: Timing and Volume of Peak/Base Flows and Water Yield. The timing and volume of peak and base flows and the total water yield of the Deschutes River is primarily influenced by the releases at Wickiup Dam upriver of the project area. There would be no direct effects to peak flows and water yield to the Deschutes River or other springs and streams within the project area under Alternative 1. Any changes in peak flows and water yield in the Deschutes River would be the result of dam operations, changes in flows in tributary streams outside of the project area, natural climatic variations, or other causes. Changes in peak flows and water yield of springs, intermittent channels, and ephemeral channels within the project area would be the result of natural climatic variations or other causes.

There is potential for indirect effects to occur under this alternative. Over time, forest health deterioration and fuels build-up within the project area could lead to stand-replacing wildfires that have the potential to change peak/base flows and water yield because of an increase in surface run-off, especially if soils become hydrophobic, and decreased evapotranspiration. However, changes would be immeasurable because of the groundwater dominated nature of the landscape that exhibits little surface runoff.

Measure #2: Water Quality-ODEQ 303(d) Parameters The water quality of the Deschutes River is primarily influenced by the altered flow regime from operations at Wickiup Dam and by private land development along the river. These activities have largely contributed to altered water temperatures, increased bank erosion,

increased nutrients, and decreased shade and riparian vegetation. (Deschutes NF, 1996). There would be no direct effects to water quality of the waterbodies in the project area, including the 303(d) parameters of dissolved oxygen, water temperature, turbidity, sedimentation, and chlorophyll a listed for the Deschutes River from selecting the No Action alternative. Any changes in water quality in the Deschutes River would be the result of dam operations, changes in water quality in tributary streams outside of the project area, natural climatic variations, activities on private lands, or other causes.

Direct effects to water quality of springs, intermittent channels, and ephemeral channels within the project area would be the result of natural climatic variations or other causes.

There is potential for indirect effects to occur under Alternative 1. Over time, forest health deterioration and fuels build-up within the project area could lead to stand-replacing wildfires that have the potential to change water quality and affect the 303(d) parameters for which the Deschutes River is listed, especially if the wildfires were to enter the RHCAs. Fisk and others (2003) summarized that riparian areas have been observed to burn less hot than upslope areas, although the burn values were positively related to upslope burn values. Higher order streams (Deschutes River is high order) riparian areas burned less similar to upslope areas than small order streams. Other research has indicated that riparian areas can burn as frequently as upslope fires (Dwire, in press). Because fire behavior is influenced by fuel characteristics, the variation in riparian vegetation likely contributes to the tendency for many fires to burn in a patchy manner through riparian areas. Wildfire within the RHCAs in the short term (episodic) could decrease pH and increase water temperatures, overland flow of sediments and organic debris, which would then affect turbidity, sedimentation, and dissolved oxygen and chlorophyll a concentrations. Wildfire would reduce riparian vegetation, standing timber, protective ground vegetation, and the organic duff layer. These features provide shade and riverbank stability, and reduce overland flow of sediments, metals, and nutrients. Adverse effects would continue until vegetation recovers.

In the event of wildfire, there is also the risk of fire retardant reaching aquatic systems during fire suppression operations, adversely affecting water quality. Other fire suppression efforts, such as dozer line construction, could also lead to overland flow of sediments or retardant or foaming agents.

There is potential for indirect effects to water quality in the long term by not taking action to close and decommission roads and campsites. Dispersed sites and roads would continue to increase in abundance and area impacted, possibly leading to degraded riparian conditions, decreased shade and increased potential for sediment delivery to the river, although measurable changes in water temperature, turbidity, and sedimentation due to these activities would be difficult to determine. Nutrient and bacteria inputs to watercourses as a result of dispersed camping practices would increase, but the changes would be difficult to attribute to these activities because of variables influencing water quality upriver in the watershed, primarily Wickiup Reservoir. Reservoirs and lakes are dynamic, and concentrations of ions and nutrients vary annually and seasonally.

Effects to ODEQ (303(d)) Parameters The No Action alternative would have no direct effects to the ODEQ 303(d) parameters for which the Deschutes River is listed. There is potential for adverse effects to occur under the scenario of stand replacing wildfire. Following is a description of effects to the 303(d) parameters should stand replacing wildfires occur near the Deschutes River.

Effects to water temperature: During the course of a wildfire within the RHCA, water temperature would be increased from the heat of the fire itself. The increase in temperature would depend on the intensity of the fire, size of the fire, proximity to the Deschutes River, discharge at the time of the fire, and duration of the fire. Post-fire, shade would be reduced, which would allow increased solar radiation and increased water temperatures in the summer and decreased winter temperatures due to the loss of buffering capacity. Albin, 1979, found that water temperatures increased an average of 1.5 C in a burned watershed 35 years after the

fire. However, this research was conducted on small 1st and 2nd order streams (Gresswell, 1999), whereas the Deschutes River is a large 4th order system.

Effects to dissolved oxygen: During the course of the fire dissolved oxygen would be decreased as water temperatures increase. Post-fire, dissolved oxygen would be decreased as water temperatures increase from the lack of shade until vegetation recovers to heights capable of shading. Full shade recovery could take several decades. Oxygen could also be depleted from metabolism of increased runoff of organic matter, until ground cover becomes re-established to limit runoff.

Effects to turbidity: During the fire, turbidity may be increased from toppling of trees that are growing on the riverbank, introducing sediment as they fall. Turbidity from this action is likely to result in minimal increases in turbidity and may be immeasurable in the river. A weather storm that resulted in heavy precipitation soon after a fire could introduce overland flow of sediments within the RHCAs into the Deschutes River that would measurably increase turbidity. Chronic, or long term small inputs of sediment from RHCAs that increase turbidity could continue for several years until vegetation groundcover is re-established. Chronic sediment inputs would likely be immeasurable in the river due to limitations of equipment and techniques of sampling. Overland flow of sediments as a result of a fire, either chronic or episodic, would be minor compared to the movement of sediments through the system from accelerated upriver bank erosion and from natural sources. Highly permeable soils, lack of precipitation, and the lack of slope within much of the RHCAs within the project area would limit the volume of sediments introduced into the Deschutes River from overland flow. Consumption of riverbank vegetation by wildfire could lead to decreased riverbank stability, increasing bank erosion and sediment introduction that could increase turbidity until riverbank vegetation and stability recover.

Effects to sedimentation: The pathways for sedimentation and the effects of the fire on sedimentation are similar to those listed under turbidity above. Sedimentation occurs as suspended and other larger sediments deposit on and in the river substrate.

Effects to chlorophyll a: During the fire, ash and smoke could introduce nutrients to the river. Spencer and others (in press) detected an increase in phosphorus and nitrogen of 5 to 60 fold above background levels resulting from smoke and ash during a fire in Montana. After the fire, increased overland flow within the RHCAs of the Deschutes River could introduce additional nutrients (nitrogen, phosphorus, organic carbon) to the river. The nutrients would increase primary production, primarily by algae, which would increase the concentration of chlorophyll a. Once ground cover is re-established, overland flow would be reduced. As mentioned previously, the potential for overland flow within the RHCAs of the Deschutes River is limited by lack of precipitation, slope, abundant ground cover, and highly permeable soils.

Measure #3 – Fish Habitat and Populations Fish habitat and populations are largely influenced by water quality and water quantity. The No Action alternative would have no direct effects to habitat or populations, including that of the sensitive species redband trout. Effects to habitat or populations would be from natural causes, fish management actions, or other causes.

Research has shown that fire can result in direct mortality to fish (Gresswell, 1999). Responses of fish populations to fire and fire-related disturbance have been documented in a limited number of studies, mostly for salmonid fishes. The influence of fire on persistence of native salmonid populations is highly variable. In some cases, local extinctions have been observed in response to fire, particularly in areas where populations of fishes have been isolated in small headwater streams. In larger interconnected systems, fish populations appear to be more resilient to the effects of fire (Dunham, 2003).

There is potential for indirect effects to fish habitat and populations, including redband trout, in the event of

stand replacing wildfires, especially if they enter RHCAs. These effects are primarily tied to water quality, effects on which were discussed above. Increased water temperatures and decreased dissolved oxygen can affect fish by increasing mortality, promoting disease, decreasing growth, and decreasing embryo survival. Suspended sediment can be abrasive to fish gills and reduce foraging ability. Fine sediments accumulated in riverbed substrates can limit survival of developing fish embryos and limit the production of aquatic macroinvertebrates, which provide forage for fish (Bjornn and Reiser, 1991, in Meehan, 1991). Fine sediments in the streambed were shown to impair growth and survival of steelhead juveniles (Suttle, 2004).

A decrease in bank stability and riparian vegetation would decrease overhead cover for fish. There would be a benefit to fish habitat from an increase in large woody material from fire-toppled trees and increased windfalls for several years after the fire. Instream large wood provides hiding cover for fish, reduces velocities to provide microhabitats, and provides habitat and a food source for aquatic macroinvertebrates. However, there would be a reduction in future recruitment of large woody material until the stands recover to maturity. An increase in primary productivity as a result of fire-introduced nutrients could increase the abundance of macroinvertebrates, thus increasing the food base for fish. Increases in macroinvertebrate abundance and diversity would likely be short term. Minshall (2003) summarized changes to macroinvertebrate communities are generally restricted to the first 5-10 years, but research was done on small order streams. The large size of the Deschutes River would likely temper any effects to the macroinvertebrate community as a result of the fire.

As mentioned previously under effects to water quality, there is also the risk of fire retardant and foaming agents reaching aquatic systems during fire-fighting operations. Fire retardant can persist in soils and produce toxic effects for weeks, especially in sandy soils (Luce, 2005). During August of 2002, fire retardant was inadvertently dropped in nearby Fall River while attempting to extinguish a small fire (<5 acres). A large fish kill was observed, estimated at 21,000 fish by the ODFW. Aquatic invertebrates were also adversely affected. Recovery of the fish population was anticipated by ODFW to take up to 9 years.

There is potential for indirect effects to fish habitat in the long term by not taking action to close and decommission roads and campsites. As discussed above under water quality, dispersed sites and roads would continue to increase in abundance and area impacted, possibly leading to increased sediment and nutrient delivery, and decreased shade. Overhead cover for fish and long term recruitment of large woody material would be reduced, but the impacts would be localized and minimal.

Due to the potential for adverse indirect effects, the Fisheries Biological Evaluation concluded that this alternative May Effect Individuals and Habitat of redband trout, but would not lead a loss of population viability or create a significant trend toward federal listing. There would be No Effect to downriver bull trout populations.

Essential Fish Habitat There would be no effects to Essential Fish Habitat from this alternative. Although the Upper Deschutes 4th field watershed (17070301) is mapped by the National Marine Fisheries Service as Essential Fish Habitat for chinook salmon, there are no present or historical records of chinook populations above Big Falls on the Deschutes River, over 50 miles downriver from the project area.

Measure #4 – Project Design Criteria and Mitigation Implementation of Project Design Criteria and Mitigation Measures are not necessary as no management activities would occur.

Cumulative Effects of Alternative 1 *Measure #1: Timing, Duration and Volume of Peak/Base Flows and Water Yield.* Under Alternative 1 the extent of effects to timing and volume of peak and base flows and water yield would not increase above existing levels as a result of implementing this alternative because no additional activities would occur. The effects of past and current management activities were previously described under

the Affected Environment sections. However, the risk of wildfire would increase over time. Should wildfire occur the indirect effects listed previously under Alternative 1 would contribute to the effects presently occurring from other activities in the basin upriver and downriver of the project area. Cumulative effects from within the project area would be transferred to areas downriver of the project area, but the changes may be immeasurable because of the groundwater dominated nature of the landscape that exhibits little surface runoff.

Measure #2: Water Quality-ODEQ 303(d) Parameters. Under Alternative 1 the extent of effects to water quality, including the 303(d) parameters, would not increase above existing levels as a result of implementing this alternative because no additional activities would occur. The effects of past and current management activities were previously described under the Affected Environment sections. However, the risk of wildfire would increase over time. Should wildfire occur the indirect effects listed previously under Alternative 1 would contribute to the effects presently occurring from other activities in the basin upriver and downriver of the project area. Cumulative effects from within the project area would be transferred to areas downriver of the project area. Under the scenario of a stand replacing wildfire in the project area, adverse effects to the 303(d) parameters could occur, which are summarized below:

Water temperature: An increase in water temperature during the fire and the decrease in shade post-fire would add cumulative effects to the increased water temperatures from the altered flow regime and removal of riparian vegetation elsewhere along the river. Temperature is presently listed as a 303(d) parameter within and for 70 consecutive miles downriver of the project area.

Dissolved oxygen: Increased water temperatures during and post-fire would decrease dissolved oxygen, adding to the upriver adverse effects on temperature as described above. In addition, fire-introduced organic matter would add to organic matter inriver supplied from other sources such as developed land and disturbed riparian areas, increasing the biological oxygen demand. Dissolved oxygen is not presently included on the 303(d) list for river reaches immediately below the project area, but is proposed to be listed under the draft 2004 list.

Turbidity: Increased overland flow of sediments and increased bank erosion would add cumulative effects to suspended sediment originated from bank erosion, algae blooms, and other sources occurring in Wickiup Reservoir. Sources of turbidity are decreased downriver of the project area from areas upriver of the project area. Turbidity is not included on the present or draft 2004 303(d) list in reaches downriver of the project area.

