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Final Environmental Impact Statement

West Bend Vegetation Management Project and Forest Plan Amendments

Bend/Ft. Rock Ranger District, Deschutes National Forest

Deschutes County, Oregon

Legal Location: T17S, R11E, S 32-34; T18S, R10E, Sections 8, 9, 12-15, 17, 19-30, 36; T18S, R11E, Sections 3-11, 14-23, 27-33; T19S, R10E, Sections 1; T19S, R11E, S 5-7; Willamette Meridian

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Final Environmental Impact Statement
West Bend Vegetation Management Project
Deschutes National Forest

Deschutes County, Oregon

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Abstract: This Final Environmental Impact Statement (FEIS) contains the Forest Service's proposal to implement timber harvest and fuels reduction that would move the area towards a more resilient landscape and provide a diversity of habitats closer to what historically occurred. The treatments would reduce forest density and fuels in order to promote and sustain late and old structured forest stands, and increase resilience to insects, disease, and stand-replacing wildfire. The project units are located within a 25,696 acre project area of Deschutes National Forest Lands adjacent to the western urban growth boundary of Bend within Deschutes County, Oregon. Four alternatives have been analyzed in this FEIS, a no action alternative and three action alternatives. Approximately 21,850 acres would be treated under Alternative 2 (Proposed Action), 21,817 acres would be treated under Alternative 3, and 21,509 acres would be treated under Alternative 4. Alternative 3 is the Forest Service preferred alternative.

Four Forest Plan Amendments (FPAs) would be required to implement any action alternative. The first FPA is proposed for the Deer Habitat Management Area (M7) to amend the General Theme and Objectives that about 30% of the area would provide thermal cover. Two FPAs are proposed for the Scenic Views Management Area (M9) foreground. The first would amend LRMP, S&G M9-27 to allow visible effects of harvest cleanup and fuels reduction for approximately five years rather than "… *not be visible to the casual forest visitor for one year after the work has been completed."* The second would amend LRMP, S&G M9-90 that would allow burning acreages that are larger than the "…*small, normally less than 5 acres,…*" as provided within the Scenic Views Management Area foreground. The last amendment is proposed for the Revised Eastside Screens Direction Concerning Timber Sales within LOS Stages that are below HRV "*…maintains moderately high levels of late and old-forest habitat because all Late and Old structure (LOS) stands are deferred from timber management, if not at or above HRV. …"*

READER'S GUIDE

This Final Environmental Impact Statement (FEIS) contains information about a project proposal that will reduce forest density and fuels in order to promote and sustain late and old structured forest stands, and increase resilience to insects, disease, and stand replacing wildfire.

The information in this FEIS is organized to facilitate consideration of the environmental effects by the public, and by the Forest Supervisor of the Deschutes National Forest, who is responsible for deciding whether or not to implement the Proposed Action or another alternative considered for this proposal.

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

Table of Contents: A table of contents is presented at the beginning of the document. Lists of tables and figures are also included.

Executive Summary: The summary of the FEIS provides a concise overview of the Purpose and Need for action, the Key Issues that became apparent during the 30-day public scoping period, and a comparison of the environmental effects of the alternatives.

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

Chapter 2 – Alternatives: Chapter 2 includes a description of the alternative development process, and discussions on alternatives and actions considered but eliminated from detailed analysis. The focus of this chapter is Alternatives Considered in Detail, including the No Action (Alternative 1), the Proposed Action (Alternative 2) as developed by the Forest Service that focused the analysis for this project, and two additional alternatives, Alternative 3 and Alternative 4, which respond to several planning issues. Mitigation measures to reduce potential resource impacts are documented in this chapter. Also included in this chapter is a comparison of alternatives that summarizes data in a table format. Finally, monitoring needs are presented at the end of this chapter that will provide important information regarding the specificity and effectiveness of treatments and mitigations.

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

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

Appendices: The appendices provide more detailed information to support the analyses presented in the EIS. Additional documentation, including more detailed analyses of project area resources, may be found in the project planning record located at the Bend/Ft. Rock Ranger Station in Bend, Oregon.

Acronyms used in this Document:

ACS	Aquatic Conservation Strategy
BA	Biological Assessment
BCC	Birds of Conservation Concern
BE	Biological Evaluation
BI	Beneficial Impact
BMP	Best Management Practices
BO	Biological Opinion
CEQ	Council on Environmental Quality
CFLRP	Collaborative Forest Landscape Restoration Project
CFR	Code of Federal Regulations
CWA	Clean Water Act
CWD	Coarse Woody Debris
CWM	Coarse Woody Material
CWPP	Community Wildland Protection Plan
DBH	Diameter at Breast Height
DEIS	Draft Environmental Impact Statement
DMR	Dwarf Mistletoe Rating
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act of 1973
FOFEM	First Order Fire Effects Model
FPA	Forest Plan Amendment
FS	Forest Service
FSH	Forest Service Handbook
FSM	Forest Service Manual
FSR	Forest Service Road
GIS	Geographical Information Systems
HRV	Historic Range of Variability
IDT	Interdisciplinary Team
INFISH	Inland Native Fish Strategy
IRA	Inventoried Roadless Area
KEHA	Key Elk Habitat Area
LFR	Ladder Fuels Reduction
LMZ	Lower Management Zone
LOS	Late and Old Structure

LRMP	Deschutes National Forest Land and Resource Management Plan
LMZ	Lower Management Zone
MA	Management Area
MIIH	May Impact Individuals or Habitat but Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species
MIS	Management Indicator Species
MST	Mechanical Shrub Treatment
NE	No Effect
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NHPA	National Historic Preservation Act
NI	No Impact
NOA	Notice of Availability
NOI	Notice of Intent
NWFP	Northwest Forest Plan
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
OHV	Off-Highway Vehicle
OSHA	Occupational Safety and Health Administration
PAG	Plant Association Group
PDC	Project Design Criteria
PETS	Proposed, Endangered, Threatened, and Sensitive Species
PFA	Post Fledgling Area
PM	Particulate Matter
PWA	Potential Wilderness Area
RHCA	Riparian Habitat Conservation Area
S&G	Standard and Guide
SDI	Stand Density Index
SSRA	Smoke Sensitive Receptor Area
TES	Threatened, Endangered, Sensitive
UMZ	Upper Management Zone
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
WUI	Wildland Urban Interface

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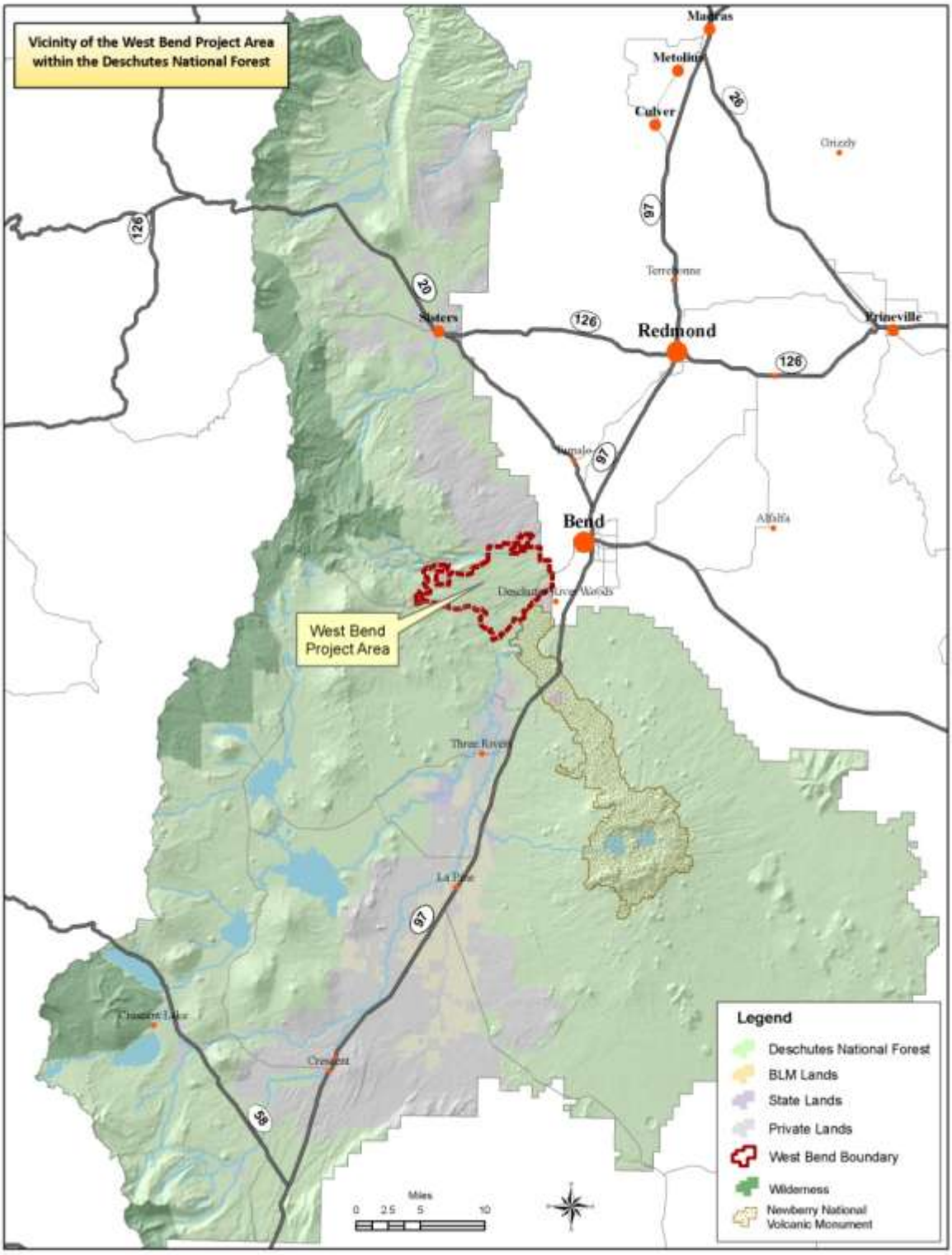


Figure 1: Vicinity Map for the West Bend Project Area, Deschutes National Forest, Bend, Oregon

Executive Summary

This Final Environmental Impact Statement (FEIS) discloses the effects of vegetation management and fuels reduction within the West Bend project area on the Deschutes National Forest. The 25,696-acre project area is in close proximity to the city of Bend, Oregon where residents and visitors enjoy numerous recreational activities such as mountain biking and Nordic skiing. Past logging practices and fire exclusion have led to conditions that put the forest at risk to insect, disease, and wildfire. The West Bend project is needed to create more resilient conditions, reduce wildfire hazard, and improve conditions for wildlife.

This section of the EIS will display a comparison of the actions proposed within alternative and a brief summary of the expected effects of those actions.

Table ES-1: Comparison of the Alternatives (see Chapter 2 and Appendix B for more detailed information on the actions included in each alternative).

Action	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)	Alternative 4 (acres)
Commercial harvest in combination with fuels treatment	0	14,475	14,522	12,167
Thinning within older plantations in combination with fuels treatment	0	2,302	2,302	1,806
Understory treatment e.g. pre-commercial thinning or ladder fuel reduction in combination with fuels treatment	0	652	827	1,143
Fuels treatment only e.g. mowing and/or prescribed burning	0	4,151	4,166	6,393
Total Activity Acres	**0**	**21,850**	**21,817**	**21,509**

Each action alternative includes resource protection measures and mitigation to reduce or eliminate unwanted effects such as restrictions on operations around riparian areas or steep slopes (FEIS pp. 52 - 62). Each action alternative also includes Forest Plan amendments (pp. 46-50): the first amends the general objective of Deer Habitat (MA-7) to have thermal cover present on 30% of the management area. The second two amendments are specific to the Scenic Views allocation (MA-9) and allow for the visual effects of prescribed underburning as well as prescribed underburning of areas greater than five acres to occur. The Eastside Screens are also amended to allow thinning within stands that have large tree structure where the existence of such structure is below the historic range of variability.

The alternatives vary by the amount of treatment, the exact location of treatments, and also the specific prescriptions to be applied during thinning. The alternatives were developed to address issue that arose during scoping. Chapter 1 of the EIS describes that issues raised by the public. For example, Key Issue #1 is a concern about creating variability and diversity in a landscape that is relatively homogenous; therefore Alternatives 3 and 4 include various stand-level resource objectives that will add a measure of variability in the thinning prescriptions.

Based on the purpose and need and response to issues, Alternative 3 is the Forest Service preferred alternative.

Table ES-2: Comparison of how the alternatives meet the purpose and need for action.

Purpose & Need	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Maintain or restore forest health				
Percentage of ponderosa area stands resistance to insect mortality (stocking level reduce below UMZ)	33%	86%	85%	73%
Percentage of ponderosa pine stands best suited to move towards LOS or continue to grow older (ponderosa pine open canopy; all sizes). HRV for open ponderosa is > 55%	32%	49%	48%	44%
Acres of increased resistance to fire mortality - ponderosa pine-dominated stands (increased growth and average diameter)	0 acres	13,235 acres	13,235 acres	10,418 acres
Treatment that will reduce mistletoe spread in ponderosa and lodgepole stands	No treatment to reduce spread of mistletoe	6,326 acres PP 1,519 acres in LP	6,271 acres PP 1,519 acres in LP	5,229 acres PP 1,519 acres LP
Reduce the threat of large scale wildfire				
Fire hazard rating (% project area)	57% low 36% extreme	87% low 1% extreme	87% low 1% extreme	87% low 1% extreme
Wildfire risk rating (burn probability) (% project area)	40% low	87% low	86% low	87% low
Contribute wood products and restoration work to the local and regional economy				
Timber volume produced	0 mmbf	31.2 mmbf	31.8 mmbf	26.4 mmbf
Jobs created or maintained	0	188	190	155

Chapter 3 of the FEIS describes the direct, indirect, and cumulative effects of implementing the actions. All alternatives treat a substantial portion of the project area to reduce risk of insect, disease, and wildfire. The effects on other resources such as wildlife and soil productivity as well as impact to recreational forest users is disclosed. The following summarizes some of the key findings.

Table ES-3: Summary of Environmental Consequences. The No Action (Alternative 1) would have no direct effects to any resources.

Resource	Alternative 2	Alternative 3	Alternative 4
Threatened Northern Spotted Owl	May Affect, Not Likely to Adversely Affect	May Affect, Not Likely to Adversely Affect	May Affect, Not Likely to Adversely Affect
Northern spotted owl Critical Habitat	May Affect, Not likely to Adversely Affect	May Affect, Not likely to Adversely Affect	May Affect, Not likely to Adversely Affect
Endangered Gray Wolf	No Effect	No Effect	No Effect
R6 Sensitive Lewis' Woodpecker	May Impact Long-term benefit to habitat	May Impact Long-term benefit to habitat	May Impact Long-term benefit to habitat on fewer acres
R6 Sensitive White-headed Woodpecker	May Impact Long-term benefit to habitat	May Impact Long-term benefit to habitat	May Impact Long-term benefit to habitat on fewer acres

Resource	Alternative 2	Alternative 3	Alternative 4
R6 Sensitive Pacific Fisher	No Impact	No Impact	No Impact
R6 Sensitive Crater Lake Tightcoil	No Impact	No Impact	No Impact
R6 Sensitive Evening Fieldslug	No Impact	No Impact	No Impact
R6 Sensitive Johnson's Hairstreak	No Impact	No Impact	No Impact
Big Game	Hiding cover retained in Thermal cover in MA7 reduced 1,124 acres 292 acres of Key Elk Area thermal cover reduced	Hiding cover retained and increased on 419 acres Thermal cover in MA7 reduced on 1,124 acres 292 acres of Key Elk Area thermal cover reduced	Hiding cover retained in Thermal cover in MA7 reduced on 419 acres 0 acres of Key Elk thermal cover reduced
Soil Productivity	85% footprint 12,830 acres mechanical treatment in areas of detrimental soil conditions	84% footprint 12,611 acres mech. treatment in areas of detrimental soil conditions	83% footprint 10,430 acres mech. Treatment in areas of detrimental soil conditions.
Water Quality	Reduction in risk to RHCA/RR on 202 acres Benefit to large woody debris and water temp. RMOs No measurable adverse effects to water quality	Reduction in risk to RHCA/RR on 202 acres Benefit to large woody debris and water temp. RMOs No measurable adverse effects to water quality	Reduction in risk to RHCA/RR on 202 acres Benefit to large woody debris and water temp. RMOs No measurable adverse effects to water quality
Potential Wilderness Areas	127 acres PWA impacted with harvest	127 acres PWA impacted with harvest	127 acres PWA impacted with harvest

CHAPTER 1
PURPOSE AND NEED

Chapter 1: Purpose and Need for Project

1.1 Introduction

This Final Environmental Impact Statement (FEIS) describes the Deschutes National Forest's proposal to conduct vegetation and fuels management in the West Bend project area which is intended to protect and maintain valuable natural resources and recreational opportunities. This project proposes to treat areas that will promote and sustain late and old structured forest stands, reduce susceptibility to bark beetles and dwarf mistletoe infestation, and reduce the fuels and resultant fire hazard within the West Bend project area.

The 25,696-acre West Bend project area is located to the west of Bend, Oregon and adjacent to its urban growth boundary. It is bounded by the Wildland Urban Interface (WUI) of Bend to the east; primarily the Deschutes River, Forest Road 41, and Highway 46 (Cascade Lakes Scenic Byway) to the south; Forest Service managed lands and private lands to the north ((north of Forest Road 4601 (Skyliner Road)); and the Bend Watershed Inventoried Roadless Area to the west. The legal description is:

- Township 17 South, Range 11 East, Sections 32-34
- T. 18 S., R. 10 E., Sec. 8, 9, 12-15, 17, 19-30, 36;
- T. 18 S., R. 11 E., Sec. 3-11, 14-23, 27-33;
- T. 19 S., R. 10 E., Sec. 1;
- T. 19 S., R. 11 E., Sec. 5-7.

The project area is very popular with recreationists with its proximity to the Cascade Lakes National Scenic Byway, Skyliner Road, and the city limits of Bend. These corridors provide access to many recreational opportunities. The area supports about 140 miles of biking, hiking, snowmobile, cross-country skiing, and snowshoeing trails where the Forest is the central component of the recreation experience. Areas adjacent to the streams are popular for day use, including sites along the Deschutes River such as Meadow and Lava Island. The popular Phil's Trailhead is located in the project area, which provides access to a large system of trails heavily used by mountain bike enthusiasts.

The project area lies primarily within the North Unit Diversion Dam 10th field watershed (about 21,000 acres) and the northern portion lies within the Tumalo Creek 10th field watershed (about 4,800 acres). The project overlaps 856 acres of the Upper Tumalo Creek 12th field watershed which is recognized as a Tier II Key Watershed within the area of the Northwest Forest Plan because of high water quality.

Changes Between Draft and Final EIS

Changes made within Chapter 1 of this FEIS were primarily clarifications of language and minor edits.

1.2 Context for Purpose and Need

Existing Forested Condition

Forested vegetation in the project area varies from east to west and south to north as the elevation rises from about 3,800 feet to 6,250 feet. Compared to the forest structure that would have been sustained historically, mid-seral stages are greatly over-represented and what was once mostly pure ponderosa pine forest in the lower 2/3 of the project area is now a mixture of lodgepole and ponderosa pine. Overstocking of the forest has led to competition and declining forest health. That coupled with heavy brush and fuels creates conditions that could support large-scale disturbance from insects, disease, or wildfire. The Deschutes National Forest Land and Resource Management Plan (LRMP, USFS 1990) as amended by the Eastside Screens and the Northwest Forest Plan (1994) provides the basis for actively addressing restoration towards the historic range of variability, increasing the long-term health and integrity of National Forest system lands, and supporting the economic and social needs of the public.

Much of the current condition can be attributed to historic forest management practices. A large portion of the project area was clearcut logged in the 1920s when owned by private timber interests. Large ponderosa pine that was once abundant on the landscape is now rare. The trees that have grown back since that time are now about 70-80 years old and very dense where thinning has not taken place. Fire exclusion has also played a role in the development of the current condition. Inventoried Roadless Areas (including the Bend Municipal watershed) and wilderness to the west of the project area have dense stands of timber with heavy surface fuel loadings. Due to prevailing weather patterns, these unmanaged forests pose a risk of wildfire moving into the West Bend planning area.

Following are brief descriptions of the current condition of each stand type.

- ***Ponderosa Pine:*** The typical stands of ponderosa pine were established in the last century and are mostly uniform, dense stands of blackbark ponderosa pine which provide a large continuous area of host for insects. Stands that need thinning are above the Upper Management Zone which puts them at risk of serious mortality from beetles. Many stands have been thinned at least once but are now stocked at a level where the trees exhibit low vigor and they are susceptible to bark beetle mortality. Mistletoe is prevalent in most areas. Understory brush, ladder fuels, and needle accumulation create a wildfire hazard.
- ***Lodgepole Pine:*** The lodgepole pine stands in West Bend Project area in the last decade have undergone a change in structure from heavily stocked stands of similar diameters and ages to a dominance of dead lodgepole pine killed by bark beetles over the last decade. The live trees in these areas are primarily smaller lodgepole with a few larger trees. In lodgepole pine stands that were regenerated (clearcut), the remaining seed trees (left to provide for the regeneration seed source) contain mistletoe that is infecting the younger trees.

  Lodgepole was historically confined to frost pockets or other harsh sites because of its prolific seed production and rapid growth. Areas of cold air drainage, unfavorable to ponderosa pine or white fir, were likely dominated by lodgepole. Most of the lodgepole-dominated stands found in the West Bend project area were less than 100 years old and single-aged due to the historical mortality cycles. Some areas of older lodgepole would develop when one or two fire cycles were missed. Because of a lack of fire, lodgepole is not limited to those areas and there is a large landscape of lodgepole pine that has been susceptible to beetles.
- ***Mixed Conifer:*** Management within the mixed conifer PAG is focused on the dry mixed conifer stands that have generally lost the dominance of large ponderosa pine. Historically these stands had fluxes of species mixes with ponderosa pine establishing and being dominant during dry periods and white fir becoming a component during moister cycles or fire free periods. A lack of fire has led to white fir becoming a larger component of stands. The white fir is not resistant to fire and not sustainable on drier sites.
- ***Mixed White Fir and Lodgepole Pine:*** These mixed conifer stands are dominated by white fir and lodgepole pine and have a heavy percentage of dead lodgepole pine, heavy understory stocking of lodgepole pine and white fir with highly variable crown density of fir. Some of these types of stands are also within wildland-urban interface.
- ***Riparian Areas:*** Riparian vegetation occurs in a narrow band along the Deschutes River, Tumalo Creek, a tributary to the Deschutes River, an unnamed stream draining Tumalo Lake, and a few seeps. Within the Deschutes River Riparian Habitat Conservation Area (RHCA), ponderosa pine stands exhibit similar fuels and stocking conditions to upland low elevation stands described above. The Riparian Management Objectives of INFISH for large woody debris and water temperature are not being met under current conditions along the Deschutes River. Aspen occurs in some of the seeps and because of a lack of fire, conifer trees have been encroaching which causes a loss of vigor in the aspen clone.

Active forest management as this plan calls for requires local mill infrastructure and a skilled contractor base. The ability to address forest health and fuels issues is directly tied to the existence of the infrastructure and workforce. Contributing wood products and jobs through this project will help to sustain that infrastructure.

Wildland Urban Interface (WUI) and Travel Corridors Fuels Conditions

Forestland, adjacent to the urban boundary of Bend, has "…been altered due to fire prevention efforts, modern suppression activities and a general lack of large scale fires…" (Greater Bend Community Wildfire Protection Plan, 2006). The eastern portion of the project area includes the 1990 Awbrey Hall Fire that burned over 3,000 acres and destroyed 22 homes. Since that time, there has been a substantial growth in population and subsequent development in the areas that border National Forest land. Past projects have addressed the need to reduce fuels in the wildland urban interface; however, the majority of previously treated areas were treated by thinning and mowing surface fuels. Mowing is effective for a short amount of time and needs to be repeated to maintain effectiveness. Others areas still have a need to be thinned in order to reduce ladder fuels as well as allow for maximum surface fuel treatments to occur. Continuing to protect private lands and provide opportunities for firefighters to safely manage a wildfire remains a priority in the area west of Bend (Greater Bend CWPP, 2006). The project area includes multiple important evacuation routes and ingress/egress corridors for homeowners, firefighters, and forest users. These corridors are in a variety of fuel conditions ranging from dense stands of mixed conifer and pine to more open stands. The majority of these stands have been excluded from any type of fire or fuels treatment and as a result bears heavy concentrations of brush and down woody material as well as ladder fuels.

Departure from Historic Range of Variability

Prior to fire suppression, surface fires would have controlled regeneration of fire-intolerant species, reduced density of small-diameter trees, consumed down wood, and opened stands to increased sunlight. These fires were predominantly low-severity fires that maintained the structural stages within the historic range of variability (HRV). Industrial logging[1] and fire exclusion have shifted the structural stages outside of the HRV. The largest departures are shown in the ponderosa pine, where large-diameter open ponderosa pine stands were once distributed across a larger proportion of the landscape but are now rare in the West Bend landscape. In their place are dense stands that originated from clearcut logging in the early part of the 20th century where the large trees were removed and stands were regenerated naturally or by planting. Other stands originated when fires burned through previously-harvested areas but did not regenerate until the 1950s or 1960s.

Shifts away from the HRV are evident in the plant associations that support ponderosa pine. Historically, ponderosa pine dominance spanned from the low areas in the east up into the mixed conifer areas (where lodgepole pine and white fir typically stocked the understory between fire cycles); only in a few places would old white fir or old lodgepole pine develop. Ponderosa pine was the dominant species because it was less susceptible to the frequent low intensity fire that would kill lodgepole and white fir. Late and old structure (LOS) open-canopy ponderosa pine was historically represented on 50 to 86% of the landscape. Currently, only 3% of the landscape is open-canopy LOS ponderosa pine.

The existing mixed conifer stands are in an area of relatively low precipitation (mixed conifer dry), which makes the current structure unsustainable. Much of the ponderosa pine was removed through past logging and has been replaced with faster-growing white fir and lodgepole pine leaving only a few remnant ponderosa pine trees in mixed conifer stands where historically, ponderosa pine was a much higher component.

[1] Much of the West Bend project area was once owned by private timber companies. Logging capitalized on ponderosa pine to meet the demands of the mills. The Forest Service took ownership of the land around 1944.

Management Direction

The Forest Plan supports proactive maintenance and enhancing the vigor of the forest in preventing a stand replacement event, rather than waiting. The goal for forest health under the Forest Plan is "to maintain and enhance the vigor of the forest ecosystem through the control of forest pests. The Forest Plan supports management of timber resources and recognizes the value in a way that is consistent with other resource objectives, environmental constraints, and economic efficiency (LMRP 4-37). The project area lies within various management allocations which help to guide management and define desired conditions through management area goals, objectives, and standards and guidelines. Table 1 lists the management allocations and the treatment objectives related to them; Section 1.7 describes the goal for each management allocation.

1.3 Purpose and Need for Action

Within the West Bend project area there is a need to restore the forest landscape toward more resilient conditions. Resilience to fire and insects is important so that disturbance events will not lead to uncharacteristic large-scale loss of forest. Creating a resilient forest allows for the development and maintenance of diverse wildlife habitats closer to what occurred historically, and contributes to a desirable recreation experience.

The purpose of the project is to 1) maintain and restore forest health; 2) reduce the threat of large scale wildfire effects to people, property, and important ecosystem components including habitat for interior forest wildlife species; 3) contribute wood products and restoration work to the local and regional economy; and 4) reintroduce fire in fire dependent ecosystems.

1.4 Proposed Action

Table 1, page 6, describes the project area divided into vegetation types and management objectives. Corresponding focal wildlife species are discussed for each vegetation type and the treatment methods that will be employed to address the management objectives and desired habitat conditions. Stand treatments would break up the fuel loads across the project landscape, particularly near high value areas, such as WUI, recreation sites, and important travel routes.

This proposed action involves active thinning and other harvest (commercial and noncommercial) over approximately 69% of the project area and fuels treatment, either in conjunction with thinning or stand alone, over approximately 86% of the project area. Details of this and the other alternatives are provided in Chapter 2.

To meet the purpose and need, objectives of the project are to:

- Use silvicultural treatments to provide a diversity of forest structure and associated wildlife habitats more in line with historical conditions.
- Use prescribed fire in fire-dependent ecosystems to create habitat conditions that will allow fire to perform its natural ecological function and more closely mimic natural processes that maintain desired structure and habitat.
- Reduce forest fuels with various techniques to maintain fuel profiles acceptable in a wildland-urban interface and along well-used public routes, as well as allow for the reintroduction of fire.
- Take advantage of opportunities resulting from vegetation management activities that offset costs and provide wood products, including saw timber, for the local economy. The project would potentially provide biomass as a byproduct of the fuels and forest health treatments, and could provide firewood opportunities.
- Amend the Forest Plan in order to implement these actions (FEIS, page 14).

Table 1: This table describes the treatment methods and objectives that are applied to stands within the various landscape areas and Forest Plan management areas that occur across the nearly 26,000-acre West Bend project area. Landscape areas are based on elevation and plant association group.

Landscape Area	Management Area(s)	Treatment Objectives, Methods, and Associated Wildlife Focal Species
Lower Elevation Ponderosa Pine	*Deer Habitat (MA-7)* *Scenic Views (MA-9)* *Wild and Scenic River (MA-17)* *Ryan Ranch Key Elk Area* *Eastside Screens*	Manage stands by thinning to reduce mountain pine beetle risk. Reduce dwarf mistletoe spread by reducing infection levels and increasing distance between trees. Increase resistance in stands to fire mortality by favoring fire-resistant species, removing lodgepole pine and retaining large diameter ponderosa pine. Reduce fire hazard by reducing shrubs and down fuels. Introduce prescribed fire and/or mowing into recently thinned stands. Reduce shrub densities to minimize nest predation for white-headed woodpecker (WHWO) by rodent population. Enhance palatable forage for mule deer. Develop old growth to provide foraging for pygmy nuthatch and chipping sparrow in the upper canopy. Recruit large snags over time for nesting WHWO. Retain unthinned areas for deer hiding cover and foraging habitat for WHWO. Highlight visibility of larger ponderosa pine for scenic view enhancement along Cascade Lakes National Scenic Byway. Thin within Riparian Habitat Conservation Area (RHCA) of the Deschutes River to promote fire and insect/disease resilience, promote riparian health and the development of large trees to provide shade and large wood recruitment (to help meet Riparian Management Objectives for large wood and water temperature), and reduce potential for adverse impacts to water from wildfire. Remove conifer encroachment in aspen stands; promote the regeneration and development of mature aspen to provide both nest and foraging habitat for red naped sapsucker.
Mid-Elevation Ponderosa Pine and Mixed Conifer Dry	*General Forest (MA-8)* *Northwest Forest Plan Matrix*	Manage stands to promote large ponderosa pine—thinning wide around the largest and most vigorous remnant ponderosa pine. Utilize variable density thinning to introduce structural diversity and accelerate the development of LOS ponderosa pine by reducing competition and increasing diameter growth. Gaps and patches will occur where white fir or lodgepole pine are removed simulating what may have developed with natural fire. Increase resistance in stands to fire mortality by leaving fire-resistant species, removing lodgepole pine and retaining large diameter ponderosa pine. Reduce fire hazard by reducing shrub and down fuels components and maintaining with fire or mowing. Help maintain and restore riparian vegetation and aquatic conditions in the watershed by reducing fuel loadings and thinning. Retain 15% of this habitat type untreated across area to provide foraging habitat for the northern goshawk and Williamson's sapsucker, including designated alternate goshawk nesting stands. Additionally, within larger blocks where existing retention patches are not mapped, 5-10% of each unit will be left in unthinned patches to provide for additional canopy cover diversity and areas where higher levels of mortality could occur. Long term objectives are to recruit large snags to provide nesting habitat for Williamson's sapsucker. Remove encroaching lodgepole pine to reduce fuel loading/ladder fuels.

Landscape Area	Management Area(s)	Treatment Objectives, Methods, and Associated Wildlife Focal Species
Mixed Conifer	*Winter Recreation (MA-13)* *General Forest (MA-8)* *Northwest Forest Plan AWD and Matrix*	Maintain ponderosa pine on the landscape through thinning mixed stands which can be returned to ponderosa-dominated stands as occurred historically. Conduct thinning and fuels reduction in white fir-dominated stands to favor ponderosa pine while leaving white fir in clumps for density and structure. All forest identified as nesting, roosting, and foraging (NRF) habitat for northern spotted owl will be retained. Retain areas identified as roosting and foraging habitat where they provide spotted owl connectivity. Where stands are heavy to ponderosa pine, to provide long-term large tree structure, remove white fir to release stress to large ponderosa pine in the stands. Where stands are an even mix of both white fir and pine, thin from below retaining both mid- to large-diameter pine and white fir to provide short-term foraging habitat for the pileated woodpecker and nest and foraging habitat for hermit thrush; while also promoting development of ponderosa pine to provide large tree habitat for flammulated owl that prefer LOS pines stand with a grassy understory; and lastly providing stands for northern spotted owl dispersal through the project area. Where stands are predominately white fir, thin it from below or leave untreated to provide pileated woodpecker habitat. Approximately 20% of this habitat type will be left untreated to provide foraging and nesting habitat for pileated woodpecker, and hermit thrush, and roosting and foraging habitat for northern spotted owl.
Lodgepole Pine	*Northwest Forest Plan Administratively Withdrawn Winter Recreation*	Maintain lodgepole pine in single age stands on the landscape. Remove dead trees and reinitiate stands with heavy beetle mortality. Conduct final removal in lodgepole shelterwood and seed tree stands. Thin younger stands of lodgepole to reduce densities for stand growth for larger diameter habitat in the future and improvement of scenic appearance and recreation opportunities. Retain 15% of regeneration units to provide habitat diversity and forage for American marten and black-backed woodpecker. Piling/burning or lop and scatter where strategically appropriate.

1.5 Scoping and Public Involvement

- A Notice of Intent (NOI) to prepare an environmental impact statement for the West Bend Vegetation Management Project was published in the Federal Register on Wednesday, November 24, 2010 (Vol. 75, No. 226, 71666-71668).
- A scoping letter, dated December 1, 2010, presented the proposed action to a total of 102 Tribal members, individuals, organizations, and other agencies. The NOI and scoping letter were also posted to the Forest Service web site. An article in the newspaper of record occurred on December 11, 2010 providing information regarding the proposed action.

  The scoping letter resulted in nine responses from individuals, organizations, and agencies. All comments were considered and categorized as either a key issue, analysis issue, or a non-significant issue that will not be considered further. This categorization is located in the project file. The key issues were used in developing alternatives (see following section).
- The project was announced in the January 2011 issue of the *Schedule of Projects for the Deschutes and Ochoco National Forests and Prineville District BLM* and project information has been posted to the Forest Service web site.
- A public open house occurred on May 18, 2011 at the Bend-Ft. Rock District office to provide interested citizens an opportunity to learn about the project, alternative methods of vegetation management being considered, collaborative aspects of the project, and opportunities for involvement. This forum provided an opportunity to discuss the project with members of the interdisciplinary team (IDT). An announcement for the open house was sent on May 5, 2011 by the Forest Service to those that were sent the scoping letter and those that had responded. A short article the day of the open house, May 18, 2011, was published in the newspaper of record. Sixteen members of the community attended.
- On June 6, 2012, the Forest hosted a field trip and meeting with the Deschutes Collaborative Forest Project's restoration subcommittee and steering committee to discuss restoration recommendations.
- A letter dated October 22, 2012 was sent to the project mailing list and posted to the web. The letter described the alternatives being analyzed in the DEIS and provided an update on the project status.
- A field meeting was held with an adjacent landowner on October 23, 2012 and another adjacent landowner on October 25, 2012 to discuss the Forest Service proposals for treatment in those areas that could affect those private lands.
- This project is a part of the greater Deschutes Collaborative Forest Project, which is a Collaborative Forest Landscape Restoration Act Project (http://www.fs.fed.us/restoration/CFLRP). Congress passed the CFLR Act in 2009. It encourages collaboration to restore forests at a landscape-scale. In 2010, the Secretary of Agriculture and the CFLR Advisory Committee selected the Deschutes Skyline Project (130,000 acres) for restoration activities. The collaborative group has developed recommendations for restoration in second-growth ponderosa pine, mistletoe-infested stands, and dry mixed conifer stands, as well as recommendations for considering recreation and tourism values during planning and implementation of restoration projects. The recommendations are included in the project file. The collaborative group has also been conducting public outreach activities to spread the word about forest restoration and the West Bend project.
- Additional outreach has taken place with recreation stakeholders in the project area, such as with Meissner Nordic, Central Oregon Trail Alliance, and the Trail User Group.
- A public comment period was provided on the Draft EIS in April 2013. See Chapter 4 and Appendix G for more information the public comment period, including responses to substantive comments.

1.6 Planning Issues

Issues are points of discussion, debate, concern, or dispute about environmental or social effects that may occur as a result of the proposed action. Issues provide focus and influence alternative development, including development of mitigation measures to address potential adverse effects. Issues are also used to compare the effects between the proposed action and the alternatives regarding a specific resource element. Issues are generally divided into Key Issues and Analysis Issues.

1.6.1 Key Issues

Key issues are those that represent a point of debate or concern that cannot be resolved without consideration of the trade-offs involved. These issues spur the design of alternatives to the proposed action that provide a different path to achieve project objectives. Trade-offs can be more clearly understood by developing alternatives and displaying the relative impacts of these alternatives weighed against the proposed action.

Key Issue 1: Variability in Thinning Approach on the Landscape

A variety of scoping responses were received that deal with the notion of landscape-scale variability and concerns with creating or maintaining a homogenous forest. Some members of the public expressed the desire for diversity and variability in how thinning is applied. Past management has created a relatively homogenous landscape and the actions proposed will work towards introducing structural diversity.

To respond to this issue, however, the interdisciplinary team identified additional stand-level objectives that could be applied to the treatment units. The silvicultural treatments that will meet those stand-level objectives, can then also lead to more diversity and variability. These objectives will be applied to Alternatives 3 and 4, and are described below with measurements used to display the difference in alternatives:

1a. Enhance habitat for *Castilleja chlorotica*. Small populations of the R6 Sensitive plant species green-tinged paintbrush *(Castilleja chlorotica)* are present within the project area. This species is closely associated with bitterbrush and open areas in the dry ponderosa pine plant association. In the areas where these populations exist, the tree canopy is limiting the potential for this species to thrive. To provide a more desirable habitat, thinning prescriptions will be modified and fire excluded (on 1,268 acres in Alternative 3 and 1,094 acres in Alternative 4) to create openings of 2 to 6 acres each.

Measurement: The number of acres that would be treated to meet the objectives of increasing populations of *Castilleja chlorotica*.

1b. Create hiding cover patches for mule deer. Some stands within Deer Habitat (M7) provide cover but are underutilized due to large stand acreages. The interior of the stands do not provide forage, which is an essential component of cover. In order to have a more optimum cover/forage ratio, it is necessary to create openings in the canopy cover, increasing the potential utilization of the stand through an increase in forage and edge effect. Alternatives 3 and 4 will modify the prescriptions to create small openings (of 0.5 to 10 acres each) for increased forage and to provide nearby hiding cover in the future. Small openings would be planted with ponderosa pine seedlings.

Measurement: The number and size of openings created for mule deer habitat.

1c. Promote sun-lighting on the highway. To add more variety in thinning prescriptions, the Scenic View corridors along Highway 46 and Skyliner Road (4601) will be thinned heavier to promote a more open character. By thinning heavier along these roads there is an added benefit of more sunlight reaching the pavement. All units along these roads would be thinned in such a way under both Alternative 3 and 4.

Measurement: Number of areas that could be thinned to increase sunlight on the road.

1d. Promote spotted owl connectivity habitat. Habitat for the Northern spotted owl is limited within the project area. Nesting, roosting, and foraging habitat occurs on a limited basis and is primarily associated

with mixed conifer wet stands. Although NRF habitat is limited, there are other stands within both mixed conifer wet and dry which provide structure for roosting and foraging, but no large tree component to provide nesting. To promote connectivity habitat (additional areas of roosting and foraging) in a north south continuum, thinning in mixed conifer under Alternatives 3 and 4 will favor ponderosa pine while retaining 20 percent in white fir clumps for density and structure.

Measurement: Number of acres that would be treated to enhance future connectivity habitat.

Key Issue 2: Lodgepole Pine Overstory/final Removal Treatments

Under Alternative 2, overstory removal is planned in 28 stands dominated by lodgepole pine which have a well-stocked understory of seedlings and saplings. Typically in these stands the live overstory is infected with mistletoe, is of poor condition with small crowns, and is at risk to mountain pine beetle. A total of 824 acres of overstory removal is proposed. Some commenters requested that an alternative be developed that foregoes these treatments because it could remove "large woody structure that is valuable for complex forest development and wildlife such as black-backed woodpeckers." Alternatives 3 and 4 address this issue by changing the prescription on 225 acres from overstory removal through harvest, to girdling of the overstory.

Measurement: Acres of existing lodgepole pine overstory treatments by removal and by girdling.

Key issue 3: Mature Trees in Wet Mixed Conifer PAG

In the wet mixed conifer (dominated by white fir and ponderosa pine), Alternative 2 would remove white fir in favor of ponderosa pine, regardless of size, particularly where ponderosa pine would have dominated historically. All of these stands occur within the area of the Northwest Forest Plan. Because treatments under Alternative 2 would remove white fir regardless of size, many large trees that could provide potential habitat would be removed. Some members of the public want to see larger trees retained. The IDT designed Alternatives 3 and 4 to retain all white fir greater than or equal to 24 inches diameter at breast height (DBH).

Measurement: Acres of mixed conifer wet plant association group managed by alternative.

Key issue 4: Goshawk Habitat Management

Within the mid-elevation ponderosa pine and mixed conifer zone, two historic northern goshawk territories exist. Based on survey information, there has not been an active nest in either site for at least five years and there is no requirement to manage the territories, which all occur within the Northwest Forest Plan area. Although these territories are not currently active, they do provide suitable nesting habitat for goshawk and are proposed for management to promote long-term nesting and post fledging habitat. The proposed action will thin across the historic territories to develop LOS ponderosa pine.

This was identified as a key issue because some members of the public are opposed to seeing any management in the historic goshawk habitat areas. Alternatives 3 and 4 were designed to take a different approach to management in the historic goshawk areas by avoiding treatment in the historic 30-acre nest areas and modifying prescriptions, in a radiating fashion from the nest stand out. Reference the description in Appendix B for prescription specifics.

Measurement: Acres of historic goshawk PFA treated and by what method.

Key issue 5: Ryan Ranch Key Elk Area Thermal Cover

The proposed action would thin, mow and/or burn 292 acres (0.58%) of the 5,000-acre Ryan Ranch Key Elk Area. All existing hiding cover will be retained; thermal cover will be reduced by approximately 180 acres but still remain within standards and guidelines of the Forest Plan. Some scoping responses requested that the Forest analyze an alternative that retained all thermal cover within the KEA. Alternative 4 was designed to retain existing blocks of thermal cover in the KEA.

Measurement: Percent of project area with thermal cover in Key Elk Habitat prior to and following treatment.

Key issue 6: Winter Range (MA-7) Thermal Cover

The LRMP General Theme and Objectives for MA-7 state "Ideally, cover and forage areas should be in close proximity for optimum use by big game, with cover making up 40 percent of the land area. Approximately three-quarters of cover areas should be thermal cover with the remainder being hiding areas. Some stand conditions may satisfy both kinds of cover."

Approximately 12% of the project area provides thermal cover. The thermal cover is in a transition area where deer migrate from south to north to the Tumalo Winter Range. Trees in the area are in need of thinning, but thinning treatments would further reduce this available thermal cover which would necessitate a Forest Plan Amendment. Alternative 4 was developed to drop thinning treatments in the thermal cover in MA-7, but still requires an amendment because of small group opening units. None of the alternatives would reduce hiding cover, which will remain at 31% in the project area.

> ***Measurement***: Percent of Deer Habitat Management Area (MA-7) with thermal cover prior to and following treatment.

1.6.2 Analysis Issues

Analysis issues are environmental components that are considered in the Chapter 3 analysis. These issues are used as a way to compare the alternatives, though they did not result in differing design elements between alternatives. These issues: 1) are generally less focused on the elements of Purpose and Need, than are the Key Issues; 2) reflect the discussions of the effects of the proposed activities to those resources; and 3) are important for providing the Responsible Official and public with complete information about the effects of the project.

Wildlife: The West Bend project area provides habitat for a number of species, including R6 Sensitive species. The wildlife section in Chapter 3 separates the analysis into groups of species and habitat elements as follows:

- Threatened, Endangered, Candidate and Sensitive Species
- Management Indicator Species
- Neotropical and Migratory Bird Species
- Survey & Manage Species
- Late and Old Structure Forest Habitat
- Late and Old Structure Connectivity
- Snags, Coarse Woody Material, and Green Tree Snag Replacements

Smoke and Air Quality: The EPA and Deschutes County officials commented during scoping that the Forest should strive to minimize smoke in proximity to Bend and to consider health and environmental effects of smoke and burning. Utilization should be emphasized over burning slash on site wherever possible. This project will emphasize utilization wherever possible, but there will be some materials that cannot be utilized. One member of the public objected to any use of fire in the project at all because of the smoke it creates. Burning is conducted under smoke management rules in order to comply with the Clean Air Act. The smoke management program is described in Chapter 3, including measures employed to reduce emissions and ensure smoke dispersion. Chapter 3 also includes an analysis of the potential impacts of burning such as production of particulate material.

Botany: Potential effects to Proposed, Endangered, Threatened, and Sensitive (PETS) plant species were considered. The Sensitive plant green-tinged paintbrush (*Castilleja chlorotica*) is the only known Sensitive plant species found in the project area. A biological evaluation considers the potential impacts to PETs plants and their habitat.

Invasive Plants: Proposed management activities have the potential to spread invasive plants or create

disturbed ground that could allow the introduction of invasive plants into areas that aren't currently infested. The analysis in Chapter 3 considers the risk of introduction and spread and assesses prevention measures that are intended to reduce that risk.

Recreation: Proposed activities would provide for public safety for those utilizing developed and dispersed areas of the project area. Actions also have the potential to impact Forest visitors by displacing them during operations, to affect the trail system with equipment, and to create visual and aesthetic changes adjacent to trails and recreation sites. The EIS considers potential impacts to recreational use, particularly along summer biking trails and winter Nordic trails and describes the project design that will minimize impacts, such as maintaining trees that define a trail.

Soil Quality: Soil quality is addressed through the analysis of project activities and their effects to soil resources. Detrimental effects are avoided, minimized, or mitigated so that, following the close of activities, soil quality is maintained or enhanced and conditions are consistent with LRMP Standards and Guides.

Potential Wilderness Inventory: Areas that meet criteria for the inventory for wilderness potential are displayed and the potential for project activities to affect the wilderness potential inventory is assessed.

Cultural Resources: The proposed management activities have the potential to either affect known existing historic and pre-historic sites. Where proposed ground-disturbing activities, such as commercial harvest, have the potential to impact cultural resources, these activities have been designed to avoid or to be conducted in a way that avoids impacts to sites.

Water Quality and Fisheries: The Deschutes River is considered water quality impaired because several parameters exceed State of Oregon standards. Project activities are assessed for their ability to maintain or improve water quality. Project activities would be directed to protect or improve the water quality and fisheries and expected to provide long-term enhancement and protection of shade and instream wood habitat. Potential effects to Proposed, Endangered, Threatened, and Sensitive (PETS) fish species were considered in a Biological Evaluation. The Sensitive redband trout (*Oncorhyncus mykiss gairdneri*) is the only known PETS fish species found in the Deschutes River adjacent to the project area.

Transportation: Transportation is discussed in relation for the need to access to and from project activities.

Economics: The associated costs and the viability of the timber sales are displayed and discussed. The potential volume to be offered and associated job creation are analyzed and disclosed.

1.7 Planning Framework

Development of this Environmental Impact Statement follows implementing regulations of the National Forest Management Act (NFMA); Title 36, Code of Federal Regulations, Part 219 (36 CFR 219); Forest Service NEPA Regulations Title 36, Code of Federal Regulations, Part 220 (36 CFR 220); Council of Environmental Quality NEPA Regulations, Title 40; CFR, Parts 1500-1508. This section describes applicable Forest Plan management direction and policy, as well as current laws, regulation, and executive order.

1.7.1 Deschutes National Forest Land and Resource Management Plan

This environmental impact statement is tiered to the Final Environmental Impact Statement (FEIS) for the Deschutes National Forest Land and Resource Management Plan (1990), as amended, guides all natural resource management activities and provides standards and guidelines for the Deschutes National Forest. The West Bend project area includes the following Management Areas (refer to Table 3 and Figure 2):

Deer Habitat (MA-7 – 8,374 acres): The goal of Deer Habitat is to manage vegetation in order to provide optimum habitat conditions on deer winter and transition ranges, while providing some domestic livestock forage, wood products, visual quality, and recreation opportunities. (Forest Plan, page 4-113)

General Forest (MA-8 – 6,412 acres): Within General Forest, timber production is to be emphasized while providing forage production, visual quality, wildlife habitat, and recreational opportunities for public use and enjoyment. The objective is to continue to convert unmanaged stands to managed stands with the aim of having stands in a variety of age classes with all stands utilizing the site growth potential. This is achieved through stand treatments which include (but are not limited to) controlling stocking levels; maintaining satisfactory growth rates; protecting stands from insects, disease, and damage; controlling species composition; and regenerating stands that are no longer capable of optimum growth performance. (LRMP, page 4-117)

Scenic Views (MA-9 – 5,700 acres): The project area contains retention and partial retention scenic views. The goal of scenic views is to provide high quality scenery representing the natural character of central Oregon. The general theme and objectives of scenic views is for landscapes seen from selected travel routes and use areas are to be managed to maintain or enhance their appearance. To the casual observer, results of activities either will not be evident, or will be visually subordinate to the natural landscape. Timber harvest is permitted, but only to protect and improve the visual quality of the stands both now and in the future. For species other than ponderosa pine, the desired condition requires obtaining visual variety through either spatial distribution of age classes and species mixes, through density manipulation, or through a mixture of age classes within a stand. Standards and guidelines restrict the amount of prescribed burning that can be conducted within this allocation (LRMP, page 4-121).

Intensive Recreation (MA-11 – 1,035 acres): To provide a wide variety of quality outdoor recreation opportunities within a Forest environment where the localized settings may be modified to accommodate large numbers of visitors. The recreation opportunities will include, but not be limited to, activities dependent on various intensities of development. Opportunities for participation in a broad range of outdoor recreation activities will be available. (LRMP, page 4-135)

Winter Recreation (MA-13 – 2,654 acres): Quality winter recreation opportunities within a forest environment that can be modified for visitor use and satisfaction will be provided. Facilities and evidence of man will be present. Roads, vegetation management, and other development activities are permitted but only as necessary to enhance the winter recreation opportunities. Social contact will vary but high social contact could be expected in some areas and during some portions of the winter use season. Facilities for tubing and sledding can be developed. Some areas will be closed to motorized use. This area is available for geothermal leasing. (LRMP, page 4-143)

Wild and Scenic Rivers (MA-17 – 841 acres): The Deschutes River forms a portion of the project area boundary and is within Segment 4 of the Upper Deschutes Wild and Scenic River. Both Scenic and Recreation designations are within the project area. The Outstandingly Remarkable Values within Segment 4 are Geologic, Fishery, Vegetation, Wildlife, Cultural, Scenic, and Recreation (USDA 1996).

Other Ownership (MA-30 – 617 acres): Other ownership is non-forest lands (not federally owned or managed) within the project boundary.

Table 2: LRMP Management Areas in the West Bend Project Area

Deschutes LRMP Management Areas	Acres in Project Area
Deer Habitat (MA-7)	8,374
General Forest (MA-8)	6,411
Scenic Views Retention Foreground (MA-9)	3,432
Scenic Views Partial Retention Foreground (MA-9)	239
Scenic Views Retention Middleground (MA-9)	2,030
Intensive Recreation (MA-11)	1,035
Winter Recreation (MA-13)	2,654
Wild and Scenic River (MA-17)	841
Front County Seen (MA-18)	65
Other Ownership	617
Total Project Area Acres	**25,698**

Other LRMP Direction

Ryan Ranch Key Elk Area (5,002 acres): Elk are found in certain key habitat areas and management will provide conditions needed to support certain numbers of summering and wintering elk. The KEA is in the southeast portion of the project area with a small portion extending to the north of Highway 46. It overlaps other management allocations. (LRMP, page 4-55 and 56)

1.7.2 Amendments to the Deschutes Land and Resource Management Plan

Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales (Eastside Screens)

Approximately one-half of the project area lies east of the spotted owl range and therefore outside the management direction of the Northwest Forest Plan. This area is subject to the Eastside Screens. The Eastside Screens amendment was the result of a large-scale planning effort to determine the best approach for maintaining future options concerning wildlife habitat associated with late and old structural stages, fish habitat, and old forest abundance. The Eastside Screens contain guidelines for management of timber sales in late-old structure (LOS) relative to the Historic Range of Variability (HRV), wildlife corridors, snags, coarse woody debris, and goshawk management. Although intended as interim direction in 1995, it remains an applicable amendment to our LRMP.

Inland Native Fish Strategy (INFISH)

The riparian management guidelines of the Forest Plan were amended by the Inland Native Fish Strategy (INFISH, 1995). INFISH was intended to be interim direction to protect habitat and populations of resident native fish and to provide for options for management. The INFISH delineated RHCAs where riparian-dependent resources receive primary emphasis. These RHCAs include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems. These areas will be managed to maintain or restore water quality, stream channel integrity and channel processes, sediment regimes, in stream flows, diversity and productivity of plant communities in riparian zones, and riparian and aquatic habitats to foster unique genetic fish stocks that evolved within the specific region. RHCAs run through and are overlaid on other allocations.

This management direction applies to activities within the RHCA of the 4.8 miles of the Deschutes River and 2.4 miles of Tumalo Creek that are within or adjacent to the project area, as well as to activity within areas outside the RHCAs that could degrade it. No activities are proposed within the RHCA of Tumalo Creek; activities within the RHCA of the Deschutes River are discussed in Chapter 3.16. The West Bend project does not involve priority watersheds under INFISH.

Northwest Forest Plan

In 1994, the Record of Decision for Amendments to the Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (USDA 1994) amended the LRMP. Standards and Guidelines from the Deschutes LRMP (USDA 1990) apply where they are more restrictive or provide greater benefits to late-successional forest related species than other provisions of the NWFP S&Gs (NWFP, page C-2).

A small portion of the project lies within the Upper Tumalo Creek 12th field watershed is which a Tier II key watershed. The NWFP requires watershed analysis to be completed prior to any timber harvest in key watersheds. A watershed analysis was updated for the area (USFS 2008). Less than 1 mile of Tumalo Lake Creek occurs in the project area; fuel treatments are proposed within the riparian reserve of Tumalo Lake Creek.

The following NWFP Land Allocations occur within the project area (Refer to Figure 3):

Administratively Withdrawn (2,658 acres): Administratively Withdrawn areas are identified in current Forest Plans and include recreation and certain visual retention and riparian areas, and other areas where management emphasis precludes scheduled timber harvest and areas which are not included in calculations of allowable sale quantity (NWFP C-19). In the West Bend project area, the Winter Recreation LRMP management area is considered Administratively Withdrawn.

Matrix (6,277 acres): The matrix consists of federal lands outside the categories listed above. Most timber harvest and other silvicultural activities would be conducted in that portion of the matrix with suitable forest lands, according to standards and guidelines (NWFP C-39). Fire and fuels management in the matrix can reduce the risk of fire and other large-scale disturbances that would jeopardize the reserves (NWFP B-8).

Production of timber and other commodities is an important objective for the matrix. However, forests in the matrix function as connectivity between Late-Successional Reserves and provide habitat for a variety of organisms associated with both late-successional and younger forests. Standards and Guidelines for the matrix are designed to provide for important ecological functions such as dispersal of organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components such as down logs, snags, and large trees. The matrix will also add ecological diversity by providing early successional habitat (NWFP, B-1 and B-2).

Riparian Reserves (440 Acres): As part of the Aquatic Conservation Strategy (ACS), Riparian Reserves provide an area along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian Reserves are important to the terrestrial ecosystem as well, serving, for example, as dispersal habitat for certain terrestrial species. Within the project area Riparian Reserves exist adjacent to Tumalo Lake and the unnamed stream that drains it, Tumalo Creek, seeps, and along intermittent streams. Project activities must not retard or prevent attainment of ACS objectives.

Table 3: Northwest Forest Plan Allocations within the West Bend Project Area

Northwest Forest Plan Allocation	Acres
Matrix	6,277
Administratively Withdrawn	2,658
Other Ownership and Outside of NWFP	16,761
Riparian Reserves (overlays other allocations)	440
Total Project Area Acres	**26,136**

Figure 2: Deschutes National Forest Land and Resource Management Plan Management Areas

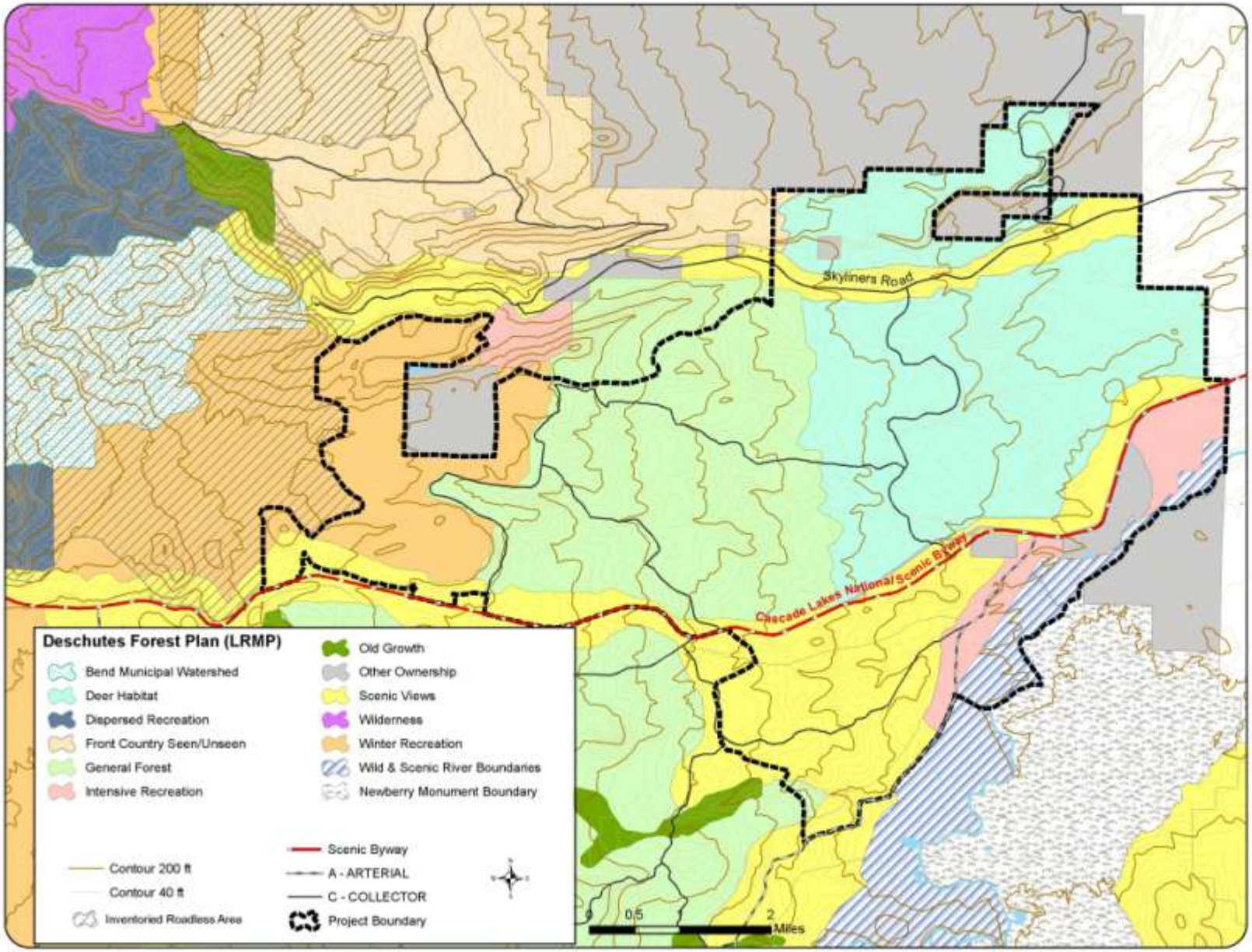
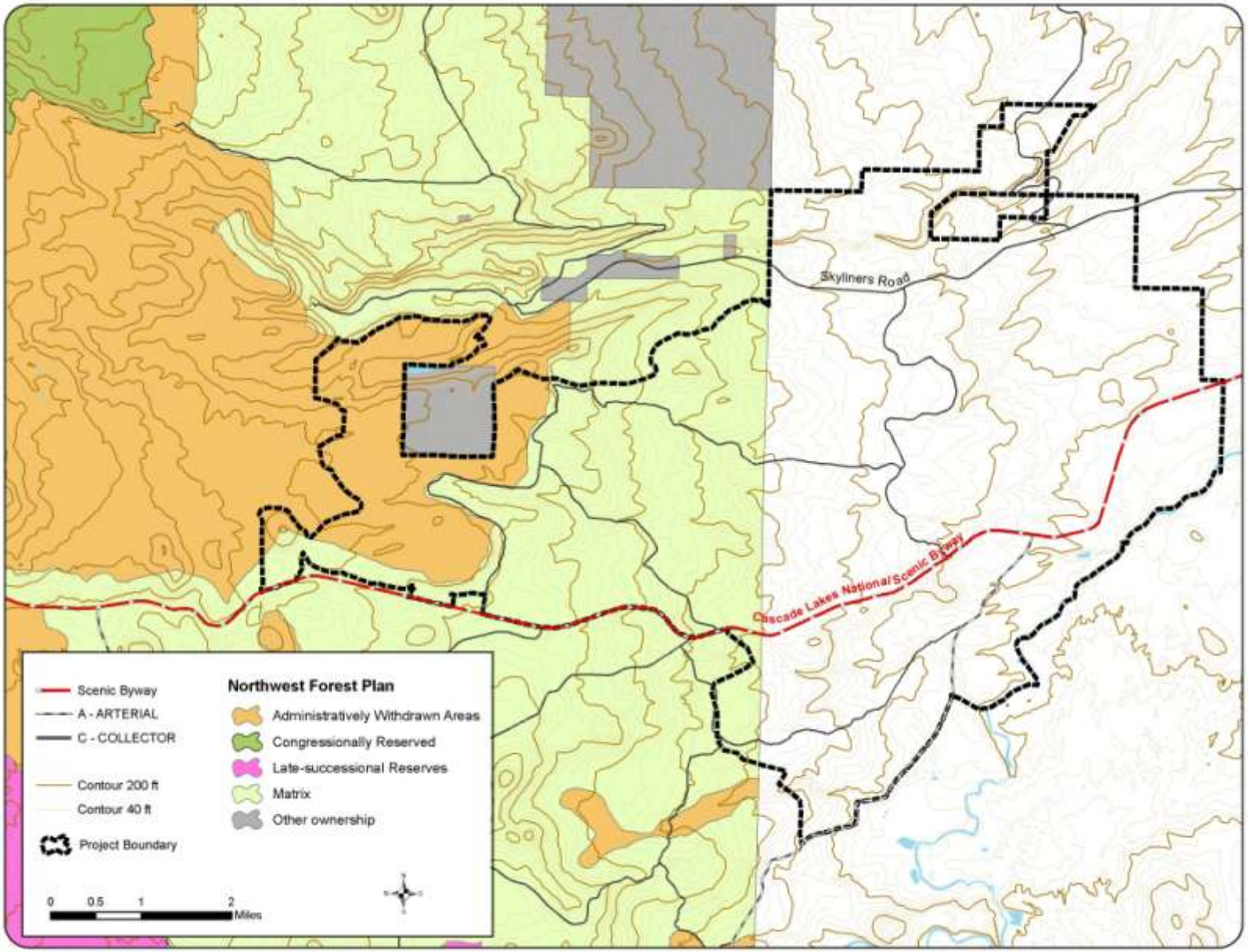


Figure 3: Northwest Forest Plan Allocations



1.8 Other Law, Regulation, Policy

Analysis and documentation has been done according to direction contained in the National Forest Management Act, the National Environmental Policy Act, the Council on Environmental Quality regulations, National Environmental Policy Act (NEPA) regulations, The Endangered Species Act, Magnuson-Stevens Fishery Conservation And Management Act of 2000, the National Historic Preservation Act, the Clean Air Act, and the Clean Water Act, and the Rescissions act, Public Law 104-19, Section 504. Following are brief explanations of each of these laws and their relation to the current project planning effort.

The American Antiquities Act of 1906: The American Antiquities makes it illegal to appropriate, excavate, injure, or destroy any historic, prehistoric ruin or monument, or any object of antiquity, situated on lands owned by the Government of the United States, without permission of the Secretary of the Department of the Government having jurisdiction over the lands on which said antiquities are situated.

The National Historic Preservation Act of 1966, as amended: The National Historic Preservation Act (NHPA) requires Federal agencies to consult with American Indian Tribes, State and local groups before nonrenewable cultural resources, such as archaeological and historic structures, are damaged or destroyed. Section 106 of this Act requires Federal agencies to review the effects project proposals may have on the cultural resources in the Analysis Area.

The Endangered Species Act of 1973, as amended: The Endangered Species Act (ESA) is to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such tests as may be appropriate to achieve the purpose of the treaties and conventions set forth in subsection (a) of this section." The Act also states "It is further declared to be the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act."

The National Environmental Policy Act (NEPA) of 1969, as amended: The National Environmental Policy Act is "To declare a national policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nations; and to establish a Council on Environmental Quality" (42 U.S.C. Sec. 4321). The law further states "it is the continuing policy of the Federal Government, in cooperation, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the present and future generations of Americans. This law essentially pertains to public participation, environmental analysis, and documentation.

The Council on Environmental Quality (CEQ) promulgated the regulations for implementing NEPA (40 CFR parts 1500-1508). The CEQ has recently provided guidance on considering past actions in cumulative effects analysis (Memo to Heads of Federal Agencies, June 24, 2005).

The National Forest Management Act (NFMA) of 1976: The National Forest Management Act guides development and revision of National Forest Land Management Plans and has several sections to it ranging from required reporting that the Secretary must submit annually to Congress to preparation requirements for timber sale contracts. There are several important sections within the act, including Section 1 (purpose and principles), Section 19 (fish and wildlife resources), Section 23 (water and soil resources), and Section 27 (management requirements).

Multiple-Use Sustained-Yield Act of 1960: The Multiple Use – Sustained Yield Act of 1960 requires the Forest Service to manage National Forest System lands for multiple uses (including timber, recreation, fish and wildlife, range, and watershed). All renewable resources are to be managed in such a way that they are

available for future generations. The harvesting and use of standing timber can be considered a short-term use of a renewable resource. As a renewable resource, trees can be re-established and grown in again if the productivity of the land is not impaired.

Migratory Bird E.O. 13186: On January 10, 2001, President Clinton signed an Executive Order (E.O. 13186) titled "Responsibilities of Federal Agencies to Protect Migratory Birds." This E.O. requires the *"environmental analysis of Federal actions, required by NEPA or other established environmental review processes, evaluates the effects of actions and agency plans on migratory birds, with emphasis on species of concern."*

Executive Order 13112 (invasive species): This 1999 order requires Federal agencies whose actions may affect the status of invasive species to identify those actions and within budgetary limits, "(i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species… (iii) monitor invasive species populations… (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded;…(vi) promote public education on invasive species… and (3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species… unless, pursuant to guidelines that it has prescribed, the agency had determined and made public… that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions."

The Clean Water Act, as amended in 1977 and 1982: 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 waterbodies is that project activities should protect and not further degrade the parameters for which it is listed.

The following executive orders are included within the Clean Water Act:

- **Executive Order 11988:** requires agencies to avoid adverse impacts associated with the occupancy and modification of floodplains.
- **Executive Order 11990:** requires agencies to avoid adverse impacts associated with the destruction or modification of wetlands.
- **Executive Order 12088:** requires Federal compliance with pollution control standards (such as the Clean Water Act).

The Clean Air Act, as amended in 1990: The purposes of The Clean Air Act are "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population; to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution; to provide technical and financial assistance to state and local governments in connection with the development and execution of their air pollution prevention and control programs; and to encourage and assist the development and operation of regional air pollution prevention and control programs."

Collaborative Forest Landscape Restoration Program: As part of the Omnibus Public Land Management Act of 2009, the Collaborative Forest Landscape Restoration (CFLR) Program was established to select and fund ecological restoration treatments for priority forest landscapes. The West Bend project area is included in one such landscape (the Deschutes Collaborative Forest) and therefore planning has included collaboration in accordance with the Act.

1.9 Other Informing Documents

Community Wildfire Protection Plan

The ***Greater Bend Community Wildfire Protection Plan*** (CWPP) was signed May 16, 2006. The CWPP was prepared under the authorities of the Healthy Forests Restoration Act by a collaborative group of representatives of federal, state, and local governments as well as private entities. The Plan describes wildland urban interface and provides priorities and goals for reducing risk of high-intensity wildfire by managing forests and wildlands for hazardous fuels reduction and fire resilience.

The ***East and West Deschutes County Community Wildfire Protection Plan*** (CWPP) was signed December 18, 2007. This CWPP boundary, unlike other CWPP plans, does not classify all areas within the CWPP as wildland urban interface. Discussions and interactions occurred during the development of these projects. Objectives identified in the CWPP are also objectives within the West Bend project and include treatments 1) which reduce flame length to less than four feet adjacent to evacuation routes and 2) around areas identified as Wildland/Urban Interface.

Landscape Analysis/Design

A landscape analysis/design was completed as part of the EIS process in order to communicate to the public how a comprehensive approach was used in addressing the issues and formulating the alternatives. The Analysis process was similar to the methodology devised by Diaz and Apostle (USDA 1992) and provides a means for reviewing broad-based goals and objectives and tailoring how these can be translated into rationale for stand-level treatments. Appendix A provides a more thorough description of the process.

1.10 Project Record

This EIS hereby incorporates by reference the Project Record (40 CFR 1502.21). The Project Record contains Specialist Reports and other technical documentation used to support the analysis and conclusions in this EIS. Chapter 3 provides a summary of the Specialist Reports in adequate detail to support the decision rationale; appendices provide supporting documentation.

Incorporating these Specialist Reports and the Project Record help implement the Council on Environmental Quality (CEQ) Regulations provision that agencies should reduce NEPA paperwork (40 CFR 1500.4), that the document shall be "analytic rather than encyclopedic," and that the document "shall be kept concise and no longer than absolutely necessary" (40 CFR 1502.0). The objective is to furnish adequate site-specific information to demonstrate a reasoned consideration of the environment impacts of the alternative and how these impacts can be mitigated, without repeating detailed analysis and background information available elsewhere. The Project Record is available for review at the Bend-Fort Rock District Office, 63095 Deschutes Market Road, Bend, Oregon, Monday through Friday 7:45 a.m. to 4:30 p.m.

1.11 Decision Framework

The scope of the project and the decision to make are limited to management of forested vegetation, connected actions, and necessary mitigation. Chapter 2 details the design of these actions. The project is limited to National Forest System land.

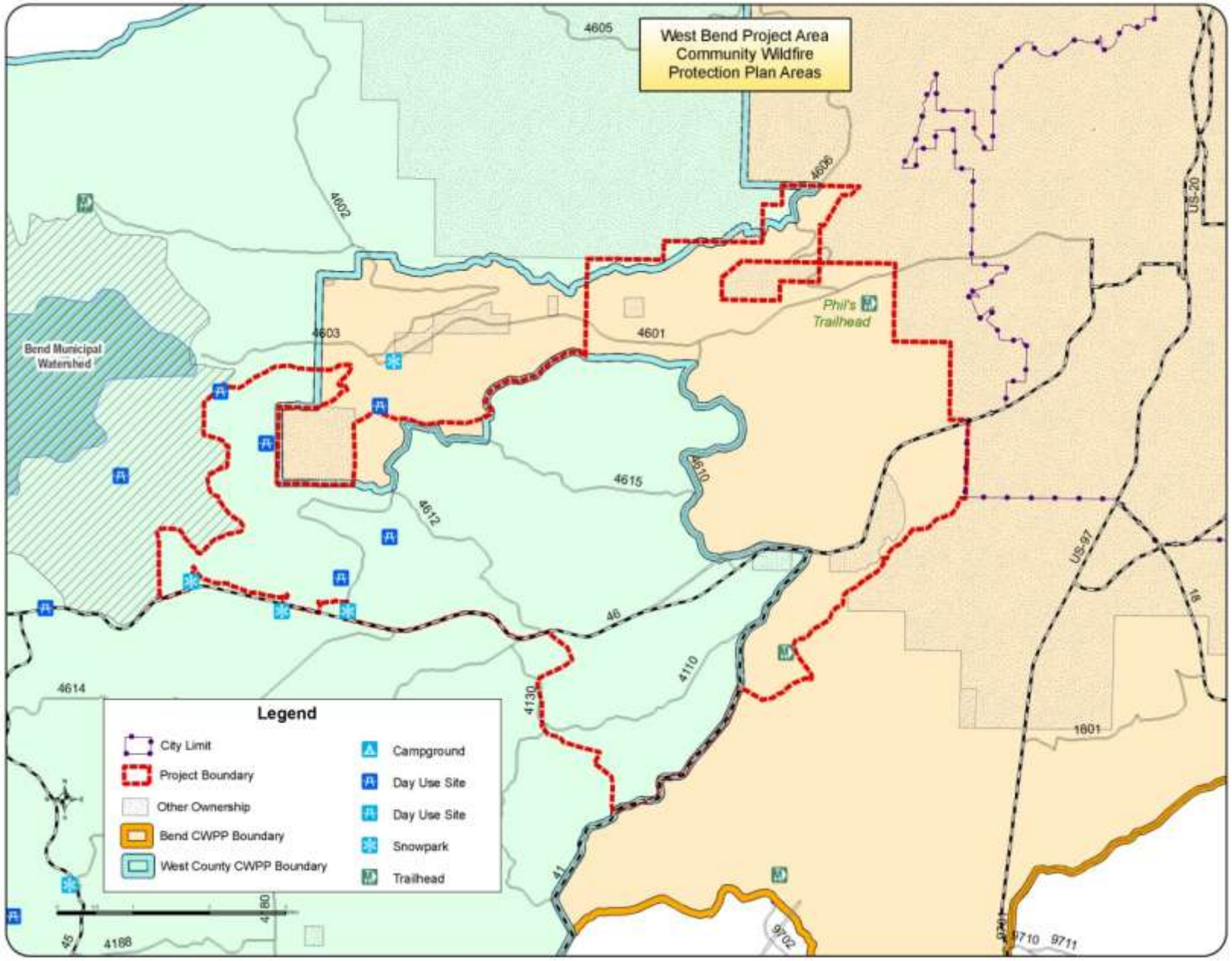
The Responsible Official for this proposal is the Forest Supervisor of the Deschutes National Forest. Based on response from the 45-day comment period, any changes made to the Final EIS, and the disclosed analysis with mitigation, the Responsible Official will make a decision and document it in a Record of Decision. The Responsible Official can decide to:

- Select one of the action alternatives that has been considered in detail, or
- Modify the selected alternative, and

- Identify what mitigation measures would apply, or
- Select the no action alternative.

The decision regarding which alternative to implement will be determined by comparing how each factor of the project purpose and need is met and the manner in which each alternative responds to the analysis issues.

Figure 4: Community Wildfire Protection Plan (CWPP) Areas



CHAPTER 2
ALTERNATIVES

Chapter 2: Alternatives

2.1 Introduction

This chapter describes and compares the alternatives considered for the West Bend Project. It includes a description of each alternative with a map of each action alternative considered. The alternatives are presented in comparative form, displaying the differences between each alternative in order to provide a clear basis for choice by the decision maker. Some of the information used to compare the alternatives is based upon the design of the alternative and some of the information is based upon the environmental effects of implementing each alternative. Current management plans, as amended, provide the basis to guide management.

Changes between Draft and Final EIS

Within Chapter 2, changes to the description of Alternatives 3 and 4 were made to correct information about how key issues were addressed. Some of the resource protection measures were clarified with additional language. Under all alternatives, Units 341 and 355 have been modified; Unit 379 has been dropped. The number of miles of temporary roads need for each alternative has been updated following the elimination of some temporary roads.

2.2 Alternatives Considered In Detail

Four alternatives have been fully analyzed for this project. Alternative 1 (No Action) would have no change in the level of management and serves as a baseline for analysis. Alternative 2 (Proposed Action) was provided to the public during the scoping period. This alternative has had slight modifications as the project has developed. Alternative 3 and Alternative 4 were developed primarily in response to the Key Issues.

2.2.1 Alternative 1 (No Action)

This alternative is required by law and serves as a baseline for comparison of the effects of all of the alternatives. There would be no change in the level of ongoing management activities within the project area. All custodial activities such as road maintenance, law enforcement, response to emergencies (including wildfire), and trail maintenance would continue. The Purpose and Need of this proposed project would not be met because no treatment would be implemented to reduce stand density and fire risk and the associated jobs that would be created would not occur.

2.2.2 Alternative 2 (Proposed Action)

The proposed action includes vegetation management activities across approximately 21,850 acres (about 86% of the project area). Actions include commercial and non-commercial thinning, slash-treatment, mowing, and underburning. Commercial thinning would occur on 14,745 acres. Of these, 37 acres are located within the Riparian Habitat Conservation Area (RHCA) of the Deschutes River. Thinning will move the area towards the historic range of variability for this biophysical environment, with ponderosa pine the most common and dominant tree species. The project design follows the principles of fire-resilient forests: reducing surface fuels, increasing height to live crown ratio, decreasing crown density, and keeping large trees of resistant species.

This Alternative has been modified slightly since scoping. Further field review and interdisciplinary team work led to minor adjustments, changes include additional fuels reduction prescriptions in units proposed for underburning. Some unit boundaries were adjusted to utilize roads as boundaries, and some units have been dropped upon further field review of the existing conditions.

Four Forest Plan Amendments for this project are presented on page 46. These amendments address big game thermal cover, scenic views, and conducting timber sales within stands of LOS that are below HRV.

The following table list the activities proposed under Alternative 2. Treatments occur in combination (such as commercial harvest followed by mowing and underburning). The activities are displayed in Figure 6 through Figure 8. Appendix B lists the specific combination of activities for each treatment unit. See FEIS, Appendix B, page 531 for description of activities.

Table 4: Alternative 2 - Summary of Activities and Associated Acres[2].

Alternative	Commercial Harvest[1]	Skid and Deck[2]	Understory Treatment Only[3]	Fuels Treatment Only[4]	Total Acres
2	14,745	2,302	652	4,151	21,850

1 Commercial harvest usually in combination with understory and fuels treatments
2 Skid and deck usually in combination with fuels treatment
3 Understory treatment only usually in combination with fuels treatment
4 Fuels treatment only (i.e. not in combination with any tree removal) consists of mowing or a combination of mowing and/or burning

Description of activities follows alternative summaries (see page 39); more detail in Appendix B.

Table 5: Alternative 2 - Summary of Commercial Harvest Activities. Harvest code is used in Appendix B.

Harvest Code	Description	Acres
HCR	Harvest- Seed tree cut with reserves	1,751
HIM	Harvest- improvement cut	181
HOR	Harvest- overstory removal	824
HTH	Harvest- thinning	11,989
Total Acres		**14,745**

Table 6: Alternative 2 - Summary of Understory Activities. Activity Code is used in Appendix B.

Understory Activity Code	Description	Acres
LFR	Ladder fuels reduction	1,514
PCT	Precommercial thinning	6,466
PCT MECH	Precommercial thinning mechanically	235
SKID AND DECK	Non-commercial thinning with utilization	2,302
WHIP	Whip-falling	1,167
Total Acres		**11,684**

Table 7: Alternative 2 - Summary of Fuels Activities. Activity Code is used in Appendix B.

Fuels Activity Code[1]	Description	Acres
PILE	Piling of slash (thinning/harvest residue)	7,719
MOW and /or BURN	Mechanical shrub treatment (MST); Prescribed underburning	18,960
LOP AND SCATTER	Cutting and scattering of slash	1,085

[1] More than one fuels activity may occur in an individual unit.

[2] Acre figures are an estimate and do not account for retention areas or recently modified units.

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Figure 5: West Bend - Alternative 2 - Proposed Overstory Activities

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Figure 6: West Bend - Alternative 2 - Proposed Understory Activities

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Figure 7: West Bend – Alternative 2 – Proposed Fuels Activities

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2.2.3 Alternative 3

Alternative 3 was developed to respond to key issues #1, #2, and #4 as described in Chapter 1.6.1, page 9. The total area treated with commercial timber harvest (14,522) would be approximately 223 fewer acres (Table 8) than Alternative 2. Invasive plant treatments are the same as described for Alternative 2. This alternative changes the approach of thinning activities through changes in thinning prescriptions and drops some of the overstory removal in lodgepole pine.

The following Key Issues were used in developing Alternative 3:

Key Issue 1 – Variability in Thinning Approach on Landscape. Prescriptions were modified to include additional objectives for thinning, which will also increase diversity and variability across the landscape. To address the issue, the following resource objectives are added to thinning under Alternative 3 in order to create variability and diversity during thinning:

> *Castilleja chlorotica* habitat will be enhanced on about 1,268 acres by creating openings. These openings would not be planted. The treatment prescription is described in Appendix B as "stands managed for *Castilleja chlorotica*."
>
> Deer forage will be increased and future hiding cover promoted on about 1,124 acres of MA-7 by creating small openings within some thinning units. These openings would then be planted with ponderosa pine. This prescription is described in Appendix B as "stands managed for deer winter range."
>
> About 631 acres of stands along the Cascade Lakes Scenic Byway and Skyliner Road will be thinned in such a way that shade to the highway is reduced, allowing more sunlight to reach the highway and melt snow and ice. This prescription is described in Appendix B as "stands managed for road sun."
>
> All old-character trees will be retained, regardless of size (per Van Pelt 2008); see project design #4.5.

Key Issue 2 – Lodgepole Pine Overstory/Final Removal Treatments. Of the 824 acres of overstory harvest proposed, 225 acres are changed to girdling of the overstory trees and there would be no timber harvest in those stands.

Key Issue 4 – Goshawk Habitat Management. Where the proposed action would thin through 1,600 acres of the two historic (non-active) goshawk territories, Alternative 3 retains the 30-acre nest stand untreated, and maintains a denser residual stand near the nests; thinning will also create small gaps by removing clumps of lodgepole. Various prescriptions are described for these stands in Appendix B under "future goshawk habitat management."

Table 8: Alternative 3 – Summary of Activities and Associated Acres[3]

Commercial Harvest[1]	Skid and Deck[2]	Understory Treatment Only[3]	Fuels Treatment Only[4]	Total Acres
14,522	2,302	827	4,166	21,817

1 Commercial harvest usually in combination with understory and fuels treatments
2 Skid and deck usually in combination with fuels treatment
3 Understory treatment usually in combination with fuels treatment. Will include units with girdling
4 Fuels treatment only (i.e. not in combination with tree removal) consists of mowing or a combination of mowing and burning

Table 9, Table 10, and Table 11 provide more details on the activities proposed under Alternative 3. Many fuels treatments occur in harvest units following harvest activities. The units are displayed Figures

[3] Acre figures are an estimate and do not account for retention areas or recently modified units.