Sedimentation: Increased suspended sediments that become deposited on and in the river substrate would increase adverse effects from sediments originated from other sources as described above under turbidity. Sedimentation is not included on the present or draft 2004 303(d) list in reaches downriver of the project area.

Chlorophyll a: Increased nutrient loading and solar radiation would add to other sources generated along the river, increasing chlorophyll a concentrations. Chlorophyll a is not presently included on the 303(d) list downriver of the project area, but is proposed for listing on reaches greater than 50 miles downriver under the draft 2004 list (below Lake Billy Chinook).

Measure #3 – Fish Habitat and Populations. Under Alternative 1 the extent of effects to fish habitat and populations would not increase above existing levels as a result of implementing this alternative because no additional activities would occur. The effects of past and current management activities were previously described under the Affected Environment sections. However, the risk of wildfire would increase over time. Should wildfire occur the indirect effects to water quantity, water quality, and fish habitat described previously under Alternative 1 would contribute to the effects presently occurring from other activities in the basin upriver and downriver of the project area.

Measure #4 – Project Design Criteria and Mitigation. Implementation of project design criteria and mitigation of project-related water or fisheries resource disturbances would not be necessary under Alternative 1.

Direct and Indirect Effects of Alternative 2. The management activities that are proposed under this alternative are described in the Alternative Descriptions (EA, Chapter 2).

Measure #1: Timing, Duration, and Volume of Peak/Base Flows and Water Yield. There would be no activity within RHCA with the exception of 0.3 miles of road closure. Based on the character of the hydrogeology of the Upper Deschutes Basin and the design of the proposed activities including mitigations and management activities, Alternative 2 would have no measurable direct or indirect effects to the timing, duration, or volume of peak and base flows nor increase the water yield, nor in any other way measurably alter the flow regime of the Deschutes River or any other channel. Infiltration of precipitation may be decreased in areas where soils become compacted as a result of management actions. Temporary pooling of water may occur in some of these compacted areas (landings, major skid trails) after intense precipitation events or snowmelt in the short term (5 years or less), but would not add to an increase in the stream drainage network.

There would be no measurable effects to the Deschutes River or any other channel as a result of implementing this alternative for the following reasons:

1) Highly permeable volcanic soils allowing high infiltration of precipitation. The groundwater table is generally near the surface near Spring River and immediately west but increases to generally 150 - 300 hundred feet lower than the river in the Meadow Camp area at the north end of the project area (Chitwood 2005, personal communication).
2) The Deschutes River has a highly managed flow regime, and highly altered from the natural regime. Source of discharge for tributary springs in the Upper Deschutes River basin is primarily from the Cascades Range recharge area. There is limited precipitation and recharge to groundwater from within the project area.
3) Lack of runoff and surface water in the project area, even in areas of moderate slopes.
4) Past management in the project area and adjacent lands has only minimally increased the stream drainage network, therefore not measurably increasing surface flows to the Deschutes River.
5) Changes in evapotranspiration would have little hydrologic effect since evapotranspiration from groundwater is rare in the Upper Deschutes basin. High infiltration rates limits volume of precipitation that can be evapotranspired as it moves through the soil to the groundwater.
6) Changes in flows in the Upper Deschutes basin have been shown to correlate to changes in climate cycles.
7) Design of project activities that excludes activities in RHCAs and includes mitigation measures to protect soil and water resources (See Mitigations section, Chapter 2).

The road density within the project area would be reduced from 4.5 miles/square mile to 2.2 miles/square mile under this alternative. The reduction in road density and associated dispersed campsites would have a minimal effect on this measure because under present conditions the road network is having little hydrologic effect.

The potential for insect and disease damage and wildland fire risk is decreased over that of the Alternative 1, thus decreasing the potential for changes in peak/base flows or water yield as a result of stand replacing wildfires.

Measure #2: Water Quality - ODEQ 303(d) Parameters There would be no vegetation management activities within the RHCAs of the Deschutes River (minimum width 300 feet) and other streams and springs. RHCAs with sufficient ground cover act as a filter to surface run-off, pollutants, and overland flow of sediments. There would be no direct effects to water quality of the waterbodies in the project area, including the 303(d) parameters of dissolved oxygen, water temperature, turbidity, sedimentation, and chlorophyll a listed for the

Deschutes River from selecting this alternative. Any changes in water quality in the Deschutes River would be the result of dam operations, changes in water quality in tributary streams outside of the project area, natural climatic variations, activities on private lands, or other causes. Changes in water quality of springs, intermittent channels, and ephemeral channels within the project area would be the result of natural climatic variations or other causes because all of them would be excluded from vegetation management activities.

This alternative reduces the potential for indirect effects to occur as described above under Alternative 1. Forest health would be improved and fuels build-up would be reduced, decreasing the potential for stand-replacing wildfires that could adversely affect water quality including the 303(d) parameters for which the Deschutes River is listed. By reducing the risk of wildfire, this alternative also reduces the risk of fire retardant reaching aquatic systems during fire-fighting operations, adversely affecting water quality.

Closure of dispersed sites and 0.3 miles of roads within the RHCAs, reducing the road density to 0.91 miles/square mile from 1.19 miles/square mile, would protect and improve riparian conditions, reduce impacts to shade, and decrease potential for sediment and nutrient delivery to the river, although measurable changes in water temperature, turbidity, nutrients, chlorophyll a, and sedimentation attributable to these activities would be difficult to determine. There would be no mechanical activity within the RHCA and closure activities such as subsoiling would take place outside the RHCA. Closed roads and sites within the RHCAs would be allowed to revegetate naturally.

Under current conditions, some stands within the RHCAs of the Deschutes River are overstocked and at risk of insect and disease infestations and increased wildland fire risk. Since there are no vegetation treatments proposed within RHCAs, the potential for wildfire within the RHCAs would continue to increase. Should wildfire burn within the RHCAs, adverse effects to water quality and the 303(d) parameters could occur. These effects would be similar to, but less than, those described above under the direct and indirect effects of Alternative 1. Upslope stands would be treated to decrease wildland fire risk and would reduce adverse effects to water quality should fire occur.

Effects to ODEQ (303(d)) Parameters

Effects to water temperature: The amount of shade provided by trees next to the stream would decrease as channel width continues to increase. The Deschutes River averages nearly 140 feet bankfull width within the project area, therefore potential shading from riparian vegetation is limited.

There would be no vegetation treatments within the RHCA of the Deschutes River. Effective stream shade would be maintained under this alternative, therefore not adversely affecting water temperature. Effective stream shade is defined as the total solar radiation blocked over a twenty-four hour period (USFS, BLM 2004). Stream shading is broken down into two zones, primary and secondary. For slopes less than 30 percent and tree heights of 80-100 feet, typical of the RHCAs of the East Tumbull project area, the primary shade distance is 40-50 feet from the stream edge, decreasing to less than 35 feet for slopes less than 10 percent (USFS, BLM 2004). The period of greatest solar radiation occurs between 10:00 am and 2:00 pm (USFS, BLM 2004). Trees located in the primary shade zone nearest the stream provide shade all day and are the only trees providing shade during this critical 4 hour period. Trees in the secondary shading zone (beyond the primary zone) can provide some shading when the sun is lower in its arc. The amount of shading in the secondary zone will depend on stand density. Within this zone, there is no added benefit to shade from over stocked stands because of the "tree behind a tree" concept, where one tree can cancel any shade benefit from another tree (USFS, BLM 2004).

Thinning activities would occur 300 feet or greater from the river, therefore effects to shading would be zero.

Effects to dissolved oxygen: Water temperatures and organic debris loading would be maintained, therefore no adverse effects to dissolved oxygen would occur. Increases in water temperature reduces dissolved oxygen, and biological metabolism of organic debris depletes dissolved oxygen.

Effects to turbidity: There would be no increase of overland flow of sediments within the project area, and no ground disturbing or underburning activities within the RHCAs, therefore there would be no measurable increase in turbidity from implementing this alternative. Ground cover, vegetation, and gentle slopes (less than 10 percent) within the RHCAs would filter potential surface run-off and overland flow of sediments, eliminating sediment from entering the Deschutes River. Vegetation treatment units near RHCAs are generally on flat to gently sloped terrain, which, along with highly permeable soils and abundant ground cover, prevents increased surface run-off as a result of management activities.

Effects to sedimentation: There would be no measurable effects to sedimentation using the same reasoning as described above under turbidity.

Effects to chlorophyll a: There would be no measurable increase in nutrient loading, which can occur with overland flow of sediments, and no increase in solar radiation, therefore there would be no effect to primary production and chlorophyll a concentrations.

Measure #3: Fish Habitat and Populations Fish habitat and populations are largely influenced by water quality, water quantity, and timing of streamflows. Since actions proposed under this alternative would have immeasurable effects to both water quality and water quantity, there would be no direct or indirect effects to habitat or populations, including that of the sensitive species redband trout, as a result of implementing these actions. Effects to habitat or populations would be from natural causes, fish management actions, or other causes. Potential for stand replacing wildfire is reduced, protecting riverbank stability, shade, future large wood recruitment to channels, and spawning gravels. The potential for short term gain in large wood recruitment as a result of wildfire is reduced.

Closure of dispersed sites and 0.3 miles of roads within the RHCAs, reducing the density to 0.91 miles/square mile from 1.19 miles/square mile, would protect fish habitat by maintaining and restoring riparian conditions. Adverse effects to shade, overhead hiding cover, large woody material recruitment, and soil stability would be reduced from these closures. However the extent of these adverse effects presently occuring as a result of open roads and campsites with the RHCAs is minimal and difficult to determine.

Under current conditions, some stands within the RHCAs of the Deschutes River are overstocked and at risk of insect and disease infestations and increased wildland fire risk. Since no vegetation treatments are proposed within RHCAs, the potential for wildfire within the RHCAs is increased. Should wildfire burn within the RHCAs, adverse effects to fish habitat and populations could occur. These effects would be similar to, but less than, those described above under the direct and indirect effects of Alternative 1. Upslope stands would still be treated to decrease wildland fire risk and reduce the potential for fire to spread to RHCAs.

The Fisheries Biological Evaluation concluded that this alternative would have No Effect to redband trout and downriver bull trout populations.

Essential Fish Habitat There would be no effects to Essential Fish Habitat from this alternative. Although the Upper Deschutes 4th field watershed (17070301) is mapped by the National Marine Fisheries Service as Essential Fish Habitat for chinook salmon, there are no present or historical records of chinook populations above Big Falls on the Deschutes River, over 50 miles downriver from the project area.

Measure #4-Project Design Criteria and Mitigation Management direction for federal land management agencies regarding 303(d) listed rivers is that project activities should protect and not further degrade the parameters for which it is listed. Management direction regarding sensitive species is that actions would benefit, have no impact, or minimize impacts so that there is no loss of population viability or creation of a significant trend toward federal listing. The management requirements, mitigation measures, and project design elements prescribed under this alternative are designed to avoid, minimize, or rectify potentially adverse effects to water quality, including the 303(d) list parameters. The design of Alternative 2 includes restriction of vegetation and fuels management activities within the RHCAs to limit potential adverse impacts to riparian vegetation, water quality, and fisheries populations and habitat, including that of redband trout. No new system roads are planned. Road closure or decommissioning would be implemented on a total of 38.4 miles.

Cumulative Effects Cumulative Effects include all past, present, and reasonably foreseeable future actions that have potential to result in changes to water quantity, water quality, fish populations, and fish habitat within the East Tumbull Project area. Past, Present, and Reasonably Foreseeable Actions for the Pilot Butte 5th field watershed were described under the Hydrology Scope of Analysis.

Proposed activities, in conjunction with present and past activities, may have an effect on watershed condition and integrity. The Equivalent Clearcut Area (ECA) methodology was used to determine where cumulative watershed effects might occur. Using ECA calculations in conjunction with field observations can provide important documentation of existing hydrological health of the watershed. The ECA methodology is defined as a watershed index of snowmelt and evapotranspiration rates relative to baseline condition where tree stands are considered fully canopied. ECA was designed as a planning tool to aid the Forest Service in assessing the cumulative effects of land management activities (Bettinger et al., 1998).

Research by Troendle and Olson (1993), Troendle and King (1985, 1987), and Troendle (1983) found that there is no one specific threshold as to how much a watershed can be clearcut before a change in peak flow can be documented. ECA thresholds, in relation to changes in peak flow, have been documented as low as 25 percent and as high as 40 percent. However, this threshold is highly dependent upon the physical characteristics of the watershed. Field visits to the East Tumbull Project area noted riverbank degradation, however, this is attributable to the highly managed and altered flow regime and not degraded upslope watershed conditions. The ECA value is partially elevated due to the presence of the city of Bend within the Pilot Butte watershed.

ECA was recently completed (2003) for the Pilot Butte 5th field watershed included in the analysis of the Kelsey Vegetation Management Project EIS (EIS in draft form), that provided the basis for the ECA analysis for the East Tumbull Project. An ECA value of 23 percent was determined for existing conditions within the watershed after adjusting for projects implemented since the Kelsey Project ECA analysis was completed. Selection of either one of the two action alternatives in the Kelsey Project would result in an ECA value of approximately 26 percent. The cumulative effect on ECA of selecting the No Action alternative for the East Tumbull Project is that the ECA would remain at approximately 26 percent. The proposed action would treat 4,211 acres, and would increase the ECA value to approximately 27 percent. Despite the level of activity in the watershed, there has likely been no measurable hydrologic effect to the Deschutes River and other stream channels. There is little correlation between activity on the surface and hydrologic effects, because of the highly permeable volcanic landscape providing for groundwater dominated hydrology as described previously.