9 through 11. Forest Plan Amendments for this alternative are the same as Alternative 2 and are described on page 46. Appendix B lists the specific combination of activities for each treatment unit.

Table 9: Alternative 3 – Summary of Commercial Harvest Activity and Associated Acres

Harvest Code	Description	Acres
HCR	Harvest- seedtree cut with reserves	1,751
HIM	Harvest- improvement cut	181
HOR	Harvest- overstory removal	586
HSV	Harvest- salvage	31
HTH	Harvest- thinning	11,973
Total Acres		**14,522**

Table 10: Alternative 3 - Summary of Understory Activities and Associated Acres

Understory Activity Code	Description	Acres
LFR	Ladder fuels reduction	1,514
PCT	Precommercial thinning	6,327
PCT MECH	Precommercial thinning mechanically	235
SKID AND DECK	Non-commercial thinning with utilization	2,302
WHIP	Whip-falling	1,167
Total Acres		**11,545**

Table 11: Alternative 3 - Summary of Fuels Activities and Associated Acres

Fuels Activity Code[1]	Description	Acres
PILE	Piling of slash (thinning/harvest residue)	7,587
MOW and/or BURN	Mechanical shrub treatment (MST); Prescribed underburning	18,949
LOP AND SCATTER	Cutting and scattering of slash	1,085

1 Fuels activities may have overlap acres

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Figure 8: West Bend – Alternative 3 – Proposed Overstory Activities

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Figure 9: West Bend – Alternative 3 – Proposed Understory Activities

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Figure 10: West Bend - Alternative 3 - Proposed Fuels Activities

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2.2.4 Alternative 4

This alternative manages fuels and vegetation on about 21,509 acres. It was developed to address key issues #1, #2, #3, #4, #5, #6, and #7 as described in Chapter 1.6.1. The following describes how Alternative 4 addresses the key issues.

Key Issue 1 – Variability in Thinning Approach on the Landscape. This issue is addressed in the same way as Alternative 3 with the only difference being a changes to the amount of acres treated:

Castilleja chlorotica habitat will be enhanced on about 1,094 acres by creating openings. These openings will not be planted.

Deer forage will be increased and future hiding cover promoted on about 419 acres of MA-7 by creating small openings within some thinning units. These openings would be planted with ponderosa pine.

About 615 acres of stands along the Cascade Lakes Scenic Byway and Skyliner Road will be thinned in such a way to reduce shade and allow sunlight to reach the highway and melt snow and ice.

All old-character trees will be retained, regardless of size (per Van Pelt 2008); see project design #4.5.

Key Issue 2 – Lodgepole Pine Overstory/Final Removal Treatments. This issue is addressed in the same way as Alternative 3. Of the 824 acres proposed for overstory harvest in Alternative 3, 225 acres are changed to girdling overstory.

Key Issue 3 – Mature Trees in Mixed Conifer Wet. Within these plant associations, all white fir greater than 24" DBH will be retained regardless of the proportion of ponderosa pine in the stand.

Key Issue 4 – Goshawk Habitat Management. Treatment within two historic territories is the same as Alternative 3. The nest site of 30 acres is left untreated; the prescription for about 1,600 acres within the territories is modified from the proposed action to retain clumps, create holes in the lodgepole, and thin with a radiating approach where the stands closest to the nest are left the densest.

Key Issue 5 – Ryan Ranch KEA thermal cover. Under Alternative 4, all stands that provide thermal cover would have no thinning or harvest treatments, approximately 791 acres.

Key Issue 6 – Deer Habitat - Winter Range Thermal Cover. Approximately 2,500 acres within Deer Habitat (MA 7) would not be thinned under Alternative 4. A large proportion of these acres are providing thermal cover. With this alternative, the LRMP amendment to the thermal cover objective would not be necessary.

Table 12: Alternative 4 – Summary of Activities and Associated Acres[4]

Commercial Harvest[1]	Skid and Deck[2]	Understory Treatment Only[3]	Fuels Treatment Only[4]	Total Acres
12,316	1,806	1,143	6,393	21,509

[1] Commercial harvest usually in combination with understory and fuels treatments
[2] Skid and deck usually in combination with fuels treatment
[3] Understory treatment only usually in combination with fuels treatment. Will include units with girdling
[4] Fuels treatment only consists of mowing or a combination of mowing and burning

Table 13, Table 14, and Table 15 provide more detail on the activities proposed under Alternative 4. The units are displayed in Figures 12 through 14. Forest Plan Amendments are described on Page 46. Appendix B lists the specific combination of activities for each treatment unit.

[4] Acre figures are an estimate and do not account for retention areas or recently modified units.

Table 13: Alternative 4 – Summary of Commercial Harvest Activities.

Harvest Code	Description	Acres
HCR	Harvest- seedtree cut with reserves	1,751
HIM	Harvest- improvement cut	181
HOR	Harvest- overstory removal	586
HSV	Harvest- salvage	31
HTH	Harvest- thinning	9,618
Total Acres		**12,167**

Table 14: Alternative 4 – Summary of Understory Activities and Associated Acres

Understory Activity	Description	Acres
LFR	Ladder fuels reduction	1,514
PCT	Precommercial thinning	5,216
PCT MECH	Precommercial thinning mechanically	235
SKID AND DECK	Non-commercial thinning with utilization	1,806
WHIP	Whip-falling	1,167
Total Acres		**9,938**

Table 15: Alternative 4 – Summary of Fuels Activities and Associated Acres

Fuels Activity[1]	Description	Acres
PILE	Piling of slash (thinning/harvest residue)	7,793
MOW and/or BURN	Mechanical shrub treatment (MST); Prescribed underburning	18,720
LOP AND SCATTER	Cutting and scattering of slash	1,079

[1] More than one fuel activity may occur in an individual unit

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Figure 11: West Bend - Alternative 4 - Proposed Overstory Harvest Activities

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Figure 12: West Bend - Alternative 4 - Proposed Understory Activities

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Figure 13: West Bend - Alternative 4 - Proposed Fuels Activities

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2.3 Description of Activities

2.3.1 Silvicultural Treatments

The project proposes thinning and regeneration treatments that include the cutting and removal of sawtimber or other wood products. Cutting would generally be done with a mechanical tracked harvester and removal would be with ground based logging systems. Mechanical and ground based logging systems would be limited to those areas where the slope is less than 30% or where slope greater than 30% is less than 100' in length. Whole tree yarding will be used. Skid trails would be located on average 100' apart. Landings where trees are de-limbed, sorted, or processed into chips would be needed at a rate of one per ten to fifteen acres. Hand thinning will be done within young plantations where trees are too small to be utilized.

Thinning is conducted to reduce tree density, primarily to maintain or improve or tree growth, maintain or enhance forest health, and addressing the historical range of variability of tree species composition. Thinning is also used to reduce ladder fuels and decrease the continuity of tree crowns to reduce the risk of initiation and spread of crown fire. Thinning will generally be from below, varying spacing to ensure that the most desirable and most dominant trees with the least amount of dwarf mistletoe are retained. Ponderosa pine will generally be favored for retention over lodgepole pine or true fir.

With thinning from below, the smallest diameter trees in the stand and/or the shortest trees are generally priority for removal. Exceptions would be where: 1) ponderosa pine are overtopped by lodgepole pine or true fir, or 2) where the largest diameter trees in the upper most canopy levels are not the healthiest, most vigorous trees. In these cases the smaller ponderosa pine or the smaller, healthier trees will be retained.[5] Where the removal of trees from the lower crown class will not reduce stocking to desired levels, trees from the dominant and codominant crown classes will be removed to favor the best trees of those same crown classes. Dead lodgepole pine, standing and down, excess to LRMP Standards and Guides (S&Gs) direction will be removed. Excess dead woody material is present primarily in stands that have no history of thinning or regeneration treatments. Desired density following thinning and fuels treatments varies depending on size of trees in the stand, site productivity, and stand objective (Refer to Forest Vegetation discussion, Chapter 3).

- ***Harvest Commercial Thin (HTH – code used in Appendix B)***

Commercial thinning is conducted in stands where stocking of trees over 7 inches diameter are stocked at a level where they are susceptible to bark beetle outbreaks. It is also conducted where understory trees which are of commercial size are competing with old overstory trees and causing decline and mortality to the overstory trees. Commercial thinning is also used to decrease the continuity of crowns to reduce the chances of propagation and continuity of crown fires.

Commercial thinning in the West Bend project will be a thinning from below which favors the largest ponderosa pine which are healthy. In the West Bend project the level of trees left within thinning treatments is in a range from 20 to 60 ft^2 BA. The lower basal area will be used in patches of stands where stabilization of dwarf Mistletoe infection levels is desired.

- ***Harvest Overstory Removal (HOR)***

Harvest removal of an overstory is conducted on areas which are intended to be single story stands which have an understory of saplings or seedlings established and still retain an overstory. In the West Bend project it is planned to use overstory removal in stands dominated by lodgepole pine which are stocked in the understory with seedlings and saplings. Typically in these stands the remaining overstory is infected

[5] Mistletoe is of concern primarily within the larger plantations of which there are 2,302 acres proposed for thinning. Within these areas, where larger mistletoe-infected trees occur in clumps, the clump will be retained and thinned out around it.

with mistletoe and is of poor condition with small crowns and heavy mortality to mountain pine beetle. The overstory removal is also planned to remove the seedtrees remaining in past shelterwood or seedtree harvests which are currently stocked with seedlings or saplings.

- ***Harvest Salvage (HSV)***

Harvest removal of stand and down firm wood lodgepole pine in excess of wildlife and soil productivity standards. This is proposed where the dead lodgepole pine has been killed by mountain pine beetle and the accumulated fuels are higher than needed or desired. HSV will be in combination with other harvest activity, such as HCR and HIM and will occur wherever a unit has dead lodgepole excess of wildlife and soil standards.

- ***Seedtree Cut with Reserves (HCR)***

This will remove dead standing and down lodgepole pine and cut the majority of the remaining lodgepole pine overstory; it is considered a regeneration harvest. Seedtrees will be left at 60 foot spacing along with trees which may increase the diversity of the stand such as white fir and ponderosa pine. The understory may be present and managed at the same time.

- ***Harvest Improvement (HIM)***

This treatment improves the stand for other resources besides timber stand objectives. Stands proposed for HIM in the West Bend project area are mostly mixed conifer and will be managed for structure for specific wildlife resources or to reduce the fuel hazard. These treatments leave white fir to support wildlife or other objectives where it is not thought to be sustainable.

- ***Aspen Enhancement (Aspen)***

This treatment is intended to reduce conifer competition with the aspen. Conifers around and within the aspen stand are cut high enough to hinge over; they then act as barriers to big game and associated herbivory of aspen sprouts.

- ***Precommercial Thin (PCT) and (PCT Mech)***

Precommercial thinning is used in two different situations. One is in regeneration stands (plantations) which are now stocked with saplings. Within plantations (planted two to three decades ago) the stocking of the trees is at a level where there is inter-tree competition which is causing reduced growth and self-pruning of lower branches. Thinning in these stands would leave trees on 16 to 25 foot spacing in order to increase growth and followed with fuels treatments increase the chance of surviving fires. The second situation is in stands where there is an overstory and an established understory which is competing with the overstory, acts as ladder fuels, and fills in openings in the overstory crown cover. Precommercial thinning in the West Bend area will be used in both these situations.

In the West Bend project precommercial thinning would also be used to manage the understory in stands which have multi-canopy characteristics. This thinning, at 20 to 30 foot spacing, would leave the biggest tree which is not in competition or acting as ladder fuels into the crown. Where underburning is planned, thinning may occur before burning to reduce the chance of killing the desired residual trees.

- ***Skid and Deck (Skid & Deck) –***

"Skid and Deck" refers to large-diameter plantation thinning. Following logging in the 1920s a large area of West Bend experienced wildfire. Fires removed the regeneration which was common in the area. The land was acquired by the USFS from Shevlin-Hixon Company in the 1940s. Reforestation efforts in the 1950s and 1960s established over 2,000 acres in the West Bend project area. Currently these stands are overstocked with ponderosa pine from the regeneration efforts. This overstocking is making the stands susceptible to bark beetle mortality and the vigor of the stands is low. The trees in the stands are too large to precommercially thin by hand with slash piled and burned, but only a small component of the trees which need to be removed are merchantable. The prescription for these stands would thin to a more sustainable stocking level using machinery and hand thinning. This prescription would thin to 80 trees

per acre, whole tree yard the slash to landings to be processed on or off site. Smaller diameter material will be hand thinned, piled, and burned. Much of these areas will be mowed and underburned. If utilization removes enough material to keep fuel levels at acceptable levels, the slash would be lopped and scattered. This would typically be followed with mowing and underburning as well.

Biomass utilization will occur in plantations where material is large enough and in commercial harvest units where less than commercial size material occurs and could be removed in conjunction with the commercial harvest. Biomass removal will use similar technologies as ground based logging except for landings which may not sort logs but chip onsite the material for removal. Within plantations landings and skid trails will be required.

- ***Whip Falling (Whip)***

Whip falling is used in stands to fall the non-merchantable trees left which are not desired due to disease or poor condition including small crowns, bole damage or very poor growth. Small tree material would be left on site. Within the West Bend project whip falling is planned in the stands which will have a seed tree or commercial thin harvest.

2.3.2 Fuel Treatments

- ***Ladder Fuel Reduction (LFR)***

LFR is very similar to the description of precommercial thinning and is used to meet fuels objectives. LFR involves mechanically cutting understory trees in the lower canopy layer of a stand to reduce potential for fire to move into the crowns of trees in the middle to upper canopy layers. Small trees are cut to a minimum of 20' spacing, 25' spacing being the ideal. Resulting slash is usually treated by lop and scatter.

- ***Lop and Scatter (LOP)***

Lop and scatter typically occurs in either light thinning slash where prescribed fire will be used as a final fuels treatment or in stands of lodgepole pine reproduction. Lopping consists of cutting the limbs off of thinned trees, rearranging the fuel bed to 15" or less off the ground. Where prescribed fire would be utilized, lopped slash located beneath residual trees will be manually scattered out from below tree canopies to best ensure low flame lengths in these areas during prescribed fire operations. In some lodgepole pine reproduction stands, outside of priority WUI/evacuation routes, lopped slash would be scattered and left to fall apart and compress over time.

- ***Hand Piling***

Hand Piling consists of piling natural and activity-created fuels (slash) by hand. Completed pile dimensions will be approximately 6' long by 6' wide by 5' high. The amount of piles per acre will fluctuate along with fuel loadings and are expected to occur at a rate of 18 to 24 piles per acre. Piles will be burned in the late fall or winter season when moisture levels minimize fire spreading to surrounding areas.

- ***Machine Piling***

Machine Piling consists of piling natural fuels and activity created fuels utilizing a Grapple Machine. Pretreatment fuel loading will generally be greater than 16 tons per acre where machine piling occurs. The number of piles per acre will vary widely depending on fuel loadings and are expected to occur within a range of 18 to 60 piles per acre. Piles will be burned in the late fall or winter season when moisture levels prevent fire spreading to surrounding areas.

- ***Mechanical Shrub Treatment or "Mowing" (MST)***

MST consists of mowing brush in and around stands. This involves the use of mechanized equipment to mow, cut, chop, grind or otherwise reduce shrub or ground fuel vertical structure to a height of about 8

inches. The objective of mowing is to decrease the height of live or dead brush. Approximately 80% of each unit would be mowed, with up to 100% of safety corridor units being mowed (safety corridors are all 2-digit and 4-digit roads). Any units proposed for both mow and underburn are units where either mowing or underburning or both mowing and underburning would be implemented.

- ***Underburning***

Prescribed underburning will follow thinning and mowing activities. Underburning would occur when fuel and weather conditions are conducive to achieving planned fuels reduction and resource objectives. Typical underburning conditions occur during spring and fall seasons, but depending on the season, objectives may still be achieved any time of year. It is also identified in the LRMP that it may be appropriate to utilize unplanned ignitions if prescribed fire plans are in place and the unplanned ignitions are burning within prescription. Any units proposed as both mow and underburn units are units where either mowing or underburning or both mowing and underburning would be implemented.

Roads and existing fireline would be used wherever possible. Up to 14,000 feet of new machine or hand line may need to be constructed. Upon completion of burning, firelines would be rehabilitated by pulling slash and other materials back over the line of prevent use by motorized vehicles.

2.3.3 Forest Plan Amendments

Action alternatives Alternative 2 (Proposed Action) and Alternative 3 will include one Forest Plan amendment (FPA) for the Deer Habitat Management Area (MA-7). Alternatives 2, 3, and 4 will include two amendments to standards and guidelines for the Scenic Views Management Area (MA-9), as described in the LRMP. And, Alternatives 2, 3, and 4 will include one amendment to the Eastside Screens. These amendments are discussed further in Chapter 3.18.

- **Deer Habitat Management Area (MA-7) Goals and Objectives from the LRMP**

The current LRMP general themes and objectives for maintaining thermal cover restrict the activities that can be implemented within Deer Habitat (winter range). It is expected that activities proposed under this project may not meet these general themes and objectives; therefore, one site-specific, short-term amendment is proposed. Refer to Chapter 3, Wildlife, Big Game, Mule Deer Thermal Cover - Forest Plan Amendment, for an analysis of effects of the changes.

Goals: To manage vegetation to provide optimum habitat conditions on deer winter and transition ranges while providing some domestic livestock forage, wood products, visual quality and recreation opportunities.

General Theme and Objectives of Deer Habitat: Vegetation will be managed to provide optimum habitat considering the inherent productivity of the land. Herbaceous vegetation will be managed to provide a vigorous forage base with a variety of forage species available. Forage conditions may be improved where conditions are poor. Foraging areas will be created where forage is lacking, maintained when in proper balance, or reduced when overabundant and more foraging areas are needed.

Long-term tree or shrub cover to moderate cold weather conditions is equally important. Ideally, cover and forage areas should be in close proximity for optimum use by big game, with cover making up 40 percent of the land area. Approximately three-quarters of cover areas should be thermal cover with the remainder being in hiding areas. Some stand conditions may satisfy both kinds of cover.

Standards and Guidelines and Reasons for Amending

The General Theme and Objectives for thermal cover (LRMP page 4-113) state *"...with cover making up to 40 percent of the land area. Approximately three-quarters of cover areas should be thermal cover..."*

The West Bend project area landscape has several plant associations that vary on an east to west gradient. The Deer Habitat MA is located in the eastern one-third of the project area. Thermal cover has been assessed for the analysis area and the value of the habitat is marginalized because of high levels of

recreation use. A strategy has been developed that will maintain important deer migration corridors where deer use the area to move south to north into the northern Tumalo Winter Range.

The objective for the management area is to provide approximately 30% of the area as thermal cover. The project area currently provides about 12% thermal cover. Any thinning within thermal cover areas will take the ratio below that. The alternatives would reduce it to 11%. Alternative 4 retains thermal cover in MA-7 except for the small group opening units that are designed to create hiding cover, but it will still require the amendment. See Figure 14 for units impacting MA-7.

Relatively low site productivity for tree-growth, coupled with recent cycles of drought, increase the risk of insect-pest epidemics killing or severely damaging tree-stands valuable for cover. Tree canopy-cover conditions for optimum thermal protection may need to be compromised somewhat in order to moderate the risk of future extensive pine beetle damage. Canopy cover should be managed at the highest percentage that will maintain healthy stand conditions with a low risk of extensive damage due to insects or disease. As a minimum, canopy cover must be 40%, but a greater canopy cover percentage is preferred.

- **Scenic Views Management Area Goals and Objectives from the LRMP**

The current LRMP standards and guidelines for maintaining visual quality restrict the activities that can be visible to the "casual observer" within certain areas, including scenic view zones of retention and partial retention in the Scenic Views management allocations that occur along the corridors of Highway 46 and Forest Roads 41 and 4601. It is expected that activities proposed under this project may not meet these standards; therefore, two site-specific, short-term amendments to these standards and guidelines are proposed. See Chapter 3, under Scenery - Forest Plan Amendments, for an analysis of effects of the changes.

Goals: To provide Forest visitors with high quality scenery that represents the natural character of Central Oregon.

General Theme and Objectives of Scenic Views: Landscapes seen from selected travel routes and use areas will be managed to maintain or enhance their appearance. To the casual observer, results of activities either will not be evident or will be visually subordinate to the natural landscape.

Landscapes will be enhanced by opening views to distant peaks, unique rock forms, unusual vegetation, or other features of interest. Timber harvest is permitted, but only to protect and improve the visual quality of the stands both now and in the future. Timber stands, which have remained unmanaged in the past because of their visual sensitivity, will begin receiving treatment to avoid loss of the stand to natural causes. Landscapes containing negative visual elements, such as skid roads, activity residue, or cable corridors, will be rehabilitated.

The desired condition for ponderosa pine is to achieve and maintain visual diversity through variations of stand densities and size classes. Large, old-growth pine will remain an important constituent, with trees achieving 30 inches in diameter or larger and having deeply furrowed, yellowbark characteristics.

For other species, the desired condition requires obtaining visual variety through either spatial distribution of age classes and species mixes, through density manipulation, or through a mixture of age classes within a stand.

Standards & Guidelines and Reasons for Amending

M9-8 (ponderosa) and M9-27 (mixed conifer) both state: *In Retention Foregrounds, slash from a thinning or tree removal activity, or other visible results of management activities, will not be visible to the casual forest visitor for one year after the work has been completed. In Partial Retention foregrounds, logging residue or other results of management activities will not be obvious to the casual forest visitor two years following the activity.*

Although activity fuels would be treated as soon as possible, especially along travel corridors, the use of prescribed fire will create visible impacts (e.g. blackened, scorched vegetation and tree trunks, slash and slash piles) for approximately five years, which exceeds the amount of time management actions can be visible within retention and partial retention allocations. In order to meet objectives, more than one entry with fire may be required. The decision to authorize this project would amend this standard to allow visible effects of harvest cleanup and fuels reduction for approximately five years.

Scenic View corridor allocations are also primary routes of public users of numerous recreation sites (Roads 46 and 4601). Treating adjacent to these primary routes of ingress/egress allow opportunities for safe evacuation of public, as well as opportunities for safe and active fire suppression. Fuel treatments along these areas also addresses recommendations of the CWPPs.

The amendment would allow visible impacts of activities for up to five years. Analysis of this amendment is located in Chapter 3.12.6.

M9-90 (LRMP page 4-131) states: *Low intensity prescribed fires will be used to meet and promote the Desired Visual Condition within each stand type. Prescribed fire and other fuel management techniques will be used to minimize the hazard of a large high intensity fire. In foreground areas, prescribed fires will be small, normally less than 5 acres, and shaped to appear as natural occurrences. If burning conditions cannot be met such that scorching cannot be limited to the lower 1/3 of the forest canopy, then other fuel management techniques should be considered.*

Limiting acreage for the use of prescribed fire to 5 acres or less in foreground areas of Scenic Views would not meet the goal of reducing wildfire hazard, providing safety corridors for the public, or creating a defensible fuel break for an advancing fire. It is necessary to amend the 5 acre limitation for fuels treatments to meet stand and fire management objectives. These areas would remain at increased fire hazard without a more comprehensive and intensive system of treatments, including prescribed fire.

There are 2,216 acres proposed for underburning treatment within foreground areas of Scenic Views MA. To maintain scorching below 30% of the crown, treatments would be based on the following:

- If stand density is too dense to burn without substantial mortality, thinning with follow-up slash pile and burning.
- If shrubs are present and stand density is low, mowing would be followed with prescribed burning. Some mortality could occur.
- If stand density is low and no shrubs are present, the area would be assessed to determine if treatment is needed.
- To achieve underburning objectives, follow-up fuels treatments may be necessary.

Ecologically, the reintroduction of fire is consistent with the restoration concept of more frequent low intensity fire on the landscape. Historically, fire played a bigger role in influencing forest succession. Interfering with one disturbance agent (fire) has increased the influence of other disturbance agents (insect and disease) (Gara 2000). These agents now exhibit their influence over entire landscapes in episodes lasting decades, which is a result of replacing open stands of shade intolerant tree species with dense, closed stands of shade-tolerant species (Agee 1993).

The following treatment units are included in Scenic Views Management Area (Foreground) (see Figure 14): 20-23, 26 36-39, 44-47, 51, 52, 54-57, 59, 61-66, 70-76, 86-88, 99, 101, 102, 136, 138-140, 142, 143, 148, 154, 156, 192-197, 200-202, 390, 402-407, 415, 416, 418-426, 428-432, 442, 444-452, 456, 499, 500, 502.

- **Eastside Screens Direction Concerning Timber Sales within LOS Stages that are below HRV**

This amendment to the Screens and the following discussion are applicable only to the portion of the project area to the east of the spotted owl range (Figure 3). Late and old structure (LOS) is an important vegetative condition specifically identified in the Regional Forester's Forest Plan Amendment #2 (Eastside Screens, June 1995). The Screens defines LOS as those vegetative structures in which large trees are a common feature.[6] Lidar imagery is used as the landscape analysis tool to estimate the existing amount of LOS, which is displayed as Late Succession/Open Canopy and Late Succession/Closed canopy for each type of biophysical environment in Table 32 and Table 33 (Forested Vegetation section 3.3).

Reasons for Amending

Eastside Screens standards and guidelines Appendix B 6 (d) Scenario A states *"If either one or both late and old structural stages falls BELOW HRV in a particular biophysical environment within a watershed, then there should be NO NET LOSS from that biophysical environment. Do not allow timber harvest activities to occur within LOS stages that are BELOW HRV."*

In 2003, following nine years of review of Screens implementation the Regional Forester encouraged Forests to consider site-specific Forest plan amendments to the Screens direction when doing so would better meet LOS objectives by moving the landscape towards HRV, and providing LOS for the habitat needs of associated wildlife (Goodman 2003). In the West Bend project area, an amendment to the Scenario A direction is included to better meet LOS objectives by protecting and promoting large tree structure.

In the ponderosa pine biophysical environment, the late succession/open canopy structure stage falls below the HRV (shown as "underrepresented" in Table 32 Chapter 3.3). Therefore, under Scenario A, a site-specific amendment would be required to conduct harvest activities within that structure stage. Ponderosa pine late succession/closed canopy on the other hand is above HRV, so thinning in these stands is consistent with the Screens direction.

Treatments are proposed in areas where the development of large trees is currently impeded, or existing large trees are at risk from fire or insects and disease. The objective of these treatments would be to improve conditions for the development and/or maintenance of large trees, thus retaining or enhancing LOS acreage in the long-term. Alternatives 2, 3, and 4 would need to employ a commercial timber sale or some other mechanism where commercial size trees are removed in order to accomplish objectives. All treated areas would remain in an LOS condition because all trees > 21" dbh would be retained. There would be no net loss of, LOS, but what is currently multi-stratum would become single-stratum as shown in Table 16.

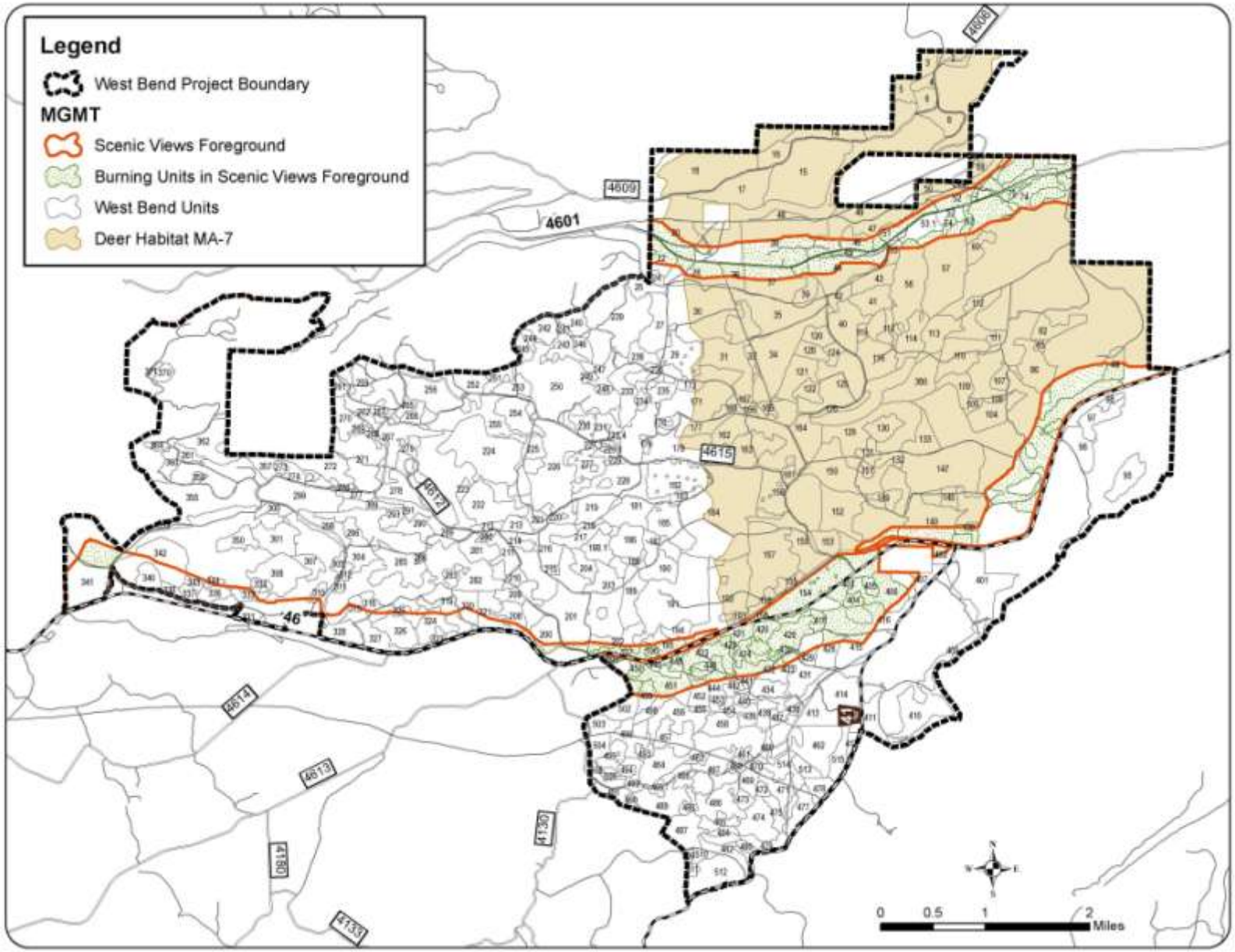
As shown in Table 16, a reduction in ponderosa closed canopy creates a corresponding increase in open canopy. The proposed amendment applies to the 683 acres of open canopy that will be thinned. Thinning within the 683 acres of late succession open canopy are the subject of the amendment because that structure stage is below HRV. An analysis of this amendment can be found in Chapter 3.18.

Table 16: Large tree structural stages in the ponderosa pine biophysical environment

Structure Stage	Existing Acres LOS	Acres Treated Alt. 2	Acres LOS following treatment
Late Succession Open Canopy	2,111 (below HRV)	683	4,553 (increased by 2,442)
Late Succession Closed Canopy	6,121 (above HRV)	2,350	3,679 (decreased by 2,442)
Total	**8,232**	**3,033**	**8,232**

[6] For the forest types in the Deschutes National Forest "common" means more than 13 large trees per acre. The minimum patch size is 40 acres. See Chapter 3.3 for more details on the methods of classifying structural stages.

Figure 14: West Bend Scenic Views and Deer Habitat Plan Amendment Areas



2.3.4 Road Activities

A road condition report was prepared for the West Bend project area. The report details the road work necessary for implementation of the project. The following table summarizes the road condition report for maintenance needs. Table 17 also displays the amount of maintenance level 1 roads that will be used during project implementation and the amount of temporary road needs. The project will not require any new permanent roads to be built.

Table 17: Associated Road Activities for each Action Alternative

Road Work	Alternative 2	Alternative 3	Alternative 4
System Road – Pre-Haul Maintenance (Miles)	39.96 miles	39.96 miles	39.96 miles
FS Highway Safety Act	*4.08*	*4.08*	*4.08*
Collector Roads	*35.88*	*35.88*	*35.88*
Use of Maintenance Level 1 Roads	30 miles	30 miles	30 miles
Temporary Roads – New	37.6 miles	37.6 miles	27.6 miles
Temporary Roads – Previous Disturbance	17 miles	17 miles	13 miles

Pre-haul maintenance would occur at the levels of system roads specified in Table 17 for all action alternatives. General maintenance includes brushing, spot surfacing, cleaning and restoring drainage, blading and shaping roadway, and felling danger trees. Forest Road 4606 will need to be resurfaced and armored rolling dips installed for drainage. Forest Road 4601 (mile post 10.24 to top of grade) will be paved or the aggregate stabilized and drainage shaped. Aggregate used for surfacing will be certified weed-free. Federal and State of Oregon safety regulations require that danger trees along project area travel routes be felled prior to activities taking place. Roadside danger trees would be felled along these travel routes and where activity units border the road system. Felled trees would then be removed. Individual road maintenance items are listed in the Roads Report Conditions and Recommendations, located in the project file.

Maintenance Level 1 Roads: Approximately 30 miles of roads that are in the maintenance category 1 (administratively closed) will be re-opened for use in this project, and then re-closed after project activities are complete. Road closure methods are described in the Deschutes National Forest Road Closure Guide (USFS 1997).

Temporary Roads: Logging systems will include temporary roads. Estimated temporary road locations are displayed in Figures 6, 9, and 12; miles are shown in Table 17. Temporary roads are constructed to access further reaches of timber sale units when access is not sufficiently available through Forest Service road system. Temporary roads are built to low specification, just enough to get equipment into landings. These roads would be built on relatively flat ground and would be constructed to the lowest possible standard capable of supporting log haul in order to minimize ground disturbance. Wherever possible, temporary roads would be constructed on top of previously established skid trails or previously disturbed areas to minimize additional soil compaction associated with use of heavy equipment. At the end of the timber sale activity, temporary roads are rehabbed to promote revegetation.

Closing System and User-Created Roads

The transportation system within the West Bend project area includes maintenance category 1 roads that are not open to vehicle traffic, but in some cases vehicles are using them because they are not effectively closed. In addition to those maintenance category 1 roads that will be used for access during project implementation (see Table 17), all maintenance level 1 roads in the project area will be monitored for closure effectiveness. Breaches of the closures will be addressed through a combination of methods (see Appendix E for more details). Existing unauthorized travel ways (such as user-created roads) will be obliterated by subsoiling or other methods to return them to a productive condition.

2.4 Resource Protection Measures

All of the alternatives would meet direction in relevant laws and policies, and the standards and guidelines in the Forest Plan except as noted in section 2.4.3. In addition, the alternatives comply with the project design criteria for the current Deschutes and Ochoco National Forests Programmatic Biological Assessment (USFS 2010). Resource protection measures are listed here to describe project design considerations and best management practices that will reduce or eliminate unwanted effects and ensure project activities are implemented to comply with standards and guidelines and other direction.

The sources of these measures include but are not limited to: Forest Plan goals, objectives, or standards & guidelines; Project Design Criteria from the Programmatic BA; Best Management Practices; conservation strategies; invasive plant prevention practices; and previous projects where the practice has been shown to be effective.

Table 18: Resource Protection Measures

Measure Number	Protection Measure	Units affected and/ or Direction
To preserve Air Quality		
1.	Conduct prescribed fire in compliance with National Ambient Air Quality Standards, Oregon Department of Environmental Quality regulations and restriction, and under the Oregon Smoke Management Plan regulations and restrictions.	All burn units
2.	Prescribed burning will be conducted under favorable smoke dispersal conditions to avoid impacts to urban areas and Class I airsheds. Inversion conditions, which would increase the potential for smoke pooling in valleys and drainages, would be avoided during burning operations.	All burn units
General Silvicultural Design		
3.	In overstory removal harvests, green tree replacements (GTRs) will be left in groups (TM-4) and where trees with mistletoe are left over advanced regeneration of susceptible species, those overstory trees will be killed in place (LRMP TM-48).	Alternative 3 and 4 only
4.	During treatment activities in overstory removal (HOR) units, advanced regeneration will be protected (TM-44 & 53).	
4.5	Retain trees regardless of size that exhibit old tree characteristics (from Van Pelt) except where they are either 1) ladder fuels which pose a threat to larger diam. trees or 2) individual DMT-infected trees that contribute to infection potential of desired understory trees.* Ponderosa old tree characteristics include all of the following 1) orange bark with plates generally more than three times wider than the darker fissures that separate them, 2) rounded crown, and 3) below the main crown, few if any dead branches present and knots not noticeable. *Mostly applicable to larger ponderosa pine plantations ("skid and deck" units). Clumps of larger mistletoe-infected trees will be retained and thinned around leaving a gap between them and the younger trees.	Alternatives 3 and 4 only
5.	To reduce the potential for long-term growth and bark beetle-induced mortality of ponderosa pine, underburning will be accomplished during conditions which will leave at least 40% crown on dominant and codominant trees. This generally should result in a crown scorch less than 50% of leave tree crowns, outside of Scenic Views.	
6.	Locate slash piles to minimize the scorch effect on adjacent trees.	All burn units
7.	When underburning in plantations, do not light around trees less than 6 inches in	All burn units

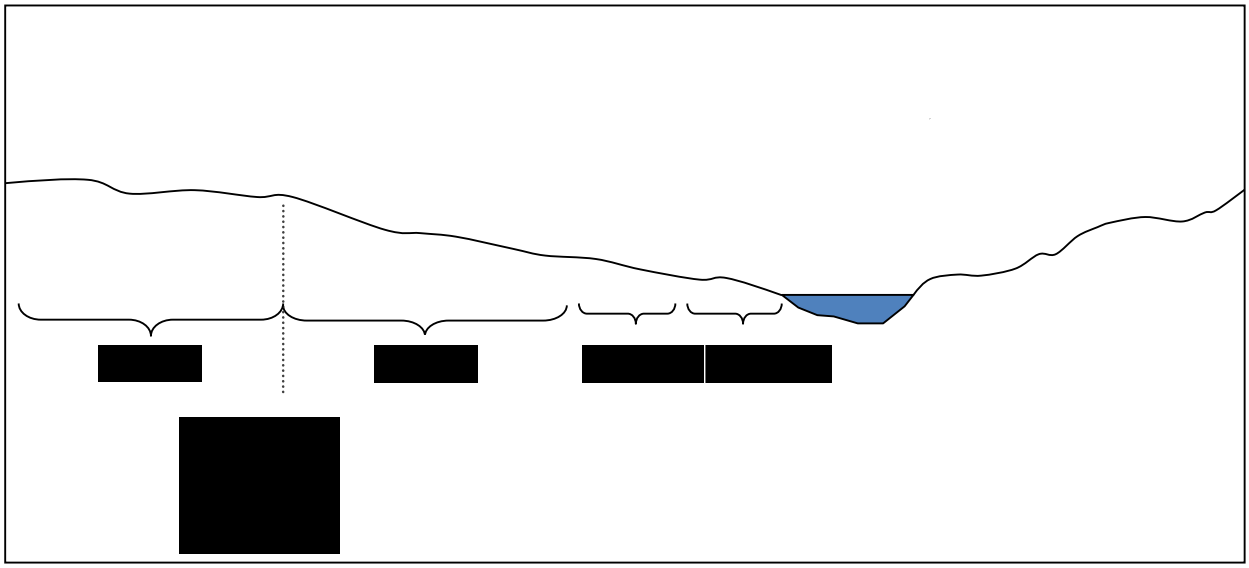
Measure Number	Protection Measure	Units affected and/ or Direction
	diameter (TM-53).	
8.	Openings larger than 2 acres caused by management activities which do not contain adequate advanced regeneration will be evaluated for reforestation.	All units
To Protect Recreation Infrastructure, Provide for Public Safety, and Preserve Visual Quality at Recreation Sites and along Trails		
9.	Avoid creating vegetative conditions that would facilitate creation of unauthorized trails, or that would facilitate unauthorized motorized access from a designated route. Ensure that temporary roads and fireline used for project administration do not become future unauthorized roads and trails by effective obliteration after use. Utilize opportunities during operations to obliterate unauthorized routes. Where possible, bury large rocks (2-3 feet in diameter) one-third of the way up the rock and scattered over the first 100 yards of road.	All treatment units
10.	To the extent possible, implementation of treatments will be designed to maintain access to the larger trail system. For example, if a large trail system is accessed by two primary trails within separate units, implement treatments within those units on different years to maintain access.	All overstory, understory and fuels treatment units with winter and/or summer trails
11.	Maintain safe public access to the Lava Island and Big Eddy Day Use sites during the spring, summer and fall seasons. These sites are important river take-out sites and need to remain accessible to the public to maintain public safety.	409, 401
12.	To the extent possible mitigate hazard trees surrounding developed recreation sites. Coordinate with the developed recreation staff to complete hazard tree assessment prior to activity.	77,260,295,328,341, 401,409,419-421
13.	To the extent possible, protect recreation infrastructure including: site identification signs, kiosks, informational signs, fences, buildings, and other recreation investments that are either owned by the US Forest Service or privately owned and authorized under a special use permit. Notify recreation staff should recreation infrastructure be damaged or destroyed during operations.	All treatment units
14.	Emphasize retention of trail defining vegetation, including trees and in some areas brush. This vegetation is part of the trail infrastructure and should be protected. Incorporate specific components into the silvicultural prescription that will retain these features. Highlight areas with sparse vegetation or soil conditions that offer fewer opportunities to define trail width and location.	All overstory, understory and fuels treatment units with winter and/or summer trails
15.	Minimize trail damage by machinery. Mow across trails and minimize turning on a trail. For other equipment, to the extent possible, cross trails with machinery at intervals no closer than 200 feet apart along the length of the trail. Inspect for trail damage and safety concerns like 'pungi sticks' after treatment.	All overstory, understory and fuels treatment units with winter and/or summer trails
16.	Snow berms created by commercial logging activities which conflict with winter recreationist routes or create a hazard will be leveled immediately where standards are recognized in Road Use Permit stipulations.	All overstory and understory treatment units with winter and/or summer trails
17.	Recreation specialist will inventory all signs prior to activities occurring and ensure signs are restored to original location/condition if damage occurs during operations. Where possible, retain trees that hold signs (including diamonds that mark winter trails).	All overstory, understory and fuels treatment units with winter and/or summer trails
18.	For any cut vegetation within 10 feet of either side of the trail, cut vegetation flat and less than 4 inches to the ground to prevent creating a "pungi stick" and other hazards to trail users. At a minimum, following completion of all treatment activities, review and evaluate the trail conditions to ensure that they meet safety standards.	All overstory, understory and fuels treatment units with winter and/or summer trails
19.	Maintain trees along trails that will help define the trail within lodgepole stands	**Alternative 2 Only**:

Measure Number	Protection Measure	Units affected and/ or Direction
	with overstory prescriptions for seedtree removal and overstory removal where understory stands are not tall enough to define the trail. Coordinate with trails staff prior to treatment design and implementation to define site specific goals.	277,286,300,310,333, 334,371 **Alternatives 2-4:** 211,262,263,265,267 270,271,272,274,282 285,289,291,296,299 301,304,305,307,308 311,315,316,319,326 327,328,331,336,337 338,342,343,344,350 353,355,362,364,389
	To Maintain Scenic Quality	
20.	Locate landings, skid trails, slash piles or staging areas using existing openings and skid trails and minimize bole damage to remaining vegetation in Scenic Views Foreground treatment areas on Cascade Lakes Scenic Byway (Hwy 46), Road 41, Road 4601, Road 4606, adjacent to developed recreation sites and trails, and areas designated as Scenic in Wild & Scenic River corridors. Flush cut stumps (6 inches or less with angle cut away form line of sight) in immediate Foreground areas (0-300 feet).	
21.	Design underburning activities to minimize short-term visual effects by maintaining crown scorch at less than 30 percent and minimize bole scorch.	
22.	Minimize amount of leave-tree markings and reduce and use waivers for tagging of trees along scenic travel corridors, trails and developed recreation site after sale closes.	
23.	Five years after work has been completed, clean-up activities along Cascade Lakes Scenic Byway (Hwy 46), Road 41, Road 4601, Road 4606, adjacent to developed recreation sites and trails, and areas designated as Scenic in Wild & Scenic River corridors including landings, skid trails, slash piles or staging areas and removal of flagging, unit boundary tags and other markings will not be visible to the casual Forest visitor (Forest Plan Amendment).	
24.	To the extent possible, avoid using the trail as a fireline which leaves a condition of black on one side of the trail and green on the other.	
	To Protect Soil	
25.	*Overstory treatments* • Restrict operations to winter only if feasible. • Retain as leave patches dense stands on inoperable ground (i.e., too rocky or steep). *Understory treatments* • Avoid post-harvest mechanical operations, conduct by hand as is practicable or combine with fuels treatment. • For young stand management, limit equipment travel and utilize machines. with long boom reach, designate and maximize distance between primary travel routes. *Fuels Treatments* • Prohibit heavy equipment operations off of existing primary skid trails. • Maintain effective ground cover and organics; retain >50% of litter/duff depth wherever it exists. • Retain as much existing large CWD as is practical where it exists	Where extent of detrimental soil conditions is high and all sensitive soils (see Appendix D)
26.	*Overstory Treatments* • Avoid operating late in the dry season. • Minimize sideslope movements by heavy equipment. • Require a parallel skid trail network when practicable.	Units with sensitive soils – steep slopes (>30%) Refer to Table 225,

Measure Number	Protection Measure	Units affected and/ or Direction
	Fuels Treatments • Minimize upslope pre-heating when underburning to minimize litter and duff consumption.	page 571, Appendix D
27.	Sensitive Soils – steep-sided confined drainage ways *Overstory Treatments* • Prohibit the placement of temporary roads and skidding in the bottom of old drainage ways, channel features, swales, and draws.	Units with sensitive soils – steep-sided confined drainage ways Refer to Table 225, page 571, Appendix D
28.	*Overstory Treatments* • Prohibit heavy equipment within 100 feet of the river. *Understory and Fuels Treatments* • Conduct all activities by hand.	Sensitive Soils – slopes adjacent to the Deschutes River Refer to Table 225, page 571, Appendix D
29.	*Overstory Treatments* • Too shallow to subsoil, avoid new landings and temporary roads as is feasible, locate new landings in existing roadways.	Sensitive soils - shallow soils on forested lavas Refer to Table 225, page 571, Appendix D
30.	*All Activities* • Avoidance - Defer activities and retain existing patches where practicable	Sensitive soils - frost pockets Refer to Table 225, page 571, Appendix D
Apply appropriate Best Management Practices (BMPs) to all ground-disturbing management activities, as described in National Best Management Practices for Water Quality Management on National Forest System Lands (USFS 2012). Listed here are BMPs most commonly practices to minimize detrimental		
31.	Convey to all equipment operators the need to limit ground disturbance as much as is feasible. Avoid traveling over untrammeled ground unless necessary.	
32.	Avoid repetitive passes by heavy equipment except over designated primary routes (i.e., roads or skid trails). Restrict travel of heavy equipment off designated primary routes to two passes or fewer.	
33.	Limit as is feasible heavy equipment, particularly tracked machinery from pivoting or unnecessary side-hill travel on slopes greater than 15 percent. Travel should mostly be down the fall-line and perpendicular to the contour of the slope.	
34.	Minimize travel of heavy equipment on slopes greater than 15 percent late in the season when soils are extremely dry and susceptible to excessive soil displacement.	
35.	Suspend operations during wet periods when soil moisture is high and heavy equipment tracks sink deep below the soil surface, particularly during spring thaw or after heavy rains.	
36.	Skidding or forwarding operations should avoid using the bottom of dry swales as primary travel routes.	
37.	Operations on sensitive soils or where the extent of existing detrimental soil impacts is high should be conducted over frozen ground as is feasible, or when the snowpack is at a depth sufficient enough to protect mineral soil. Travel of heavy equipment off of designated primary routes on sensitive soils should be avoided as much as is feasible. All attempts should be made to avoid new landings and skid trails in previously managed stands on sensitive soils.	
38.	Re-use existing log landings and primary skid trails whenever feasible. Locations	

Measure Number	Protection Measure	Units affected and/ or Direction
	of new landings, primary skid trails, and temporary roads must be approved by the Forest Service prior to use.	
39.	For whole-tree harvest systems, primary skid trails will be spaced at least 100 to 150 feet apart, except at convergence zones around landings or where terrain limitations dictate otherwise.	
40.	For cut-to-length harvest systems, spacing of primary forwarder trails should be at least 65 feet, except where terrain limitations dictate otherwise. To the extent possible, slash mats should be deposited over primary forwarder trails during cutting operations.	
41.	Restrict grapple skidders to designated areas only (i.e., roads, landings, primary skid trails) and on slopes 30 percent or less.	
42.	The location of temporary roads will be approved by the Forest Service prior to construction. Temporary roads shall be located on terrain where minimal width can be maintained, and where the least amount of cut-and-fill construction is needed.	
43.	Avoid locating temporary roads on sensitive soils, and prohibit them from being routed down through the bottoms of swales, draws, abandoned channels, or dry natural drainageways.	
44.	Landings and temporary roads shall be constructed using drainage control structures. Erosion and sediment control measures should be emplaced to prevent accelerated erosion and off-site transport of sediment to a water source.	
45.	Install water control structures (i.e. waterbars) on all segments of primary skid trails and temporary roads on slopes 10% or greater. Spacing of waterbars shall depend on the steepness of the slope and its length.	
46.	Conduct preventive road maintenance regularly to avoid deterioration of the prism and prevent accelerated erosion and sedimentation.	
47.	Subsoil or decompact all temporary roads and landings after use. Outslope any segments requiring a cut into the hillslope.	
48.	Piling of post-activity fuels should be limited as is feasible to existing primary travel routes and skid trails. Restrict travel of heavy equipment off designated primary routes to two passes or fewer. On sensitive soils, prohibit machine travel off of primary skid trails altogether.	
49.	Locate machine constructed slash on primary designated skid trails as much as possible.	
50.	Minimize the amount of large diameter CWD that is incorporated into slash piles, particularly those that are relatively sound or “buckskin” (i.e. decay classes 1 through 3, particularly pieces that are gray and without bark). Except where there are heavy concentrations of residual dead and downed wood, retain as much residual large CWD as possible (where it exists). In previously harvested areas, refrain from incorporated existing CWD in slash piles as much as is feasible.	
51.	Underburning activities should be conducted so that at least 40 percent of the duff and litter layer across an activity area is retained. Target underburning when relative humidity and fuel moistures are favorable for litter and duff retention so that as much of the effective ground cover as possible is maintained. Litter and duff layers should have enough moisture to detect by hand, and not be too brittle.	
52.	Sites where the organic layers are thin such as frost pockets or heavily disturbed areas where effective ground cover is less than 50% conduct underburning in a manner that retains at least 50% of the duff and litter layer depth.	
53.	Retain a portion of live understory (where it exists). To facilitate an increase after fire in the production and turn-over of the litter, fine roots, and soil biota a proportion of the underburn should be non-lethal so that a mosaic of the understory is retained.	
54.	Minimize the consumption of sound, large diameter CWD during prescribed	

Measure Number	Protection Measure	Units affected and/ or Direction
	underburns. Where CWD is close to or in contact with the ground attempt to minimize the duration and intensity that it burns to lessen the effects to soils.	
55.	Restore as much machine-constructed fire lines as is feasible by redistributing displaced topsoil and unburned woody debris over the disturbed surface.	
To Protect Water Quality and Riparian Vegetation		
Best Management Practices prescribed for the West Bend Project were derived from the National Best Management Practices for Water Quality Management On National Forest System Lands (USDA 2012a)		
Vegetation Management Activities		
BMP Veg-2 – Erosion Prevention and Control Within RRs/RHCAs		
56.	Operate equipment when soil compaction, displacement, erosion, and sediment runoff would be minimized. Avoid ground equipment operations on unstable, wet, or easily compacted soils and on steep slopes unless operations can be conducted without causing excessive rutting, soil puddling, or runoff of sediments directly into waterbodies. No mechanized equipment will operate on slopes greater than 30% in RHCAs	212, 213, 214, 216, 277, 278, 281, 289, 291, 292, 299, 355, 389, 401, 409, 410, 451,456, 464, 480, 482, 487, 498
57.	Evaluate site conditions frequently to assess changing conditions and adjust equipment operations as necessary to protect the site while maintaining efficient project operations.	212, 213, 214, 216, 277, 278, 281, 289, 291, 292, 299, 355, 389, 401, 409, 410, 451, 456, 464, 480, 482, 487, 498
BMP Veg-3 – Aquatic Management Zones (AMZ)		
58.	Design silvicultural or other vegetation management prescriptions and operations in the AMZ to maintain or improve the riparian ecosystem and adjacent waterbody. Retain trees as necessary for canopy cover and shading, bank stabilization, and as a source of large woody debris within the AMZ.	212, 213, 214, 216, 277, 278, 281, 289, 291, 292, 299, 355, 389, 401, 409, 410, 451, 456, 464, 480, 482, 487, 498
The Riparian Reserves (RRs) and Riparian Habitat Conservation Areas (RHCAs) are the Aquatic Management Zones for the West Bend Project. The RHCA of the Deschutes River (which is 300 feet slope distance from edge of channel) is divided into zones for the purpose of applying specific silvicultural prescriptions. Refer to Figure 19 for a diagram of these zones that are referenced in the following thinning setbacks.		401,409, 410
Zone 1 (high water line of stream edge to 12 feet): No thinning of trees of any size. **Zone 2** (12 feet to 28 feet): Hand thinning of trees < 20 feet tall dbh allowed. Machinery is excluded. **Zone 3** (28 feet to machinery boundary): Hand thinning of trees < 10" dbh with no height restriction. Machinery is excluded **Zone 4** (machinery boundary (100 feet or greater) to outer limit of RHCA,): Thinning of trees <21" dbh with machinery allowed. Thinning prescription can be the same as adjacent unit located outside the RHCA.		

Measure Number	Protection Measure	Units affected and/ or Direction
Table 19: Riparian Habitat Conservation Area (RHCA) Zones of the Deschutes River (only applies to west bank) 		
59.	Heavy equipment limited to 100 feet or greater from the edge of the Deschutes River	401, 409, 410
60.	For intermittent channels, heavy equipment limited to 50 feet or greater from edge of channel. Equipment can utilize boom to harvest trees within the 50 foot buffer. Intermittent channels are defined as a drainage feature with an identifiable channel and evidence of annual scour or deposition.	212, 213, 214, 216, 277, 278, 281, 286, 291, 292, 299, 355, 389, 480, 482, 487
61.	Fisheries Biologist or hydrologist to assist tree marking crews in identifying stream buffers in the field.	212, 213, 214, 216, 277, 278, 281, 286, 291, 292, 299, 355, 389, 401, 409, 410, 456, 464, 480, 482, 487, 498
62.	Mechanized equipment limited to 25 feet or greater from edge of wetland vegetation.	355, 410
63.	No skid trail crossings of channels, including intermittent.	212, 213, 214, 216, 277, 278, 281, 289, 291, 292, 299, 355, 389, 451, 456, 464, 480, 482, 487, 498
64.	Directionally fall hand –thinned trees away from steams and rivers to limit streamside disturbance.	379, 401, 409, 410
65.	Retain maximum number of snags in RRs and RHCAs. For hazard trees (that are felled) with potential to fall into streams, fall toward stream and leave on-site.	212, 213, 214, 216, 277, 278, 281, 289, 291, 292, 299, 355, 379, 389, 401, 409, 410, 451, 456, 464, 480, 481, 482, 483, 487, 498
66.	Retain all aspen and other hardwoods.	355, 401, 409, 410, 498
BMP Veg-4 – Ground-based Skidding and Yarding Operations		

Measure Number	Protection Measure	Units affected and/ or Direction
Within RRs/RHCAs		
67.	Locate skid trails outside of RRS/RHCAs to the extent practicable. When within RRs/RHCAs, maximize skid trails perpendicular to slope. Avoid long runs on steep slopes.	212, 213, 214, 216, 277, 278, 281, 289, 291, 292, 299, 355, 379, 389, 401, 409, 410, 451, 456, 464, 480, 481, 482, 483, 487, 498
68.	Use existing road and skid trail network to the extent practicable.	
69.	Use suitable measures to stabilize and restore skid trails after use. Reshape surface to promote dispersed drainage, mitigate soil compaction to improve infiltration and revegetation conditions, and apply soil protective cover on disturbed areas where accelerated erosion may occur.	
BMP Veg-6 – Landings		
70.	No landings or temporary roads will be located within RRs/RHCAs.	212, 213, 214, 216, 277, 278, 281, 289, 291, 292, 299, 355, 379, 389, 401, 409, 410, 451, 456, 464, 480, 481, 482, 483, 487, 498
71.	Locate landings to minimize the number of required skid trails.	
Prescribed Fire Management Activities		
BMP Fire-2 – Use of Prescribed Fire		
Within RRs/RHCAs		
72.	Keep high-intensity fire out of RRs/RHCAs. To minimize potential sedimentation, plan prescribed fire with an intensity that will not result in hydrophobic soils or excessive consumption of ground cover and downed coarse wood.	212, 213, 278, 401, 409, 410, 451, 456, 464, 480, 481, 482
73.	Minimize machine fireline construction within RRs and RHCAs. Utilize handline construction whenever feasible. Construct firelines to the minimum size and standard necessary to contain the prescribed fire and meet overall project activities. Maintain firebreaks in a manner that minimizes exposed soil to the extent practicable. All firelines will be rehabilitated immediately after underburn is completed.	
74.	Ignitions during underburning should be at least 50 feet or more from streams. Fire is allowed to creep toward streams.	
75.	Handpiling is allowed 50 feet or greater from streams. Placement of handpiles would focus on upslope areas and avoid areas of washes and depressions that may facilitate water run-off toward streams. Burning would occur under conditions that do not allow excessive creeping from the pile, generally 10 feet or less. Handpiles should not exceed 50 ft^2.	216, 355, 379, 389, 401, 409, 410, 451, 480
76.	Evaluate the completed burn to identify sites that may need stabilization treatments or monitoring to minimize soil and site productivity loss and deterioration of water quality both on and off the site. Provide for rapid revegetation of any denuded areas through natural processes supplemented by artificial revegetation where necessary.	212, 213, 278, 401, 409, 410, 451, 456, 464, 480, 481, 482
77.	Machine or grapple piling is allowed 150 feet or greater from the Deschutes River and 100 feet from other streams, seeps, wetlands, and waterbodies in the project area. Locates slash piles in areas where the potential for soil effects is lessened and that do not interfere with natural drainage patterns.	216, 355, 389, 401, 409, 410, 451, 480, 487
Road Management Activities		
BMP Road-5 – Temporary Roads		
78.	No temporary roads will be constructed within RRs/RHCAs.	212, 213, 214, 216,

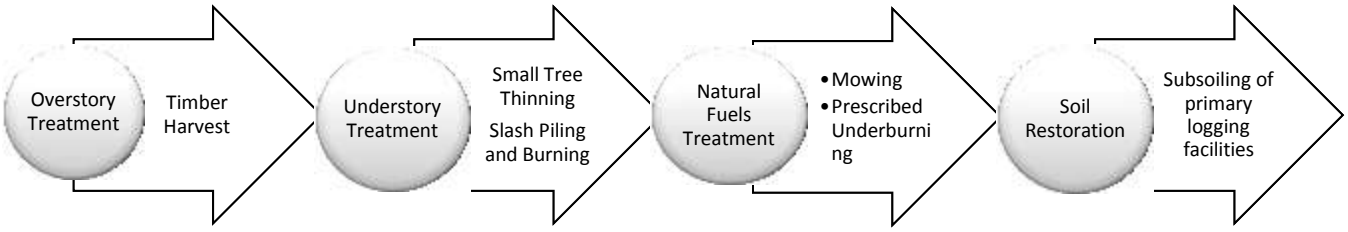
Measure Number	Protection Measure	Units affected and/ or Direction
		277, 278, 281, 289, 291, 292, 299, 355, 379, 389, 401, 409, 410, 451, 456, 464, 480, 481, 482, 483, 487, 498
79.	Temporary roads and landings will be obliterated after use, with the surface deeply ripped; natural drainage features re-established, road effectively drained and blocked; and road returned to native vegetation through either replanting or natural succession.	All units with temp. roads and landings (none are within RRs/RHCAs)
All Management Activities (Vegetation, prescribed fire, temporary road construction and decommissioning)		
BMP Road-10 – Equipment Refueling and Servicing		
80.	Develop or use existing fuel management plans (e.g. spill response plan) when assigning the equipment and refueling and servicing sites.	212, 213, 214, 216, 277, 278, 281, 289, 291, 292, 299, 355, 379, 389, 401, 409, 410, 451, 456, 464, 480, 481, 482, 483, 487, 498
81.	To prevent pollutants from entering water, all servicing and refueling of equipment shall occur outside of RRs/RHCAs.	
82.	Storage of fuels and other toxicants used during management activities shall be stored outside of RRs/RHCAs.	
To Minimize Impacts to Wildlife		
Raptors		
To prevent disturbance to nesting birds during breeding season		
83.	Restrict disturbance activities within ¼ mile of any known or newly discovered nests. This condition may be waived in a particular year if nesting or reproductive success surveys reveal that the species indicated is non-nesting or that no young are present that year. The following are a list of raptors and their nest restriction dates in which habitat is identified within the project area: • Red-tailed hawk: March1 – August 31 • Northern goshawk: March 1 – August 31 • Cooper's and Sharp-shinned hawks: April 15 – August 31 • Osprey: April 1 – August 31 • Northern Spotted Owl: March 15 – September 3 • Golden eagle: February 1 – August 15 • Great gray owl: March 1 – June 30 Great blue heron: March 1 – August 31	Deschutes LRMP, Eastside Screens, and NWFP
84.	Goshawk: If a new goshawk territory is discovered, a 30 acre no treatment area around the nest will be identified and a 400 acres Post Fledging area will be delineated.	
85.	Northern Spotted Owl: If a new spotted owl territory is discovered, a 100 acre nest core/ no treatment area around the nest will be identified.	
86.	For treatments such as clearcuts with reserves and shelterwood harvests, 15% of the area associated with each cutting unit is to be retained. This does not apply to intermediate harvests (thinning). At a minimum, snags are to be retained within the harvest unit at levels to sufficient to support species of cavity nesting birds at 40% potential population levels based on published guidelines and models. A minimum of 120 lineal feet per acre greater than or equal to 16 inches in diameter and 16 feet long should be retained. Decay class 1 and 2 logs count towards these totals and down woody material already on the ground should be retained and protected to the greatest extent possible during activities	Northwest Forest Plan Matrix
87.	Mowing and underburning where Lewis' Woodpecker monitoring sites occur will take place between September 1 and April 15.	89, 90, 91

Measure Number	Protection Measure	Units affected and/ or Direction
Landbirds		
88.	To minimize disturbance and direct impact to nesting landbirds, which includes Neotropical Migratory Bird species, limit the amount of thinning, mowing, and burning to the extent feasible March 15 to June 15	
Retention Areas		
89.	Within black-bark thinning units, previously-identified retention areas (from earlier projects) will be retained. (LRMP WL-59)	
Snags and Green Tree Replacements		
90.	For sale activities: 1) maintain snags and green tree replacements (GTRs) of ≥15" dbh at 100% maximum potential population (MPP) for all vegetation types except lodgepole pine; 2) for lodgepole pine, maintain snags and green tree replacements of >10"dbh at 100% MPP; and 3) maintain down logs ranging between 3 and 20 pieces per acre depending upon vegetative series	
91.	During prescribed fire operations, consumption of down wood at least 12 inches diameter at small end and at least 6 feet in length at rate of 40 lineal feet per acre in ponderosa pine and 140 lineal feet per acre in mixed conifer will not exceed 3 inches total (1 ½ inches per side)	Eastside Screens Forest Plan Amendment #2 (USDA 1995)
Lewis' Woodpecker – monitoring sites		
92.	Mowing and burning should be completed between August 15 and April 15. Early spring or fall implementation is preferred.	Units 89, 90, 91
To Prevent the Introduction and Spread of Invasive Plants		
93.	Clean all equipment before entering National Forest System lands. Remove mud, dirt, and plant parts from project equipment before initially moving it into project units and before proceeding to the next project.	
94.	To prevent the introduction of weeds, the district botanist or designee will inspect all fill material for the presence of weeds prior to use on the project.	
95.	To avoid the spread of weeds, if a significant weed site is located on a landing or skid trail, an alternate, uninfested site will be used, unless a workable solution is found between the noxious weed coordinator and the sale administrator to avoid having to move it.	
96.	All weed sites listed in Table 157, page 323, that lay within project activity units, will be treated as described in the Forest's Invasive Plant FEIS prior to project initiation.	
97.	Any water source proposed for this project will be evaluated for weeds by the district botanist or designee and if weeds are found, another source may be recommended, or if possible, the site will be treated prior to use.	
To Protect Sensitive Plant Species		
98.	To avoid impacts to Newberry's Gentian, (*Gentiana newberry*) the stringer meadow within EA unit 355 will be an "Area to Protect" (ATP) during any part of project implementation, including post-sale and fuels work.	Unit 355
99.	To avoid direct impacts to green-tinged paintbrush populations, CACH populations will be flagged out of units in all action alternatives by the district botanist or her designees. They will be Areas to Protect.	
100.	The Areas to Protect will include CACH populations and the Newberry's Gentian population. The ring immediately adjacent to the CACH population will be clearcut to a distance of one tree length (about 70'). The second ring, another tree length, adjacent to the clearcut, will be heavily cut but not clearcut.	
101.	Regarding fuels treatments, there will be no mowing or lighting within the CACH ATPs, including the outermost ring; measures will be taken to prevent fire creeping into the CACH populations.	
102.	To avoid impacts and added shading to the green-tinged paintbrush (CACH), the CACH sites within units will not be planted post-sale within any of the concentric ring areas surrounding the actual sites in any action alternative.	

Measure Number	Protection Measure	Units affected and/ or Direction
103.	All skid trails, temporary roads, landings and cut trees and/or slash will be placed outside CACH15 areas.	
To Protect Cultural Resources and to avoid potential effects on eligible and unevaluated sites		
104.	In units to be underburned, light flames are permissible through ground-based eligible prehistoric sites. Eligible historic sites will be avoided with a 100 foot buffer by flames. No fireline construction through, staging of fire vehicles on, or mop up within eligible prehistoric sites..	Units listed in Heritage Report
105.	No slash piles will be built within 100 feet of eligible historic or prehistoric sites.	
106.	Mowing will avoid all eligible historic sites. No turning and maneuvering of the equipment within ground-based eligible prehistoric sites.	
107.	Precommercial thinning by hand (chainsaw) will not affect historic or prehistoric sites but mechanical thinning and machine piling will avoid all eligible historic and prehistoric sites.	
108.	Commercial thinning, will exclude all eligible sites from treatment units, landings, temporary roads and skid trails. Avoidance areas will be marked in contractor files or maps as area to be protected (ATP) and not as archaeological sites.	
109.	Where sites need to be avoided by project activities, an archaeologist will mark the area to be avoided prior to layout and/or design, and implementation.	

2.5 Implementation

Project implementation is likely to take several years to complete. For stands with a commercial timber component, the first phase of treatment is the overstory treatment (e.g. commercial thinning). Where units are small tree thinning or natural fuels treatment only, they could begin at the same time as the timber sale units. The West Bend project area is likely to involve more than one timber sale or stewardship contract, and operations could span all seasons, except where proscribed because of wildlife or recreation site restrictions (see Resource Protection Measures).



2.6 Comparison of the Alternatives Analyzed in Detail

Alternative 2 would treat approximately 21,850 acres, Alternative 3 21,817 acres, and Alternative 4 21,509 acres. The differences in the alternatives are primarily a result in how the treatments would occur.

Table 20: Summary of Treatment Acreage Differences by Alternative

Treatment	Alternative 2 (Acres)	Alternative 3 (Acres)	Alternative 4 (Acres)
Commercial Harvest	14,745	14,522	12,167
Skid and Deck	2,302	2,302	1,806
Understory Treatment Only	652	827	1,143
Fuels Only	4,151	4,166	6,393
Total Acres	**21,8502**	**21,817**	**21,509**

Figure 15: Comparison of Treatment Acres by Alternative

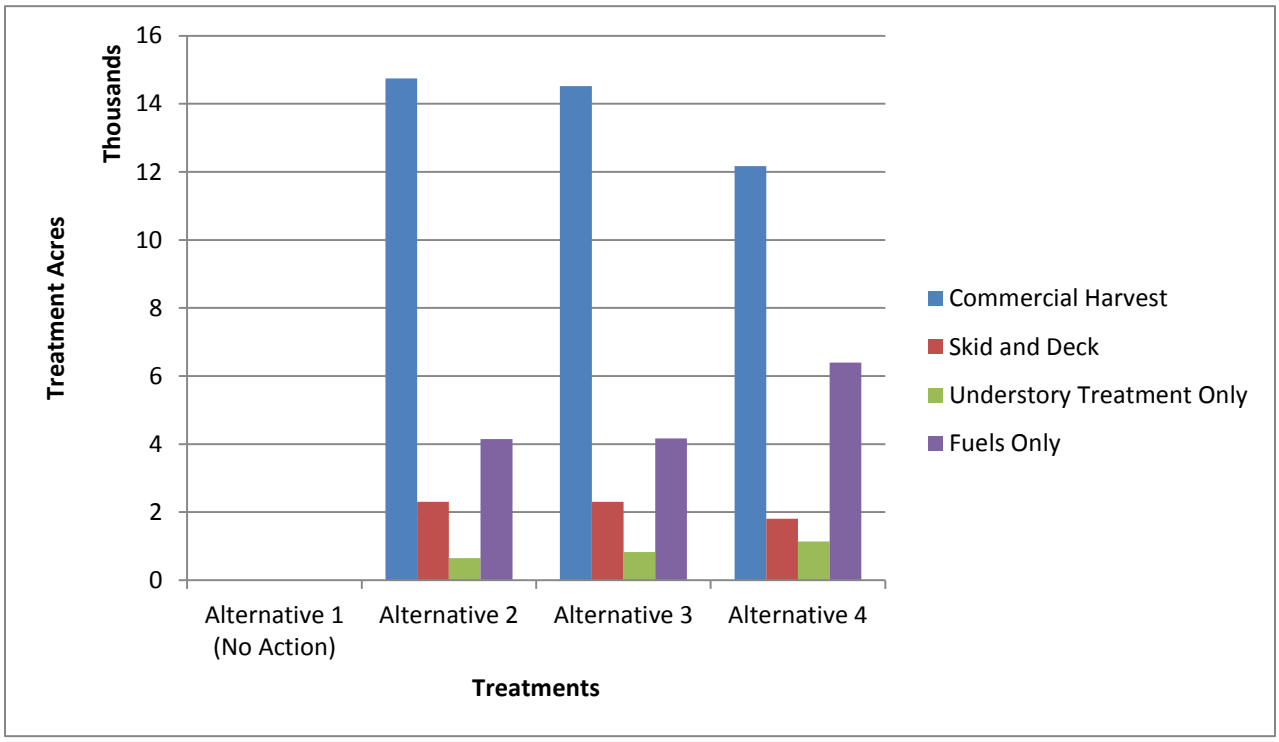


Table 21: Comparison Summary of Overstory Activities and Associated Acres

Harvest Code	Description	Alternative 2 (Acres)	Alternative 3 (Acres)	Alternative 4 (Acres)
HCR	Harvest- seed tree cut with reserves	1,751	1,751	1,751
HIM	Harvest- improvement cut	181	181	181
HOR	Harvest- overstory removal	824	586	586
HSV	Harvest- salvage	0	31	31
HTH	Harvest- thinning	11,989	11,973	9,618
Total Acres		**14,745**	**14,522**	**12,167**

Table 22: Comparison Summary of Understory Activities and Associated Acres

Understory Activity	Description	Alternative 2 (Acres)	Alternative 3 (Acres)	Alternative 4 (Acres)
LFR	Ladder fuels reduction	1,514	1,514	1,514
PCT	Precommercial thinning	6,466	6,327	5,216
PCT MECH	Precommercial thinning mechanically	235	235	235
SKID AND DECK	Non-commercial thinning with utilization	2,302	2,302	1,806
WHIP	Whip-falling	1,167	1,167	1,167
Total Acres		**11,684**	**11,545**	**9,938**

Table 23: Comparison Summary of Fuels Activities and Associated Acres

Fuels Activity[1]	Description	Alternative 2 (Acres)	Alternative 3 (Acres)	Alternative 4 (Acres)
PILE	Piling of slash (thinning/harvest residue)	7,333	7,587	7,793
MOW and/or BURN	Mechanical shrub treatment (MST) Prescribed underburning	18,960	18,949	18,720
LOP AND SCATTER	Cutting and scattering of slash	1,085	1,085	1,079

1 Fuels activities may have overlap acres

Table 24: How the Alternatives Address the Purpose and Need

Purpose & Need	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Maintain or restore forest health				
Percentage of ponderosa area stands resistance to insect mortality (stocking level reduce below UMZ)	33%	86%	85%	73%
Percentage of ponderosa pine stands best suited to move towards LOS or continue to grow older (ponderosa pine open canopy; all sizes). HRV for open ponderosa is > 55%	32%	49%	48%	44%
Acres of increased resistance to fire mortality - ponderosa pine-dominated stands (increased growth and ave. diameter)	0 acres	13,235 acres	13,235 acres	10,418 acres
Treatment that will reduce mistletoe spread in ponderosa and lodgepole stands	No treatment to reduce spread of mistletoe	6,326 acres PP 1,519 acres in LP	6,271 acres PP 1,519 acres in LP	5,229 acres PP 1,519 acres LP
Reduce the threat of large scale wildfire				
Fire hazard rating (% project area)	57% low 36% extreme	87% low 1% extreme	87% low 1% extreme	87% low 1% extreme
Wildfire risk rating (burn probability) (% project area)	40% low	87% low	86% low	87% low

Contribute wood products and restoration work to the local and regional economy				
Timber volume produced	0 mmbf	31.2 mmbf	31.8 mmbf	26.4 mmbf
Jobs created or maintained	0	188	190	155

*mixed conifer dry and ponderosa pine plant associations.
**may be accomplished with mowing and/or burning.

Table 25 summarizes how each of the alternatives addresses the key issues identified in Chapter 1.

Table 25: How the Alternatives Address the Key Issues

Key Issue	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Key Issue 1: Variability in Thinning Approach on the Landscape	0 acres thinning	Thin to average BA of 60 ft.² on 11,989 acres	Additional objectives incorporated to add structural diversity on 3,078 acres	Additional objectives incorporated to add structural diversity on 2,183 acres
Key Issue 2: Lodgepole Pine Overstory/Final Removal Treatments	0 acres removed	824 acres HOR	586 acres HOR 225 acres girdling	586 acres HOR 225 acres girdling
Key issue 3: Mature Trees in Wet Mixed Conifer PAG	0 acres treated	White fir removed regardless of size	WF > 24" dbh retained	WF > 24" dbh retained
Key issue 4: Goshawk Habitat Management	9,803 total acres; 0 acres treated	Historic PFAs not addressed differently with thinning	1,590 acres modified Rx in PFAs	1,590 acres modified Rx in PFAs
Key issue 5: Ryan Ranch Key Elk Area Thermal Cover	791 total acres; 0 acres treated.	292 acres thermal cover affected	292 acres in thermal cover affected	0 acres in thermal cover affected
Key issue 6: Winter Range (MA-7) Thermal Cover	1,545 total acres (12% of MA-7) 0 acres treated	1,124 acres thinned; thermal cover reduced to 11%	1,124 acres treated; thermal cover reduced to 11%	419 acres in thermal cover treated; reduced to 11%.

2.7 Summary of Alternatives and Project Design Considered but not Analyzed in Detail

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action expressed concerns they had with the proposed action and in some cases provided suggestions for a different course of action. Most of those issues are addressed with analysis or were used to develop the Alternatives, as

described previously in this chapter. Alternatives or project design that were considered but dismissed from detailed consideration are summarized below.

No Vegetation Management in RHCAs

Some commenters requested that riparian reserves and RHCAs not be entered because stream density is low in the project area and protection is necessary to provide landscape heterogeneity, dispersal habitat functions, shade, and large wood recruitment.

Approximately 105 acres are proposed for commercial and pre-commercial thinning, or mowing and burning, or a combination of the four activities within the Deschutes River corridor and RHCA. The thinning, mowing, and burning are proposed to promote attainment of the Riparian Management Objectives (RMOs); promote fire and insect resilience, and promote the development of large trees for shade and instream wood recruitment. This issue is primarily addressed by following current direction plus additional project design to be incorporated near the Deschutes River (see Resource Protection Measures). A separate alternative that did not enter RHCAs or riparian reserves was not analyzed in detail; however, project design is incorporated into all alternatives to protect streambanks and riparian resources while conducting treatments that will meet Riparian Management Objectives.

Emphasis on Biomass Utilization

The Environmental Protection Agency recommended including an alternative that would emphasize slash chipping or removal for utilization over burning the slash on site. The ID Team did not develop a separate alternative to emphasize utilization because under all action alternatives there would be an emphasis on utilization wherever it is possible. There will, however, be materials that cannot be utilized. Burning of slash is conducted under smoke management rules in order to comply with the Clean Air Act (refer to the Clean Air Act, page 118).

2.8 Monitoring

Soil Disturbance Monitoring

Type of Monitoring: 1) Monitor the implementation and effectiveness of resource protection measures to limit the accrual of detrimental soil conditions that can result from forest operations. 2) Monitor the effectiveness of post-harvest mitigation measures that have been prescribed to ameliorate the extent of detrimental soil conditions where temporary roads, landings, and primary skid trails are located. 3) To determine from the effectiveness monitoring how well the District is meeting LRMP S&Gs SL-1, 3, 5, and 6 regarding the maintenance of long-term site productivity and post-activity soil conditions.

Monitoring Elements: 1) Implementation monitoring will necessitate a search in the office of related documents and the applicable protection measures, followed by a field review. 2) Effectiveness monitoring will occur on-site to evaluate the extent and types of ground disturbance.

Methods/Parameters: 1) Qualitatively evaluate how well a prescribed protection measure can be tracked in the documentation trail, from the planning and analysis phase through the implementation phases, and to determine if the measure was implemented on the ground. 2) Quantitatively estimate the extent of soil disturbance and detrimental conditions by sampling along a transect line(s), using a method similar to or like the protocol identified in General Technical Report WO-82b (Page-Dumroese et al 2009).

Frequency/Duration: To be determined. The activity units that will be sampled will be selected randomly from a list of units grouped together based upon similar characteristics. These would include units where the extent of detrimental soil conditions before operations was high, units with certain soil types, units where a mechanical harvest operation would be followed by a post-harvest mechanical operation, certain units where prescribed fire is planned, units where temporary roads are planned, and units where post-activity subsoiling is prescribed. Between 6 and 12 units could be monitored.

Responsibility: The Bend-Fort Rock Ranger District soil scientist.

Effectiveness monitoring for road closures

Field observations will be made during implementation to document specific areas of closure failure.

Effectiveness monitoring for green tinged paintbrush (*Castelleja chlorotica*)

Monitoring would occur following harvest and fuels treatments to assess the effectiveness of treatments in stimulating growth of the existing populations of the green-tinged paintbrush.

Invasive plant control and effectiveness monitoring.

Monitoring of post-sale improvement projects for weed introduction (E). Areas where equipment is used in subsoiling (road decommissioning, landings, skid trails, and temporary roads.

2.9 Sale Area Improvement Projects

Money may be collected from the timber sales to complete certain projects such as required mitigation, and enhancement and restoration projects in the vicinity of the timber sale areas. Required reforestation items (R) and mitigation measures (M) have the highest priority for funding, but may be funded by other means such as appropriated funds to insure that requirements are accomplished. Other items are considered enhancement (E).

This list is intended to serve as an overall guide for the analysis area. As timber sales are defined, specific priorities may be adjusted to meet the needs for each sale area. This priority setting should be documented briefly in the implementation file for each timber sale.

Some projects listed here were not analyzed as part of this EIS and would require documentation through a separate NEPA process.

1. **Whipfelling and associated piling (R).** Site preparation to facilitate reforestation efforts. Treatments are part of the regeneration harvest treatments under Alternative 2-4. Whipfelling follows commercial harvest and consists of felling submerchantable whips that are diseased, poor vigor, or excess to retention requirements. Piling of fuels excess to desired fuel loadings done either by hand or grapple piling.
2. **Stocking surveys (R).** Stocking surveys to monitor progress in establishing a new stand following all regeneration harvest treatments.
3. **Subsoil – Restoration/Enhancement – Sale Area Improvement (M/E).** Approximately 957 acres (Alternative 2), 930 acres (Alternative 3) and 763 acres (Alternative 4) of the soil resource within proposed activity areas are likely to need subsoiling restoration treatments of previous impacts in order to meet LRMP standards for soil productivity (see FEIS, Appendix D). Subsoiling treatments on skid trails, log landings, and temp roads additional to these acres in any units receiving mechanical harvest treatments, would further reduce the cumulative amount of detrimentally compacted soil and result in a net improvement in soil quality over a larger portion of the project area.
4. **Planting (R).** Openings created for deer cover will be planted with ponderosa pine seedlings.
5. **Removal of Sale Area Flags/Tags and Marking (M).** Remove visible boundary marking indicators from Scenic View areas, trails and developed recreation sites following harvest and fuels treatments.
6. **Precommercial (small-diameter) thinning and associated slash piling (E).** A component of the thinning treatments analyzed with Alternatives 2-4 consists of the cutting of trees too small to

have commercial value, as identified in Appendix A. Treatment follows a timber sale or occurs separately within plantations.

7. **Scenic Views Slash Cleanup (E).** Following harvest/thinning treatments, quick removal of slash piles, pile burning or physical removal of slash, within two years of completion of unit activities.
8. **Rehabilitation of unauthorized trails and user-created roads (E)**. Natural barriers are the preferred method. Rehabilitation of user-created roads and/or trails, road closures (from previous NEPA decisions). Rehabilitation will include seeding with a locally-adapted native seed mix.
9. **Invasive plant control and effectiveness monitoring (E)**. Invasive plant sites listed in Chapter 3 that are to be treated prior to other project work. Treatment will be according to 2012 Invasive Plant FEIS.
10. **Monitoring of post-sale improvement projects for weed introduction (E).** Areas where equipment is used in subsoiling (road decommissioning, landings, skid trails, and temporary roads)
11. **Mulch (E)** (i.e., dirty green chips from grinding) in units 15 & 17 (potentially units 95, 97, 401) to enhance soil productivity.
12. **Road maintenance for watershed improvement (E):**
    - Clean two culvert inlets under road 4615 crossing over unnamed stream (section 21).
    - Segments of road 4612/4612-400 encroachment on semi-seasonal channel – road intercepted runoff diverted to channel and causing low to moderate surface erosion.
    - Segments of powerline road contributing runoff to semi-seasonal stream reach and leading to low to moderate surface erosion where it crosses draw in sec 31, T18S R11E.
    - Segments of the 4601-310 road divert road intercepted runoff to draw/swale and road 300 that have resulted in a low to moderate degree of surface erosion, deposition to the 4601 road occurs seasonally.
    - Gully erosion in segments of the treads of roads 4110 and 4615.
13. **Road closure failure repair:** As described in Appendix E, road closures that are not effective in eliminating vehicle traffic are to be re-closed following methods described in the Deschutes National Forest Road Closure Guide.