Cumulative Effects of Alternative 2 *Measure #1: Timing, Duration and Volume of Peak/Base Flows and Water Yield* There is minimal potential for the proposed action to have cumulative effects to peak and base flows because of the hydrogeology of the project area accounting for a groundwater driven system, built-in project design criteria, and mitigation measures. Projects that have occurred since ECA analysis for the Kelsey Project was completed include: Kapka, Kit, and Katalo vegetation management projects, and the Sunriver US Highway 97 Interchange. Reasonably foreseeable projects include: Kelsey and Lava Cast Vegetation

Management Projects. The ECA value would increase less than 1 percent under this alternative, for a total of ECA of 27 percent. This value is not considered high enough to have measurable changes to this measure because of reasoning described previously under direct and indirect environmental effects of Alternative 2. In summary, the lack of surface water, low precipitation , highly permeable volcanic soils, and the groundwater driven nature of the watershed reduce impacts to the flow regime to immeasureable levels as a result of management activities proposed. This alternative reduces the risk of wildfire and the potential cumulative effects to flows and water yield that could occur thereof as described under cumulative effects of Alternative 1; which deducted that, in summary, the flow regime could be altered by wildfire but changes may be immeasurable due to the groundwater-driven nature of the watershed and the highly managed and altered flow regime of the Deschutes River.

Measure #2: Water Quality - ODEQ 303(d) Parameters There is minimal potential for the proposed action to have cumulative effects to water quality and the 303(d) parameters because of the hydrogeology of the project area accounting for a groundwater driven system, built-in project design criteria, and mitigation measures. This alternative reduces the risk of wildfire and the potential cumulative effects to water quality that could occur thereof that were described above under the No Action alternative.

Measure #3 – Fish Habitat and Populations There is minimal potential for the proposed action to have cumulative effects to fish habitat and fish populations because of the minimal cumulative effects to water quality and quantity, built-in project design criteria, and mitigation measures. This alternative reduces the risk of wildfire and the potential cumulative effects to water quality and quantity that could occur thereof, which would in turn affect fish populations and fish habitat, including redband trout.

Measure #4 – Project Design Criteria and Mitigation The project design under this alternative including management requirements and mitigation measures was structured to eliminate or minimize the potential for cumulative effects. The design of Alternative 2 includes restriction of vegetation and fuels management activities within the RHCAs to limit potential adverse impacts to riparian vegetation, water quality, and fisheries populations and habitat, including that of redband trout. No new system roads are planned. Road closure or decommissioning would be implemented on a total of 38.4 miles.

LRMP/Other Management Direction Consistency

Consistency with Executive Order 11988 (Floodplains) and Executive Order 11990 (Wetlands)
<u>*Floodplains*</u>: Executive Order 11988 provides direction to avoid adverse impacts associated with the occupancy and modification of floodplains. Floodplains are defined by this order as "…the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands, including at a minimum, that area subject to a one percent [100-year recurrence] or greater chance of flooding in any one year."
<u>*Wetlands*</u>: Executive Order 11990 is to avoid adverse impacts associated with destruction or modification of wetlands. Wetlands are defined by this order as, ". . . areas inundated by surface or ground water with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds."

Floodplains and wetlands within the project area are primarily associated with the Deschutes River, as other streams are spring-driven, intermittent, or ephemeral with narrow floodplains (<10 feet wide). Floodplains adjacent to the Deschutes River vary from narrow (<20 feet wide), transitioning quickly into upslope vegetation stands of ponderosa or lodgepole pine and bitterbrush, to several hundred feet wide composed of sedge and willow communities that form wetlands.

Floodplain conditions would be improved through the closure of dispersed campsites and 0.3 miles of road within RHCAs. Neither new or temporary road construction, nor any vegetation treatment units are proposed within floodplains or wetlands. Riparian buffers, as described under the INFISH discussion below, have been prescribed to provide protection to floodplains and wetlands. There would be no adverse effects to floodplains or wetlands from implementing this alternative.

LRMP Consistency Standards and guidelines include, but are not limited to: maintain or enhance riparian areas and the riparian dependent resources (water quality and quantity, fish, and certain wildlife and vegetation that owe their existence to riparian areas) associated with these areas (RP-2); meet or exceed water quality standards for the State of Oregon through application of BMPs (RP-7), (WT-1,2); evaluate cumulative effects of proposed projects on water quality, runoff, stream channel conditions, and fish habitat and adopt measures to avoid adverse effects to these resources (RP-8).

Consistency is done by following the provisions of the CWA (WT-1) as discussed above under environmental effects and implementing the pertinent BMPs (RP-7, refer to Chapter 2) into the design of Alternative 2. Consistent with BMP T-10: All log landings would be located outside the RHCAs to prevent potential sedimentation; T-21, To prevent pollutants from entering water, all servicing and refueling of equipment would occur outside of RHCAs; F-3, Prescribe fire would be conducted outside of RHCAs.

LRMPs R-3, 22, 23, 24 would be addressed by decommissioning roads (subsoiling) when the probabilities of rain are low and closing 38.4 miles of existing road to minimize ongoing soil erosion.

Consistency with the Upper Deschutes River Plan standards and guidelines of V-9, V-11, V-12 and V-17 is discussed under the Wild and Scenic River Values section. Probable Actions listed in the river plan and incorporated into Alternative 2 to maintain and enhance riparian areas and dependent resources (RP-2) include: reduce the amount and distribution of natural fuel loads; manage vegetation to protect and enhance ORVs; reduce the lodgepole pine component within historic ponderosa pine forests; and remove vegetation to reduce competition to ponderosa pine (page 60, 62).

All actions proposed under Alternative 2 are consistent with the standards and guidelines listed above. The proposed action would maintain riparian resources and protect water quality through design measures including the avoidance of vegetation treatments within RHCAs and the implementation of BMPs to protect water and soil resources. Cumulative effects analysis, including the use of ECA methodology, has been completed (RP-8).

INFISH Consistency

Riparian Management Objectives Compliance Management direction within INFISH (USFS, 1995) requires RHCAs to be delineated for watersheds. They are portions of watersheds where riparian-dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines. RHCAs include riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems by (1) influencing the delivery of coarse sediment, organic matter, and woody debris to streams, (2) providing root strength for channel stability, (3) shading the stream, (4) protecting water quality, and (5) providing a network of uninterrupted habitats to serve as connectors for migrating species. Management of RHCAs are intended to achieve Riparian Management Objectives (RMOs), described by habitat features indicating “good” watershed health and inland native fish habitat.

Interim RHCA widths apply where watershed analysis has not been completed. Site-specific widths may be increased where necessary to achieve riparian management goals and objectives, or decreased where interim widths are not needed to attain management goals and objectives, or avoid adverse effects. RHCA standard

widths are applied based on the category of stream as defined by INFISH (1995), page E-5 and E-6. Interim widths are as follows:

Category 1 areas (fish-bearing streams) will consist of a riparian area that incorporates the stream and the area on either side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site potential trees, or 300 feet slope distance (600 feet, including both sides of the stream channel), whichever is greatest.

Category 2 areas (perennial non-fish-bearing streams) will consist of a riparian area that incorporates the stream and the area on either side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year flood plain, or to the outer edges of riparian vegetation, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance (300 feet, including both sides of the stream channel), whichever is greatest.

Category 3 areas (ponds, lakes, reservoirs, and wetlands greater than 1 acre) will have a riparian area that consists of the body of water or wetland and the area to the outer edges of the riparian vegetation, or to the extent of the seasonally saturated soil, or to the extent of moderately and highly unstable areas, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance from the edge of the maximum pool elevation of constructed ponds and reservoirs or from the edge of the wetland, pond or lake, whichever is greatest.

Category 4 areas (seasonally flowing or intermittent streams, wetlands less than one acre, landslides, and landslide-prone areas) will consist of a riparian area that includes the extent of landslides and landslide-prone areas, or the intermittent stream channel and the area to the top of the inner gorge, or the intermittent stream channel or wetland and the area to the outer edges of the riparian vegetation, or one half site potential tree, or 50 feet slope distance whichever is greatest. For Priority Watersheds the area from the edges of the stream channel, wetland, landslide, or landslide-prone area to a distance equal to the height of one sit-potential tree, or 100 feet slope distance, whichever is greatest.

In non-forested rangeland ecosystems, the interim RHCA width for permanently flowing streams is the extent of the 100-year floodplain.

The RMOs from INFISH are listed in the next two tables below. According to INFISH, not all of the described features may occur within a specific stream segment of a stream within a watershed, but all generally should occur at the watershed scale for stream systems of moderate size. Components of what is considered good habitat can vary geographically, and site specific RMOs are encouraged to be established through watershed analysis or site-specific analysis. Latitude can be used for assessing the importance of an objective based on the condition of the other objectives. The RMOs applicable to a forested system include pool frequency, water temperature, large woody debris, and width/depth ratio. The analysis below is focused on the Deschutes River. Data is from a stream survey recently completed (Dachtler, 2005).

Pool frequency: Pool frequency is not being met within the project area. The average bankfull width of the Deschutes River in the project area is approximately 180 feet. According to Table A-2 from INFISH, there should be between 9 and 12 pools/mile. Under existing conditions there are only approximately 3.5 pools/mile. This value likely approximates the historic frequency. Spring-fed systems often have low pool frequencies, and are dominated by glide habitats.

Water temperature: This objective is not being met within the project area, and has been addressed under the Affected Environment section. The water temperature standard is being met in some of the other reaches above and well below the project area.

Width/depth ratio: The existing width/depth ratio for the project area ranges from 20.9 to 64.4, far exceeding the <10:1 ratio objective listed in INFISH, but is typical for the Deschutes River from Wickiup Reservoir to Bend, a distance of 60 miles. This ratio is presumed to have increased since flow regulation began more than 50 years ago at Wickiup Dam due to widening of the channel -width has increased 20 percent during this time. However, the ratio was likely not under 10:1 prior to regulation. Spring-fed systems often have naturally high width/depth ratios.

Large Woody Debris: This objective is not being met. The stream survey documented about 14 pieces/mile. Recent habitat projects have added several hundred trees to the Deschutes River within the project area, however most of these were smaller than 12" diameter and 35' length.

Table 3-47. Interim Riparian Management Objectives (RMOs)

Habitat Feature	Interim Objectives
Pool Frequency	Varies by channel width (See Table below)
Water Temperatures	No measurable increase in maximum water temperature (7-day moving average of daily maximum temperature measured as the average of the maximum daily temperature of the warmest consecutive 7-day period.) Maximum water temperatures below 59° F within adult holding habitat and below 48° F within spawning and rearing habitats.
Large Woody Debris (forested systems)	East of Cascade Crest in Oregon, Washington, Idaho, Nevada, and western Montana: >20 pieces/mile; >12" diameter; >35' length.
Bank Stability (non-forested systems)	>80 per cent stable.
Lower Bank Angle (non-forested systems)	>75 per cent of banks with <90° angle (i.e., undercut).
Width/Depth Ratio	<10, mean wetted width divided by mean depth

Table 3-48. Interim objectives for pool frequency

Wetted width (feet)	10	20	25	50	75	100	125	150	200
Pools per mile	96	56	47	26	23	18	14	12	9

There would be no direct or cumulative effects to the objectives, as described under the Environmental Effects section for Alternative 2. Alternative 2 takes action to reduce the potential for indirect effects to the objectives from stand replacing wildfire by promoting healthier stands in the watershed. Hydrologic or bank stability changes would not occur that would change pool frequencies or width/depth ratios. Shade is maintained to not cause adverse effects to water temperature. Large wood recruitment is maintained. In the long term, large wood recruitment from some stands may be diminished because overstocked stands within the RHCAs are not receiving vegetation treatments.

Alternative 2 meets INFISH standards and guidelines, specifically TM-1, RF-2, RM-2, FM-1, RA-4 and WR-1.

Heritage and Cultural Resources, Ceded Lands Introduction

Scope of the Analysis The scope of the analysis is confined to the project area. There are no other on-going or reasonably foreseeable activities within the project area that would affect cultural resources because all heritage and cultural resource sites would be avoided.

Affected Environment-Existing Heritage and Cultural Condition A field investigation and literature review of the East Tumbull project area was concluded. A total of 93 cultural properties are recorded within the project area. Of the recorded sites there were 4 determined eligible for the National Register of Historic Places, 5 determined ineligible and 84 unevaluated. Four of these cultural properties have an historic and prehistoric component, 25 are historic and 64 are prehistoric. Surveys in the project area have identified two primary

complexes of cultural properties. The prehistoric complex is dominated by open-air lithic scatters of varying size. The historic complex is centered on logging camp features, such as telephone lines, can scatters, including the railroad grade system associated with the Shevlin-Hixon logging era and features from Camp Abbot's military exercises.

Areas such as Slough Camp, Dillon Falls, Big Eddy, Aspen Camp, Lava Island Falls, Benham Falls, the Harper Bridge area adjacent to Sunriver and Bend communities, lands adjacent to the Inn of the Seventh Mountain, Widgi Creek Golf Community and the adjacent Broken Top Development Community, have increased recreational use of the project area. Recreational activities, such as dispersed camping, river rafting, canoeing, fishing, mountain bike trail riding, horse back riding and hiking have partially denuded some of these areas, creating impacts to cultural properties.