CHAPTER 3

Affected Environment and Environmental Consequences

Chapter 3: Affected Environment and Environmental Consequences

3.1 Introduction

This section of the environmental assessment considers the environmental consequences of implementation of the various alternatives. The following discussion of effects follows CEQ guidance for scope (40 CFR 1508.25(c)) by categorizing the effects as direct, indirect, and cumulative. The focus is on cause and consequences. For this analysis, in general, direct and indirect effects have been discussed in the context that most readers are accustomed to: those consequences which are caused by the action and either occur at the same time and place, or are later in time or farther removed in distance but are still reasonably foreseeable (40 CFR 1508.8). Cumulative effects are discussed where there is an effect to the environment which results from the incremental effect of the action when added to other past, present, or reasonably foreseeable future actions (40 CFR 1508.7).

Measures to mitigate or reduce adverse effects caused by the implementation of any of the actions proposed are addressed in Chapter 2, Resource Protection Measures. Effective mitigation avoids, minimizes, rectifies, reduces, or compensates for potential effects of actions. After mitigation is applied, any unavoidable adverse effect to each resource area is addressed in the section titled "Other Disclosures" in this chapter of the EIS. The temporal and spatial scale of the analysis is variable depending upon the resource concern being evaluated, particularly for cumulative effects. The landscape within the West Bend project area boundary is the focus of this EIS, but adjacent lands are considered in portions of this analysis process.

3.2 Basis for Effects Analysis

3.2.1 Specialist Reports

The interdisciplinary team (IDT) includes Forest specialists for each discipline (see Chapter 4, section 4.3 for team members and their qualifications). Specialists on the IDT prepared technical reports to address the affected environment and expected environmental consequences of proposed action and alternatives of the West Bend project. All reports are maintained in the project file, located at the Bend/Ft. Rock Ranger District office in Bend, Oregon. In some cases, this chapter provides a summary of the report and may only reference technical data upon which conclusions were based. In all instances, the majority of each of the specialist reports are included in this FEIS. When deemed appropriate, those parts of specialist reports that are not included in this FEIS are incorporated by reference (40 CFR 1502.41).

3.2.2 Role of Science

Science information improves the ability to estimate consequences and risks of decision alternatives. The effects of each alternative are predicted based on science literature and the professional experience of the Interdisciplinary Team (IDT) specialists. The conclusions of the IDT specialists are based on the best available science and current understanding. Relevant and available scientific information is incorporated by reference and a complete bibliography is included at the end of this FEIS. Referenced material is a consideration of the best available science.

3.2.3 Cumulative Effects

The Environmental Consequences disclosures in this FEIS include discussion of cumulative effects. Where there is an overlapping zone of influence, or an additive effect, this information is disclosed. In order to understand the contribution of past actions to the cumulative effects of the proposed action and

alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects. Most of these actions and natural events are displayed in Table 26, page 72, and Table 27, page 73.

The cumulative effects analysis in this FEIS does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions. Additionally, focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events, which may contribute to cumulative effects, just as much as human actions.

By looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. Finally, the Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions."

The cumulative effects analysis in this EIS is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which state, in part:

> "CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR 1508.7)

Table 26, page 72, lists the groups of actions that have contributed to the existing conditions within the project area. The effects analysis throughout this Chapter considers these past actions as contributing to the current condition. For example, the discussion of existing soil conditions (Chapter 3.13) and the Table 225, page 571 in FEIS Appendix D which shows soil condition concerns.

Table 26: Past Actions and Events that Contribute to the Current Conditions in the Project Area and Cumulative Effects Area

	Timing	Description	Residual Effects
Transportation System	Present	Road system developed. 155.29 open road miles (3.87 miles per sq. mile density); 29.89 miles closed (maintenance level 1). Current transportation system, road density, access, habitat fragmentation.	
Industrial Timber Operations	1920s-1930s	Extensive railroad logging across project area, primarily clearcutting. Land received from Shevlin-Hixon in 1944. Land for timber 11,006 acres.	
Large Wildfire	1900s	Swampy Lake Fire (1914) burned 200 acres; 101 within project area Bridge Creek Fire (1979) burned 3,364 acres; 245 within project area Skyliner Fire (1984) burned 114 acres, all within project area Inn of the 7th Mtn. Fire (1988) burned 75 acres, all within project area Awbrey Hall Fire (1990) burned 3,032 acres, 506 within project area	
Travel Management Rule	Ongoing	Across project area and Forest. Motorized travel in Central Oregon restricted to designated roads and trails only. Access to dispersed camping would have special provisions to limit access to sensitive areas.	
Vegetation Management / Fuels Reduction Projects			
Previous thinning and other harvest	1970s 1980s 1990s	603 acres entered once 175 acres entered twice 1,017 acres entered once 79 acres entered twice 2,192 acres entered once 560 acres entered twice * *not all past activities harvest recorded*	Past harvest has contributed to the current vegetative structure in the area and is reflected in the current condition assessment for forested vegetation and fuels. Multiple entries may be important to soils analysis. More recent entries are listed separately and may continue to have visible effects of activities.
Katalo East and West Projects		Within center 1/3 of project area. Commercial thinning, understory thinning, fuels treatments.	
Fry timber sale and fuels treatment	2011-2012	Surrounded by project on north end. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest and understory treatments completed, Fuels treatments remaining.	
Roadkill Firewood	2011	Within West Bend project area. Firewood recreational removal; dead lodgepole within 150 feet of roads; no vehicles off roads.	
Recreation			
Cascade Lakes National Scenic Byway	Ongoing	Southern boundary of project area. Brings thousands of Forest visitors into the area;	Within Scenic Views – 2 FPAs for
Development of Summer Trail Systems	Ongoing	Recreation use by hikers, mountain bikers and equestrians primarily during the spring, summer and fall seasons.	Miles of Hike/Pedestrian Trail: 4.6 miles Miles of Mtn. Bike Trail: 77.7 miles Miles of Equestrian Trail: 7.3 miles
Development of Winter Trail Systems	Ongoing	Recreation use by cross country skiers, snowshoers and snowmobilers during the winter	Miles of ungroomed Cross Country ski Trail: 16.7 miles

	Timing	Description	Residual Effects
		season.	Miles of groomed Cross Country ski Trail: 20.1 miles Miles of Snowshoe Trail: 7.3 miles Miles of groomed Snowmobile Trail: 5.2 miles

Table 27: Ongoing or Reasonably Foreseeable Future Actions, in the Project Area and Lower Little Deschutes Watershed, that may contribute to Cumulative Effects.

Project Name / Activity	Status/Timing	General Description of Activities
Miscellaneous / Special Uses		
Bearwallow Firewood	Ongoing (second year)	Accessed from the 4601 road. Outside West Bend project area. Firewood recreational removal; dead lodgepole within 150 feet of roads; no vehicles off roads.
City of Bend Waterline Replacement Project	Planning	Implementation scheduled for 2013; involves replacing 10 mile water pipeline underground along Skyliner Road and upgrade of intake facility near Tumalo Falls.
Recreation		
Phil's Trailhead Enhancement	Implementation 2013	Providing paved parking area, toilets, and trailhead kiosks. Approximately 1.4 acres impacted.
Snowmobiling	Ongoing in winter	Within and around West Bend project area. Motorized recreation and grooming of trails. Some tree cutting for trails and safety.
Cross-Country Skiing	Ongoing in winter	Within and around West Bend project area. Bipedal recreation and grooming of trails. Some cutting of trees for trails and safety.
Mountain Biking	Ongoing	Within and around West Bend project area. Wheeled and bipedal recreation of trails. Some cutting of trees for trails and safety.
Deschutes River area recreation	Ongoing	Day use areas at several locations.
Developed and Dispersed Camping	Ongoing	Dispersed camping throughout project area. No developed camp sites.
Meissner Snopark Expansion	Implementation 2013	Existing parking area to be expanded. Parking will be available for a total of 180 spaces. A Nordic event start/finish area would be approximately 2 acres and would not be returned to a forested condition.
Cascade Lakes Welcome Station and parking lot	Implementation 2013	Providing building with power and water, restrooms, interpretive trail and paved parking lot for access to site and trail systems.
Welcome Station Trail Connections	Planning	Provide mountain bike connecting trails to the new Welcome Station on Highway 46.
Ryan Ranch	Planning	Restoration of wetland, removal of dike, interpretive trails and boardwalk. Implementation schedule unknown.
Roads		
Road Maintenance	Ongoing	Grading, ditching, and brushing out of roads
Skyliner Road reconstruction /	Implementation in 2014	FHWA categorical exclusion. Within northern portion of project area. Road to be resurfaced

Project Name / Activity	Status/Timing	General Description of Activities
realignment		and realigned in some locations.
Cascade Lakes Scenic Byway Use and Maintenance	Ongoing	Paving, weed control, danger tree maintenance, snow removal, traffic
Vegetation Management		
Rocket Vegetation Management	Planning	Within the North Unit Dam-Deschutes River watershed, about 7,500 acres of commercial thinning, plus mowing and underburning. Approx. 40 miles of road closure and decommissioning.
West Tumbull HFRA Project	Implementation	North of project area. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest understory thinning completed. Fuels treatments remaining
Sparky timber sale and hazard tree removal.	Ongoing	Along project boundary and Cascade lakes highway. Commercial thinning, salvage, understory thinning, fuels treatments (pile, mow, burn).
Jet Timber Sale part of West Tumbull project	Ongoing	Skyliners road upper community. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest continuing Understory treatments and fuels treatments remaining.
East Tumbull HFRA Project (Net T.S., Set T.S., NT7)	Ongoing	Within project east 1/3 of West Bend Project. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest finished, understory treatments for fuels remaining.
Feline Timber Sale	Ongoing	Within project area. Tree harvest and understory treatment finished. Fuels treatments remaining.
Invasive Plant Control EIS	Planned	Within project area and across Forest. Herbicide and manual treatment of invasive plant populations
Activities on adjacent private land	Ongoing/Periodic	Fuels treatments, new housing structures (Section 16, Skyliner, Adjacent to east boundary

3.3 Forested Vegetation

3.3.1 Introduction

The West Bend project area spans a diverse landscape from forest dominated by dry ponderosa pine, to higher elevation dominated by mixed conifer species of white fir, lodgepole pine and mountain hemlock. The resource objectives are equally diverse, including wildlife, forest health, forest products, and recreation.

Existing stand structure is mostly the result of past management. The original forest was logged early in the last century to feed the need of Bend and the mills which arrived on the heels of the railroad. Much of the West Bend project area was owned by the Shevlin-Hixon company and the lower elevation ponderosa pine ground was harvested to meet their demands. As the low elevation supply ran out, logging continued up in elevation capitalizing on ponderosa pine. Some of the area was burned by wildfire causing high mortality of the regeneration, although few records of this area are available. Following the logging and fire some areas remained regenerated but much required planting of trees. In the 1950s and the 1960s planting of the brush-dominated areas occurred. Since then various management activities through the area have occurred including precommercial thinning, commercial thinning, seed tree harvest in the lodgepole pine, prescribed fire, as well as wildfire.

Chapter 1 outlines the objectives for vegetation management in the project area. Table 1 gives a general idea of the various forest types by elevation and management allocation, and the corresponding objectives that inform what actions to use for addressing the purpose and need.

This section of the EIS addresses the following components of the physical environment related to forested vegetation:

- Stand Resistance to Insects and Disease
- Comparison to the Historic Range of Variability
- Stand Resistance to Fire
- Mistletoe Spread and Intensity

These components demonstrate how well each alternative meets the purpose and need. This section also includes a brief discussion of the following key issues: Deer Winter Range Thermal Cover, Overstory Removal, and Stocking Variability.

Changes between Draft and Final

In this section of the EIS, a number of updates were includes between draft and final. Edits to clarify effects analysis discussions, address comments on the DEIS, and make corrections.

Due to modifications to two lodgepole pine units in the eastern portion of the project area, the acres of potential wilderness area affected were reduced (Chapter 3.14) and the corresponding number of temporary roads reduced (throughout Chapter 3).

3.3.2 Management Direction and Regulatory Framework

In addition to the guidelines described in Chapter 1, the following LRMP management allocations provide specific direction for management of vegetation.

Intensive Recreation: Vegetation treatments in Intensive Recreation in ponderosa pine are intended to maintain or create a visual mosaic of numerous, large diameter, yellow-barked trees with stands of younger trees offering visual diversity and a sense of depth in landscapes.

General Forest: Objectives include converting unmanaged stands to managed stands. And utilizing the site growth potential achieved through stand treatments including controlling stocking levels; maintaining satisfactory growth rates; protecting stands from insects, disease, and damage. Fuel loadings will be treated to reduce the chances of fire starts and rates of spread to acceptable levels.

Deer Habitat: The goal in deer habitat is to manage vegetation to provide optimum habitat conditions on deer winter and transition ranges considering the inherent productivity of the land. The area is also meant to provide some wood products, visual quality and recreation opportunities. Vegetation management in the Deer Habitat allocation is meant to maintain tree vigor for resistance to stand-threatening insect damage, or encourage desirable forage in deficient areas.

Scenic Views: In ponderosa pine types, the goal of Scenic views is intended to achieve and maintain visual diversity through variations of stand densities and size classes. Large, old-growth pine will remain an important constituent. For lodgepole pine the emphasis is on managing healthy, full crowned young trees. It is desired to have a mosaic of even-aged stands with additional visual diversity provided by occasional groups of other tree and shrub species.

Winter Recreation: The west end of the project area is higher in elevation, keeping snow the longest. Vegetation management in the Winter Recreation allocation is intended to provide suitable conditions for winter recreation and to address potential wide-spread situations such as fire or insect and disease damage. The objective of any treatments is to improve winter recreation opportunities.

Wild and Scenic Rivers: Wild and Scenic rivers have their own plans and the forest plan identifies the sections where the values that qualified the segments of river are protected and enhanced. Vegetation management in this allocation is meant to enhance the scenic character of the landscape and the appearance over the long-term should remain near-natural

Front Country: The furthest northwest portion of the project area contains a small piece of the Front Country allocation. This allocation is intended to provide and maintain a natural appearing forested landscape on the slopes near Tam MacArthur Rim and provide sustainable levels of timber. Uneven-age management in this allocation in ponderosa pine is the preferred treatment.

Northwest Forest Plan

Administratively Withdrawn: These areas include recreation and visual areas and other areas where management emphasis precludes scheduled timber harvest and which are not included in calculations of allowable sale quantity (NWFP C-19). In the West Bend project area, Winter Recreation and Scenic Views are Administratively Withdrawn.

Matrix: The matrix consists of federal lands outside the categories listed above. Most timber harvest and other silvicultural activities would be conducted in that portion of the matrix with suitable forest lands, according to standards and guidelines (NWFP C-39). Fire and fuels management in the matrix can reduce the risk of fire and other large-scale disturbances that would jeopardize the reserves (NWFP B-8).

Production of timber and other commodities is an important objective for the matrix. However, forests in the matrix function as connectivity between Late-Successional Reserves and provide habitat for a variety of organisms associated with both late-successional and younger forests. Standards and Guidelines (S&Gs) for the matrix are designed to provide for important ecological functions such as dispersal of organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components such as down logs, snags, and large trees. The matrix will also add ecological diversity by providing early successional habitat (NWFP, B-1 and B-2).

Eastside Screens

The Screens require watersheds to be characterized for patterns of stand structure by biophysical environment and compared to the HRV. The HRV is based on pre Euro-American-settlement era conditions. Where the amount of late/old structure (LOS) is below HRV, Scenario A applies and timber sale activities will:

- Maintain all remnant late and old seral and/or structural live trees greater than or equal to 21" dbh that currently exist within stands proposed for harvest activities.
- Manipulate vegetative structure that does not meet late and old structural (LOS) conditions, in a manner that moves it towards these conditions as appropriate to meet HRV.
- Maintain open, park-like stand conditions where this condition occurred historically. Manipulate vegetation in a manner to encourage the development and maintenance of large diameter, open canopy structure.

There is also direction to maintain connectivity and reduce fragmentation of LOS stands by maintaining or enhancing the current level of connectivity between LOS and designated Old Growth habitats through a network pattern of connectivity corridors. Harvesting is allowed in connectivity corridors if some amount of understory is left in patches and the stand is managed within the top one-third of site potential.

3.3.3 Analysis Methods

Stand Resistance to Insects

Introduction

Stand Resistance to insects, specifically bark beetles, is mostly related to tree vigor and density. The amount of moisture allowed for a stand must be apportioned to all the plants and trees growing on a site. Higher tree density in a stand means more competition and less resistance to insect and disease. Plant associations indicate the level of moisture and soil depth. This helps identify the tree stocking levels which are not susceptible to beetle mortality (Cochran 1994). Mistletoe infection in stands has been observed to increase stand susceptibility to bark beetle mortality (Conklin 2000).

Scope and Scale of Analysis

The scope of the analysis for resistance to insects, primarily bark beetles within the West Bend planning area will focus on the condition within each stand. The beetle influence is not far outside the stand area (Andris Eglitis personal communication). The overall landscape of the West Bend planning area susceptible to mountain pine beetle will also be analyzed for each alternative to show landscape level change. Short term is the next decade while long term is the next two to three decades.

Measures

Competition between trees is identified through stand density. Higher tree density in a stand means more competition and less resistance to insect and disease. Stand Density Index (SDI) and Basal Area (BA) are two methods for comparing the level of trees on a site. Stand densities in lower moisture areas have relatively higher competition than the same densities on higher moisture areas. SDI values in different plant associations will have different competition and stress inferences (Cochran 1994). SDI values and basal area ranges for each plant association, above which beetle mortality or outbreak may occur is referred to as the Upper Management Zone (UMZ) and the lower level where trees are still occupying the site potential is identified as the Lower Management Zone (LMZ). The range between the LMZ and UMZ is also considered the upper 1/3 of site potential. The UMZ, LMZ and basal area ranges for each of those are listed in the Forest Vegetation Report, Table 9.

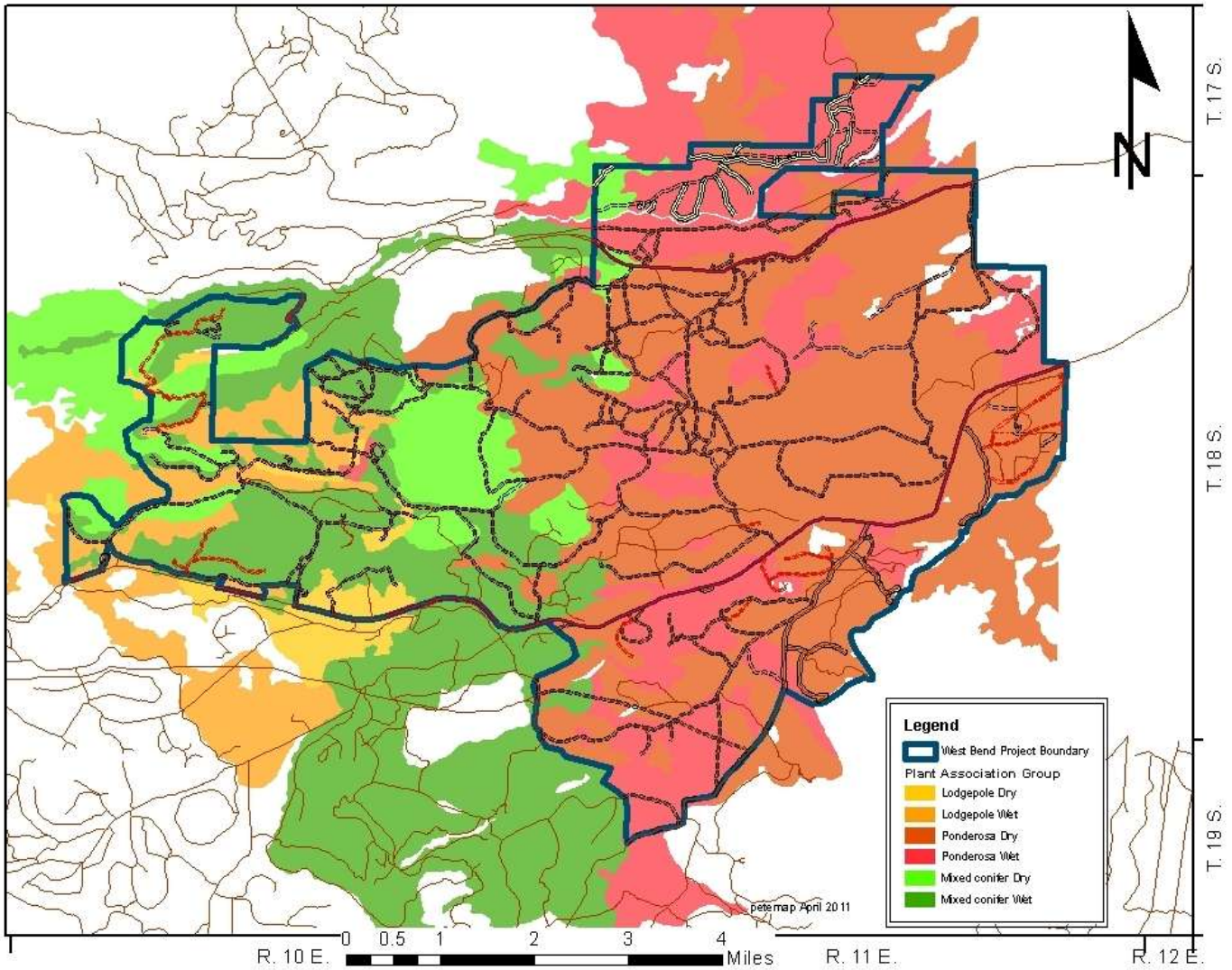
Methods

Dense ponderosa pine stands in the ponderosa pine and mixed conifer dry plant associations present in the West Bend project area were identified and selected using Photo Interpretation (PI) data. Stands identified from the PI data with more than 20% total crown closure were selected as stands which were above the UMZ for ponderosa pine and susceptible to beetle mortality.

Lidar is a technology which uses laser reflecting back to the Lidar apparatus to identify the distance from the source. This was used from an airplane to map the project area and develop products such as elevation maps, tree canopies and a few other products including tree heights. Lidar data was used to identify the highest points through an area and determine the heights of these points. These high points were tree tops and the height for each point was recorded and the subsequent tree diameter was predicted through regression analysis. From this information trees per acre, diameters, basal area and stand density index were calculated for areas 30 meter square (pixels of a 30 meter grid). This grid data was averaged for the original 1995 PI stands. Comparison of alternatives will use these stands with Lidar averaged Stand Density Index (SDI) data. The data from the original PI delineation has gone through a decade and half of change through harvest and mortality. Updating the data with Lidar derived data seemed prudent. The comparison of stands averaging above the UMZ SDI and the treatment of stands, which reduce the stand densities to less than the UMZ, is the basis of this analysis.

In order to predict the effect of treatments on stand density, data collected in stand exams during 2009 and 2011 will be manipulated in the Forest Vegetation Simulator (FVS). FVS is a model available on the web at www.fs.fed.us/fmsc/fvs (Dixon 2002). The Southern Oregon Northern California SORNEC variant was used. FVS and comparison with research identifying stocking levels and resistance to beetle risk was conducted. Stands over the UMZ (See Table 9 of the Forest Vegetation Report) will be at risk to beetle outbreak and mortality. Stand groupings for representative modeling and the steps for modeling are found in Appendix D of the Forest Vegetation Report.

Figure 16: West Bend Plant Association Groups



Comparison to the Historic Range of Variability Analysis (HRV)

Introduction

The historic range of variability (HRV) is based on a large landscape level. It is sometimes a desired condition to be within the HRV, with the assumption that the historic conditions and balance of structures was sustainable and provided for wildlife habitat at a desired level. While any individual stand may be within the historic range of conditions on the landscape, the analysis compares the existing structure stages to the historic range on the entire landscape. Within different plant associations the historic condition would have been different. This analysis tries to identify the ranges of condition which may have occurred. The range gives an image of factors of climate, stand development, and chance that occur in natural ecosystems.

Historic condition of the vegetation can be classified with four main identifiers. The four identifiers are average tree age or size, stand density, species composition, and fuel loading (Youngblood 2004). The Eastside Screens identify the different seral stages by the sizes of trees present and by structure (USFS 1995). The tree size and density have been aggregated into definitions of structure. The analysis for the West Bend project uses a model developed for Land Fire FRCC (Fire Regime Condition Class) which is a five box model. The model uses a combination of size and structure to describe an array of vegetation types and states found across the landscape. The biophysical setting determines the plant vegetation type and then each pixel was assigned a size and canopy closure state. Table 28 shows the structures which were analyzed from the five-structure FLN FRCC modeling and their relation to the seven structures from the Eastside Screens.

Table 28: Structural stages for use with HRV analysis

Label	FLN FRCC Structural Stage	Definition	Eastside Screens Structural Stage
1	Early Successional	Grass, Forbs, Brush, Seedlings, Saplings	Stand Initiation
2	Mid Succession Closed Canopy	Poles – small timber with closed canopy	Stem Exclusion Closed Canopy, Multi-stratum without large trees, Understory reinitiation, Stem Exclusion Closed Canopy
3	Mid Succession Open Canopy	Poles – small timber with open canopy	
4	Late Succession Open Canopy	Large timber with open canopy.	Late and Old Structure Stages: Multi-stratum with large trees Single-stratum with large trees
5	Late Succession Closed Canopy	Large timber with closed canopy	

Structural stages 4 and 5 (Table 28) are considered late/old structure (LOS), defined in the Eastside Screens as those vegetative structures in which large trees are a common feature. These structural stages do not guarantee old growth conditions, especially in a young area such as West Bend, but it is a useful tool for identifying possible structure. In the case of West Bend, stands of blackbark pine 70-80 years of age are beginning to grow trees into the 21" size range, particularly on high productivity sites. To maintain and enhance this structure, thinning from below is as important in these stands as it is in stands where few or no trees have reached that size.

Scope and Scale of Analysis

The HRV analysis is to be conducted on a large landscape where forest types, environmental settings, and disturbance regimes are relatively uniform (USFS 1995). For this comparison the two watersheds which encompass the West Bend Planning Area were selected. These are at the 10th Field HUC which is similar to the 5th Field HUC of the previous decade. This scale is used since part of the project area is

within the range of the spotted owl and analysis for Late Structure Old Growth (described below) is directed to be at that scale (USDA/USDI 1994). The two 10th field watersheds analyzed are the North Unit Diversion Dam watershed of the Deschutes River covering 101,224 acres and the Tumalo Creek watershed which is 38,004 acres. Only the area within the watersheds under federal management will be analyzed.

The comparisons will be for ponderosa pine-dominated forest land within these watersheds. Ponderosa pine and mixed conifer dry plant association groups in these watersheds are dominated by ponderosa pine, have similar fire regimes, and were both classified as ponderosa pine type forests in the 1930s (Harrington 2003). There is mixed conifer wet and lodgepole pine plant association within the watersheds, but less than 100 acres of mixed conifer wet plant association groups are within the Eastside Screens area as shown in Figure 16.

The Rocket planning area is also located within the North Unit Diversion Dam watershed and proposed activities there will possibly influence vegetation structure within the watershed. The HRV analysis for will consider the issue of structure compared to historic range, and the effects of the proposed treatments on the structure and its development and will include the Rocket project in cumulative effects.

For this analysis, the short term is considered the next decade while the long term is the future of the stands in the next two decades.

Classification of Historical Structural Stage

The classification of the historical condition was conducted by The Nature Conservancy (TNC), Mike Simpson and other collaborators within the Fire Learning Network (Waltz et al. undated). This classification uses the viable ecosystem model which is then collapsed into a five box model. The five box model used successional stages. Because of the similarity in disturbance intervals and patterns, the ponderosa pine and mixed conifer dry plant association groups were combined. To assist in identifying the historic range of stand condition within areas similar to that in this project, Mike Simpson (Forest Ecologist) used numerous watershed assessments and ecological subzones to determine the range of historic structures by viable ecosystem methodology. The ponderosa pine subzone HRV range was used from the viable ecosystem for mixed conifer dry and all ponderosa pine subzones. This grouping was done for three main reasons: 1) historic records from the 1930s indicate all these groups as ponderosa pine (Harrington 2003); 2) all these plant association groups are in the same disturbance regime; and 3) these plant groups are dominated by ponderosa pine dry on this landscape and it influences the pattern of disturbance. The historic range from the Fire Learning Network (FLN) – FRCC modeling successional stages was also used to show variation in professional assumptions (Waltz et al. undated).

Classification of Existing Structural Stage

The structural stages will be compared by one main PAG of ponderosa pine for the same reasons indicated above.

Lidar is a technology which uses laser reflecting back to the Lidar apparatus to identify the distance from the source. This was used from an airplane to produce very precise accurate and high-resolution images of the surface of the earth and vegetation. Vegetation attributes calculated using regression analysis from individual tree heights includes tree diameter (dbh), basal area (BA), stand density index (SDI) and crown width. Canopy cover is directly calculated from the raw point clouds based on the percentage of canopy point returns versus ground point returns. From this information trees per acre, diameters, basal area and stand density index were calculated for areas 30 meter square (pixels of a 30 meter grid). In the analysis for eastside screens comparison of alternatives will use a Lidar derived data set with averaged trees per acre of different size groups. The tree sizes were divided into three groups, small, Large and anything in between. The mid-successional and late-successional successional stages

were separated into open-canopy or closed canopy. The tree sizes are implicit to the age reference of late-successional, mid-successional or early stand condition. This analysis is detailed in Appendix A of the Forest Vegetation Report.

Measures

The structure of the landscape will be measured with the current stand condition and the changes of structure by treatment by acres; fuels only treatments will not change the structural classification. Where pixels are identified as LOS but are less than 40 acres, they are classified as mid-successional. Commercial thinning in blackbark stands will maintain or move these stands into open canopy structures. Thinning treatments in stands where large trees are common will not change the structure identified since all stories will remain-only the crown density will change.

Late-Successional/Old Growth Analysis in Northwest Forest Plan Area

Under the Northwest Forest Plan, an additional analysis is required to determine the level of late-successional/old growth (LSOG) in the watershed. Where it is less than 15% of the federally-owned portion of a watershed, then the existing LSOG must be retained. LSOG under the Northwest Forest Plan is defined "as a forest stand usually at least 180-220 years old with moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indication of old and decaying wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground. (FEMAT, USDA/USDI 1994). This definition emphasizes more of the characteristics of old growth than the definition for LOS in the Eastside Screens.

To determine LSOG, the Forest used Lidar-derived data. The analysis is similar to that found in *Northwest Forest Plan- The first 10 years 1994-2003:Status and Trend of Late-Successional and Old-Growth Forest (USDA 2005)*. Those pixels identified as large structure by plant association with the Lidar data were identified as having large tree structure and at least 10% canopy structure. The methodology followed is for the older forest with medium and large trees defined by potential natural vegetation zone. This method was chosen because of the landscape and lodgepole pine and subalpine fir types making up the vegetation types.

Though using age would have been nice this monitoring report recognized that "tree or stand age is difficult or impossible to infer directly from remotely sensed information….As a result, we rely on more readily measurable attributes, such as tree diameter and height as a substitute for stand age, decadence or seral condition. Average large-tree size is a useful attribute because it is easy to measure and well correlated with age, when local site and stand density factors are controlled for. Large trees are also fundamental to old-forest structure, function, and composition and are the precursor to large snags and down logs."

In the Tumalo watershed 24% (5,369 acres) of the forest land is LSOG structure and in the Deschutes North diversion dam watershed 19% (13,834 acres) of the watershed is in LSOG structure. Therefore, within the Northwest Forest Plan area it is permissible to treat within LSOG stands as long as the proportion does not fall below 15% of the watershed.

The following table compares the analysis of late-successional/old growth (LSOG) and late and old structure (LOS), both of which are structural stages that are subject to certain standards and guidelines under the NWFP and Eastside screens respectively Table 29.

Table 29: LSOG and LOS definition and applicable standards and guidelines under Eastside Screens or Northwest Forest Plan.

Forest Type	Definition	Analysis under the Eastside Screens	Analysis under the Northwest Forest Plan
Late-Successional / Old Growth (LSOG)	Large trees are common (lodgepole > 12" dbh and 60 per acre; other species > 21" dbh and 13 per acre)	N/A	Assessed for federal land within watershed across all PAGs. Standard and guidelines requires retention of existing LSOG if less than 15% remains in the watershed.
Late and Old Structure (LOS) (As part of HRV analysis which includes determining all existing structural stages)	Large trees (> 21") are common (> 13 / acre); patch size > 40 acres	Assessed across watershed in Eastside Screens area • Ponderosa Pine and • Mixed Conifer Wet If the amount of LOS in a PAG is below HRV, then timber harvest in that LOS stage is not allowed unless there is an ecological basis for it.	N/A

The analyses for LSOG and LOS use 21" DBH to identify large trees because Region 6 Interim Old Growth Definitions for the Ponderosa Pine Series and for the Grand Fir/White Fir Series (USFS 1993b) uses 21" DBH as the minimum required diameter to define old growth for these potential vegetation series. The Status and Trend of Late Successional and Old-Growth Forest (Moeur et al. 2005) also cites a 21" minimum quadratic mean diameter in reference to "older forest with size indexed to vegetation zone" for the Oregon Easter Cascades. Additionally, the Eastside Screens use 21" as a diameter size class boundary for management purposes.

Stand Resistance to Fire

Introduction

Stand resistance to fire mortality at the tree level is a function of species composition, stem diameter and crown height. Within the West Bend planning area the tree species of note are lodgepole and ponderosa pine and white fir. Lodgepole pine is not resistant to fire due to thin bark in all tree sizes and ages. Ponderosa pine and white fir increase in fire resistance with diameter and age; however, white fir is only moderately fire resistant (Brown & Smith 2000).

Scope and Scale of Analysis

The individual stand level is the scope of this analysis progression of average stand diameters will be compared. Individual stands can change fire behavior and individual trees can survive or die depending on the three resistance characteristics. Stands of lodgepole pine are not resistant to fire no matter their diameter (Brown & Smith 2000).

Measures

Stand level resistance will be measured by the average diameter of trees in a stand. Height to crown will not be used as a measure here because it is dealt within the Fire and Fuels section.

Ponderosa pine are resistant to fire mortality when diameters are greater than 8 inches and flame lengths are not higher than 4 feet. This is the target fire behavior for fuels treatments in the project area. An average tree diameter above 8 inches as the threshold for meeting resistance to fire. As fuels accumulate and brush grows in, the potential level of flame length may increase. Comparison of alternatives for an increased flame length to 8 feet is intended. Ponderosa pine of 14 inches dbh and greater are resistant to mortality from 8 foot flame lengths (USFS 2009). The Quadratic mean diameter of stands modeled in FVS will be used to compare alternatives following treatments for three decades.

Mistletoe Spread and Intensity

Introduction

Mistletoe is a naturally-occurring agent in the forest. It is a parasitic plant which spreads in and between crowns of trees by shooting seeds. Mistletoe at higher levels reduces tree vigor, health and growth increasing susceptibility to mortality from other agents, especially bark beetles. Mistletoe spreads between trees and within trees by seeds dispersed from mistletoe plants into tree foliage. Mistletoe infections are more widespread and intense than found historically in the ponderosa pine landscape (Hessburg 1994). Most of the increase from historical condition is due to the increased stocking levels, stands with overstory infections and close proximity of infected trees to uninfected trees. Each of these characteristics is more apt to facilitate spread and increase in intensity of mistletoe infections (Hawksworth 1996).

Scope and Scale of Analysis

Mistletoe is analyzed on the individual stand basis. With mistletoe infections increasing in intensity and spreading mostly within specific stands the effects are relative to the individual stand. Adjacent stands if infected can spread mistletoe outside the stand boundary this spread will be fast if the adjacent stand has mistletoe in upper canopy layers and the adjacent stand is a lower canopy stand. The spread and increase of intensity of mistletoe within stands will be modeled using FVS in stands with mistletoe. The between stand effects will not be analyzed because of the relative patch distribution of mistletoe in the West Bend planning area. The short term is the time of implementation of these treatments in the next decade while the long term is the next two to three decades.

Measures

Mistletoe is measured for individual trees on a scale of one to six as prescribed by Hawksworth mistletoe rating system (Hawksworth 1977). The System divides the tree crown into thirds with a rating of one to three for each third. The ratings for each third are added for the individual tree rating. Stand level analysis uses two systems, one to identify the overall stand infection level which is the Dwarf Mistletoe Rating (DMR) and the other is to identify the stand infection intensity the Dwarf Mistletoe Intensity (DMI). DMR is an average of the whole stand infected and uninfected trees. DMI is the average of ratings for infected trees only. A DMR rating of two or greater or a DMI rating of three or greater will cause more growth loss than desired as identified in the Forest Plan. FVS modeling will model the effects of the different alternatives and dwarf mistletoe ratings. The ratings of dwarf mistletoe immediately after treatment and for four decades following treatment will be the analysis temporal bounds.

3.3.4 Summary of Key Findings

The following table summarizes the effects analysis for the components of forested vegetation that were analyzed.

Table 30: Summary of Forested Vegetation Effects by Alternative

Measure	Alternatives			
	1	2	3	4
Percentage of ponderosa area stands resistance to insect mortality (stocking level reduce below UMZ)	33%	86%	85%	73%
Percentage of ponderosa pine stands best suited to move towards LOS or continue to grow older (ponderosa pine open canopy; all sizes). HRV for open ponderosa is > 55%	32%	49%	48%	44%
Acres of increased resistance to fire mortality - ponderosa pine-dominated stands (increased growth and ave. diameter)	0 acres	13,235 acres	13,235 acres	10,418 acres
Treatment will reduce mistletoe spread in ponderosa and lodgepole stands	No treatment to reduce spread of mistletoe	6,326 acres PP 1,519 acres in LP	6,271 acres PP 1,519 acres in LP	5,229 acres PP 1,519 acres LP
Mistletoe Intensity 2012 Ponderosa DMR/DMI	0.9 / 2.2	0.5 / 1.8	0.5 / 1.8	0.5 / 1.8

3.3.5 Environmental Consequences

Resistance to Insects

Existing Condition

The insects with the most impact on stand health in the project area are bark beetles. Mountain pine beetle affects lodgepole pine and ponderosa pine. Western pine beetle impacts mostly large old ponderosa pine and the fir engraver impacts the true firs including white fir and subalpine fir. The stands in the West Bend project area, for bark beetle susceptibility, are separated into three main species groups, lodgepole pine, mixed conifer wet and ponderosa pine dominated stands.

Lodgepole pine are resistant to mountain pine beetle attacks when the trees are less than eight or nine inches in diameter. The lodgepole pine stands in the West Bend project area which had trees larger than nine inches diameter have been heavily attacked by a mountain pine beetle outbreak for the last 10 years. This attack is decreasing but still killing susceptible trees.

The second stand type is mixed conifer wet. Mixed conifer wet stands are highly variable within and between stands. White fir, lodgepole pine and ponderosa pine trees can be found in different stocking levels. In these stands high densities and lodgepole pine are the main reason for bark beetle mortality.

Ponderosa pine is susceptible where stocking levels are high or lodgepole pine greater than 9 inches in diameter is in proximity. The proximity of lodgepole pine allows emerging bark beetles to attack ponderosa pine even though they are a less desired host. In this case unlike in lodgepole pine the bark beetle do not cause more contagion of impacts. Mortality of ponderosa pine and lodgepole pine typically is throughout the diameter ranges in the stand and may even be emphasized in the larger tree size groups. White fir in these stands has so far escaped the effects of fir engraver. High densities leave white fir susceptible to outbreaks of fir engraver especially if a drought cycle occurs.

Ponderosa pine stands found in the ponderosa pine and mixed conifer dry plant association groups dominate more than three quarters of the West Bend project area. These stands are blackbark stands and most were established in the 1920 and 30s and some as late as the 1960s. The blackbark stands are somewhat variable depending on productivity and location. Many stands are pure ponderosa pine but stands with higher productivity may have lodgepole pine or some white fir tree stocking. Unmanaged stands, tend to be dense with poles and larger blackbark trees and typically have heavy fuels from beetle mortality. The fuels are mostly down dead lodgepole pine from previous beetle infestations; however ponderosa pine and white fir mortality is becoming more common due to tree stress caused by heavy stocking levels. Managed stands of ponderosa pine have been precommercially or commercially thinned and are now 60 – 130 square feet of basal area. These stands have responded to lower stocking levels with increased growth, crown volume and understory tree and brush establishment. However, many of these stands still contain lodgepole pine and are above the UMZ.

Stocking levels and species mix leave the stands susceptible to beetle attack. Typically mountain pine beetle attacks on trees greater than 8 inches and less than 16 inches in diameter. Mountain pine beetle will generally be quite a bit less of a mortality agent for trees greater than 16 inches dbh and in these diameters typically only in lodgepole pine. However if lodgepole pine is in stands of ponderosa pine, all size trees and both species can be affected by emerging mountain pine beetles. Dense stands of ponderosa pine blackbark trees are susceptible to mountain pine beetle with or without lodgepole pine present. The mortality in these conditions will include the largest trees in the stand. Western pine beetle is the causal agent of mortality in larger ponderosa pine when densities or stresses are high.

Currently mountain pine beetles are infecting stands and causing mortality throughout the West Bend planning area. This impact is occurring in lodgepole pine, mixed conifer, ponderosa pine and mixed lodgepole and ponderosa pine stands. As shown in Figure 17, aerial detection surveys from 2001 through 2010 identified a cumulative 10,200 acres of bark beetle impact. Generally, a higher percentage of the larger diameter trees are impacted in these areas.

From the aerial surveys, beetle impact in 2001 totaled a low of 93 acres and increased steadily to 3,320 acres with active beetle mortality in 2005 and decreasing to 2,406 acres in 2010. The most cumulative activity period seems to have been 2005 through 2010 with 9,200 acres affected. Based on field visits to the West Bend project area, 42% of the area dominated by ponderosa pine had bark beetle mortality and 73% of the lodgepole pine dominated stands had bark beetle mortality. With the combination of dense stands and lodgepole pine, the susceptibility to mountain pine beetle attack and mortality continues. These two factors identify a large part of the planning area with risk to mortality from bark beetles. Where large old ponderosa pine occurs in and adjacent to the project area some mortality due to increased densities and the susceptibility to western pine beetles has occurred recently. This can be seen in Figure 17 on the west half of the project area as small individual centers.