Affected Environment-Tribes The East Tumbull project area is within the aboriginal territory of the Klamath Tribes, and a small portion of the Ceded Lands of the Confederated Tribes of the Warm Springs Reservation. It is also within the areas of interest to the Klamath Tribes, the Confederated Tribes of the Warm Springs Reservation and the Burns Paiute Tribe. All three tribes were consulted with on both a government-to-government and staff-to-staff basis prior to and during project scoping. There are no known traditional cultural uses of the project area by the various tribes or tribal members at this time.

Heritage and Cultural Resources Management Direction Management direction for cultural resources is found in the Deschutes LRMP (CR-1 to CR-6), Forest Service Manual section 2360, in federal regulations 36CFR64 and 36CFR800, and in federal laws including the National Historic Preservation Act of 1966, the National Environmental Policy Act of 1969, and the National Forest Management Act of 1976.

Standards and Guidelines of the LRMP states:

> CR-1 Surveys will be conducted based on an inventory plan and design agreed to by the Forest and State Historic Preservation Officer (SHPO); from this database the forest will develop and maintain a forest-wide cultural resource overview.
> CR-2 Cultural properties located during inventory will be evaluated to determine their eligibility for listing in the National Register of Historic Places.
> CR-3 The Forest will develop the thematic National Register nominations and management plans for various classes of prehistoric and historic resource properties.
> CR-4 Cultural properties in conflict with ground disturbing projects will be evaluated and depending upon the nature of the project, the activity may be redesigned to avoid damage or a mitigation will be developed.
> CR-5 Management of cultural resources will be coordinated with other agencies including the State Historic Preservation Office and Advisory Council on Historic Preservation. This management will be coordinated with the Warm Springs and Klamath tribal groups.
> CR-6 Management of the Native American cultural resources will be coordinated with the appropriate Native American Tribe. This coordination will include notification of the appropriate Tribal Group when projects are proposed in areas of known concern.

Heritage and Cultural Resource Environmental Effects

Important Interactions Effects to heritage resources are a concern because the resource is non-renewable and as the cultural property is further disturbed and impacted, it may no longer be able to provide information that can help determine how the area was used by prehistoric and historic peoples.

In EA units proposed for thinning, using heavy equipment, machine piling and creating landings can heavily impact cultural properties. Activities such as prescribed fire and handpiling with the intention of pile burning can effect a cultural property through breaking artifacts, changing their association and locations and damaging any research potential with the loss of artifact hydration rinds from intense and prolonged heat. This same type of management activity can be implemented with no effect on cultural properties if completed by hand (chainsaws) with no pile burning. Mowing, mechanical shrub treatment and underburning does not have an effect on prehistoric cultural properties. Underburning can have impacts to historic sites that contain perishable materials. They can be affected by damaging glass and tin artifacts in historic debris dumps or scatters and any remains of historic structures, corrals, and fence lines.

Decommissioning roads by subsoiling can destroy, break or redistribute artifacts. Road closures that involve installed barriers such as gates to road use can do similar damage to a site by inadvertent breakage or damaging of sites involved in digging holes for posts and foundations.

Direct and Indirect Effects of Alternative 1 There would be an effect to eligible or potentially eligible cultural properties if prescribed underburning treatments are not implemented. The result would be a heavier fuel load which would result in a high intensity fire such as the 1990 Awbrey Hall Fire that occurred in the project area. Fire effects on cultural properties state that temperatures above 650 degrees F can affect stone artifacts. (1998, BLM Protocol). Wildfires also have the potential to reveal new cultural properties because the duff layer is typically entirely consumed; attracting artifact hunters.

Not conducting road closures would continue motorized vehicle access to the project area that could facilitate degradation and destruction of cultural properties. The potential for impact to cultural properties from other sources such as erosion and visitor collection would not change.

Direct and Indirect Effects of Alternative 2 The project does not have the potential to impact eligible or potentially eligible cultural properties because:

1. Cultural properties determined eligible and/or potentially eligible would be avoided by redesigning project EA units or completed by using hand methods.
2. Cultural properties located within EA units which have underburning will not be impacted according to: (1) the 2004 Programmatic Agreement, Appendix A #26 – Landscape-scale low-intensity underburning where fire sensitive historic properties are absent and existing fire lines or existing roads or natural barriers will be used as fire lines; (2) The prescribed burn plan completed for underburning activities is designed for cool, moist conditions and a low intensity ground fire that prevents degradation of cultural resources and artifacts. (3) All known sites would be excluded from underburning.
3. In areas such as the WUI and high use recreation areas where safety is a concern, treatments may be implemented in EA units which contain cultural properties. In order to avoid ground disturbance within cultural site boundaries, thinning treatments would be completed by hand. Pile burning would not occur within the site.
4. Conducting road closures would limit access to cultural properties and would have the beneficial effect of stopping ongoing damage from road use and maintenance. There would be no impact to cultural properties under the 2004 Programmatic Agreement, Appendix B #5.

Indirect effects from implementation of this project are not expected but the potential, although small, does exist. Unevaluated sites and significant cultural properties avoided by project implementation would have more people working in the vicinity of the property over the short term. There is potential to have surface tools or other artifacts observed and collected by contractors working on a project although this has never been

documented or suspected to occur on the district. On the other hand, road closures would reduce motor vehicle access to the area and human caused ignitions lessening the potential for damage due to wildfires and artifact collection.

Burning operations could potentially escape the planned burn location and impact adjacent areas with both fire and fire control activities although there has been no escaped fires on the district for the previous 15 years.

There is currently no known traditional use of the project area by tribes or tribal members and none of the alternatives would effect existing treaty rights or prevent the tribes from utilizing the area for traditional uses currently or at some future date. Although some roads would be closed under Alternative 2; vehicular access is still maintained to every section within the project area by roads proposed to remain open.

Cumulative Effects of Alternative 1 There are no cumulative effects because there would be no proposed activities with alternative. Expected future potential sources of disturbance would include continued collection from visitors within heavy recreational areas and continued recreation activity.

Cumulative Effects of Alternative 2 Under this alternative any and all effects are expected to be avoided or mitigated by using hand tools (see mitigations Chapter 2) to avoid damage. There would be no cumulative effects associated with the combination of Alternative 2 and the ongoing burning of 411 acres (BB 90 units 1, 3, 4, 10; Pine 90 unit 2; BB 89 units 8, 10; Katalo units 17, 23), 26 acres (Katalo Units 8 and 10) of mowing and other activies in the project area such as the Storm King Mountain Bike Trail Extension and Kiwa Springs Mountain Bike Trail because all the other projects avoid all of the cultural resource sites.

LRMP (Forest Plan) Consistency
Alternative 2 would not affect any listed or eligible cultural or historic resources because all heritage resources would be avoided (Appendix K.) or mitigated to avoid damage therefore, the undertaking meets the criteria given in Stipulation III.B.2 of the 2004 Programmatic Agreement among the USDA Forest Service, the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer.

Under Alternative 2, compliance with LRMP standards and guidelines CR-1 and CR-5 were addressed by conducting adequate surveys and recording cultural properties under current heritage standards within the Central Oregon Heritage Group database. This database includes the Ochoco National Forest, Deschutes National Forest, Bureau of Land Management, the State Historic Preservation Office and The Confederated Tribes of the Warm Springs.

Compliance with CR-2 to CR-4 is addressed by redesigning the EA units to avoid all sites until they can be evaluated to determine their eligibility for listing in the National Register of Historic Places. One EA unit would have thinning by hand to avoid damage to an unevaluated site. Handpiles would be located outside of the site before they were burned or trucked to a biomass energy plant.

Compliance with standard and guideline LRMP CR-6 has been addressed by notifying the appropriate Tribal groups of the proposed project area and areas of their concern would be addressed.

Commercial Timber Harvest, Economic and Social Analysis Introduction
The need for maintaining and restoring healthy forest conditions in an economically cost-efficient manner is addressed under Alternative 2 by commercial thinning, where appropriate, small diameter ponderosa pine and lodgepole pine trees. The economic gain from harvesting these trees does not cover all the costs associated with maintaining and restoring healthy forest conditions while reducing the potential for a stand replacement wildfire

in the East Tumbull project area. This is due to the large number of acres included in Alternative 2 that need vegetation treatment and fuels reduction activities but do not need commercial harvest to meet the purpose and need. The inclusion of commercial harvest in Alternative 2, where appropriate, meets the purpose and need at the least cost to the public.

Scope of the Analysis Economic effects analysis of the activities proposed in the East Tumbull project area focuses on the makeup of the communities and five counties of Central Oregon, a comparison of recent local work, unemployment data to the state of Oregon as a whole, and a discussion of economic trends by industry.

Social factors important to Central Oregon, and specifically to land and forest management as a source of local income include: the region's rural setting and its history of a large wood products industry, farming, ranching; the manner in which the local population utilizes resources for recreation; the collection of wood for fuel, fish and game for sport; and the effect of an increasing population on the region's job market and economy.

Affected Environment-Economic and Social Analysis Existing Condition Demographics Five Oregon counties; Jefferson, Crook, Klamath, Lake and Deschutes Counties are considered in this analysis. The major population centers within the five county area are: Klamath Falls, Prineville, Bend, Redmond, Madras, and La Pine. The East Tumbull project area is located within Deschutes County. The total population for the five county area during the 2000 Census totaled 224,735. Assuming an average growth rate of 3.5 percent for the five county area this total population grew to an estimated population of approximately 267,000 by the end of 2005. Growth rates for the region and by each individual county continue to mirror the rate of change displayed in the table below with Deschutes, Crook, and Jefferson Counties continuing with aggressive growth.

Table 3-49. Central Oregon Population Growth

	Population		Change	
	1990	2000	Actual	Percent
Central and South Central Oregon	167,623	224,735	57,112	34.1
Jefferson County	13,676	19,009	5,333	38.9
Klamath County	57,702	63,755	6,053	10.5
Deschutes County	74,958	115,367	40,409	53.9
Crook County	14,111	19,182	5,071	35.9
Lake Co.	7,176	7,422	245	3.4

As with the nation and Oregon as a whole, the population in the Central Oregon area is becoming both older and more diverse; but there are major differences within the area. For instance, the major cities, Bend, Redmond, Prineville, Madras, had lower medium ages than Oregon, in fact Prineville's, Madras's, and Redmond's medium age has actually decreased since 1990. Whereas more rural counties like northern Klamath County and unincorporated areas such as La Pine, are much older than the National or Oregon average with a higher proportion of retirees. Although racial diversity is increasing, with the Hispanic population increasing the fastest, Central Oregon, except for Jefferson County, is less diverse than Oregon as a whole. According to the 2000 census, Lake is 91 percent white with the Hispanic population increasing 50 percent, Crook is 93 percent white with the Hispanic population increasing 179 percent, Deschutes is 95 percent white with the Hispanic population increasing 182 percent, Jefferson is 69 percent white with the Hispanic population increasing 133 percent. Klamath is 87 percent white with the Hispanic population increasing 66 percent. Oregon as a whole is 87 percent white with a Hispanic population increase of 144 percent.

The education attainment level, except for Deschutes County, is also lower than Oregon's as a whole. The

percentage of population having graduated from high school is 47 percent in Crook, 56 percent in Deschutes, 44 percent in Jefferson and 49 percent in Klamath and Lake Counties. For Oregon as a whole it is 53 percent.

Affected Environment-Employment According to the 2000 Census, estimated civilian labor force is: Crook, 7,525, up 12 percent since the 1990 census; Deschutes, 57,614, up 40 percent since the 1990 census, Jefferson, 8,570, up 31 percent since the 1990 census, Klamath, 28,753, up 6 percent since the 1990 census and Lake down 4 percent since the 1990 census. Where as the labor force in Oregon as a whole increased 18 percent. In Crook County the three largest sectors were trade (1,640), lumber and wood products (1,510), and government (1,180). In Deschutes County the three largest sectors were finance, insurance, real estate (14,170), trade (13,080), and government (6,900). In Jefferson County the three largest sectors were government (2,460), trade (1250), and lumber and wood products (1,150). In Lake County the three largest sectors were government (940), trade (500), and lumber and wood products (290). In Klamath County the three largest sectors were finance, insurance, real estate government (5,580), trade (5,510), and government (5,400).

Unemployment rates in the five county area also tend to be higher than the unemployment rate for Oregon as a whole. The economies of Deschutes and Jefferson are the most robust in the area. In Deschutes County, although there has been an increase in the number of jobs created, the huge increase in the labor force (up 40 percent) has negated much of this success, at least in terms of the unemployment rate. But, due to their diversity, both economies are expected to remain very strong. Crook, Lake and Klamath Counties, with their low overall low economic diversity, dominated by either one manufacturing sector industry (lumber and wood products) or limited trade sectors (Les Schwab in Crook County), have had their economies lag behind Oregon's as a whole.

Affected Environment-Income Average annual wages in Central Oregon are displayed below.

Table 3-50. Average Annual Wages in Central Oregon 1990 – 1999 *

Industry	1990	1999	Change	Percent Change
All Industries	$25,152	$25,516	$ 363	1.4
Private Coverage	24,089	24,617	527	2.2
Agriculture, Forest, and Fish	19,630	17,983	(1,647)	-8.4
Construction and Mining	29,156	28,532	(625)	-2.1
Manufacturing	30,633	30,807	174	0.6
Lumber and Wood Products	31,251	31,811	560	1.8
Other Manufacturing	29,028	29,547	520	1.8
Trans., Comm., and Utilities	33,963	35,231	1,267	3.7
Wholesale and Retail Trade	18,510	19,415	905	4.9
Fin., Ins., and Real Estate	26,286	28,468	2,181	8.3
Services	21,493	23,264	1,771	8.2
Government	30,760	30,485	(274)	-0.9
Note: * Adjusted to 1999 $ Sources: Oregon Covered Employment & Payrolls by County & Industry; Oregon Employment Department; US Bureau of Labor Statistics				

Per capita personal income in 1999, as reported by the U.S. Department of Commerce, Bureau of Economic Analysis by county were as follows: Lake $20,285; Klamath $20,886; Crook, $21,168; Deschutes, $26,077; and Jefferson, $18,808. Although the per capita income in the area is traditionally lower than Oregon's as a whole, there has been a widening of the gap mainly due to the loss of relatively high paying jobs in the lumber and wood products industries. Deschutes County's per capita income, which is the highest in the area and close to Oregon's as a whole, is attributable to a number of factors. The first being that although Deschutes County also lost significant jobs in the wood products industry they have been replaced by other high-paying manufacturing

jobs. In addition, the increase of high-paying "high" tech jobs, and an influx of wealthy new comers have bolstered all income measures (per capita, total personal income, and medium family income) as compared to the other counties.

Although there has been a significant reduction in employment within the lumber and wood products industry, the lumber and wood products industry is still an important contributor to the local economies. In Crook County, 1,510 people were employed in the lumber and wood products industry. This accounts for 25 percent of all wage and salary employment in the county, and represents the third highest paying job in the county. In Deschutes County, 4,770 people were employed in the lumber and wood products industry. This accounts for 10 percent of all wage and salary employment, and represents the seventh highest paying job in the county. In Jefferson County, 1,150 people were employed in the lumber and wood products industry. This accounts for 19 percent of all wage and salary employment, and represents the third highest paying job in the county. In Klamath County, 3,180 people were employed in the lumber and wood products industry accounting for 19 percent of all wage and salary employment. In Lake County, 13 percent of all wage and salary employment was in the lumber and wood products industry.

Agricultural is an important use in Central Oregon. Leading crops include cattle, forage and hays. In Jefferson County there is also a substantial amount of seed and vegetable products. Total agricultural sales by county in 2000 were as follows: Crook, $34,604,000; Deschutes, $21,855,000; Jefferson, $46,431,000; Lake $54,508,000; and Klamath $128,806,000. Although farm income is a very small portion of total personal income in the area, the agriculture sector's role in the local economies is substantial in all but Deschutes County.

Employment and income statistical references do not specifically track recreation and tourism as a sector. Instead recreation and tourism contributes to several sectors, transportation, services (accommodations, eating and drinking, recreation), retail trade, and even government. The Oregon Tourism Commission publishes an annual report with estimates to total travel related spending in each County. Estimates for 1999 were 20.4 million in total travel spending in Crook, 414 million in Deschutes, 99.7 million in Klamath, 10.4 million in Lake, and 52.9 million in Jefferson. Estimated employments from these expenditures are as follows. In Crook, 380 people were employed in industries supporting recreation and tourism, representing 6.3 percent of all wage and salary employment. In Deschutes County, 5,160 people were employed in industries supporting recreation and tourism. This represents 10.5 percent of all wage and salary employment in the county. In Jefferson, 1,040 people were employed in industries supporting recreation and tourism. This represents 16.8 percent of all wage and salary employment in the county. In Lake, 170 people were employed in industries supporting recreation and tourism. This represents 7.7 percent of all wage and salary employment in the county. In Klamath 1,930 people were employed in industries supporting recreation and tourism. This represents 8.3 percent of all wage and salary employment in the county.

Affected Environment-Social Surrounding physical and biological environments influences human social life. This is most evident in rural areas where the variety and quality of available natural resources often determines the chief means of economic livelihood and what leisure activities people are likely to pursue and, therefore, influence local preferences for the use of public lands. From a historical prospectus it is evident that all of the local community's cultures were natural resource based and especially in the more rural less populated areas, still are. Livestock, agriculture and timber were the backbone of the economic structure and as a result strongly shaped the social fabric that still largely defines the communities today. Since most of the surrounding land is administered by federal agencies, chiefly the Ochoco, Deschutes, Winema, Fremont National Forests and the Prineville and Lakeview Districts of the BLM, changes in federal land use policies can impact the socioeconomic and socio-cultural way of life.

One needs to keep in mind that the various communities, and the individuals within them, contain a broad

spectrum of perceptions and values related to the use of resources and road system on the surrounding national forests. Many of the communities (rural industrial, as defined in the Deschutes LRMP) within Central and South Central Oregon, such as Crescent and Gilchrist, are closely tied to the Forests in work, subsistence, and play, and are directly affected by what happens on the Forests. The relationship between the Forests and these communities is based in part on access to logs so that individuals can make a living from harvesting, manufacturing, and transportation businesses; and catering to tourists drawn to the area. People from these communities also use fuelwood, fish, and game for part of their subsistence and/or recreational activities. Recreation (often roaded and/or motorized) is also an important component of the life styles for many of the people living in these communities.

The Sunriver destination resort and Inn of the 7th Mountain communities are defined by recreation opportunities and amenities and recreation residences (rural recreation and residential, as defined in the Deschutes LRMP). Environmental and scenic amenities and nearby recreational opportunities plays the major role in their existence instead of extraction-based activities.

Bend (Central Oregon Urban Center, as defined in the Deschutes LRMP), is the dominant community in the area. It has a large industrial sector with secondary wood products playing a major role, and a large service sector based on recreation and tourism. In addition its' financial, real estate sectors, and economy as whole has increased substantially as people have moved into the area because of the amenities the surrounding area provides, much of which is associated with the national forests. It is also the major shopping and service center for most of the communities within the area. Due to its population size and density, and economic and social diversity, the health of the wood products and service sectors of the economy, along with environmental and amenity values, play an important role in defining what is important to the Bend community.

Communities such as Prineville, Redmond, and Madras, from a historically perspective, better fit the "rural industrial" community described above. They all have rapidly expanding populations and diversifying economies but it is clear that these communities still have very strong ties to the woods product industries both economically and culturally. Other communities (such as Paulina, Silver Lake and to some extent Madras) can generally be defined as ranching or farming communities. These communities are closely tied to the Forests in work, subsistence, and play, and are directly affected by what happens on the Forests. These communities are linked more economically because of the need for summer forage for livestock, not timber, and to provide services for recreation and tourists. . These communities generally have no manufacturing based industries and have small, undiversified economies. Like "rural industrial communities", the people who reside in these communities also use fuelwood, fish, and game for part of their subsistence and/or recreational activities.

The one over-riding demographic trend in the area is that of rapid population increase through in-migration. With the general gentrification that is occurring through the area and the influx of retirees, many of whom are well to do, and professionals from many specialty areas, is resulting in rapid economic and social change.

Commercial Timber Harvest, Economic and Social Analysis Management Direction Forest Service Handbooks 1909.17 and 2409.18 direct the evaluation of Economic Efficiency for proposed projects.

Commercial Timber Harvest, Economic and Social Analysis Environmental Effects Introduction To assess the economic efficiency of Alternative 2, the costs and anticipated timber volumes were entered into TEA.ECON (http://www.fs.fed.us/rp/nr/fp/FPWebPage/ForestProducts/ForestProducts.htm). The commercial thinning sale was evaluated with a 4 percent discount rate. TEA.ECON uses the Transaction Evidence Appraisal (TEA) system to generate basic gross timber values and estimated advertised rates. Values for timber are generated using advertised rates in the appropriate geographic area and appraisal zone. Rates were updated for the analysis and used the following cost file: version 05531, 06/30/2005.

The analysis can be used to compare alternatives, not to give an absolute number for the outputs. Numbers useful for comparing and evaluating a given alternative include a benefit/cost ratio, discounted benefits, discounted costs and present net value. Effects on the local economy include estimated number of jobs created or maintained.

Value and Volume As noted, timber value was derived from TEA.ECON (Appendix F). Timber volume estimates of 7,740 CCF (@ 4.0 million board feet) of ponderosa pine and lodgepole pine sawtimber and 1,760 CCF of non-sawtimber products for Alternative 2 were derived by comparing similar commercial thinning sales located in the same general geographic area and same "black bark" pine timber type. Certified Region 6 timber cruisers were used to evaluate the comparison sales.

Costs The net sale value would depend on the market value of the timber when sold and the actual logging costs. Logging costs include stump to truck (what it costs to get the trees from the commercial thinning unit to the truck loading site), haul (trucking the trees to the mill), road maintenance, establishing temporary logging facilities and slash disposal. Cost assumptions are as follows: 80 percent of the zone average was used for stump to truck and 90 percent of the zone average for log haul due to the utilization of high production, modern, ground based mechanized systems and shorter than average haul to the nearest mill location at Gilchrist; zone averages were used for brush disposal, road maintenance, and temporary road development.

Table 3-51. Expected Logging Costs of Alternative 2

System	Acres	Total Volume (ccf)	Stump-Truck (ccf)	Brush Disp. (ccf)	Road Maint. (ccf)	Temp. Road (ccf)	Haul (ccf)	Total Cost/ccf
Ground-based	2,627	9,500	$67.63	$8.38	$5.43	$0.37	$19.32	$101.13

The logging costs were added to the additional costs of activities needed to implement a timber sale. These include: weed treatment/monitoring of off-road equipment to reduce the potential of spreading nonnative plants ($2,500); subsoiling costs of $9,750; sale preparation costs of $6.25/CCF; sale administration costs of $2.00/CCF; NEPA planning, roads analysis review and survey costs of $16.84/CCF ($160,000).

Table 3-52. Alternative Financial Efficiency

Alternative	Estimated Volume CCF	Present Net Benefits (PNB)	Present Net Costs (PNC)	Present Net Value (PNV))	Benefit/cost Ratio (B/C)
Alternative 1	0	0	$166,400	-$166,400	0
Alternative 2	9,500	$253,799	$247,338	$11,593	1.05

The negative PNV for alternative1 reflects planning and survey costs associated with the preparation of this EA. The net revenues generated by the sale of small diameter trees under Alternative 2 would provide a potential additional source of funding for reforestation (KV receipts).

The following are costs of non commercial vegetation management activities which are intended to lower the risk of a stand replacement wildfire, and expedite the restoration of LOS stage ponderosa under Alternative 2.

Table 3-53. Additional Vegetation Management Costs

Activity	Cost
Close 11.9 miles of road	$5,000

Create 1313 snags 18-26" dbh	$65,500
Aspen enhancement	$10,000
Remove tags in Scenic Views	$1,000
Road to trail conversion 4100200	$2,500
Non commercial thin 3,631 acres	$363,100
Handpile 1,041 acres	$130,125
Machine pile 1,526 acres	$190,750
Mow 2,414 acres	$120,700
Prescribe burn 1,587 acres	$79,350

Direct and Indirect Effects of Alternative 1 Selection of this alternative would result in no active management of vegetation except for ongoing management activities such as fire suppression and hazard tree felling adjacent to roads and recreation sites. There would be no economic return and no additional jobs would be created or maintained. This alternative would likely have negative impacts to the local economy because timber-related jobs would not be maintained.

Although Alternative 1 would generate no current revenues to return to the Treasury of the United States of America there is a cost resulting from the expenditure of planning monies as shown above.

Cumulative Effects of Alternative 1 The cumulative effects of either alternative with regard to economic efficiency in the foreseeable future are based on costs and revenues. The cumulative effects on forest resources are discussed in other portions of this EA. All resources have a value, though many are difficult to identify in dollar terms. There would be no cumulative effects on commercial timber, economic and social activities with Alternative 1 because there would be no vegetation management , road closure or other projects.

In Alternative 1 no fuels reduction or thinning would occur. Future fires within the East Tumbull project area would have the potential to be more difficult to control due to the yearly increase in fuel loading. This potential could require more resources to control fire, create increased dangers to wild land fire fighters and increase costs to contain a fire than compared to Alternative 2.

Direct and Indirect Effects of Alternative 2 The commercial thinning units under Alternative 2 have a positive economic return. When the related revenues and costs (including all planning costs) are analyzed the PNV is $11,593 with a benefit/cost ratio of 1.05. The costs associated with non commercial vegetation management, prescribed burning, mowing and other activities is estimated at an additional $977,775. The net sale value is estimated to be $279,946 of which some or all could be used to offset the additional vegetation management costs displayed above.

The number of jobs maintained or created was calculated by using figures for the Deschutes National Forest from Appendix B-5 of the FY 1997 Timber Sale Program Annual Report. Excluding firewood from the volume harvested on the Deschutes National Forest in Fiscal Year 1997, an estimated 9.6 jobs per million board feet were maintained or created. Of the total estimated volume, approximately 4 million board feet is sawtimber. At 9.6 jobs per million board feet, Alternative 2 would maintain or create 38 jobs. Non sawtimber volume of one million board feet consisting primarily of the tops of trees as well as trees under 8 inches in diameter were not used in the calculation of the total estimated number of jobs created or maintained with Alternative 2. Estimated employee income of $1,208,818 is derived by multiplying the average 1999 salary of $31,811 for lumber and wood products jobs and the number of jobs (38 jobs) created or maintained.