Figure 17: Aerial Detection of Tree Mortality from Insects – 2001 - 2010

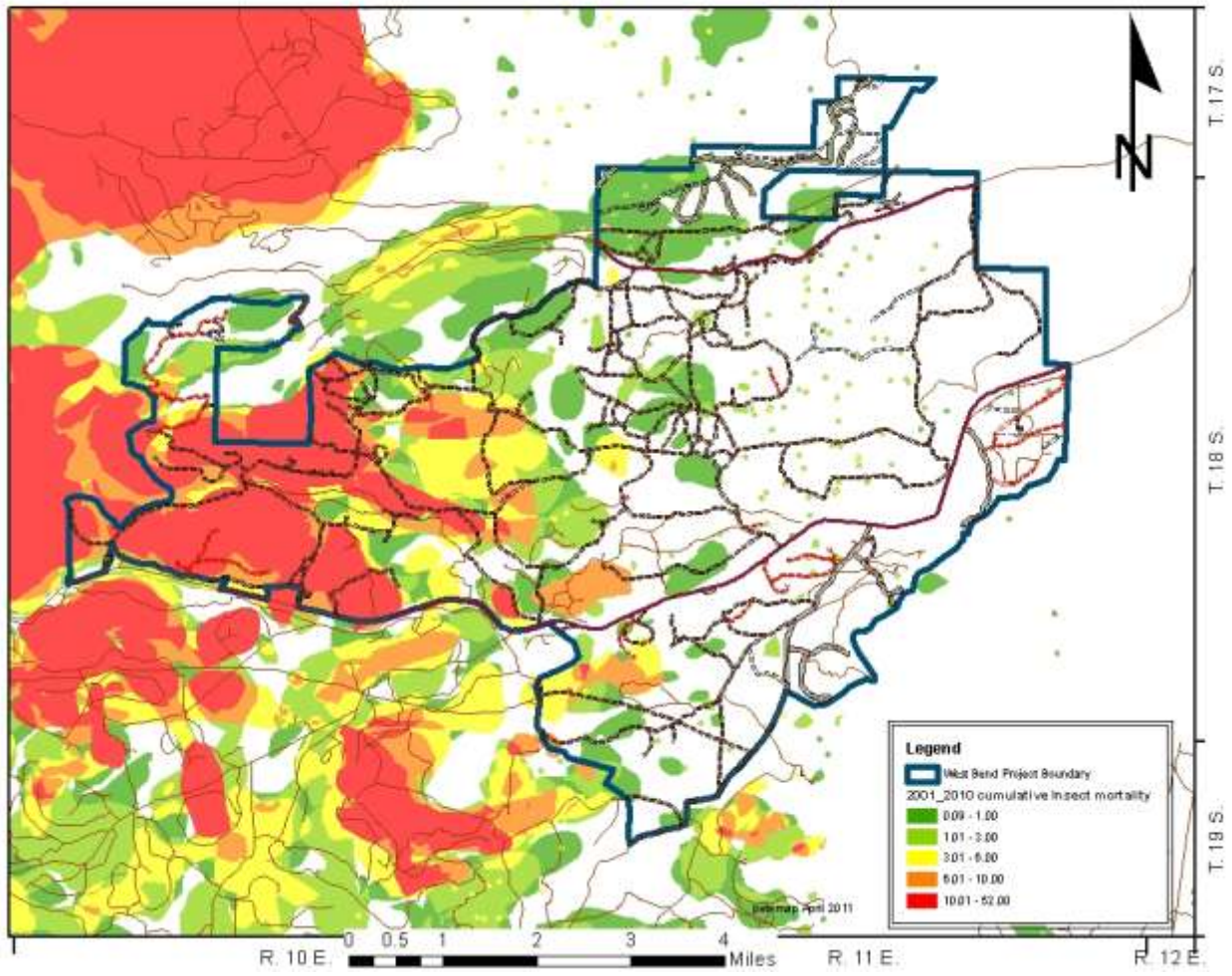


Table 31: West Bend Stocking Reduction by Plant Groups

Plant Association Group	Project area	Stocking level reduction acres		
		Alternative 2	Alternative 3	Alternative 4
Lodgepole Pine	1,391	993	993	993
Mixed Conifer Wet	4,088	1,956	1,951	1,909
Mixed Conifer Dry and Ponderosa Pine	19,808	13,235	13,257	10,418
Mixed Conifer Dry and Ponderosa Pine Project area where SDI is Below UMZ	33%	86%	85%	73%

Alternative 1 (No Action)

Direct and Indirect Effects: The ecological trend will continue with increased mortality in all stand types and especially ponderosa pine dominated stands above the UMZ and white fir stands as drought cycles occur. Stands sampled in the ponderosa pine and mixed conifer dry plant associations average 145% and range from 110% to 250% above of the upper management zone (UMZ). Of sampled stands, 64% had current bark beetle mortality. Using stand stocking estimates from Lidar data, 67% of the

stands through the area were above the UMZ. Of stands that were field reviewed 33% had stocking of lodgepole pine which has the potential to increase bark beetle mortality in blackbark ponderosa pine stands. In ponderosa pine dominated stands, the wide impact of bark beetles can be expected to continue because of high stand densities and the intermixing of lodgepole pine. Bark beetle mortality in both, the ponderosa and lodgepole pine, will reduce the number of larger overstory trees on the landscape and increase the time it takes for stands to develop large tree structure. The extent and contagion of insect outbreaks in ponderosa pine stands is not found to be as predictable as in lodgepole pine stand. Some contagion on the Bend Fort Rock district has been observed in scattered stands. On the Winema/Fremont National Forest more expansive outbreaks have been observed in ponderosa pine stands. Dense Stands of ponderosa pine may have larger areas impacted by bark beetle outbreaks. Fuels hazard will increase as dead trees fall and increase the down fuel loading.

In the lodgepole pine stands sampled, the stands had stocking 96 – 168% of the UMZ and all stands had bark beetle mortality. The current level of beetle mortality in all size groups of ponderosa pine and lodgepole pine will continue, however, beetle activity in lodgepole pine stands may decrease in the next few years as fewer trees remain alive which are conducive to bark beetle brood development.

Modeling of stand exam data identifies that all ponderosa pine and mixed conifer dry stands where exams were available were above the UMZ (Figure 18) and will remain at beetle risk until some form of mortality changes the stand density.

Alternative 2 (Proposed Action), Alternative 3 and Alternative 4

Direct and Indirect Effects: The action alternatives will all decrease the amount of area which is susceptible to bark beetle mortality. This will be accomplished through removing lodgepole pine from ponderosa pine dominated stands, reducing the amount of trees in overstocked ponderosa pine dominated stands and reducing the amount of area dominated by older lodgepole pine.

The action Alternatives 2 and 3 will conduct stocking reduction over 13,000 acres of ponderosa pine and white fir dominated stands in the planning area and Alternative 4 would treat about 3,000 acres less. Alternative 4 has no treatment of identified elk thermal cover stands. The thinning of ponderosa pine and lodgepole pine will reduce stocking levels and bark beetle mortality risk. This reduction will allow future growth without becoming at risk to beetle outbreak for over two decades (Figure 18). This reduced risk is brought about by reducing stand density to below the UMZ and removing most of the lodgepole pine component of ponderosa pine stands. The reduced bark beetle mortality will promote large trees to survive and recruit the larger trees in small diameter stands into the larger diameter groups faster than leaving them alone.

Current beetle activity with Alternatives 2 and 3 can be expected to be noticeably reduced. The areas mapped with recent bark beetle activity by aerial surveys are areas to be treated. Following treatments about 85% of the planning area in the ponderosa pine dominated plant associations will have stocking levels at low enough densities to be at low risk to beetle mortality and outbreaks. This level will continue through the majority of stands for about two decades. Bark beetles will continue to cause mortality through all stand types but at lower levels. Bark beetle mortality will continue in areas which are left for retention areas and trees with lower vigor due to mistletoe or drought. The low level of mortality will have less effect on stand density and increasing fuels.

Enhancement of the lowered beetle risk in ponderosa pine stands will also occur through the removal of lodgepole pine in mixed stands of ponderosa and lodgepole pine. With Alternative 2, 92% of field reviewed stands dominated by ponderosa pine but with a lodgepole pine component will have the lodgepole pine removed. In Alternative 3 this amount of lodgepole pine stands will be reduced slightly to 91%, and in alternative 4, 81% of the stands identified as containing lodgepole pine will be treated. Each of the alternatives greatly reduces the bark beetle attraction to the stands by susceptible lodgepole pine.

Lodgepole pine dominated stands treated in the West Bend project will have the majority of lodgepole pine susceptible to mountain pine beetle removed. The lodgepole pine susceptible to mountain pine beetle is usually 8" dbh or larger. Of the lodgepole pine dominated stands visited in West Bend 80 percent in all action alternatives will be treated. In these stands the focus is to leave trees of other species which are more resistant to mountain pine beetle or leave lodgepole pine trees which are of smaller diameter and are thus resistant to mountain beetle. Retention areas to meet NWFP standards will be left for each stand.

Using FVS to model growth response to thinning shows after treatment all the treated stands in the ponderosa pine type will be below the upper management zone ranging from 74 to 107 SDI. Some stands are lower through removing more lodgepole pine or mistletoe, while stands with higher SDI values following treatments are due to trees larger than 21" diameter making up a portion of the trees left. In the longer term, after two decades, 48% of the stands modeled would be above the upper management zone (Figure 18). Within the plantations which are currently growing into sizes susceptible to mountain pine beetle following treatments all stands will be below the UMZ and in two decades 50% of the stands sampled will still be below UMZ.

The lower stocking levels will allow increased growth increment in treated stands as shown in Figure 19, which shows the average increment for stands treated and not treated. Increments above 15/20ths of an inch are typically resistant to bark beetle outbreak and mortality.

Alternatives 3 and 4 will leave some stands at 80 square feet of basal area and will not maintain a low enough level of stocking to last more than a decade below the UMZ. Alternative 4 will also leave heavier stocked portions of stands which are considered Elk Thermal cover. These stands by definition have high stocking levels and will continue to be susceptible to bark beetle mortality.

Figure 18: Stand Density Index – Comparison of Alternatives

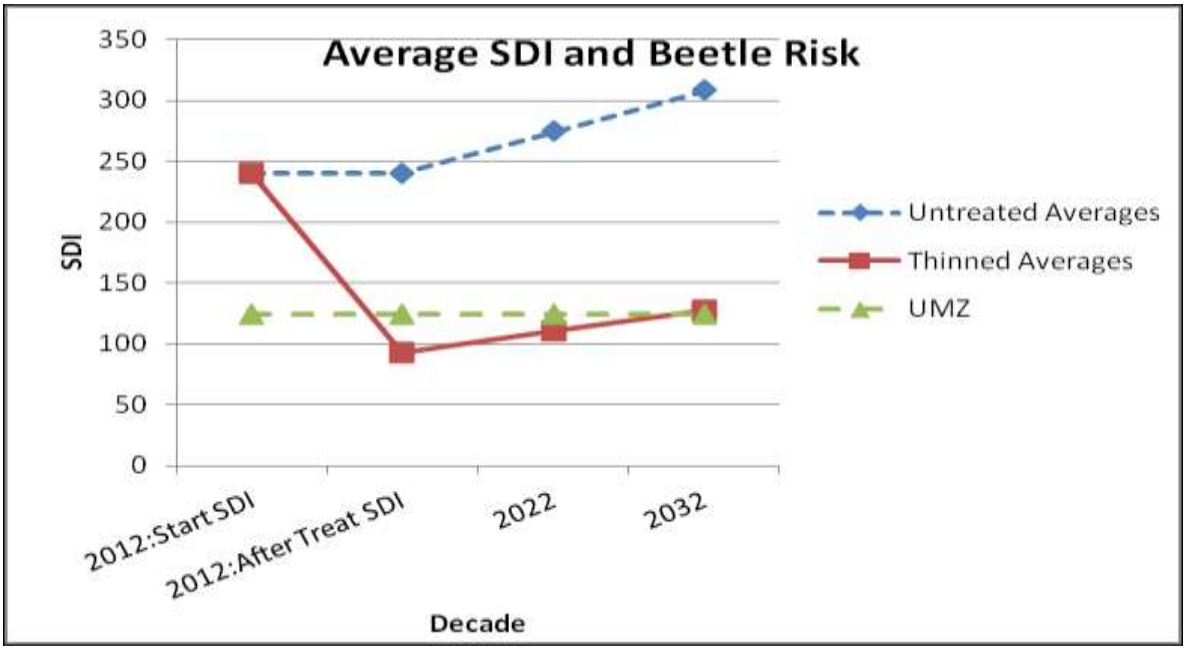
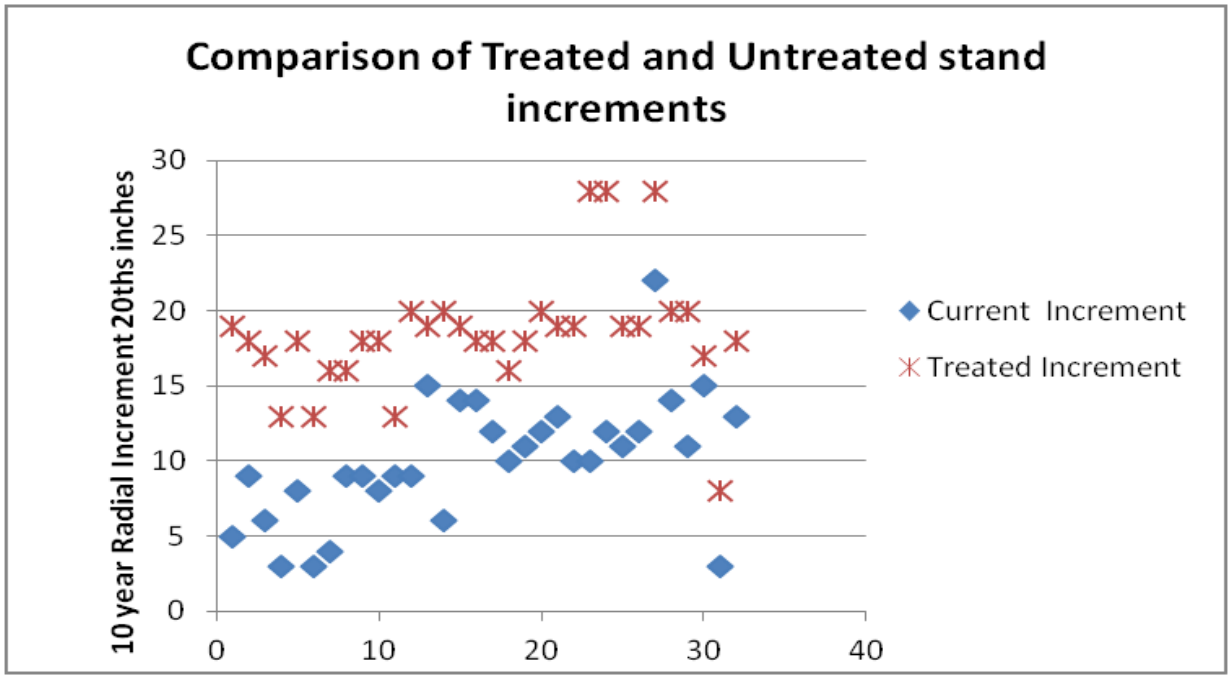


Figure 19: Stand Growth Increments



Cumulative Effects

Beetle impacts will continue throughout the black bark pine and lodgepole pine stands adjacent to the West Bend area. However, beetle effects are mostly confined to individual stands except in area where large landscapes are dominated by susceptible lodgepole pine. The other activities in and around the West Bend project which reduce stand densities and lodgepole pine stocking will have effects on the landscape impact of beetle mortality but not outside their own boundaries.

Comparison to Historic Range of Variability (HRV)

Existing Condition

Historic and current structure for ponderosa pine are displayed in Table 32. Ponderosa pine stands originally harvested in the1920s regenerated in the 20s, 30s, and partly in the 60s. This has led to a landscape dominated by younger stand or blackbark structure which tends to have dense canopies and homogeneity over the landscape. Blackbark stands which have been thinned recently are commonly detected by aerial imagery as mid-size open condition while dense, unthinned stands are detected as mid-size closed canopy. These two structures dominate the ponderosa pine landscape. The current structure analysis shows late/old structure (LOS) within the West Bend project area. Most of this is due to large diameter trees present even though the majority of the trees present are less than 100 years old. Figure 22 displays the current stratification of structure within the ponderosa pine dominated areas in the watersheds containing the West Bend project area compared to the HRV.

The mixed conifer wet plant associations are dominated by mid-size open structure as shown in Table 33. This is mostly due to the preponderance of lodgepole pine in many of these stands which limits the age and size potential of the average trees in the stands and the open condition is dominating due to the recent mortality in the lodgepole pine reducing the stand canopy closure. The domination by lodgepole pine was also noted in the 1930s with the forest inventory (Harrington 2003). This dominance is

changing with lodgepole pine mortality allowing release of more shade tolerant understory trees of white fir and mountain hemlock.

Reference Condition

The ponderosa pine and mixed conifer dry plant associations in the West Bend area around the time of European settlement, were dominated by open ponderosa pine stands with large diameter trees. Stands with smaller diameters and dense stocking were few on the landscape. The species mix in the ponderosa pine and mixed conifer dry associations would be dominated by fire resistant ponderosa pine with juniper, white fir and lodgepole pine occurring in very scattered locations. Disease and mortality due to fires or insects were confined to pockets within the landscape, few larger than a few acres (Agee 1993). The pockets of mortality would eventually become stocked and would fill in with a new cohort. The open pine condition with fire dominating the landscape would keep fuels levels and disease levels, including mistletoe and bark beetle outbreaks at a low level. In the 1930s bark beetle outbreaks were considered at the start of an outbreak when more than 50-100 trees per square mile were killed (Grant 1939). This level is equivalent to less than one tree per six acres. Higher levels of infestation occurred, however they were in pockets and was the reason why sampling and reporting occurred over the section. Open stand conditions allowed for high vigor which was limited mostly by nutrients and moisture. Stand vigor is tied to beetle mortality resistance and stand sustainability (McDowell 2003; Kolb 2007). Grasses dominated the understory in frequent fire regimes with burning limiting the amount of brush survival and development. Observing other prescribed fire use on the forest the brush tends to be low and patchy due to the arrangement of trees and fuels following fire. This patchy arrangement of brush is similar to historical fire influenced environment (Hessburg et al. 2005). More open stands would be able to support brush in open areas where little needle cast from overstory pine would accumulate.

Table 32: Historic range and current structure for ponderosa pine-dominated landscape

Structure	Successional Description	Current Structure Acres	Current Percent of West Bend	Viable HRV Range Min-max	FLN HRV	Current Comparison to HRV
1	Early Stand Condition Grasses, Forbes Seedlings, Saplings	3,089	6%	10-45%	25%	Under-represented
2	Mid Succession Stand Closed Canopy; 5” dbh – 20” dbh	25,573	50%	0-10%	5%	Over-represented
3	Mid Succession Stand Open Canopy; 5” dbh – 20” dbh	14,557	28%	30-87%	25%	Within
4	Late Succession Closed Canopy; 20” and Greater	6,121	12%	0-7%	5%	Over-represented
5	Late Succession Open Canopy; 20” and Greater	2,111	4%	25-59%	40%	Under-represented

Stands in the mixed conifer wet (MCD) PAG are more moist and occur at higher elevation than those where ponderosa pine dominated. These can be dominated by white fir, mountain hemlock, lodgepole pine or subalpine fir. In reviewing 1930 forest surveys 73% of the mixed conifer wet plant associations in the West Bend planning area were mapped as lodgepole pine (Harrington 2003). However in lodgepole pine plant associations less than 3% of the area in 1930 had white fir mapped stands. Some of the current stocking levels of the mixed conifer stands are affected by mortality of susceptible lodgepole pine. An expected historical landscape would have a wider range of possibilities for dominating structures because of the inconsistent disturbance impacts from fire and diseases. With lodgepole pine sometimes dominating the landscape widespread fire or disease could quickly change a large portion of any landscape to an early condition quickly or not at all. In all succession and size groups closed canopy would have dominated most of the landscape due to the infrequency of fire, reproductive capacity of

white fir and lodgepole pine and the relative tolerance of both species to dense canopies. Each size or age group in a mixed conifer wet landscape could have a plurality of the area within it at any one time as shown in Table 33.

Table 33: Historic range and current structure for wet mixed conifer-dominated landscape

Structure	Successional Description	Current Structure Acres	Current Percent of West Bend	Viable HRV Range Min-max	FLN HRV	Current Comparison to HRV
1	Early Stand Condition Grasses, Forbes Seedlings, Saplings	3,089	11%	5-36%	15%	Within
2	Mid Succession Stand Closed Canopy 5" dbh – 20" dbh	25,573	25%	22-63%	40%	Within
3	Mid Succession Stand Open Canopy 5" dbh – 20" dbh	14,557	52%	10-35%	15%	Over-represented
4	Late Succession Closed Canopy 20" and Greater	6,121	8%	12-23%	20%	Under represented
5	Late Succession Open Canopy 20" and Greater	2,111	4%	4-10%	10%	Within

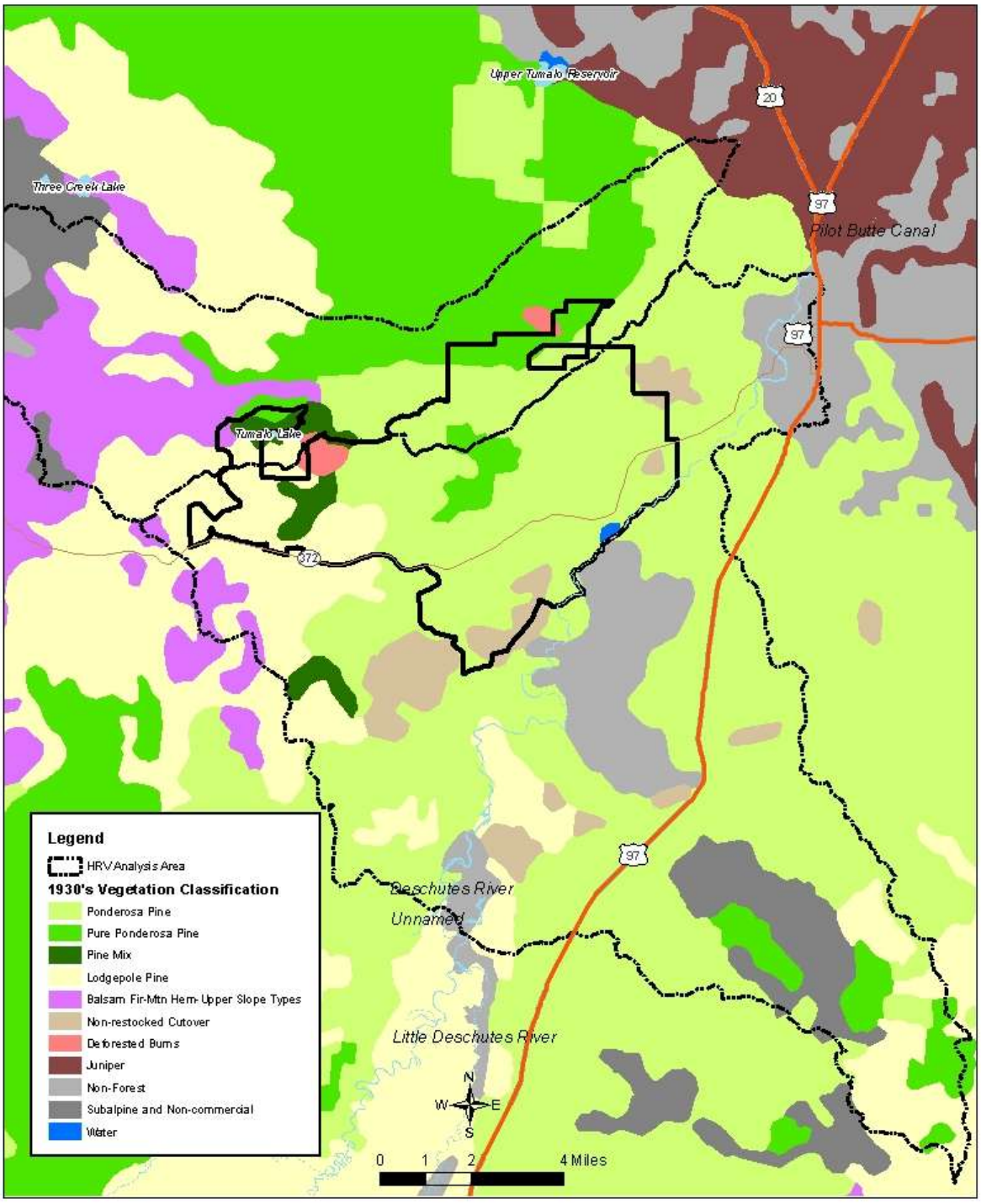


Figure 20: 1930s historic species distribution (Harrington 2003)

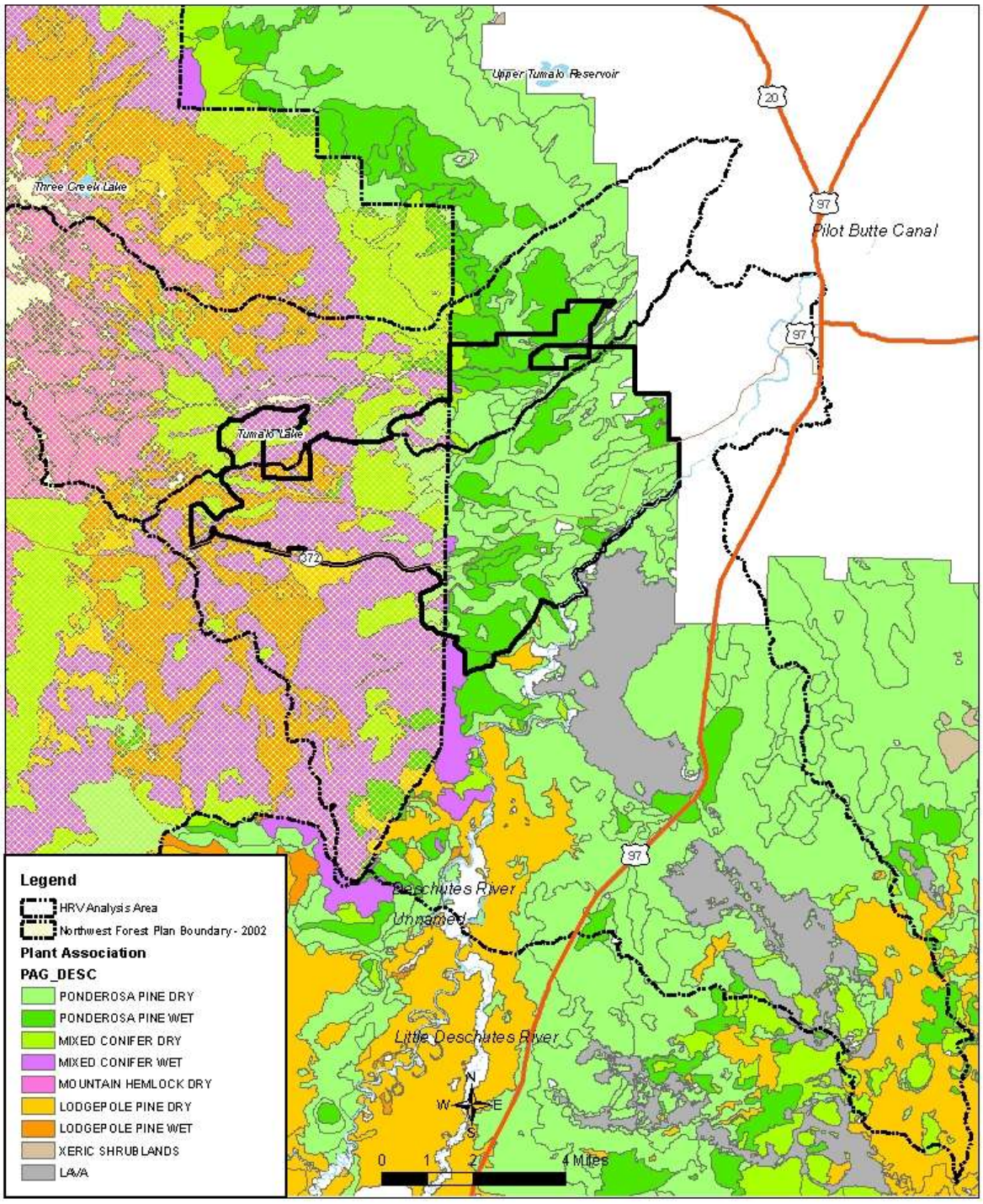


Figure 21: Plant association groups (PAGs) (Volland 1985)

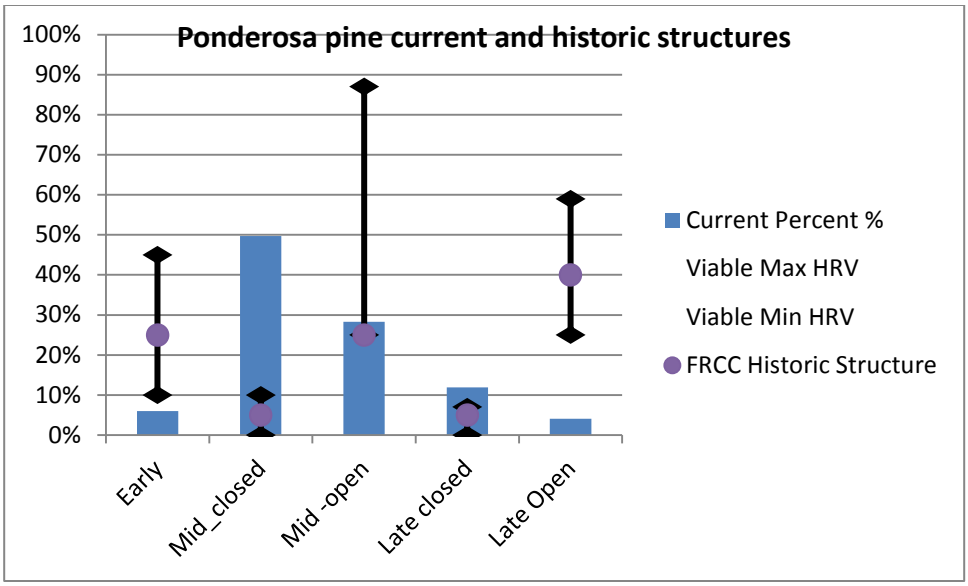


Figure 22: Ponderosa pine current structure compared to HRV

Figure 22 shows that the current amount of mid-closed structure is far above the HRV. It also shows that mid-open structure is at the lowest end of HRV and late-open structure is far below HRV. The following table (Table 34) displays the change in structure that is anticipated for each alternative.

Table 34: Expected structure in ponderosa pine-dominated associations by alternative

Structure	Description	Viable HRV Range Min-max	FLN HRV	Alt. 1 Current	Alt. 2	Alt. 3	Alt. 4
Early	Early Stand Condition	10-45%	25%	6%	6%	6%	6%
Mid-closed	Mid Succession Stand Closed Canopy	0-10%	5%	50%	38%	39%	41%
Mid -open	Mid Succession Stand Open	30-87%	25%	28%	40%	39%	36%
Late-closed	Late Succession Closed Canopy	0-7%	5%	12%	7%	7%	8%
Late -open	Late Succession Open Canopy	25-59%	40%	4%	9%	9%	8%

Where the proportion of structure stage late-closed decreases from 12% to 7 or 8%, it is a movement into structure stage late-open which shows corresponding increases from 4% to 9 or 8%. At 9% across the landscape the late-open structure stage of ponderosa pine-dominated associations remains far below the historic range of 25-59%. The over-represented mid-closed stage is reduced moving closer to HRV, but at 38 to 41% would still remain far above the historic range of 0-10%.

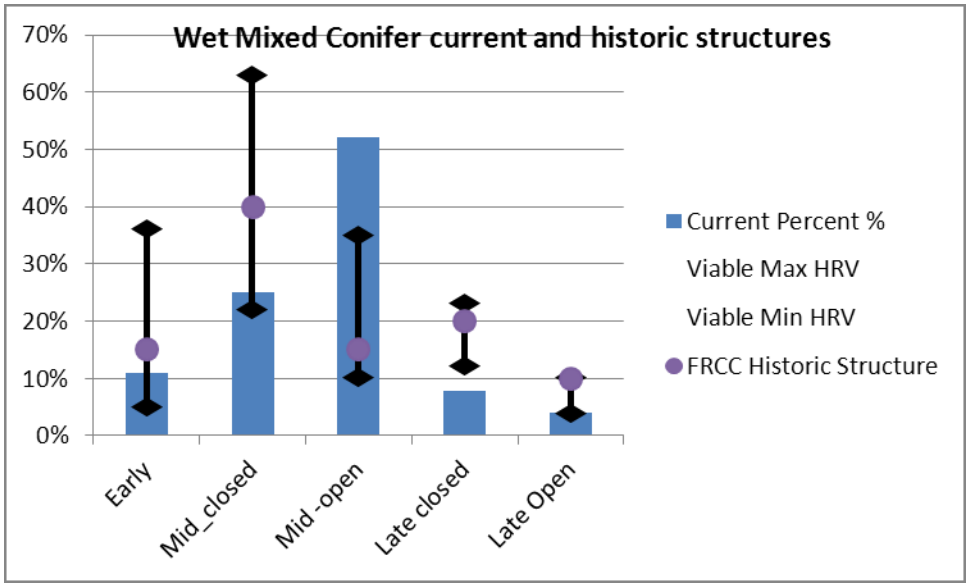


Figure 23: Mixed conifer wet current structure compared to HRV

Figure 23 displays the historic range that structures occupied within the wet mixed conifer biophysical environment. In this case, structures below or at the low end of the range are early, mid-closed, late-closed, and late-open. The mid-open structure is within HRV.

Table 35 displays the anticipated changes in structure from the alternatives. Discussion of effects follows the table.

Table 35: Expected Structure in Mixed Conifer Wet PAG by Alternative for the Watershed

Structure	Description	Viable HRV Range Min-max	FLN HRV	Alt. 1 Current	Alt. 2	Alt. 3	Alt. 4
Early	Early Stand Condition	5-36%	15%	11%	16%	16%	15%
Mid-closed	Mid Succession Stand Closed Canopy	22-63%	40%	25%	22%	22%	23%
Mid -open	Mid Succession Stand Open	10-35%	15%	52%	50%	50%	50%
Late closed	Late Succession Closed Canopy	12-23%	20%	8%	8%	8%	8%
Late Open	Late Succession Open Canopy	4-10%	10%	4%	4%	4%	4%

Alternative 1 (No Action)

Direct and Indirect Effects: Alternative 1 (No Action) would leave the same structure mix as is present with a trend of lower growth and increased mortality to disturbance factors. In ponderosa dominated stands, compared to the HRV, there a low amount of large open tree structure (Table 34). This paucity indicates a lack of meeting the objective of the Screens of managing for large open structure in the long run. The number of trees reaching 21" in diameter, which is one of the thresholds for developing large tree structure, will be less than in a managed condition as shown in Figure 28.

The development of stands into late succession open and closed structures is dependent on the structures with smaller diameter trees growing from the mid-succession stages. Typically an open canopy condition has a high chance of growing into large open structure, especially with low-intensity fire (USDI 2007). Mid-succession closed canopy structures take longer and have the chance of not developing into LOS due to increased mortality risks. The structural stages which have dense stocking in ponderosa pine and dry mixed conifer types have a high probability of beetle mortality and reduced diameter growth.

Mixed conifer wet plant associations will shift slowly to more early succession or open canopy structure due to lodgepole pine dominated stands with overstory mortality. Much of the mid-sized structure may grow into a multistory or closed canopy with large tree component. This is not too far from historical ranges. However with high densities, possible drought cycles and insect cycles the large tree and dense stands in this area are not very sustainable over the long term. Over time the mix of mortality and ingrowth of lodgepole pine and understory white fir will make the future condition a very dynamic affair tending towards closed stand conditions with multi-cohort layers.

Alternative 2 (Proposed Action), Alternative 3 and Alternative 4

Direct and Indirect Effects: In ponderosa pine-dominated stands, treatments under all action alternatives will move stands towards HRV by managing them into a condition with more potential to become large ponderosa pine (open condition, resistant to insects, disease and fire). The largest structure type to shift towards the open condition is the mid-succession closed canopy stands (structure 3). This is because thinning in these dense, closed stands (structure 2) will allow development into mid-sized open canopy structure (structure 3).

Alternative 4 will have less mid-succession closed structure moved toward a more open stand due to the reduction of treatments to preserve deer thermal cover in the Deer Habitat management area. Alternatives 3 and 4, due to the cutting of openings for specific management objectives, will start a new cohort of trees and move some blackbark stands into a more uneven- aged stand condition. The increase in mid succession, open has more potential to become large pine structure in the future (USDI 2007). Stands could then develop into either open or closed large structure, but that trajectory will be determined by future entries for thinning; i.e. maintained below the UMZ to avoid beetle mortality and fuel profile maintained to avoid unwanted fire behavior.

The reduction of stocking levels in all size groups increases growth and vigor and reduces mortality potential (Cochran 1994; Spies 2006). This growth increase has the potential of increasing the area where large diameter trees are common sooner, as shown in Figure 28. Thinning from below increases the average stand diameter by removing many of the smaller trees. The increase in growth with thinning prescriptions will keep the 10 year growth average above 1.5" per decade (Figure 19, page 90). This increase in average diameter growth is much larger than that for the no action alternative because of the average diameter and the lower level of competition between trees (McDowell 2003). Modeling thinned stands shows trees per acre larger than 21" dbh developing over the next two decades as shown in Figure 28 and Table 36; a rate more than the no action alternative, thus moving to a desired condition sooner.

Alternatives 2, 3, and 4 require an amendment to harvest within the late-open structure stage in ponderosa pine biophysical environment because it is currently below HRV. See Chapter 3.18 for an analysis of the amendment.

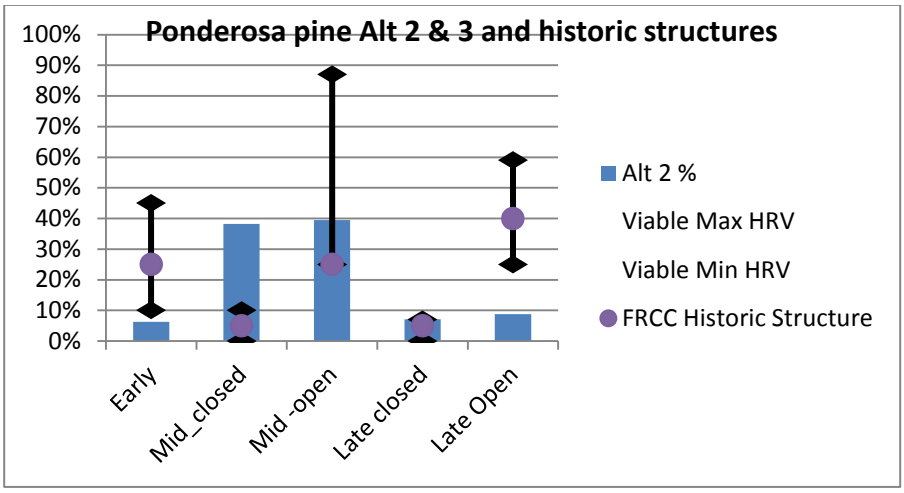


Figure 24: Ponderosa Pine Historic Structure and Alternatives 2 and 3 Structure

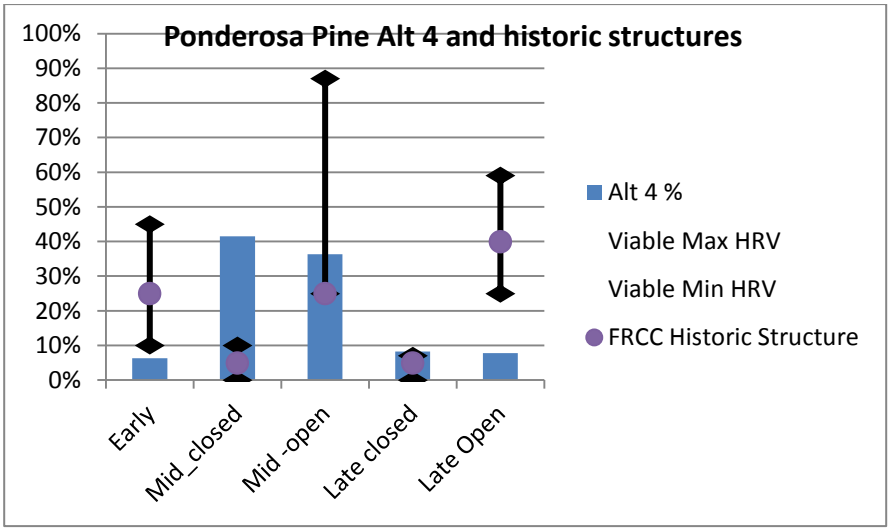


Figure 25: Ponderosa Pine Historic Structure and Alternative 4 Structure

Stands in the mixed conifer wet plant association group dominated by lodgepole pine will be moved into early succession structures as the bark beetle infestation finishes up. Following treatments all the treated lodgepole pine stands will be at the early succession structure, which will be within the historic range of variability for lodgepole pine. The stands of created open canopy will return with natural regeneration of lodgepole pine and white fir and fast growth in the fairly productive ground in the West Bend area.

Most large structure in mixed conifer wet will get very little management. Table 35 shows a decrease in mid-sized stand structures 2 and 3 and an increase in the early stand structure due to the seed tree cutting of lodgepole pine stands which occur in the mixed conifer wet areas. As these stands develop, the understory species of white fir, spruce, and subalpine fir will have a higher occurrence which increases the longevity and diversity of the next stand developing on these sites.