Cumulative Effects of Alternative 2 Under both alternatives the possibility of wildfire returning is high because of the location, weather and vegetation. What varies between alternatives in regards to fire is the fuels and future stand structure following implementation of Alternative 2. The level, type and structure of natural

fuels remaining would contribute directly to the investment needed to control a wildfire in the project area to protect houses, facilities and other infrastructure. The fuels accumulating in the next two-three decades would need treatments to protect the developing young ponderosa pine forest. These treatments may include thinning, prescribed fire or mechanical mowing of the shrub layer.

Alternative 2 includes commercial and noncommercial thinning, underburning and mowing that reduces flame heights and current fuel loads. Resources required to control or manage fires could be substantially less than Alternative 1. This alternative has the best opportunity to accelerate the establishment and development of a large diameter ponderosa pine stand and provides the best assurance that the stands within the project area can develop past the immature age when the relatively small diameter trees are susceptible to ground fire mortality. Alternative 2 also provides for current and future opportunity for employment in the woods industry.

Over the last 10 years (1995 to 2004), an annual average of approximately 65.7 MMBF of timber has been sold from the Deschutes National Forest. In the near future, the amount of timber offered for sale is expected to be near this annual average and as such Alternative 2 would not provide a cumulative increase in economic activity. The Deschutes National Forest is expected to continue offering timber for sale and is expected to continue making contributions to the local economy as a result of timber harvest activities.

If Alternative 1,was chosen, the project area would not contribute any additional benefits to the local economy as a result of timber harvest. In this scenario, the projected amount of volume from Alternative 2 would likely not be provided to the local economy because of the unfeasibility of substituting and implementing other ongoing planned projects. This is due to the resources (specialist time, surveys and analysis) and time expended on the East Tumbull project.

LRMP (Forest Plan) Consistency Consistent with FSH 1909.17 and 2409.18 this economic efficiency analysis was completed. Net public benefits are measured by both qualitative and quantitative criteria rather than a single measure of index such as PNV or benefit cost ratios. When considering only commercial thinning direct and indirect costs the project has a positive return. The PNV would be negative when including all of the non thinning related projects and costs. The Forest Service is not mandated by law to show a profit from land management activities although it is one consideration when designing and implementing vegetation management activities.

Civil Rights and Environmental Justice Introduction

Environmental Justice is defined as the pursuit of equal justice and protection under the law for all environmental statutes and regulations, without discrimination based on race, ethnicity, or socioeconomic status. The minority and low income populations groups living in counties surrounding the East Tumbull project work in diverse occupations. Some minorities, low income residents, and Native Americans may rely on forest products or related forest activities for their livelihood. This is especially true for those individuals that reside in the rural Central Oregon communities.

Scope of the Analysis Identical to the Commercial Timber Harvest, Economic and Social Analysis the effects analysis area focuses on Central Oregon and land and forest management activities.

Affected Environment-Economic and Social Analysis Existing Condition Demographics were covered in the previous section.

Civil Rights and Environmental Justice Management Direction. Civil Rights legislation and Executive Order 12898 (Environmental Justice) direct an analysis of the proposed alternatives as they relate to specific subsets of the American population. The subsets of the general population include ethnic minorities, people

with disabilities, and low-income groups.

The Deschutes LRMP includes minimizing social and administrative barriers to use of the forest (HM-1) and consideration of the needs of the handicapped (HM-4).

Direct and Indirect Effects of Alternative 1 This alternative would continue the local economic situation as described above and not reduce the potential for a large, stand-replacement wildfire in the East Tumbull project area.

Recent research by the Center for Watershed and Community Health outline both the direct and indirect effects of wildfire on the health and welfare of impoverished individuals, families, and communities. Beside the direct impacts of the fire on potential jobs and income, there are also negative impacts to the value of property and other assets created by the public perception of risk created by local wildfires.

The long-term effect of a decrease in a sustainable local timber supply for local mills combined with a short-term decrease in recreational opportunities can also affect major local employers and taxpayers. This means that the tax base decreases and the costs of sustaining local services cost more. Thus poor householders in local communities are especially vulnerable to the fallout of a wildfire like this on their local economy. They have limited financial ability to cope with the disruptive effects this may have on local economic activity and dependent social services. The effects discussed in this section, are difficult to measure, but would tend to have a disproportional impact on local low income households. Minority groups from outside the immediate area that are attracted to vegetation management work such as noncommercial thinning would probably see fewer changes in income when compared to local groups.

Direct and Indirect Effects of Alternative 2 Alternative 2 has the potential to provide local employment and to bring in workers from outside the community to perform commercial thinning, trucking, noncommercial thinning, mowing and other related fuels reduction activities. The primary services needed by outside workers would be food and shelter. Local businesses that can supply food (grocery stores and restaurants) and other services would capture most of the money being spent by the workers in the area. This would likely result in increased local household incomes during implementation of project activities. Since these businesses have supported similar workforces in the past, capitol expansion would probably not be required. As noncommercial thinning, hand, machine piling and other fuels reduction activities are expected to span a period of years; it is reasonable to expect a good proportion of the work will go to minority-based small businesses, as in the past.

Cumulative Effects No cumulative effects were identified. Although road closures included with Alternative 2 and other adjacent ongoing or reasonably foreseen projects such as Katalo and Kelsey would limit motorized access and could, in theory, make dispersed camping less convenient for low income individuals and families, there are still numerous other locations in and near the area that would remain available for free camping. Motorized road access would still be provided for low income and disabled persons to every section in the project area, as well as every section in the adjacent project areas.

LRMP (Forest Plan) Consistency The analysis did not identify discrimination based on race, ethnicity, or socioeconomic status from the implementation of Alternative 2. On the contrary, it identified economic opportunities for all disadvantaged groups while maintaining vehicle access to each section within the project area (HM-4) and minimizing social and administrative barriers to legitimate use of the forest (HM-1) by handicapped individuals and other subsets of the American population.

Other Effects and Findings
Wetlands, fisheries, water quality and designated floodplains would not be adversely affected by any of the

proposed management activities (Water Quality/Fisheries and Wild and Scenic River Values).

There would be no direct, indirect, or cumulative adverse effects to inventoried roadless areas, Pacific Yew or habitat, park land or prime farm land under Alternatives 1 and 2 because none exist within or adjacent to the project area. No significant permanent or irretrievable commitment of resources would occur under Alternative 2 with the exception of a negligible, irretrievable loss of fugitive dust caused by mechanical operations.

No significant adverse effects to public health or safety have been identified. Proposed activities in Alternative 2 would improve public health and safety by reducing the risk of entrapment from wildfire, especially along the WUI and the negative effects on air and water quality from a large stand-replacing wildfire. All other proposed activities would not expose the public to an elevated risk of injury above hazards associated with routine forest practices such as tree felling and operation of mechanized equipment that are regulated by the Oregon Occupational Safety and Health Division.

The effects of implementation of the alternatives are well known, not highly controversial from either a scientific or public perspective, and do not involve any unique or unknown risks. During scoping and collaboration , the level of concern voiced by the public regarding was minor (Chapter IV). Numerous projects similar in size and complexity over the last 10 years within the Bend/Fort Rock Ranger District such as the Katalo and Katalo West projects have not identified any unknown risks, effects or scientific controversy. This project is similar in all respects to the adjacent Katalo project that was chosen by the Governor of Oregon's Scientific Advisory Team as the type of project that could build consensus between academia and the public on the use of small tree harvest and fuels reduction to treat forest health and wildfire issues.

The effects of all other Sale Area Improvement projects have been discussed previously with the exception of reducing conifer encroachment (lodgepole pine) within a four acre aspen stand (Stand 10042) located southwest of Ryan Ranch Meadow (see map Appendix G). The small understory lodgepole pine seedlings would be hand felled and left to deteriorate naturally to eliminate any negative effects on soils or other resources from pile burning. There would be no effect on cover because the lodgepole pine seedlings are currently not contributing to cover. Over the short and long-term this treatment would be beneficial to habitat diversity and species that use aspen trees for nesting and foraging.

Vegetation Management Analysis, Noxious Weeds Introduction Noxious weeds, as defined in FSM 2080.5, generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and being native or new to or not common to the United States or parts thereof. In addition to noxious weeds, which are designated by the State of Oregon, there is a group of non-native plants that are aggressive, such as mullein and cheatgrass, and that can also reduce diversity and create land management problems.

Scope of the Analysis The analysis focuses on the existing condition within the project area, the major access roads and transportation of equipment to the area. There are no other on-going or reasonably foreseeable activities within the project area that would spread noxious weeds because no heavy equipment is involved and highly effective mitigation measures are in place to prevent noxious weed introduction and spread on the already approved 411 acres (BB 90 units 1, 3, 4, 10; Pine 90 unit 2; BB 89 units 8, 10; Katalo units 17, 23) of prescribed burning and 26 acres (Katalo Units 8 and 10) of mowing. The reasonably foreseeable Storm King Mountain Bike Trail Extension and Kiwa Springs Mountain Bike Trail would not introduce or spread noxious weeds because all activity would be completed by hand.

Affected Environment-Existing Noxious Weed and Non-Native Plant Populations of Concern The project area contains many weed populations, introduced and spread by the high level of recreation activity in the

project area, and proximity to Bend and its many weeds. There are two noxious weeds of concern within the project area: spotted knapweed, *Centaurea maculosa* and Dalmatian toadflax, *Linaria dalmatica* and one non-native, cheatgrass. Cheatgrass is present throughout the project area. Spotted knapweed and Dalmatian toadflax are locally confined to discrete areas (see Noxious Weed Risk Assessment Report and maps, Appendix C for locations)

Currently, only hand-pulling and biologic controls are occurring in the project area; herbicides are not authorized for use in the project area.

Noxious Weed Management Direction Forest Service Manual direction requires that a Noxious Weed Risk Assessment (Appendix C) be prepared for all projects involving ground-disturbing activities. For projects that have a moderate to high risk of introducing or spreading noxious weeds, Forest Service policy requires that decision documents must identify noxious weed control measures that will be undertaken during project implementation (FSM 2081.030).

In addition to FSM 2081.030, an Executive Order (2/3/99) requires Federal agencies to use relevant programs and authorities to prevent the introduction of invasive species and not authorize or carry out actions that are likely to cause the introduction or spread of invasive species unless the agency has determined, and made public, documentation that shows that the benefits of such actions clearly outweigh the potential harm, and all feasible and prudent measures to minimize risk of harm will need to be taken in conjunction with the actions.

This EA is tiered to a broader scale analysis; the R6 2005 FEIS). The R6 2005 FEIS culminated in a Record of Decision (R6 2005 ROD) that amended the Deschutes National LRMP by adding management direction relative to invasive plants. This project is intended to comply with the new management direction by cross referencing each guide to ensure consistency with the appropriate standard from the R6 2005 FEIS and ROD.

Target Landscape condition Preventing the introduction and spread of noxious weeds so that current populations of undesirable non-native plants can be contained, reduced or eliminated.

Direct and Indirect Effects of Alternative 1 There would be no direct and indirect effects because implementation of the project would not occur; however ongoing recreational use of the area would continue to spread and introduce noxious weeds. This is because noxious weeds within the project area are typically associated with roads, pumice pits and trails. Under alternative 1, motorized vehicular access would remain as is and private vehicles would continue to act as weed vectors by possibly bringing in or spreading weed seed from roadsides and pumice pits that have current high populations of weeds. Ongoing high recreation use such as mountain bikes and horse back riding would also continue; possibly further spreading noxious weed populations along trails. Hand pulling and limited use of biologic controls have already been implemented within the project area and hopefully would be able to maintain current weed populations at current levels.

This alternative would not reduce the potential for a large, stand-replacement wildfire in the East Tumbull project area. In the event of a fire within the project area all available engines would rapidly respond due to the areas proximity to Bend. The potential for introduction and spread of noxious weeds would be high because few, if any, of the vehicles would be cleaned before entering National Forest system lands. The very real scenario exists of a city of Bend (or other department or agency) engine going directly from a knapweed site in the city to a fire within the East Tumbull project area. The ability to control operations by avoiding current weed sites would also not occur leading to the spread of existing populations of noxious weeds.

The ground disturbance caused by both fire suppression operations and a high intensity wildfire would provide ideal conditions for noxious weed and cheatgrass spread exacerbated by the ongoing motor vehicle access that

would remain under this alternative.

Direct and Indirect Effects of Alternative 2 There are no anticipated direct or indirect effects from implementation of this alternative after incorporation of the design elements and site-specific recommendations for preventing the introduction and spread of noxious weeds (see mitigations for noxious weeds, Chapter 2) and cheatgrass.

The strategy for managing noxious weeds under Alternative 2 is prevention. The prevention strategies incorporated into this alternative would alleviate most potential problems associated with the potential introduction or spread of noxious weed populations and cheatgrass within the project area. However, if monitoring indicated that prevention measures are not adequate in preventing the introduction and spread of noxious weeds, early treatment consisting of hand pulling would be implemented.

In areas where undesirable weeds currently exist, there would be a "high" risk associated with the implementation of Alternative 2 if mitigation measures were not included. This is due to the following assumptions: noxious weeds are known to grow within the project area; some project operations would be carried out adjacent to existing noxious weed sites; mechanized machinery would be used for some of the work; and there would be some ground disturbance. Spotted knapweed grows in several places along roads 46, 4601 and 41 where it is found adjacent to some of the EA units. Most of the work along these roads would be conducted by hand crews to reduce the risk of introduction and spread of noxious weeds. Actual noxious weed populations within all EA units, except EA unit 115, would be flagged out and avoided by all vegetation management activities. EA unit 115 would not use heavy machinery and all thinning and piling activities would be done by hand. Mowing of the understory shrubs within EA unit 115 would not occur where spotted knapweed populations exist. In all EA units where heavy machinery would operate, all equipment would be cleaned before coming into the project area. All of these requirements (discussed further under LRMP/Other Management Direction Consistency) have been shown to be effective and the risk of noxious weed introduction or spread through implementation of Alternative 2 would be low.

Proposed road closures would help offset the risk of introduction and spread of noxious weeds by private vehicles. The 38.4 mile reduction in roads open to motorized vehicles exceeds the total miles of the final proposed transportation system. Another major contributor to reducing the introduction and spread of noxious weeds and other non-native undesirable plant species within the project area is the lessened risk of a large stand replacing wildfire. As seen in the 18 Fire of 2003, that was located within and adjacent to the Bend WUI, undesirable non-native plants like Russian thistle and noxious weed populations can quickly take advantage of wildfire disturbance and spread rapidly.

Cumulative Effects No cumulative effects were identified. High levels of recreation would continue within the project area, bringing with it the possibility of new weed introduction and spread.

LRMP and Management Direction Consistency The following goals and guidelines, relative to timber harvest and fire management are listed in the *USDA Forest Service Guide to Noxious Weed Prevention Practices*. This guide discusses weed prevention practices that support implementation of FSM, the February 1999 Executive Order direction on Invasive Species and the R6 2005 FEIS. Each appropriate guideline *(italics)* is followed by a description of how it is addressed in the design of Alternative 2. Consistent with management direction the strategy pursued by the East Tumbull project is prevention.

This project is intended to comply with the new management direction by cross referencing each guide to ensure consistency with the appropriate standard from the R6 2005 FEIS.

Prescribed Fire

Fire 13/ R6 2005 FEIS Standard #1. Avoid ignition and burning in areas at high risk for weed establishment or spread due to fire effects. Treat weeds that establish or spread because of unplanned burning of weed infestations. All established noxious weed populations would be excluded from underburning. Funds for noxious weed monitoring and hand pulling would be used for weeds that spread into EA units.

Fire 14/ R6 2005 FEIS Standard #1. When possible use staging areas and helibases that are maintained in a weed-free condition. Staging areas would be located outside noxious weed sites. All implementers will be given maps of weed sites. Helibases would not be used.

Fire 16/ R6 2005 FEIS Standard #1. Use appropriate preparation and suppression tactics to reduce disturbances to soil and vegetation. Burn prescriptions are designed to minimize duff consumption and exposure of bare mineral soil.

Forest Vegetation Management

Forest Veg 1/ R6 2005 FEIS Standards #1, 11. Treat weeds on projects used by contractors, emphasizing treatment of weed infestations on existing landings, skid trails, and helibases before activities commence. On going treatment of noxious weed sites is occurring within the project area and identical to Fire 13 and 14 above, all noxious weed sites would be excluded from timber harvest operations.

Forest Veg 2/ R6 2005 FEIS Standard #1. Train contract administrators to identify noxious weeds and select lower risk sites for landings and skid trails. The contract administrators are aware of the noxious weed problem, can readily the noxious weeds and non-natives of concern for the East Tumbull project and routinely select lower risk sites for landings and skid trails.

Forest Veg 3/ R6 2005 FEIS Standard #1. Encourage operators to maintain weed-free mill yards, equipment parking, and staging areas. Noxious weeds are discussed at pre-work meetings.

Forest Veg 4/ R6 2005 FEIS Standard #1. Use standard timber sale contract provisions such as WO-C/CT 6.36 to ensure appropriate equipment cleaning The equipment cleaning clause is included and used in all contracts.

Forest Veg 5/ R6 2005 FEIS Standard #1. Minimize soil disturbance to no more than needed to meet project objectives. Logging practices to reduce soil disturbance include, but are not limited to:

- *Over-snow logging* On average over half of the timber sale harvest on the district occurs during the winter months. The requirement to complete work outside of the busy summer recreational months would necessitate winter operations on many of the EA units.
- *Skyline or helicopter logging* Modern ground based boom-mounted shears with designated skidroads would be used to minimize ground disturbance.
- *Reuse landings, skid trails and helibases when they are weed free.* Landings and skid trails are routinely reused.

All EA have gentle or flat slopes (average 1 to 10 percent). Sensitive soil areas with slopes greater than 30 percent have been excluded from vegetation management activity. This reduces the amount of soil displacement.

Forest Veg 6/ R6 2005 FEIS Standard #1. Minimize period from end of logging to site preparation, revegetation, and contract closure. Timber Sales would likely have a three year or less contract. There would

be no site preparation or revegetation because vegetation management is confined to thinning, mowing and underburning.

Post Vegetation Management Operations

Forest Veg 7/ R6 2005 FEIS Standard #1. Minimize soil disturbance to no more than needed to meet vegetation management objectives. Prevention practices to reduce soil disturbance include, but are not limited to:

- *Treating fuels in place instead of piling* All commercial and most non-commercial thinning includes whole-tree removal to minimize soil disturbance and detrimentally burned soils.
- *Minimizing heat transfer to soil in burning* Biomass utilization is the preferred method to reduce effects on soils. Monitoring of machine piles shows that they typically do not exceed one percent of an individual EA unit.
- *Minimizing fireline construction* All underburning operations are designed to maximize use of roads for firelines. The current high road density in the project area facilitates underburning and reduction of ground disturbance.

Forest Veg 8/ R6 2005 FEIS Standards #1, 12, 13. For long-term restoration and weed suppression where forested vegetation management has created openings, recognize the need for prompt reforestation. There would be no created openings or need for site preparation or reforestation. Natural grass and forbs response on subsoiled roads completely occupies the growing site within two seasons.

Road Management

Road 1/ R6 2005 FEIS Standard #1. For timber sale purchaser road maintenance and decommissioning, use standard timber sale contract provisions such as WO-C/CT 6.36 to ensure appropriate equipment cleaning. This provision is used in all contracts.

Road 5/ R6 2005 FEIS Standards #1, 2, 8. Avoid acquiring water for dust abatement where access to the water is through weed-infested sites. Besson Day Use area will be used for this activity; no weeds are currently known at the site

Road 8/ R6 2005 FEIS Standards #1, 2, 11. Treat weeds in road decommissioning and reclamation projects before roads are made impassable. Reinspect and follow-up based on initial inspection and documentation. All roads proposed for decommissioning and subsoiling of temporary roads, skid roads, and landings in East Tumbull units 104, 108, 115, 116, 117, 118, 121, 124, 130, 135, 136, 138, 139E, 140, 141, 144, 146, 147, 148E, 148W, 149, and 176 would be inventoried for weeds in the summer prior to decommissioning and weed populations treated by hand pulling, if found.

Refer to mitigation measures for noxious weeds in Chapter 2.

CHAPTER 4 CONSULTATION WITH OTHERS

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Friedman of 7th Mountain Resort, Glenn Ardt of ODFW, Jennifer O'Reilly of USFWS, Deschutes County Forester Joe Stutler and Katie Lighthall Program Director, Project Wildfire and team leader of the Bend CWPP. Ms. Coulter and Mr. Riverwind of Blue Mountain Biodiversity were invited to review the proposed action in the field with members of the Forest Service but declined the invitation.

Following the signing of the Sunriver CWPP; the proposed action was finalized and mailed on May 31, 2005 to 65 individuals, organizations, agencies, tribes and businesses. This was followed by a second mailing to an additional 25 interested individuals, organizations, agencies and businesses on June 14, 2005. The complete list of contacts can be found in Table 4-1. The letters identified site-specific areas being considered for resource and vegetation management activities and timelines for providing input (Appendix J). To ensure the greatest possible coverage, television, radio, and newspaper stories, articles, and advertisements were run in addition to two public meetings that were held on the East Tumbull project on June 9 and June 22, 2005.

Persons and organizations that provided written comments in response to the public meetings, press releases, media coverage or direct mailings along with a copy of their comments are located in Appendix J (District Files). A summary of input received during scoping, consultation and collaboration and how the ID team addressed the recommendation or concern follows immediately below.

Collaboration

Sunriver, Bend The teams that developed the Sunriver and Bend CWPP identified and set the priorities for areas needing hazardous fuel reduction treatments as well as the types and methods of treatments included in the proposed action and helped provide for community outreach and feedback on the East Tumbull project. Ongoing treatments on private lands within Sunriver and Bend were designed to be mutually complementary to the treatments proposed with East Tumbull.

Highlands Deb Crowson met with ID team members on the ground and shared maps of the development and ongoing fuel reduction efforts within the subdivision. Based on the field review it was decided to not locate wildlife cover clumps within 300 feet of the private property line. The team incorporated Ms. Crowson's suggestion to prune trees along the property line to reduce ladder fuels into the design of Alternative 2.

7th Mountain Resort Bill Friedman and Bill Kinney of the 7th Mountain Resort reviewed maps of the project area and provided suggestions regarding the types and methods of vegetation management and fuels reduction activities. Their suggestion to forego prescribed underburning adjacent to the resort was incorporated into Alternative 2. Instead of underburning, slash treatment of the noncommercial trees and shrubs would consist of handpiling and mowing.

The Nature Conservancy (TNC) Garth Fuller of TNC reviewed the proposed action in the field and expressed verbal support for the project.

Oregon Department of Fish and Wildlife (ODFW) Glen Ardt of ODFW provided input on cover clumps, travel corridors and elk calving areas. Based on his input, important elk calving areas were excluded from vegetative treatment (Chapter 2). In addition, more extensive wildlife travel corridors were added and wildlife hiding cover and screening areas were increased from the LRMP standard and guide of 10 percent to 20 and 30 percent

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for thinning less than 12 inches dbh and less than 21 inches, respectively.

United States Fish and Wildlife Service (USFWS) Jennifer O'Reilly reviewed the proposed action in the field with members of the ID team and provided support for the project.

Oregon Natural Resources Council (ONRC) Tim Lillebo, ONRC Eastern Oregon Field Representative, reviewed a draft proposed action in the field with members of the ID team on May 11, 2005. Based on this review and subsequent discussion the following changes were made to the proposed action: 1) Marking guidelines for thinning EA units less than 21" dbh and for thinning EA units less than 12" dbh would specify the retention of one or two clumps per acre of 3-7 (or more) trees. These areas would be in addition to the 20 to 30 percent of each unit left for wildlife cover. The purpose of the retention of these small "groups" is to more closely emulate the stand structure that is commonly seen in LOS ponderosa pine stands. 2) Removal of conifers less than 21" dbh around aspen and willow trees, where present, would be included in EA thinning units. One of the sale area improvement projects would be to reduce conifer encroachment around aspen trees and willows outside of the EA units and RHCA. 3) Thirteen acres of LOS treatment was added (EA unit 124) to alternative 2. The prescription would be to cut and handpile white fir up to 12" dbh to reduce the stress on the overstory ponderosa pine trees that have been experiencing accelerated mortality while providing for defensible space adjacent to the evacuation road from the Benham Falls Overlook.

Other suggestions Tim provided such as thinning within the RHCA of the Deschutes River and thinning and underburning more of the existing young ponderosa pine stands were not included. Vegetation management within the RHCA and outside of 1.5 miles of an at-risk community (except for along evacuation and access roads) was excluded to simplify the purpose and need and the analysis.

Public Meetings

Public meetings were held during the evening of June 9 and during normal business hours on June22. No one from the public attended the June 9 meeting. A total of 35 people attended the June 22 meeting. and participated in informal discussions on the East Tumbull Project with members of the interdisciplinary team. Representatives of the Sunriver Community Wildfire Protection Plan team (Environmental Manager Kelly Walker; Sunriver CWPP-Team Leader) and the Bend Community Wildfire Protection team (Deschutes County Forester Joe Stutler; Bend CWPP-Team Member) were on hand to lend support and answer questions.

No negative oral or written comments were received during the meeting. The overwhelming majority of the attendees gave positive feedback to team members. The overall tone of the comments besides being positive centered on when on the ground fuels reduction efforts of thinning, mowing and underburning would begin. Follow up written comments were positive from attendees and no written negative comments were received from anybody who attended the public meeting.

Scoping (written comments)

ONRC On July 11, 2005 a letter from Chandra LeGue of ONRC's Western Field Office was received at the Bend/Fort Rock Ranger District. In the letter Ms. LeGue noted that "Tim Lillebo, ONRC's Eastern Oregon Field Representative has been involved in touring and commenting on this project throughout the public process." "Please defer to Tim if there are any inconsistencies in our comments."

Tree removal larger than 12 inches dbh. Ms. Chandra Legue, Mr. Tad Hodgert and Ms. Karen Coulter all expressed concern over commercial thinning and harvest of trees larger than 12 inches (or 8 inches) dbh.

In the letter and in support of Ms. LeGue's suggestion to not include tree removal "generally over 12 inches in diameter" numerous references are made to the July 2003 study *Rural Technology Initiative- Investigation of Alternative Strategies for Design, Layout, and Administration of Fuel Removal Projects* (Mason et al. 2003).

This study is not entirely comparable or applicable to the East Tumbull project.