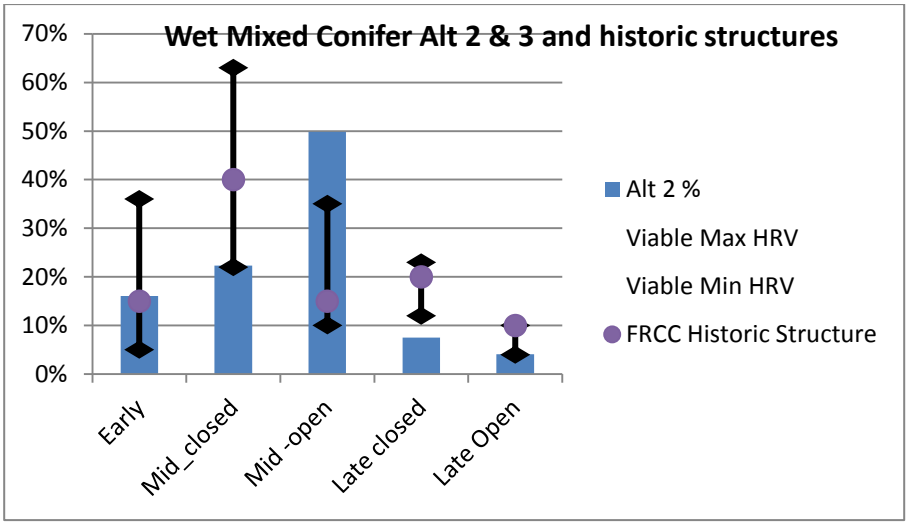


Figure 26: Wet Mixed Conifer Historic Structure and Alternatives 2 and 3 Structure

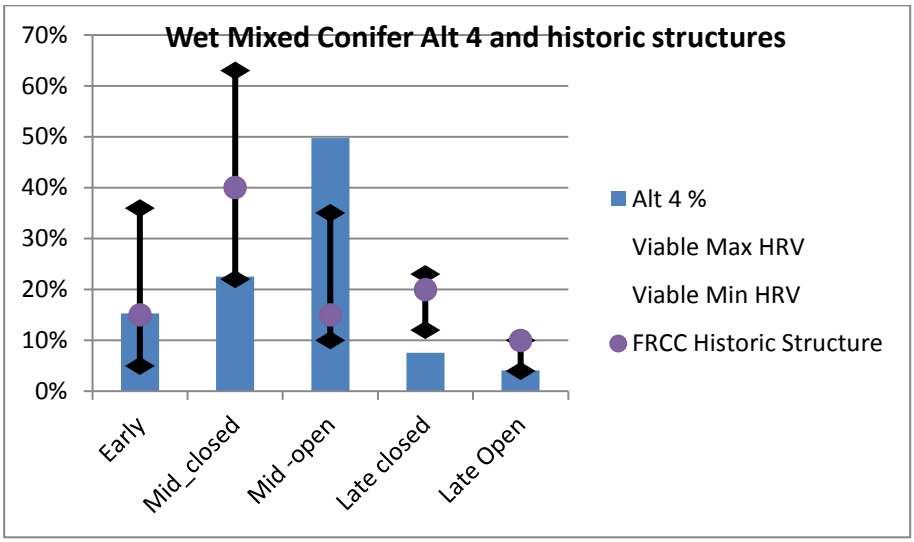


Figure 27: Wet Mixed Conifer Historic Structure and Alternative 4 Structure

Figure 28: Decadal Large Trees per Acre Ponderosa Pine Stands

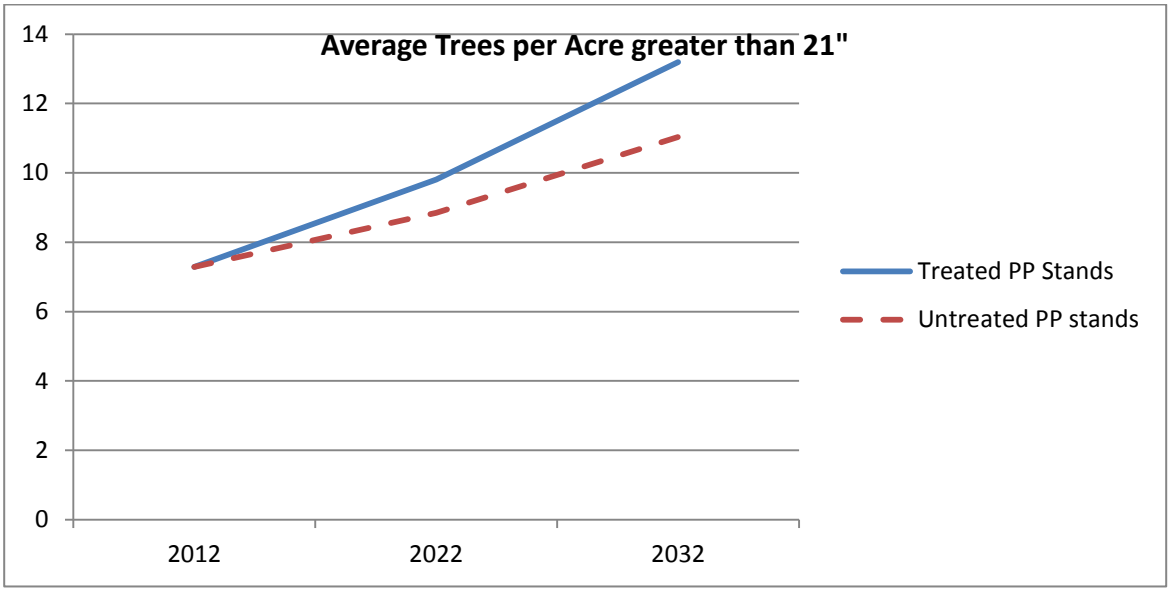


Table 36: Decadal Stand Level Trees Per Acre > 21" dbh

2012:StandID	2012:TPA GT 21	2022:TPA GT 21	2032:TPA GT 21
06010105420010007	6.94	10.37	16.14
06010105420010009	0	1.53	3.81
06010105420010016	6.09	8.83	13.49
06010105460010022	3.15	5.69	7.88
06010105460010028	3.86	4.17	5.64
06010105460010031	9.53	9.9	14.11
06010105460010035	8.89	10.09	13.91
06010105460010036	15.78	18.2	19.54
06010105460010046	3.62	8.95	17.28
06010105460030004	11.76	17.4	19.51
06010105460010008	12.63	16.99	19.63
06010105460010029	6.69	8.84	14.48
06010105460030010	11.02	13.38	16.2
06010105520030020	2.11	2.92	3.1
Averages	***7***	***10***	***13***

Cumulative Effects

The treatments in West Bend would have a cumulative impact on structural stages in the watershed when the Rocket Vegetation Management project is considered. Rocket proposes to treat nearly 7,000 acres of ponderosa pine stands with density and fuels reduction which would continue the trend of moving from closed canopy condition to open canopy condition and creating conditions where LOS is more likely to develop. An assumption can be made that there will not be removal of large trees from the late succession stands.

The Rocket project will be executed in the same 10th field watershed as West Bend and will therefore affect the overall condition with regard to HRV. Shown in Tables 37, 38, and 39, most effects are changing stands from a closed canopy condition to an open canopy condition. Within the ponderosa pine association, will be a landscape decrease of ten percent of mid succession closed canopy which transposes to an increase of ten percent of the mid succession open stand condition due to the Rocket treatments. This change is one percent in the mixed conifer wet plant associations. These changes bring the ponderosa pine association closer to the historical condition in mid succession closed stands while mixed conifer wet would be slightly under HRV due to the thinning treatments. The ponderosa pine plant associations will be over in all mid-sized structure whereas the mixed conifer associations would be within HRV for the mid succession open structure. The effect of all this is to allow more of the landscape growing to a late succession condition faster than in the no action alternative. The late succession stages are within HRV for ponderosa pine closed stage, and mixed conifer wet open stage. The other late succession stages are less than HRV. All action alternatives have large effect in reducing the overall amount of the landscape in closed canopy mid-succession. These stands will grow into a closed canopy in a similar time frame as the stands in West Bend within the next two decades.

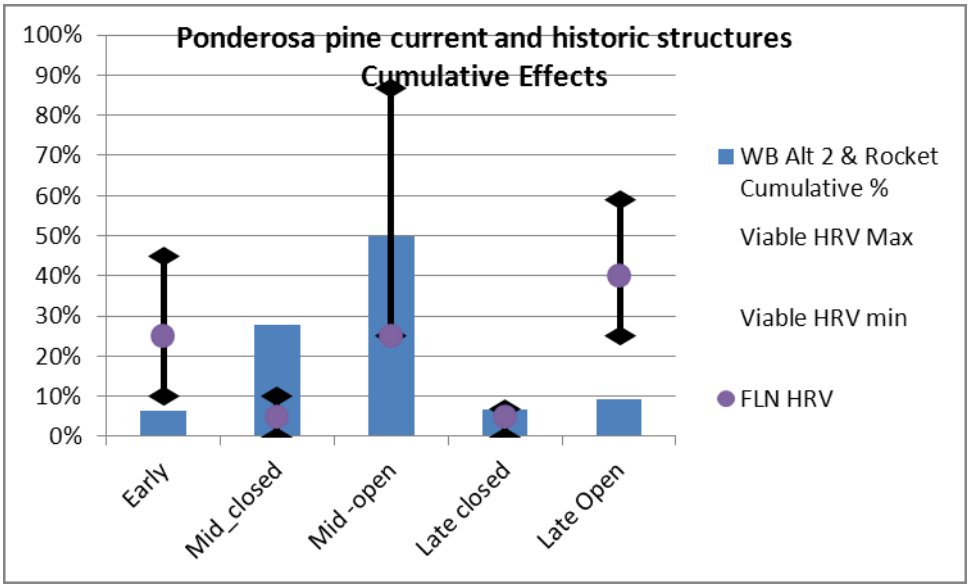


Figure 29: Ponderosa Pine Cumulative Effects to Structure

Table 37: Ponderosa Pine Cumulative Effects to Structure

Structure	Description	Viable Historic Range	FLN HRV	Current Percent %	Alt 2 %	Alt 3 %	Alt 4 %	Alt 2 & Rocket Cumulative %
1	Early Stand Condition	5-45	25%	7%	7%	7%	7%	7%
2	Mid Succession Stand Closed Canopy	1-12	5%	59%	49%	49%	52%	34%
3	Mid Succession Stand Open	24-48	25%	20%	29%	29%	26%	44%
4	Late Succession Closed Canopy	0-9	5%	12%	9%	9%	10%	8%
5	Late Succession Open Canopy	50-86	40%	3%	6%	6%	5%	7%

Figure 30: Mixed Conifer Wet Cumulative Effects to Structure

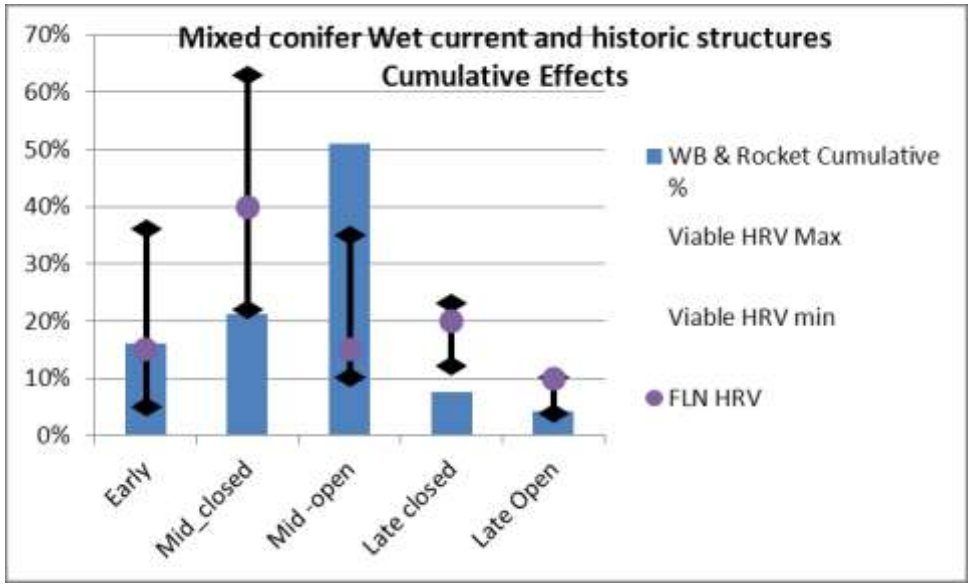


Table 38: Mixed Conifer Wet Cumulative Effects to Structure

Structure	Description	Historic Range	Percent %	Alt 2 %	Alt 3 %	Alt 4 %	WB & Rocket Cumulative %
1	Early Stand Condition	5-36	11%	16%	16%	15%	16%
2	Mid Succession Stand Closed Canopy	22-63	25%	22%	22%	23%	21%
3	Mid Succession Stand Open	10-35	52%	50%	50%	50%	51%
4	Late Succession Closed Canopy	12-23	8%	8%	8%	8%	8%
5	Late Succession Open Canopy	4-10	4%	4%	4%	4%	4%

Table 39: Lodgepole pine HRV Cumulative Effects

Structure	Description	Historic Range	Percent %	Alt 2 %	Alt 3 %	Alt 4 %	WB & Rocket Cumulative %
1	Early Stand Condition	0-60	59%	61%	61%	61%	61%
2	Mid Succession Stand Closed Canopy	5-40	3%	3%	3%	3%	2%
3	Mid Succession Stand Open	10-50	7%	5%	5%	5%	5%
4	Late Succession Closed Canopy	0-41	6%	6%	6%	6%	6%
5	Late Succession Open Canopy	5-41	25%	25%	25%	25%	25%

Stand Resistance to Fire

Existing Condition

Currently most of the West Bend area where active management has not occurred has accumulated fuels, and the average diameter of trees is small. Unthinned stands when modeled in FVS have average diameters under 7" dbh. Stands which are open have average diameters greater than 11 inches dbh. The larger diameters are more resistant to fire mortality (Agee 2005). Analysis on similar areas showed trees resistant to mortality with 4' flame lengths and 8" dbh, and resistant to 8' flame lengths if diameters are greater than 14" dbh (USFS 2009). These two thresholds are used in this analysis.

Alternative 1 (No Action)

Direct and Indirect Effects: Alternative 1 will not change the average diameter in the stands. Diameters will increase half as fast as stands thinned. The average diameter of trees in the modeled stands averaged 8.6" dbh. This means that at least half the trees are not resistant to fire mortality at the

low flame length level of 4'. Growth in the untreated stands can be expected to be at or below current rates averaging less than one inch of diameter growth over the next decade (Hall 1987).

Alternative 2 (Proposed Action), Alternative 3 and Alternative 4

Direct and Indirect Effects: Following thinning the average diameter predicted in ponderosa pine dominated stands is 13.8" dbh. This size group tends to be resistant to fire with 4' flame lengths, and half the trees would be resistant to fire mortality at the 8' flame length. In thinned stands the growth can be expected to be as high as two inches in diameter each decade, which would provide stands with average diameters around 16" in a decade. The difference between the alternatives is mostly the amount of acres thinned; an increase in diameter from thinning and growth will occur wherever thinning occurs. Similar to the beetle risk there will be an increase over the existing condition of stands where thinning has occurred though in Alternative 4 the area treated is about 3,000 acres less thinning in the ponderosa pine type. Stocking reduction in the ponderosa pine type is 67% of the total ponderosa pine area in Alternatives 2 and 3 while it is 52% in Alternative 4. Another cause for increased stand resistance to fire mortality, in all stands where ponderosa pine is dominant, is the removal of lodgepole pine and white fir, both of which are less resistant to fire mortality.

Figure 31: Average Stand Diameter Increase Following Thinning

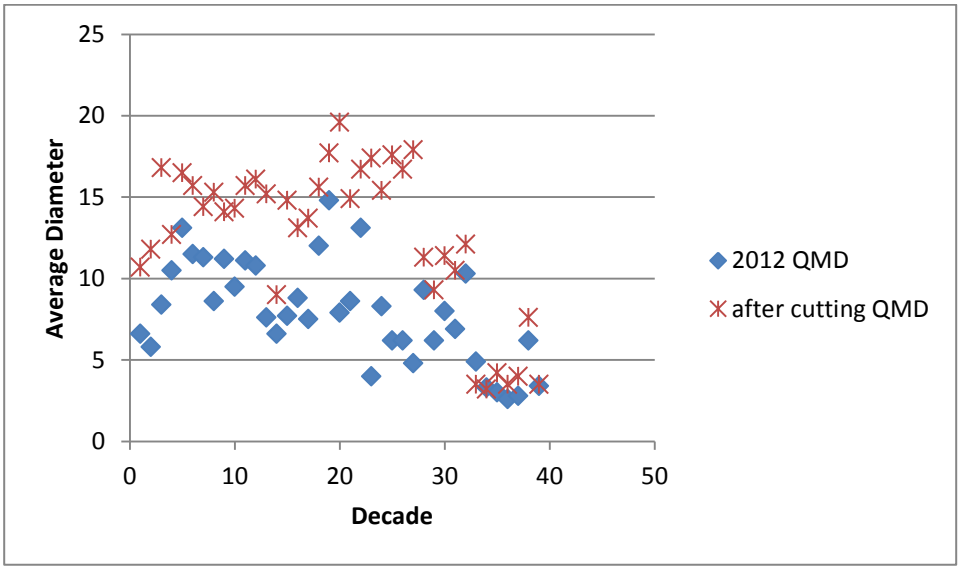
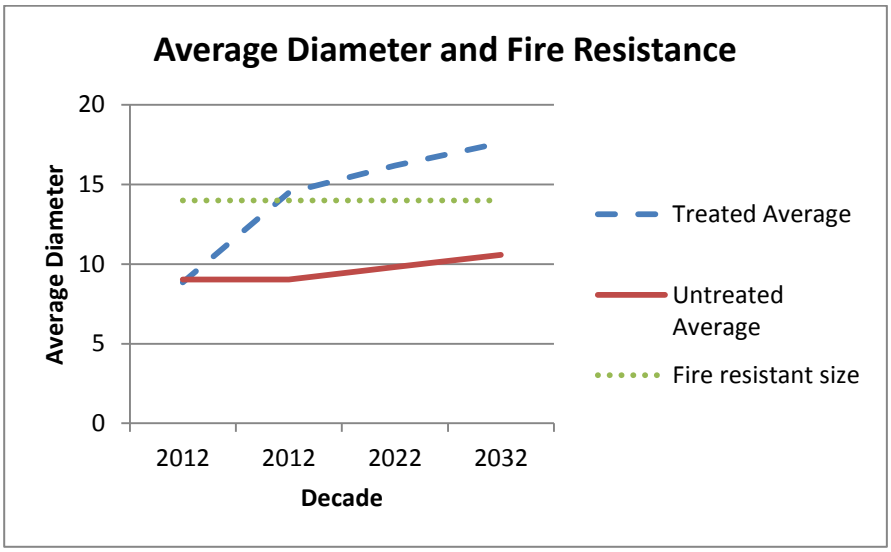


Figure 32: Stand Diameter and Resistance to Fire



Cumulative Effects

The three action alternatives would have no effect on the resistance of adjacent stands or areas to fire mortality. The fire resistance is relative to each stand with tree diameter as the resistance mechanism, and has no cumulative effects from other actions within or outside the planning area. Chapter 3.4 addresses effects to fire hazard rating and fire behavior.

Mistletoe Spread and Intensity

Existing Condition

Field review identified 186 units with mistletoe, representing 52% of the area visited. In the ponderosa pine dominated stands where exams were established, 64% of the stands had identified dwarf mistletoe. The spread of mistletoe is influenced by species, tree density, and tree canopy layers. The current stands in the West Bend project area have a variety of tree species, tree densities which are moderate or high, and some have two canopy layers. Each of these factors modifies dwarf mistletoe intensity, and distribution. The modeling of mistletoe infected stands shows dwarf mistletoe intensity (DMI) between 1.2 and 4.1. The stand average dwarf mistletoe rating (DMR) is also variable between 0.1 and 4.0. This reflects the clump distribution of the mistletoe with high intensity in those clumps. Well connected, fairly consistent species, forested with ponderosa pine stands contribute to the increase in spread and intensity of dwarf mistletoe.

Mistletoe in lodgepole pine is common in most stands. Mistletoe infected trees in stands which have been regenerated are common in the West Bend area. Mistletoe in overstory trees above regeneration is the quickest way to get mistletoe spread (Hawksworth & Johnson 1989). Two story stands of lodgepole pine are starting to form with the heavy overstory mortality in the lodgepole pine. The overstory is usually formed by intermediate trees which were subordinate to larger trees and had a better chance of becoming infected. As understory trees become established, mistletoe infection intensity will increase.

Alternative 1 (No Action)

Direct and Indirect Effects: Alternative one will maintain the infection levels of mistletoe at current levels. The stand level DMR can be expected to be in a range of .1 and 4 and DMI of 1.2 and 4.1. The DMI level above 3 would impact tree growth more than 10%. Over the next 10 years the DMR and DMI would increase due to proximity of uninfected trees with infected trees, and overstory trees above

regeneration. Modeling of the ponderosa pine mistletoe indicates DMR and DMI levels in heavier infected stands reaching the thresholds within about three decades.

The highest impact of mistletoe infection is expected in lodgepole pine, especially where overstory lodgepole pine is infected with mistletoe. Overstory mistletoe, if it has not infected the understory already, can be expected to infect a majority of the trees within a decade (Hawksworth & Johnson 1989). Lodgepole pine mistletoe is not modeled in this analysis. This is due to the lack of spatial ability in the model and the well-spaced occurrence of most lodgepole pine seed trees and the expected spread distance to understory trees.

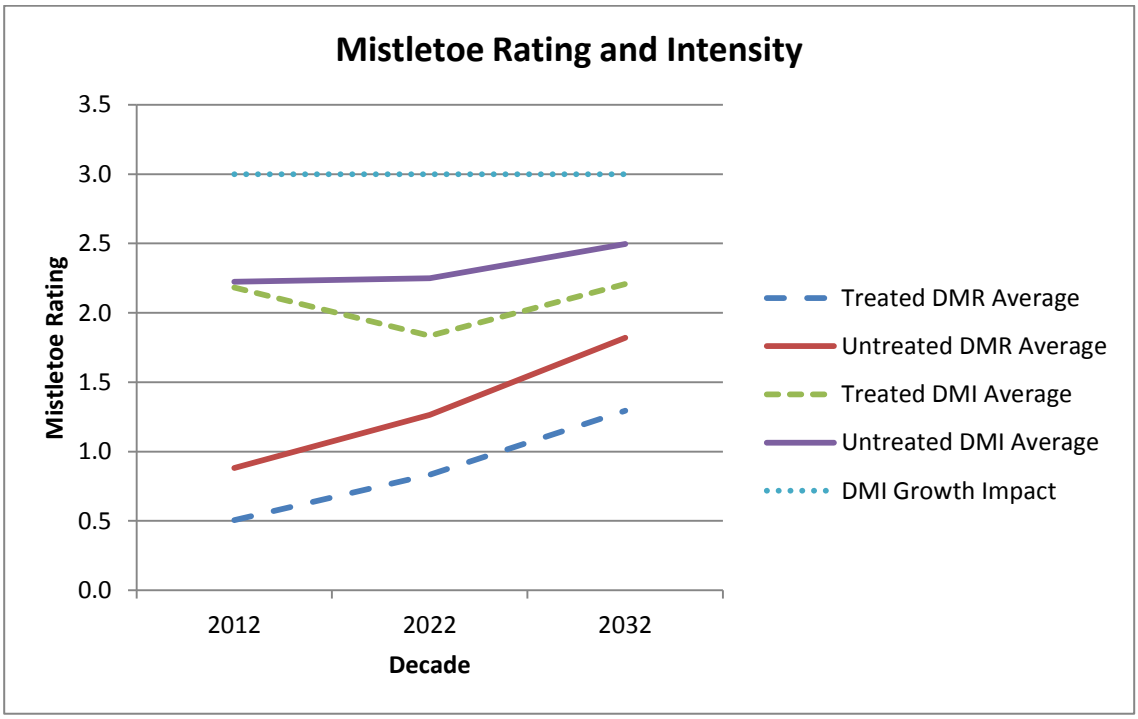
Alternative 2 (Proposed Action), Alternative 3 and Alternative 4

Direct and Indirect Effects: Alternative 2 and 3 will have similar effects on mistletoe, due to the acres treated and the approach in thinning wider in mistletoe infected portions of stands and trying to cut buffer areas between infected and uninfected portions of stands. Alternative 2 and Alternative 3 will have stocking reduction on more than 6,000 acres in ponderosa pine and 1,500 acres of lodgepole pine stands which have mistletoe infection. Alternative 4 will have fewer acres treated at just over 5,000 acres of ponderosa pine stands with mistletoe.

The action alternatives will address three main factors for limiting the spread and infection levels of mistletoe: removal of heavily infected trees will reduce the infection intensity, increasing stand spacing will reduce the lateral spread of mistletoe, and reducing two layer components of stands will reduce the vertical spread of mistletoe. All action alternatives will also reduce the spread of mistletoe in lodgepole pine regeneration by removing the seed trees in seedtree cut units once the stand under the seed trees has regenerated. This staged cutting will occur approximately 5 years following the main harvest. The removal of seed trees can be accomplished through harvest or by causing the mortality of the seed trees using girdling or pheromones which attract mountain pine beetle. Including the seed tree removal during this planning time frame will help with ensuring the development of the stands without mistletoe infections.

In modeled ponderosa pine stands the DMI rating went down in most stands and up in a few. The rating increase was because of the number of trees left in the stand which were of larger diameter and because species selection favored ponderosa pine, which actually had mistletoe which would not be removed in the thinning. Once the stocking reduction is implemented there are fewer total infected trees left in the stand. The DMR for the stands modeled showed a similar response as the DMI (Figure 33, page 107). Longer term the stands did not reach the DMR or DMI thresholds of two or three in the three decades modeled. Reducing the overall infection and the worst infections within the stands will also have the effect of reducing mortality from mistletoe and fire (Hawksworth 1997, Hessburg, 2008).

Figure 33: Mistletoe Rating Over Time



Cumulative Effects

Past projects and projects adjacent to the West Bend area will have little or no effect on the dwarf mistletoe infection within West Bend, nor will the West Bend treatments have any effect on adjacent projects since mistletoe effects are local to the stand level. Therefore, there will be no cumulative effects on dwarf mistletoe levels from any alternative. Tables 26 and 27 were referenced for actions that may add to cumulative effects.

3.3.7 Key Issues and Effects

Deer Winter Range Thermal Cover

Direct and Indirect Effects: This issue is discussed in the wildlife section, as treatment within thermal cover has potential to affect big game. In regards to forest health issues, existing thermal cover in action Alternatives 2 and 3 would not be avoided in stand selection or treatment design. Approximately 1,124 acres of identified thermal cover would be thinned under these alternatives. Alternative 4 would avoid the thermal cover identified larger than 2 acres. Under Alternative 4, these stands which are above the UMZ would continue to be susceptible to bark beetle mortality and fire mortality, especially making underburning more prone to cause tree mortality due to tree size, density and ladder fuels conditions. Effects of treatment to big game are discussed in the wildlife section.

Overstory Removal

Direct and Indirect Effects: Alternatives 3 and 4 reduce the amount of area where overstory trees are removed. This is less than alternative 2 by 12 stands or about 250 acres. The overstory trees in Alternatives 3 and 4 in these stands will be killed by girdling or some other method. This is to keep understory mistletoe infection levels limited to that which is currently present. The effects will be to reduce the volume available by over 12,000 board feet of lodgepole pine. The overstory mistletoe will still be eliminated though more snags will remain. Additional effects are discussed in the wildlife section.

Stocking Variability

Direct and Indirect Effects: Stand heterogeneity in the West Bend project area is limited by the amount of large trees and large tree dominated stands. The stocking variability is addressed differently in each alternative. All alternatives will have some stocking variability within treated stands. In another recent vegetation management project the level of variability within stands was measured (Rib Stocking Plots). That thinning has similar objectives as West Bend. The variation found in Rib timber sale had a target basal area of 45 and the sampling of the area gave a range from 0 to 100 square feet of basal area with an average of 48 and a standard deviation of 17. This standard deviation was 38% of the target. Variability, especially in ponderosa pine dominated stands, will occur due to two inherent factors in management emphasis: selection against lodgepole pine and white fir and selection against mistletoe infected trees.

Selection against lodgepole pine and white fir trees: In ponderosa pine-dominated stands retention of lodgepole pine and white fir reduces stand resistance to fire and bark beetle mortality. In most ponderosa pine-dominated stands proposed for treatment, all white fir and lodgepole pine will be removed. Because of the sometimes contagion or clumpy stocking of these two species, openings and low stocked areas are expected in the stands after treatment. This variability is on the stand scale.

Selection against mistletoe infected trees: In stands dominated by ponderosa pine, selection against trees with mistletoe infections will be common. Trees with heavy mistletoe infections (Hawksworth rating of four or higher) will be removed and trees in infected portions of stands will be left at a spacing of 30 feet or wider between trees, which is wider than leaving the dominant trees at 60 square feet of basal area. This will leave widely spaced areas and openings within the stands with mistletoe, which represent about 64% of the stands in the ponderosa pine dominated area. This variability is on the stand scale.

Alternatives 3 and 4 were designed to have more between-stand and within-stand variability in stocking in the ponderosa pine dominated stands. The stocking variability is based on management focus for four other resource objectives. The four resource objectives introduced and affecting treatment variability are managing for *Castilleja chlorotica* propagation, deer hiding cover, goshawk habitat and day lighting snow and ice prone roads.

Castilleja chlorotica is a sensitive, hemi-parasitic plant the host being brush species. Host viability or mortality affects the propagation and survival of the plants. High tree canopy closure in the West Bend area has reduced understory brush health and density. Alternatives 3 and 4 will remove trees in an area around the current Castilleja populations to enhance the obligate brush species. These open areas will be at least two tree heights from the edge of populations. A possible secondary benefit of this open area is a reduction of the accumulation of pine needles, which in the future could mean less chance of fire burning through the populations which would in turn increase the possibility of longer survivability of the brush. This treatment will occur in stands totaling over 1,000 acres and cover up to ten percent of the stands in openings from one quarter to ten acres. These openings would not be replanted but would slowly be naturally regenerated as seeds from adjacent trees fall and germinate. It is not expected to be wholly regenerated within five years but may be minimally stocked with seedlings within ten years as directed by the LRMP in uneven-aged management. Site growth potential would not be utilized during the ten years. This will allow development of another cohort and emulate uneven-aged management with group selection. This treatment will enhance within-stand variability.

Deer hiding cover and dense recreation use in the West Bend area affect the deer herds which traverse the area in the fall and winter. The fairly plain topography and abundance of blackbark stands in the deer winter range mean there is little effective hiding cover for deer to rest in. In Alternatives 3 and 4 eight stands representing more than 1,000 acres furthest from trails and roads were selected to create openings that will then start new stands of trees for hiding cover. Openings from 2-10 acres covering up to 10% of each stand will be made in these stands and planted with ponderosa pine seedlings. This will

start a new cohort of trees and initiate uneven-aged management with group selection in blackbark stands. This is a removal of trees before the culmination of mean annual increment but will not remove the areas from productivity. The variability initiated with this treatment is within-stand variability.

Goshawk habitat has historically provided nesting within the project area (there are two historic nest sites). Currently there is no active goshawk nesting. To improve the habitat conditions for goshawk, a strategy to improve habitat conditions for goshawk involves 69 stands cover almost 1,800 acres. Within these stands, clumps and gaps will be increased for within-stand diversity; different stocking levels will be prescribed across stands for between-stand variability; white fir and lodgepole will be retained in some stands for species diversity; and nest cores will be retained untreated.

Snow and ice has been observed to melt sooner in areas with no or lower tree shading than shaded portions of the roads. The Cascade Lakes Highway and Skyliners road are two paved roads traversing the project area east west. These roads carry traffic year round. During the winter snow and ice accumulates; reducing the tree densities along the roads more than called for in the proposed action will increase the amount of sunlight that reaches the pavement. This treatment will reduce the stocking of stands to between 20 and 40 square feet of basal area in over 600 acres of blackbark stands. This will reduce the stocking to below the lower management zone, so the site will not be totally occupied, but will keep the stands at least minimally stocked. It will also increase the time before management is needed again, which keeps the stand resistant to bark beetle outbreak. This treatment will introduce more between-stand variability.

Alternative 4 will have dense stands which meet thermal cover standards left untreated. This will increase some of the between stand variability with the tradeoff of ponderosa pine stands remaining at risk to bark beetle mortality.

Variability created by mortality from prescribed fire will be a possibility under all action alternatives. However, where fire or thinning causes openings larger than two acres, they will be assessed for reforestation. Openings are not common in prescribed fire activities following mowing or piling and burning. The main driver for mortality is the scorch of trees scorch of > 30% of the crown will reduce tree growth.

A majority of the rest of the stands in Alternatives 3 and 4 are similar to Alternative 2 with emphasis on thinning to 50-60 square feet of basal area leaving the dominant and codominant healthiest ponderosa pine. In Alternative 3 this is more than 7,000 acres or 61% of Alternative 2 and in Alternative 4 it is almost 6,000 acres or 49% of Alternative 2. The within stand variability identified at the introduction is the part which will be experienced.

Cumulative Effects

Tables 26 and 27 were considered for actions that could contribute to cumulative effects. Past projects within or adjacent to West Bend were included in the existing condition. Adjacent projects would not have any effect on the insect or disease levels within the West Bend project nor will the West Bend project have any noticeable effects on the insect and disease condition in adjacent stands because the effects discussed are at the stand level and do not extend to the rest of the landscape. At the landscape level the Rocket Vegetation project will increase the reduction in area susceptible to bark beetle mortality within the watershed.

3.3.8 Consistency

National Forest Management Act (NFMA)

Adequate Restocking of Land following Final Regeneration Harvest.

Within all action alternatives final removal of seed trees and seed tree harvest are planned within stands of lodgepole pine. Within action Alternatives 3 and 4, thinning harvest within some of the ponderosa

pine stands will create openings larger than two acres (Deer forage/cover enhancement and *Castilleja chlorotica* propagation).

The Lodgepole pine areas within West Bend which will receive seed tree cuts are in areas where natural regeneration in previous cuts is prolific. Some areas do have sedge competition and gopher activity both of which reduce the amount of regeneration. This has not kept enough regeneration from occurring in any of the previously cut stands. All the stands where overstory removal is proposed have been reviewed in the field and are adequately stocked with seedlings and saplings and now only have overstory mistletoe possibly putting them on an unhealthy trajectory. Within the lodgepole overstory seed trees will be left where seedlings and saplings are less than 200 trees per acre the minimum stocking level is 100 trees per acre, however 200 trees per acre allows for some damage and mortality due to logging activities. The natural regeneration potential for stands where a seed tree cutting is proposed is good with some plant associations affected by sedge or gophers reducing regeneration success (Voland, Leonard, 1985). Some loss of stocking will occur from the tree removal process but will not impact enough to change their stocking status from a currently adequately stocked regeneration to under stocked area.

In ponderosa pine types, where openings will occur, reforestation will need to occur through planting. Within the ponderosa pine dominated stands openings will occur due to lodgepole pine and white fir removal and possibly due to fire mortality from prescribed burning. There are a few areas where natural regeneration is occurring in the planning area but it is not consistent enough to ensure areas are reforested within 5 – 10 years, so these openings will be evaluated for reforestation. Natural seeding may be acceptable in some stands which are showing current cone production and some seedling establishment. Reforestation with planting may be done but only after at least one prescribed fire and preferably two have been introduced. The second prescribed fire is important to reduce fuels from the original fire, which may be as heavy as the original conditions, and to reduce brush competition further from brush established through persistent seed in the soil.

Openings designed to provide forage and hiding cover in the longer term following the West Bend treatments will be planted with ponderosa pine seedlings at stocking levels designed to provide hiding cover for the longest term possible (Methodology in Smith & Long 1987). Openings provided for *Castilleja chlorotica* propagation will not be reforested though the openings may be larger than 2 acres they will not be wider than 120 feet. This is less than two tree heights and will have fairly good chances of regenerating to a minimum level of 100 trees per acre within 10 years. However the intent is not for regeneration of forest but of propagation of *Castilleja chlorotica*, which as a hemiparasite, in this area is dependent on older more decadent bitterbrush. Enhancing bitterbrush and reducing overstory needle cast and competition is the intent. This is in line with the LRMP TE-7 “Where possible, opportunities to enhance the propagation of sensitive plants will be pursued.”

3.4 Fire and Fuels

3.4.1 Description of Fuels Activities

Small and medium size tree harvest is accomplished using ground based harvest equipment. Some small tree thinning may be accomplished by hand, using chainsaws. Small tree thinning units identified as pre-commercial thinning (PCT) would be thinned at a level desired to meet silvicultural objectives.

Slash from PCT units may be 1) lopped and scattered or 2) piled by grappler or by hand and burned or removed as biomass. Ladder fuel reduction (LFR), thinning of small trees, would occur on a spacing of 25’ by 25’ or approximately 80 trees per acre (tpa). Excess slash material remaining within LFR treatment units would be grapple piled or piled by hand and burned or utilized as biomass on approximately 7,800 acres.

Mowing is proposed on approximately 18,800 acres under all action alternatives to decrease the height of live or dead brush through the mastication (mowing) of brush in the stands. About 80% of each unit would be mowed; up to 100% of units adjacent to critical transportation routes (see Appendix C, Section 1 for definition) would be mowed. Underburning is proposed on approximately 17,400 acres, following thinning and mowing activities. Underburning would occur when fuel and weather conditions are conducive to achieving planned fuels reduction and resource objectives. Typical underburning conditions occur during spring and fall seasons, but depending on the season, objectives may still be achieved any time of year. It is also identified in the LRMP that it may be appropriate to utilize unplanned ignitions if prescribed fire plans are in place and the unplanned ignitions are burning within prescription.

Underburning results in some amount of first order, or short-term, fire effects that include bole scorch, needle scorch, shrub mortality and at times may also result in some mortality of the smallest trees. These effects depend on underburning and stand conditions. Figures 34-37 represent typical underburning fire effects in the Ponderosa pine stand types that dominate the West Bend project area. Two photos for each example stand are shown (for which there are two examples), the first photos show underburning effects two days after completion of underburning; the second photos show underburning effects two years after completion of underburning. Arrows are used as points of reference from the first to the second photo of each of the two examples.

Figure 34: Example of post-burn fire effects to stand conditions 2 days after the burn (arrows at trees can be used as points of reference).

Figure 35: Same location/same stand of trees as Figure 1: post-burn fire effects to stand conditions 2 years after the burn (arrows at trees can be used as points of reference).

Figure 36: Example of post-burn fire effects to shrub conditions 2 days after the burn (arrow at the log can be used as a point of reference).

Figure 37: Same location/same stand of trees as Figure 36: post-burn fire effects to shrub conditions 2 years after the burn (arrow at the log can be used as a point of reference).

Any units listed in Appendix B proposed as both mow and underburn ("mow/burn") are units where either mowing or underburning or both mowing and underburning would be implemented. Fire behavior analyses shows that both achieve short-term desired conditions. Longevity of the treatments and other ecological values, like brush response, recruitment of beneficial species, and nutrient cycling, indicate that prescribed underburning is the desired treatment over mowing in stands that have been both proposed for mowing and/or underburning. Best available science shows that all intermediate treatments should be accompanied by surface fuel modification, and the most success related to effective fuel reduction is achieved when using prescribed fire for such treatments (McIver et al. 2012; Graham et al. 1999). It may be necessary to apply fire up to two separate times or entries in order to achieve both prescribed fire and vegetation management desired conditions (see desired condition discussion).

Roads and existing fireline would be used wherever possible. Up to 14,000 feet of new machine or hand line may need to be constructed. Upon completion of burning, firelines would be rehabilitated by pulling slash and other materials back over the line to prevent use by motorized vehicles.

This project will be designed to minimize or eliminate unwanted impacts by incorporating measures such as utilizing existing skid trails and landings, utilizing slash wherever possible, and restoring soil productivity through subsoiling where post-harvest conditions show a need.

A Forest Plan Amendment is proposed in order to allow for visible effects of harvest cleanup and fuels reduction for approximately five years in units that fall within scenic views retention/partial retention foregrounds. An amendment also proposes to amend the five acres size limitation for prescribed fire treatment. Amendments are described in Chapter 2.

The areas falling under scenic views allocation along county roads 46 and 4601 are primary routes of ingress/egress for public users of numerous recreation sites across the western portion of the district, including but not limited to Tumalo Creek and Tumalo Falls, access routes to the Deschutes River, the High Lakes that are located east of the Cascade crest, and Mt. Bachelor. Treating areas adjacent to these primary routes of ingress/egress allow opportunities for safe evacuation of public, as well as opportunities for safe and active fire suppression. Treating these areas also address recommendations in the Greater Bend and East &West Deschutes County Community Wildfire Protection Plan (CWPP) priorities for treatment. Roads 46 and 4601 fall under the definition of a critical transportation route, as determined by the CWPP. These roads have been identified in the CWPP as having extreme hazard and are second in priority in the plan. Because treatments necessary to achieve objectives related to reducing hazard in these areas may require multiple entries and time of more than five years to accomplish, it would be necessary to amend the current standard and guidelines for Scenic Views allocations. Current standard and guidelines in Scenic Views limit treatment areas to less than five contiguous acres. Because these critical transportation routes continue for many miles within the project area, in order to achieve objectives, it would be necessary to treat areas that are larger than five contiguous acres.

Prescriptions and guidelines for fuels treatments proposed within the Scenic View Allocation are described in Chapter 2 of the EIS; refer to Forest Plan Amendment for description. Best efforts would be made to utilize natural features, roads and trail systems for control lines. Hand line and/or machine line would only be considered if no other options are available or immediate fire containment was necessary. Where there is sufficient material to warrant piling, piles would be constructed and burned to minimize scorch to residual stand. Underburning would occur in favorable conditions that would minimize scorch, mortality and smoke impacts.