The Mason et al. (2003) study modeled fire hazard reduction, economic cost, habitat protection and carbon sequestration for wildfires and for fuel reduction treatments. Forest inventory plot data from the Fremont and Okanogan National Forests were used in the study simulations. Four thinning regimes were modeled: 1) Removal of all trees 9 inches DBH and smaller (9 & Under); 2) Thin from below removing 50 percent of the existing basal area per acre (Half BA); 3) Thin from below with a residual BA of 45 square feet per acre favoring ponderosa pine and western larch (BA 45); 4) Removal of all trees 12 inches DBH and larger (12 & Over). In addition, a control was modeled (No Action), as was a crown fire representative of each forest (Wildfire). The study simulated treatments in the year 2000 and modeled stand vegetation and fuel recovery through 2030. The simulations were modeled with periodic maintenance underburning or other treatments to remove ingrowth and fuels (Without Regeneration) and without further treatments (With Regeneration).

The most effective thinning treatment modeled for fire hazard reduction in the study was the BA 45 without regeneration treatment, a thinning followed by periodic underburning to maintain the fuel reduction. The next best was Half BA without regeneration, followed by 9 & Under without regeneration. The 12 & Over regime, which simulates an overstory removal or economic harvest, did little to reduce fire hazard. The results may be viewed on pages 23 through 32 of the Mason et al. study, and more extensively in the Appendices.

The reason that few trees were removed that were larger than 12 inches in diameter in the most effective BA 45 thinning regime appears to because few plots used in the study had substantial numbers of trees larger than 12 to 14 inches in diameter. Generally, if a treatment retains the largest and best quality trees by thinning from below, the trees in the upper diameter classes would be kept, not harvested, unless they were not a favored species. This is true for both the BA 45 treatment and the East Tumbull treatments. In the Fremont data, of the 154 “high risk” (hazard) plots, only 2 percent of the trees were larger than 12” dbh. In the “moderate risk” category (236 plots) only 1 percent of the trees exceeded 12” dbh. In the “low risk” category (112 plots) 13 percent of the trees were larger than 12” dbh. Overall in the Fremont plots only an estimated 5 percent of the trees were > 12 inches. The quadratic mean diameter distributions may be seen in Appendix B of the study.

A similar diameter distribution exists in the Okanogan data. Of the 117 “high risk” plots, none of the trees were larger than 12” DBH. The largest quadratic mean diameter group in this category was 10 inches. In the moderate risk category (200 plots) again, no trees exceeded 12” DBH, as this was the largest diameter group represented. In the low risk category (117 plots) 15 percent of the trees were larger than 12” DBH. Overall in the Okanogan plots only an estimated 4 percent of the trees were larger than 12 inches. The diameter distributions may be seen in Appendix C of the study, pages C-1 to C-11.

In the East Tumbull project area, the commercial EA units would generally be thinned to 60 or 80 square feet (range 50 to 90 square feet) of basal area. The average residual mean diameter would average 16 inches in diameter with a range of 13 to 22 in the commercial thinning EA units. The number of trees retained within the commercially thinned EA units would average between 40 to 60 trees per acre.

Although the diameter distribution of the study and East Tumbull areas are dissimilar, some of the findings and concepts are applicable to the East Tumbull Project. A total of 19 (Chapter 2, Table 2-1) of the 42 EA units included in the East Tumbull project would not include removal of any trees larger than 12 inches in diameter. The 23 EA units that include removal of some of the trees larger than 12 inches in diameter as part of the proposed fuel reduction and forest health treatment would receive the same thin from below thinning prescription as the BA 45 thinning modeled in the Mason et al. (2003) study. Target residual basal areas however in the East Tumbull project area would be considerably higher due to site quaility. In a thin from below prescription, the higher the residual basal area is, the lower the emphasis is on removing larger diameter trees to achieve the target basal area. The average diameter of the harvested trees is estimated to be 11 inches.

The authors of the above study summarized their findings in a cover letter accompanying the publication, stating that "Computer generated thinning simulations show that harvests of smaller trees with retention of larger trees can substantively reduce risk of catastrophic wildfire." The target basal area in East Tumbull is 60 to 80 square feet per acre; the largest and best quality trees would be retained as the stands are thinned from below; all trees 21" dbh and larger would be retained, and ponderosa pine would be favored over other species. The effectiveness of these treatments is discussed in Chapter 3 under Issue #1, Fire/Fuels Hazard Reduction. The estimated reduction in fuel hazard and the time period of 15-20 years in which it remains effective are, on average, similar to those modeled for BA 45. An analysis of EA units (Appendix J) that are proposed for thinning of trees less than 21 inches in diameter, without removing any of the trees over 12 inches in diameter, shows that the residual basal area would not be reduced enough to meet the purpose and need of reducing crown fire, insect and disease risk to future forest values (Chapter 1).

Not all EA units would be thinned up to 21 inches dbh in order to meet the purpose and need. A total of 1,004 acres of thinning were identified that meet the purpose and need while responding to the suggestion to not remove trees over 12 inches dbh. An additional 535 acres of underburning and 45 acres of mowing would be done without any thinning. This is in addition to the previously approved but not yet completed underburning of 411 acres and 26 acres of mowing. In total, approximately 44 percent of the approved and planned vegetation management activity within the project area would not cut trees larger than 12 inches dbh.

Ms. LeGue also suggested the following: 1) Fuel reduction must focus on the smallest fuels and must consider the long-term costs of maintaining treatments. 2) Don't focus on reducing canopy fuels. 3) Fuel reduction thinning must retain enough trees to ensure long-term recruitment of future old-growth. 4) Disclose the effect of removing trees over 12 inches.

Response: 1/2) As discussed in Chapters 1 to 3, the East Tumbull project is an integrated fuels reduction project that thins from below and focuses on surface and ladder fuels reduction by a combination of mowing, prescribed burning, pruning and thinning 3) Pacific Northwest Region 6 Old Growth Definitions for the ponderosa pine series specify a minimum of 10 to 13 trees per acre. The retention on average of 40 to 60 trees per acre would ensure long-term recruitment of future old growth trees while allowing for some needed mortality to provide interim snag and down wood wildlife habitat. 4) The effect of removing trees over 12 inches in discussed at length in Chapter 3.

Ms. LeGue also included 6 comments under the header Fuels Reduction: General Principles.

Response: As discussed in this EA all of these comments including ensuring meaningful public participation, prioritizing treating high risk areas starting in the community zone, ensuring fuel reduction treatments are effective, including environmental safeguards, using rational and informed decision making and ensuring adequate funding have been the focus of this project and addressed.

Ms. Coulter provided suggestions for a wide range of concerns to include in the analysis of direct, indirect and cumulative effects as well as suggestions such as no thinning in critical elk habitat.

Response: Critical elk habitat was excluding from thinning (Chapter 2, Alternatives/Areas Dropped from Further Consideration). All other suggestions and concerns were addressed in Chapters 1 to 4.

National Environmental Fuels Association (NEFA) In addition to supporting the East Tumbull project the NEFA requested that: "Please, in developing and implementing this project, consider offering as much of the on-the-ground work, including prescribed fire, for bid by private contractors. This would apply to stewardship contracts on any other contract means suitable for the job."

Response: At this time the District plans on implementing different portions of the project with a diversity of contracting authorities. This mix will likely include contracts for mowing, thinning and piling. At this time the Deschutes National Forest has not contracted out the use of prescribed fire.

Ochoco Lumber Company (OLC) The OLC submitted a letter dated 7/1/05 supporting the proposed action and the purpose and need for the East Tumbull project.

American Forest Resource Council (AFRC) The AFRC submitted a letter dated 7/9/05 supporting the efforts to reduce the risk of catastrophic wildfire on the Westside of Bend and Sunriver.

Mr. Dean Richardson attended the June 22, 2005 meeting and expressed written support for Alternative 2.

Mr. James Hart of Sunriver attended the June 22, 2005 public meeting and wrote a letter to express his support for the East Tumbull HFRA project.

Ms. Wendy Larson and Mr. Jim Larson attended the June 22, 2005 meeting and expressed written support for the proposed project.

Table 4-1 Individuals, Organizations, Agencies, Tribes and Businesses (scoping list)

Tribes Consulted: Confederated Tribes of Warm Springs Department of Natural Resources c/o Mr. Clay Penhollow	 Confederated Tribes of Warm Springs Off Reservation Habitat Biologist c/o Mr. Scott Turo
Confederated Tribes of Warm Springs Depatment of Natural Resources c/o Ms. Fara Ann Currim	Burns Paiutes Tribe Cultural Resources c/o Ms. Beth Coahran
The Klamath Tribe Natural Resources Department c/o Mr. Elwood Miller	Burns Paiutes Tribe Natural Resources c/o Mr. Amos Firstraised
Burns Paiutes Tribe Tribal Council c/o Mr. Albert Teeman, Chairperson	
Organizations/Agencies/Businesses/Resorts Contacted:	
Ochoco Lumber Co. c/o Mr. John Morgan	American Forest Resource Council c/o Mr. Chuck Burley
The Bulletin c/o Ms. Lily Raff	KTVZ 21 Resort Broadcasting Company Bend, OR
Eastside Oregon Forest Protection Association Prineville, OR	Oregon Natural Resources Council c/o Mr. Tim Lillebo
Oregon Natural Resources Council, Eugene Office c/o Mr. Doug Heiken, Ms. Chandra LaGue	Deschutes River Conservancy c/o Mr. Scott McCaulou
The Wilderness Society NW Regional Office	Pacific Rivers Council Eugene, OR
Trout Unlimited c/o Mr. Eric Suhulz	Sierra Club – Juniper Group c/o Mr. George Wilson
Sierra Club – Juniper Group c/o Ms. Marilyn Miller	KFXO Mr. Andy Andrews
NEDC c/o Ms. Lauren Rule	OHA – Bend Chapter Mr. Steve Mathers
Forest Conservation Council Western Regional Office	John Muir Project c/o Mr. Simon Flory
Sunriver Anglers Sunriver, OR	Blue Mountain Biodiversity Project c/o Ms. Karen Coulter
Sunriver Owners Association c/o Mr. Kelly Walker, Environmental Director	Wild Wilderness c/o Mr. Scott Silver
Clean Air Committee c/o Mr. Greg McClarren	Central Oregon Flyfishers Bend, OR
Forest Service Employees for Environmental Ethic c/o Mr. Forrest Fleischman	Upper Deschutes Watershed Council c/o Mr. Ryan Houston

US Fish & Wildlife Service Portland, OR c/o Mr. Jeff Dillon	US Fish & Wildlife Service Bend, OR c/o Ms. Nancy Gilbert
Midstate Electric Coop, Inc. c/o Mr. Darwin Thurston	Earthjustice Legal Defense Fund c/o Mr. Randy Moorman
ODFW, Fall River Fish Hatchery c/o Mr. Phil Mckee	ODFW Bend Office, c/o Mr. Steve George, Mr. Glenn Ardt, Mr. Steve Marx
Central Oregon Running Club Bend, OR	Sunriver Fire Department c/o Mr. George Fox
Bend Fire Department/CWPP Team c/o Mr. Don Jensen	DEQ – Regional Office c/o Mr. Dick Nichols
Water Resources Department c/o Mr. Kyle Gorman	Cascadia Wildlands Project c/o Mr. Josh Laughlin
D.R. Johnson Lumber Company c/o Mr. Gerald Keck	Blue Ribbon Coalition c/o Ms. Joni Mogstad, Treasurer
Central Electric Cooperative, Inc. Redmond, OR	Oregon Department of Transportation, La Pine Office, c/o Mr. Swede Barber
Governor's Forest Policy Team Salem, OR	Bonneville Power Administration c/o Ms. Libby Johnson
Portland General Electric c/o Mr. Mike Livingstone	Oregon Department of Transportation, Bend Office, c/o Mr. Bob Bryant
Sunriver Public Affairs Committee c/o Mr. Frank Allen	Wild and Scenic Rivers Program American Rivers Washington, D.C., c/o Kristen McDonald
Pacific Corporation Portland, OR	Seventh Mountain Resort c/o Jim Kinney
Highlands at Broken Top c/o Ms. Deb Crowson	Wildfire Fuels Reduction c/o Mr. Jack Owen
Northwest Fire Service c/o Mr. Scott Benedict	Central Oregon Trails Alliance Mr. Kent Howes
Individuals Contacted:	
Mr. James D. Noteboom	Mr. Bruce McCullough
Dr. Stuart G. Garrett	Mr. David H. Tjomsland
Mr. Don Churchill	Mr. Bob Mullong
Ms. Carey A. Killen	Mr. Daylin Melhorn
Mr. Robert Speik	Mr. Gene Keane
Mr. Roger White	Mr. Paul Dewey
Ms. Kate Kimball	Ms. Cindi O'Neil
Mr. Michael W. Gendler	Mr. Tom Sedwick
Mr. Jon Cain	Mr. Lawrence Brumwell
Mr. Mark McGarigal	Mr. Tad Hodgert
Mr. Stan Summers	Mr. Lloyd Althison
Mr. Arlie Holm	Mr. James Farrel
Mr. Gary Zimmerman	Mr. Terry Skjersaa
Ms Cindy and Mr. Derek Bower	Mr. George Ward
Mr. Jim Terhaar	Mr. Paul Hammerquist
Ms. Susan Jane M. Brown	Ms. Joani Duford
Mr. James Hart	Mr. Dean Richardson
Mr. Mark Davis	Robert P. Davison
Mr. Jim & Ms. Wendy Larsen	Mr. Carl Jansen
Mr. Paul Hauser	Ms. Sue and Mr. Don Lukinbeal