3.4.2 Management Direction

Deschutes National Forest Land and Resource Management Plan (1990)

Fire and fuels management are guided by the goals, objectives and standards and guidelines in the Deschutes Land and Resource Management Plan (USFS 1990) (refer to Table 40). Recent changes in fire management policy and the latest available scientific data also guide the planning of activities.

In response to large, high intensity fire events prior to 2000, the National Fire Plan of 2000, formally called "September 8, Managing the Impacts of Wildfires on Communities and the Environment; A Report to the President in Response to the Wildfires of 2000, (USDA & USDI 2000) was co-authored by the Forest Service and Department of Interior. This document outlines operating principles for firefighting readiness, prevention through education, rehabilitation, hazardous fuels reduction, restoration, collaborative stewardship, monitoring, jobs, and applied research and technology transfer. In May 2012, A National Cohesive Wildland Fire Management Strategy updated the National Fire Plan. The 'Cohesive Strategy' identifies the vision for the next century as *Safely and effectively extinguish fire, when needed; use fire where allowable; manage our natural resources; and as a Nation, live with wildland fire.* Three primary factors were identified as presenting the greatest challenges and the greatest opportunities for making a positive difference in addressing the wildland fire problems to achieve this vision. They are:

- Restoring and maintaining resilient landscapes.
- Creating fire-adapted communities
- Responding to wildfires

Table 40: Applicable Forest Plan Direction

Deschutes NF LRMP (Forest Plan)	
Goal: To provide a well-managed fire protection and prescribed fire program that is cost efficient, responsive to land stewardship needs, and resource management goals and objectives. FF-1: Prevention of human caused wildfire will focus on areas of high use and high risk. Identified areas of high use and high risk include • Recreation use along major travelways FF-10: Unplanned ignitions may be used as prescribed fires if (1) a prescribed fire plan has been prepared and approved and (2) the fire is burning within prescription. Normally, prescribed burning will be by planned ignition. M7-26: The prescribed use of fire will be necessary to maintain diversity within the plant communities. Burning prescriptions will provide for the reestablishment of bitterbrush within 20 years. Approximately 2-2.5% of this management area could be burned annually. M7-28: In that portion of the Management Area designated non-suitable for timber, the preferred	M9-90: Low intensity prescribed fires will be used to meet and promote the Desired Visual condition within each stand type. Prescribed fire and other fuel management techniques will be used to minimize the hazard of a large high intensity fire. In foreground areas, prescribed fires will be small, normally less than 5 acres, and shaped to appear as natural occurrences. If burning conditions cannot be met such that scorching cannot be limited to the lower 1/3 of the forest canopy, then other fuel management techniques should be considered. FF-10: Unplanned ignitions may be used as prescribed fires if (1) a prescribed fire plan has been prepared and approved and (2) the fire is burning within prescription. Normally, prescribed burning will be by planned ignition. FF-11: Levels and methods of fuels treatment will be guided by the resource objectives within the management area. M11-42: Prescribed fire may be used to reduce hazardous fuel concentrations and to form fuelbreaks adjacent to the high use, high fire occurrence areas such as the Lower Metolius, upper Metolius, Twin Lakes, Pringle Falls, and Deschutes River. Prescribed burning can be done to enhance the recreation experience. Burning will be

Deschutes NF LRMP (Forest Plan)	
slash treatment method is to lop and scatter. In areas of heavy slash, machine piling and burning may be necessary. M7-28, M11-44: See Forest Plan for references to optimum fuel loadings. M8-25: Prescribed fire may be used to protect, maintain, and enhance timber and forage production. The broadest application of prescribed fire will occur in the Ponderosa pine type. M8-26, M13-15: The lowest cost option which meets the silvicultural, soil, water, and fire objectives should be selected. M8-27, M13-16: Slash will be treated to reduce the chances of fire starts and rates of spread to acceptable levels, but will not be cleared to the point that the forest floor is devoid of all slash and logs. Some slash and larger dead material will be left for ground cover for soil protection, microclimates for establishment of trees, and small mammal habitat. See Forest Plan for references to optimum fuel loadings. M9-8: In Retention areas, slash from a thinning or tree removal activity, or other visible results of management activities, will not be visible to the casual forest visitor one year after the work has been completed. In Partial Retention areas, logging residue or other results of management activities will not be obvious to the casual forest visitor two years following the activity.	planned to have the minimum impact on recreation use or appearance of the area. M11-43 Treatment methods that will not be visible over a long period of time should be emphasized. Treatment should occur outside the normal recreation season. M13-14: Prescribed fire may be used to remove concentrations of material that hinder winter recreation activities and to reduce the risk of conflagration fires. M15-19: Prescribed fire is not appropriate in lodgepole pine stands. In Ponderosa pine and mixed conifer stands, prescribed fire may be used to achieve desired old growth characteristics. It may also be used there to reduce unacceptable fuel loadings that potentially could result in high intensity wildfire. M15-20: Prescribed fire is the preferred method of fuel treatment. However, if prescribed fire cannot reduce unacceptable fuel loadings, other methods will be considered. M17: Stands and Guidelines are now contained in the Upper Deschutes Wild and Scenic River Plan.

Wildland Urban Interface (WUI)/Community Wildfire Protection Plan (CWPP)

In portions of the lower elevations of the forest, there is an interface between urban growth and the National Forest, where urban and suburban development in or near wildland vegetation poses risks for wildland fire managers in their ability to control threats to the natural resources and private structures. This area is known as the Wildland Urban Interface (WUI). The WUI definition in the Federal Register was developed to identify communities at risk in the vicinity of public lands. According to this definition, "the Wildland Urban Interface is the area where houses meet or intermingle with undeveloped wildland vegetation," (USDA and USDI 2001).

The WUI has received considerable attention because of recent increases in both the number of structures destroyed and the area burned annually by wildland fire. This WUI zone poses tremendous risk to life, property and infrastructure in associated communities and is one of the most dangerous and complicated situations firefighters face. The WUI is also where human-caused fire ignitions are most common (Radeloff, Hammer et al., 2005). Both the National Fire Plan and the Ten-Year Comprehensive Strategy for Reducing Wildland Fire Risks to Communities and the Environment place

a priority on working collaboratively within communities in the WUI to reduce their risk from large-scale wildfire.

In 2001, the Federal Register listed the communities at risk from wildland fire within the United States. A total of 93 communities appeared on the list in Deschutes County. After the Federal Register was published, a coalition of fire managers in Central Oregon re-evaluated this list and improved the assessment which resulted in the current list of 136 Central Oregon communities. Each community was buffered by one and one-half miles to identify the WUI boundary. The Deschutes National Forest lands within the West Bend project area and bordering the western boundary of the city of Bend, as well as any private inholdings, are categorized as WUI.

When congress passed the Healthy Forests Restoration Act (HFRA) of 2003, the WUI became increasingly important with regard to fire management direction, and the definition for WUI was redefined as "…an area within or adjacent to an at-risk community that has been identified by a community in its wildfire protection plan." (Project Wildfire 2007). In response to the HFRA, collaboration occurred to develop Community Wildfire Protection Plans (CWPP) that include the identification and prioritization of areas needing hazardous fuels treatment.

Community members of Bend and its surrounding areas, City of Bend Fire Department, Deschutes County Rural Fire Protection District #2, Oregon Department of Forestry (ODF), USDA Forest Service, USDI Bureau of Land Management, and Deschutes County collaborated to develop the plans applicable to the West Bend area; Greater Bend (updated in 2011) and East & West (E/W) Deschutes County CWPP (updated in 2012).

The CWPPs identified the following goals for Federal lands:

Table 41: Greater Bend and East & West Deschutes County Community Wildfire Protection Plans

Greater Bend and East & West Deschutes County CWPP – Goals for Federal Lands
• Treat Condition Class 2 and 3 lands* with the goal of returning the landscape to Condition Class 1 and reduce the potential of extreme fire behavior regardless of stand type or Condition Class by reducing fuel loads to that which can produce flame lengths of less than four feet; • Starting within a ¼ mile buffer of adjacent communities at risk, and working out in ¼ mile increments, until the WUI boundary is reached; • Within 300-500 feet (depending on CWPP) of any critical transportation route or ingress/egress that could serve as an escape route from adjacent communities at risk. See Appendix for county definition of critical transportation route • Maintenance of previously treated lands is also a top priority. Treatment and maintenance of previously treated lands before treatment begins again in other places is an important component of keeping communities safe.

*See Condition Class discussion beginning page 114.

The E/W Deschutes County CWPP - ODF rated the hazard of wildfire for the evacuations routes in West Deschutes County as extreme. The ODF rankings of assessment of hazard indicate that there is a high resistance to control once a wildfire ignites. The composite ODF assessment of risk and condition class, with consideration for population and structures, rated the same evacuation routes second in risk next only to the reservoirs of West Deschutes County. The composite ranking identifies and assigns priorities for treatments.

Clean Air Act

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 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. The pollutants thought to affect human health include particulate matter emitted in smoke that is less than 10 microns in diameter (PM10). The 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. The prevention of Significant Deterioration provisions of the CAA requires measures, to preserve, protect, and enhance the air quality for areas designated as "Class 1"airsheds (42 U.S.C. 7475(d)(2)(B). The closest Class 1 airshed is the Three Sisters Wilderness, located approximately four to six air miles west/northwest of the project area. The city of Bend, Oregon is the closest Smoke-Sensitive Receptor Area (SSRA). One of the requirements of the act is to minimize smoke intrusions into SSRAs and Class 1 airsheds to avoid adversely affecting air quality.

3.4.3 Fire and Fuels Hazard Reduction Analysis, Methods, Assumptions and Scope of Analysis

The intent of the proposed project, as addressed in the Purpose and Need for the West Bend project 'is to create more resilient forest conditions closer to their historic range of variability which will contribute to desirable recreation experiences, conserve and enhance wildlife habitat, increase public and firefighter safety, and provide commercial forest products in support of our local economy.'

Historic landscape conditions and disturbance patterns are commonly measured in terms of fire regimes and condition class that develop over time and at a larger scale than the project level. For this reason, the existing condition may be described in those terms. For this reason, the existing condition may be described in those terms, but because the proposed action alternatives happen within a set amount of time and on a smaller scale, it is not appropriate to measure condition classes for each of the proposed action alternatives within the project area.

The ability to support historic conditions and disturbance patterns, as they relate to fire at the project level, may be implicated by potential wildfire behavior, measured in this report as Fire Hazard and Fire Risk, within the project area. This fire and fuels analysis addresses the effects to fuels, fire behavior and fire effects to ponderosa pine as a result of the no action and three action alternatives.

The area of analysis was initially expanded in order to be large enough to encompass average natural disturbance events (like fire or insect outbreaks) within each vegetation type. This larger area could be a specific Hydrologic Unit Code (HUC), which is a watershed of particular size or the area could be something more arbitrary but still larger than the bounded planning area. Even if a larger area was initially used for analysis, for the purpose of this report most results are shown as having been bound by the West Bend project area. In the case where analysis results represent an expanded area of analysis, a note of such will be made.

The attributes used to evaluate the effects were fire behavior (hazard and risk), fire effects on ponderosa pine, and air quality. The following measures were used for the analysis:

- Measure 1: Acres of project area falling within each fire hazard class. Fire hazard is represented by a matrix of both flame length potential and crown fire potential
- Measure 2: Acres of project area falling within each fire risk class. Fire risk being represented by burn probability
- Measure 3: Number of trees by size class effected by predicted flame lengths
- Measure 4: Production of Particulate Matter (PM) 10 & 2.5

Only fire and fuels reduction activities that occurred within the project area during the preceding 15 years were considered in the analysis of cumulative effects. District experience and field reviews have shown that vegetation management activities such as thinning followed by mowing and prescribed fire have the beneficial effect of reducing fire intensity and fire behavior for an average of 15 years, perhaps longer depending on location and treatment intensity.

Analysis Methods

The following sections describe the analysis methods used for the four measures listed above. For measures 1 and 2, the analysis method differs between action alternatives and the no action alternative.

Existing Condition / No Action - Fire Behavior Measures 1 and 2

Fire behavior for the existing condition of the West Bend Planning area has been predicted by using a number of state of the art tools. Remote sensing satellite imagery from 2004 was updated using ArcFuels (Ager et al. 2011) to reflect activities accomplished since 2004. The data was then analyzed in the computer model FlamMap (v. 3.0) under specific weather conditions. FlamMap, a fire behavior mapping and analysis program that computes fire behavior characteristics (rates of spread, flame length, crown fire potential, etc.) over an entire landscape, was used to determine the existing stand condition's potential fire behavior. FlamMap is a state of the art tool used by many researchers and modelers (Finney 2006; Stratton 2004; Ager, Finney & McMahon 2006; Gercke & Stewart 2006; Opperman et al. 2006; Ager et al. 2006; Yohay et al. 2009; Krasnow et al. 2009; Arca et al. 2007; Stratton 2006; Knight & Coleman 1993). FlamMap output lends itself well to landscape comparisons (e.g. pre- and post-treatment effectiveness) and for identifying hazardous fuel and topographic combinations, thus aiding in prioritization and assessments (Stratton 2004). Although the (modeling) approach has limitations, model outputs yield useful information for planning, assessing, and prioritizing fuel treatments (Stratton 2004).

The data inputs necessary for FlamMap include aspect, slope, elevation, fuel model, canopy height, canopy base height, crown bulk density, and crown class. The fuel conditions used were those representing the 97th percentile weather from the Lava Butte Remote Automated Weather Station (RAWS). The Lava Butte RAWS is one of the weather stations closest to the project area (approximately 3-4 air miles from the western end of the project area) and best represents summer fuel conditions for the project area. The wind conditions used were conditions reported from the Bend Watershed Remote Access Weather Station. The Bend Watershed RAWS is also close to the project area (approximately 3-4 air miles from the western end of the project area) and best represents summer wind conditions for the project area. The 97th percentile fuel moisture conditions and wind conditions used can be referenced in Appendix C - Fire/Fuels. More information on 97th percentile weather can also be found in the General Assumptions section on pages 10-11. A fuel moisture conditioning period of August 10th at 1300 to August 13th at 1300 was used. The weather (.wtr) and wind (.wnd) files used for fuel moisture conditioning can also be referenced in Section 3 of Appendix C of this EIS. The model assumes constant weather and fuel moisture conditions (beyond the fuel moisture conditioning period) for each scenario. Results from modeling in FlamMap were analyzed in ArcGIS and are shown in this report as both tabular and spatial outputs.

Action Alternatives 2, 3, and 4 - Fire Behavior Measures 1 and 2

Predicted fire behavior for the Action Alternatives was analyzed using the same technique as the analysis for the existing condition (no action alternative). The updated remote sensing satellite imagery data (representing existing conditions) was changed using ArcFuels (Ager et al. 2011) to reflect the proposed treatments on the ground, as per the professional judgment (and FVS modeling) of Peter Powers, silviculturist and Deana Wall, fuels specialist. The change in data is available as part of the West Bend project record. One of the recognized limitations to this type of data and analysis is that changes made to 30 meter pixel satellite data in order to reflect post treatment stand and fuels data occurs at the stand level. In doing so, it is possible that pixel data within a stand that is changed to reflect treatment over the entire stand may be changed to data that appears to worsen predicted fire behavior for those particular pixels. Much experience with this type of modeling shows that these occurrences are rare and result in a small amount of acres being perhaps misrepresented. Although the (modeling) approach has limitations, model outputs yield useful information for planning, assessing, and prioritizing fuel treatments (Stratton, 2004). Once the data was changed, the data was modeled in FlamMap (v3.0), under the same extreme summer weather fuel and wind conditions from RAWS that were used for the existing condition. Results from modeling in FlamMap were analyzed in ArcGIS and are shown in this report as both tabular and spatial outputs.

All Alternatives - Fire Effects Measure 3

BehavePlus 3.0.2 is a fire modeling system that is a collection of models that describe fire behavior, fire effects, and the fire environment, and has been used to determine crown scorch based on flame lengths for the planning area. BehavePlus was used for modeling probability of mortality in ponderosa pine under wildfire. Ninety seventh percentile weather attributes (temperature and winds) were used with a .4 mid-flame wind reduction factor to account for treated stands providing less sheltering to the wind.

Although post-treatment fire effects are a result of thinning and the thinning in and of itself would result in less trees post-treatment, for a fair comparison across both the no action and comparative action alternatives fire effects to trees is being shown to all pre-existing trees. The number of trees that would be removed during proposed treatment under any action alternative is not reflected in the tables. Flame length outputs came from modeling in FlamMap (as described in prior description of analysis) and tree size data came from LIDAR data. LIDAR is laser-scanning technology that is a specialized, aircraft-based type of system that provides extremely accurate, detailed 3-Dimensional measurements of the ground and vegetation. The Deschutes National Forest was scanned in 2011 and the product provided individual tree points with x, y and z coordinates. The x, y and z coordinates were translated to tree size data that was utilized for this measurement. Tree size data that was analyzed is size data only for trees proposed to be treated with underburning under action alternatives. It is assumed for the purpose of analysis in order to represent potential effects to ponderosa pine that all trees within proposed underburn areas are ponderosa pine. Flame length outputs and tree size data were subsequently analyzed together in ArcGIS.

All Alternatives - Air Quality/Smoke Management Measure 4

In order to determine the differences in particulate matter released during wildfire compared to prescribed fire or pile burning for either the existing condition/no action alternative or the two action alternatives, an analysis was done in the computer models FOFEM (First Order Fire Effects Model) (Keane et al., 2000) and Consume 3.0 (Anderson et al, 2008). FOFEM is a computer program that was developed to meet needs of planners in predicting and planning for fire effects, including smoke impacts. Consume 3.0 is a computer program that was designed for resource managers and scientists to estimate fuel consumption and emissions (used in this analysis strictly for pile burning). The assumptions made within FOFEM, as well as Consume 3.0, are as follows;

- Prescribed underburning occurs in Interior Ponderosa Pine (SAF 237) and wildfires occur under Interior Ponderosa Pine (SAF 237), Lodgepole Pine (SAF 218) and White Fir (SAF 211) under natural fuel conditions

- Prescribed underburning is conducted under spring and moderate fuel moisture default conditions; wildfires occur under summer and very dry fuel moisture default conditions with an adjustment of the 10 hour fuels to 3%, and 1000 hour fuels to 7% (97th percentile conditions)
- Prescribed underburning would be conducted with light 3+ inch diameter fuels and sparse herbaceous, shrub, foliage, and branch conditions; wildfires occur under typical, default conditions for all fuel types
- Pile burning emissions were predicted using a range from 5.94-18.26 tons/acre depending on species being cut/piles and regardless of machine or hand piles. Pile type #1 or #2 (depending on species), 0% soil and clean pile quality (see Consume 3.0 for details)

General assumptions made in effects analysis

Alternative development and environmental effects are based on the following assumptions:

- Lightning will remain a source of potential ignitions.
- The earth has entered an era of rapid environmental change and global warming that present unknown challenges (Millar et al. 2007).
- An increase in average tree diameter of the stand reduces fire severity. Larger trees have thicker bark and are more resistant to flame scorch from surface fuels. The more acres thinned from below, the greater the average diameter of remaining trees.
- Treatment of natural surface fuels will reduce fire severity.
- Wildland fire will not be eradicated in these ecosystems. A successful strategy will be built upon designing a vegetative environment, including species and structural characteristics that will produce desired, safely manageable fire behavior in the event of an unplanned ignition.
- There are no ecosystems that are completely "fire safe." Certain combinations of ignition, fuel moisture in the live and dead vegetation, wind, and relative humidity can combine under extreme circumstances to threaten any vegetated ecosystem.
- Public and firefighter safety is the top priority in fuels and fire management. Treatments in the forest will focus on creating a safe working environment for fire suppression forces.
- Ground suppression forces can operate safely adjacent to flames that are 4 feet in length and less. Extreme fire behavior, including crown fire, rapid surface spread and long range spotting, create an unsafe environment for the public and firefighters.
- The West Bend Planning Area is valued for a variety of reasons, including wildlife habitat, unique vegetative communities and visual quality among others. Any management done in the name of hazardous fuels reduction in that zone must also consider the other objectives.
- Weather conditions at the 97th percentile for FlamMap analysis are defined as the combination of temperature, relative humidity, and wind speed on a summer day that is warmer, drier, and windier than 97% of all other recorded summer days. "Fire season" is defined as the 92 day period between July 1st and September 30th, during which most fires and acres burn. Under 97th percentile conditions, there will be about 3 days on average that are hotter, drier, and windier than those 97th percentile conditions.
- For the analysis in this document, the effects of treatments are assumed to cover 100% of the treatment area. There is currently no way to spatially analyze untreated areas within treatment units (i.e. it is not possible to capture the analysis of the effect of leaving 10 or 20% of mowing

units unmowed). Leaving certain areas of units untreated would likely reduce the effectiveness of hazard fuel reduction indicated in the analysis, but to what extent is unquantifiable.

- Any analysis completed using any of stated models adopts all limitations and assumptions of the models themselves.
- Fire effects to ponderosa pine are measured by predicting probability of mortality based on flame length and DBH. Fire effects to other species is not otherwise measured or modeled in this fire and fuels analysis. For any other discussion regarding mortality or fire effects outside what is considered in this analysis, it is assumed from best available science that fuels treatments reduce fire severity and crown scorch (Pollet Omi 1999; Ritchie, Skinner Hamilton 2007). It is assumed from best available science that larger diameter and taller trees generally survive greater levels of damage (Wyant et al. 1986; Harrington 1993; Rogelbrugge and Conard 1993; Stephens and Finney 2002; Thies et al. 2005). It is also assumed from best available science that fire damage to the crown and bole influences a tree's probability of surviving fire, and that either crown scorch, consumption or a combination of the two are important to mortality of ponderosa pine trees (Dieterich 1979; Wyant et al. 1986; Saveland and Neuenschwander 1990; Stephens and Finney 2002; Wallin et al. 2003; McHugh & Kolb 2003; McHugh et al., 2003). Ground fire severity is also assumed to be linked with postfire mortality (Swezy & Agee 1991; McHugh & Kolb 2003), as well as beetles that may be attracted to fire-damaged trees (McCullough et al. 1998; Parker et al. 2006).

3.4.4 Affected Environment – Existing Vegetation, Condition Class, and Fire History

Vegetation

For the purpose of analysis of vegetation condition, the area considered is the 10th field Hydrologic Unit Code (HUC) (watershed), which for the West Bend planning area is the Tumalo Creek and North Unit Diversion Dam, Deschutes River, 10th field HUCs, which cover 139,228 acres. The vegetation condition analysis for West Bend is part of the analysis conducted by the Upper Deschutes Basin Fire Learning Network (2007).

About 52% of the two HUCs is made up of the ponderosa pine Plant Association Groups (PAG). Ponderosa pine PAGs develop over an extremely long period, covering centruies, and are dominated by ponderosa pine, with a presence of lodgepole pine and white fir in areas ecotonal to the lodgepole pine or mixed conifer plant associations. These PAGs are categorized into what is considered Fire Regime I (refer to FEIS Appendix C, section 1 Definition/description of fire regime and condition class). Historically, in these PAGs, less than 25% of the dominant overstory vegetation were replaced by low severity fire. However, mixed severity fires can replace up to 75% of the overstory on occasion. Large stand-replacing events are rare events (200+ years) (NIFTT 2010).

The low-severity fires that typify Fire Regime I happen most frequently (0-35 years). Many scientists cite similar frequent fire frequencies for Fire Regime I landscapes (Weaver 1951; Dieterich 1980; Savage & Swetnam 1990; Weaver 1959; Soeriaatmadja 1966; Morrow 1985). This short interval fire cycle would indicate that most of the Fire Regime I area would have burned more at least two times without human influence and intervention since the land exchange of 1944 when the Forest Service received a large part of the West Bend project area land. An analysis of the historical large fire record since 1944 for the Deschutes National Forest indicates that about 6% (4,347 acres) of Fire Regime I within the two 10th field HUCs has burned. This would indicate that, due to fire exclusion and other management strategies, more than ninety percent of the area has missed three or more entries of fire over the course of the last century. The 6% of Fire Regime I that has burned has only burned once in that amount of time, and therefore is either currently missing an interval or more of fire, or had been missing an interval or more of fire before fire entered the regime. Refer to Table 42, page 124 for

current conditions of Fire Regime I in relation to missed fire cycles as well as other management activities.

Twenty four percent (28,329 acres) of the two 10th field HUCs is made up of the dry and wet mixed conifer PAGs. These stands can be dominated by ponderosa pine, lodgepole pine and white fir. Western white pine, historically, would have been associated with these plant associations. Due to the white pine blister rust disease, this species is now rare. These stands were established and maintained with a fire return interval of about 35-100 years. Fire in these areas tends to be of mixed severity which results in heterogeneous landscapes. Within these landscapes, a mix of stand ages and size classes are important characteristics; generally the landscape is not dominated by one or two age classes. Large stand replacing fires occur, but are usually rare events. Such stand-replacing fire may "reset" large areas (10,000-100,000 acres) (NIFTT 2010). These PAGs are categorized into what is considered Fire Regime III.

The 35-100 year fire cycle would indicate that most of the Fire Regime III area would have burned at least once, possibly as many as two times, without human influence and intervention since the land exchange in 1944. The historical large fire record since 1944 indicates that about 9% (2,438 acres) of Fire Regime III within the two 10th field HUCs has burned indicating that more than 90% of this fire regime has missed one or more entries of fire over the course of the last century due to fire exclusion and other management strategies. The 9% of Fire Regime III that has burned has only burned once in that amount of time, and presumably is functioning within or near within its historical range of variability. Refer to Table 42, page 124 for current conditions of Fire Regime III in relation to missed fire cycles, as well as other management activities.

About 12,284 acres (10%) of the two 10th field HUCs is in the Lodgepole pine PAG. Lodgepole pine PAGs are seral communities that arise from and/or are maintained by stand-replacement fires. Fires are of stand-replacing severity, since Lodgepole pine is not fire resilient, and typical fire return intervals are 35-100+ years (NIFTT 2010). These PAGs are categorized into what is considered Fire Regime IV. The 35-100 year fire cycle would indicate that most of the Fire Regime IV area would have burned at least once, possibly as many as two times, without human influence and intervention since the land exchange in 1944. The historical large fire record since 1944 indicates that no acres of Fire Regime IV within the Fall River 10th field HUC has burned. This would indicate that, due to fire exclusion and other management strategies, the entire fire regime has missed one or more entries of fire over the course of the last century. The 19% of Fire Regime IV that has burned has only burned once in that amount of time, and presumably is functioning within or near within its historical range of variability. Refer to Table 42, page 124 for current conditions of Fire Regime IV in relation to missed fire cycles as well as other management activities.

About 8,137 acres (7%) of the two 10th field HUCs is typified by the Mountain Hemlock PAG. Mountain Hemlock PAGs are communities found at the cold and wet extremes of the environment. Fires are rare with fire return intervals of over 200 years. When fires do occur they tend to be stand replacing. These PAGs are categorized into what is considered Fire Regime V.

The fire cycle of over 200 years would indicate that this regime is probably still functioning within or near its historical range of variability. An analysis of the historical large fire record for the forest indicates that no acres of Fire Regime V within the two 10th field HUC has burned since 1944.

Condition Class

The HRV departure index for each of the fire regimes has been further classified into condition classes to help indicate the amount of departure from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity and pattern and other disturbances. Again, this departure is due to fire exclusion, as well as timber harvesting, introduction and establishment of exotic plant species, insects or disease (introduced or native), or other past management activities. This

departure has resulted in alterations of key ecosystem components such as species composition, structural stage and canopy closure.

Some ecologists have questioned use of the HRV concept in planning because pre-Euro American settlement climatic conditions were somewhat cooler than present conditions (Bradley & Jones 1993; Veblen 2003; McKenzie et al. 2004). However, fire regimes and associated vegetation for most biophysical settings (BpS) types were relatively stable for at least several centuries before attempted fire exclusion (Agee 1993; Swetnam & Baisan 1996; Barrett et al. 1997; Frost 1998; Morgan et al. 1998; Brown & Smith 2000; Hemstrom et al. 2001; Heyerdahl et al. 2007; Miller 2007; Heyerdahl et al. 2008; Keane et al. 2008; Nowacki & Abrams 2008). Therefore, HRV-based reference conditions are acceptable for use in FRCC and other types of ecological assessments (Keane et al. 2007; Morgan et al. 2007).

Condition class 1 represents areas that fall most within their natural or historical regime of characteristics. Condition class 2 and 3 represent areas that have moderate and high departures from the natural or historical regime of characteristics. The specifics for each condition class can be found in Appendix C of this FEIS.

In order to simplify the concepts behind condition classes within each fire regime, the three condition classes have been grouped into two descriptive categories of acres: restoration acres and maintenance acres.

- Restoration acres are those acres that fall into condition class 2 and 3. These acres are at an elevated risk of loss of components that define those systems as unique. It is recognized that there are other management objectives that require some of the restoration areas to remain in or near their current condition. The objective is not to attempt to treat every acre within restoration areas in order to restore conditions that historically existed. 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.
- Maintenance acres are assumed to be functioning within expected parameters with respect to overstory condition. Often, maintenance acres are still in need of treatment due to their surface conditions, i.e. a well-developed shrub layer presenting high flame lengths and the potential for crown fire initiation. Treating these surface fuels, although they are not a factor taken into consideration when determining Condition Classes of areas, is important to decreasing fire suppression resistance and the potential for crown fire initiation.

Refer to Table 42 for the summary of acres for each of the PAG/Fire Regimes now specific to the West Bend project area and their current condition; maintenance or restoration.

Table 42: Fire Regime/Condition Class Summary for Tumalo Creek and North Unit Diversion Dam, Deschutes River – 10th Field HUCs

PAG/Fire Regime	Severity Description	Maintenance Acres	% of Regime	Restoration Acres	% of Regime	Total Acres
FR I Ponderosa Pine	0-35 year return, low intensity	24,639	36	43,236	64	67,875
FR II Range/Grass/ Shrub	0-35 year return, stand replacing	0	0	0	0	0
FR III Mixed Conifer	35-100+ year return, mixed	11,914	42	16,415	58	28,329
FR IV Lodgepole Pine	35-100+ year return, stand replacing	6,815	55	5,469	45	12,284
FR V Fir/Mtn	>200 year return, stand replacing	3,863	47	4,274	53	8,137

PAG/Fire Regime	Severity Description	Maintenance Acres	% of Regime	Restoration Acres	% of Regime	Total Acres
Hemlock						
TOTAL		47,231	40	69,394	60	116,625*

*The combination of both 10th field HUCs total 117,590 acres, 965 acres of analysis are recorded as having no Fire Regime/Condition Class data.

Stand and Fire Suppression History

Within the West Bend project area, there are a few fires on record. One fire, the Swampy Lake fire burned 101 acres of the project area in 1914. It is the only fire on record for Forest Service lands prior to 1944. In 1944, the Forest Service gained 89,759 acres of land through a 'land for logs' exchange with private landowners. The land had an average 30 board feet to the acre, indicating that the large amount of logging that occurred across this particular landscape had resulted in little remaining overstory. Approximately 11,000 acres of these lands procured in 1944 by the Forest Service fall within the West Bend project area. Since 1944, fire history records for the Deschutes National Forest indicate that there have been four other large fires across the entire West Bend project area. The largest and most recent fire to directly impact the area, the Awbrey Hall fire of 1990, was arson-caused and burned a total of 3032 acres and consumed 22 Bend residences within its first burning period. Today, the Awbrey Hall fire scar spans the eastern portion of the project area.

Across the West Bend project area, in addition to the land exchange and fire exclusions, past commercial/non-commercial thinning, mowing and underburn activities have changed stand and fuel conditions. These activities have also had a major influence on the stands' proximity to HRV.

Pre-Euro-American low elevation dry conifer forests of the western United States were fundamentally shaped by frequent low- or mixed-severity disturbances such as wildfires (Heyerdahl et al. 2012; Bork 1984; Agee 1993; Taylor & Skinner 1998; Everett et al. 2000; Ottmar & Sandberg 2001; Wright & Agee 2004; Youngblood et al. 2004; Hessburg et al. 2005; Arabas et al. 2006; Van Horne & Fule 2006) and insect attacks (McCullough et al. 1998; Hayes & Daterman 2001) mediated by diverse environmental gradients of topography, soils, and weather. Surface fires, ignited predominantly by lightning during the time of year when moisture content of fine fuels was lowest (Agee 1993; Rorig & Ferguson 1999), controlled regeneration of fire-intolerant species, reduced density of small-diameter stems consumed litter and down wood, opened the stands to increased sunlight, led to vertical stratification of fuels by eliminating fuel ladders between the forest floor and the overstory canopy, and maintained relatively stable plant associations. Consequently, the structure of these low elevation dry forests generally consisted of open, predominantly widely spaced medium to large and old live trees, scattered dead trees, low levels of surface fuels, and continuous low herbaceous understory vegetation (Wickman 1992; Agee 1994; Youngblood et al. 2004; Arabas et al. 2006).

Many of these dry forests today have characteristics that place them at greater risk of uncharacteristic disturbances. These features include an accumulated mass of down woody debris and continuity of the fuels mosaic at landscape scales, more small trees and fewer large trees, greater amounts of young multi-storied forest with fire intolerant conifers in both understory and overstory strata, increased fuel ladders that contribute to greater flame lengths during fires, and new or altered forcing of regional climate on plant community structure and organization (Agee 1993; Covington & Moore 1994; Arno et al. 1997; Taylor & Skinner 1998; Harrod et al. 1999; Youngblood et al. 2004; Fitzgerald 2005; Hessburg et al. 2005; Stephens & Gill 2005; Youngblood et al. 2006; McKenney et al. 2007). In many dry forests of the Pacific Northwest, the altered fuelbeds and shifts in forest structure and composition resulted from fire exclusion and suppression, livestock grazing, timber management activities, and changes in climate (Bergoffen 1976; Steele et al. 1986; Dolph et al. 1995; Arno et al. 1997; Fitzgerald 2005; Richardson et al. 2007). Increases in overall stand density over the past century have led to increased competition among trees for below-ground nutrients, water, and growing space. Increased

competition among trees and reduced tree vigor increases susceptibility to attack from bark beetles and other forest insects and diseases (Mitchell 1990; Hessburg et al. 1994; Oliver 1995; Fettig et al. 2007). Mortality in ponderosa pine attributed to mountain pine beetle is positively correlated with high stand density (Sartwell & Dolph 1976; Fettig et al. 2007). Thinning has been shown to reduce the amount of ponderosa pine caused by mountain pine beetle unless surrounding areas are allowed to develop epidemic population levels (Fettig et al. 2007). The mountain pine beetle often kills extensively when contiguous stands or landscapes become vulnerable. These changes have occurred more recently against a backdrop of natural and human-caused climate change that may first be manifest in the distribution of herbaceous species and woody shrubs, and may eventually result in a redistribution of tree species (McKenney et al. 2007; Richardson et al. 2007). Collectively, these altered structural conditions contribute to increased probability of multiple, interacting stresses and may lead to altered or new disturbance regimes.

Expected Fire Behavior

Potential fire behavior within the West Bend planning area is described, in part, by wildfire hazard. Hazard describes the resistance to control once a fire starts. Fire hazard has been qualified into the following hazard ratings of low, moderate, high and extreme. The hazard ratings are determined by the potential flame length and fire type at any given pixel. Table 43 provides a hazard matrix that shows the predicted wildfire hazard for the existing condition in acres for the West Bend Planning area. Figure 38, page 128 is a spatial map of the existing condition fire hazard.

Table 43: Wildfire Hazard Rating Matrix

Fire Type	Flame length potential (feet)			
	0-4	4-8	8-11	11+
Surface	Low	Moderate	High	Extreme
Passive Crown	Low	Moderate	High	Extreme
Active Crown	Moderate	High	Extreme	Extreme

Potential fire behavior hazard ratings start with flame length potential. Flame length potential ratings of 0-4 feet, 4-8 feet, 8-11 feet, and greater than 11 feet are determined based on Fire Behavior Characteristics Charts found in Appendix B of the National Wildfire Coordinating Group Fireline Handbook (NWCG 2006). Fire Behavior Characteristics Charts are used by firefighters to determine a fire's resistance to control and spread rates. Built into the hazard ratings along with flame length potential is fire type. Fire type is related to the potential for a crown fire and a firefighter's ability to safely engage the fire.

Surface fire types are fires that have no potential for either type of crown fire. There are two stages to the crown-fire process:

- The first is torching, or movement of fire into the crown (passive crown fire). A passive crown fire is a surface fire with individual tree torching. Passive crown fires, although not as intense as an active crown fire, can make suppression difficult due to high flame lengths and short and long range spotting;
- The second is active spread of the crown fire where fire moves from tree crown to tree crown through the canopy (active crown fire) (Fitzgerald 2005). An active crown fire is a fire involving the crowns of trees with support from a surface fire.

Potential fire hazard that rates as low generally allows fire suppression resources to safely and efficiently attack the fire at the head with hand tools. This is not a guide to personal safety. Fires can be dangerous at any level. Wilson (1977) has shown that most fatalities occur in light fuels on small fires or isolated sections of large fires. Low fire hazard also generally allows for multiple operational

alternatives to be considered such as aggressive full perimeter control, point source protection or utilizing barriers either natural or manmade.

Moderate fire behavior is where fire suppression efforts may be limited, due to the availability of the type of equipment that may be necessary to be successful. At 4 to 8 foot flame lengths, you have exceeded the capabilities of hand crews has been exceeded and, handline cannot be relied on to hold the fire, and equipment, such as bulldozers, engines and retardant aircraft, would be necessary.

High hazard fire behavior presents serious control issues related to torching, crowning and spotting. Control efforts become ineffective. Extreme hazard fire behavior does not allow for safe working conditions for any type of fire suppression resources directly related to the fire.

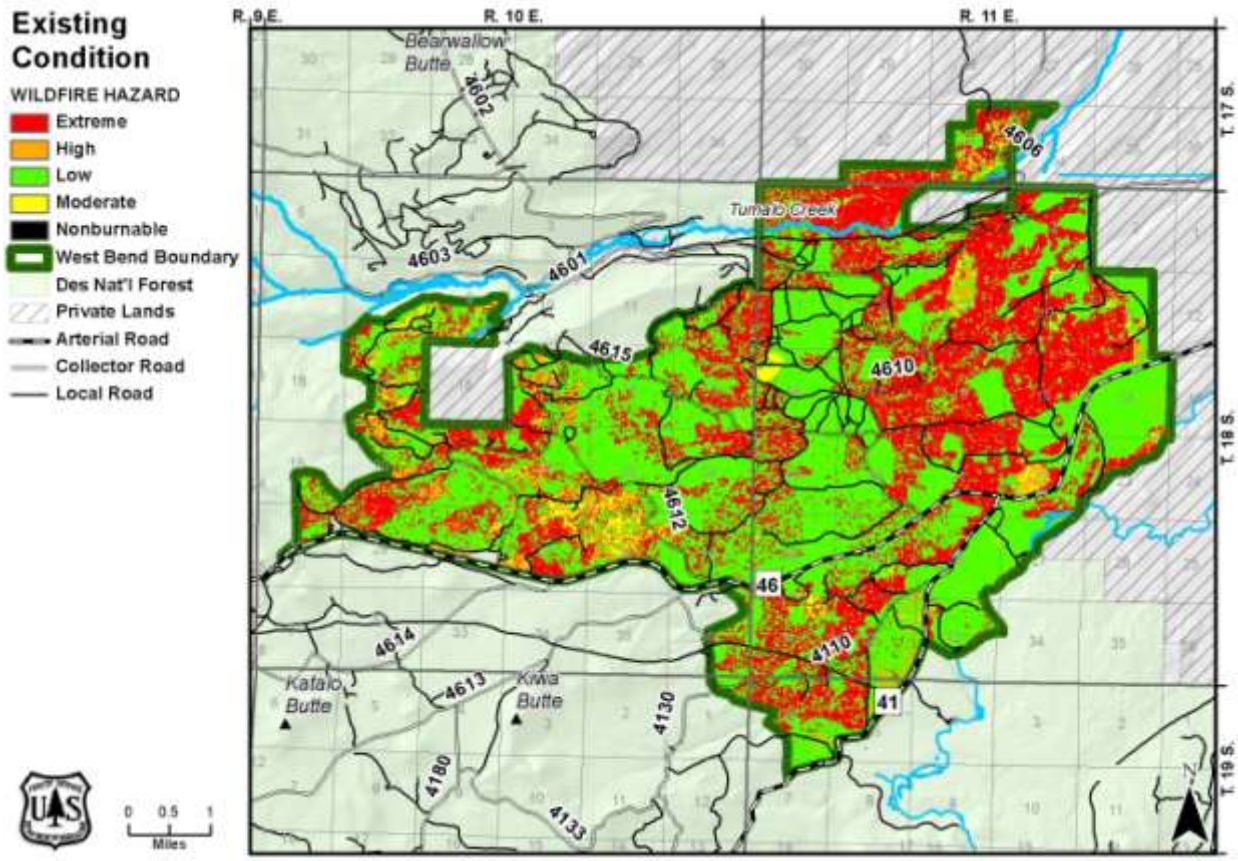
Table 44 shows the predicted wildfire hazard for the existing condition in acres for the West Bend project area using the hazard matrix shown in Table 43.

Table 44: Existing Condition Hazard Ratings and Acreage

Hazard	Acres*
Low	14,772
Moderate	661
High	932
Extreme	9,317
Total Acres	25,682

*There is a difference of 14 acres between the total acres for the project (25,696 acres) and the total analysis acres for existing condition (25,682 acres), these acres represent minute pieces of ground that get dropped during GIS analysis (related to pixel size of data) and represent an analysis error of less than 0.1%.

Figure 38: Existing Condition Wildfire Hazard Map



About 57% of the project area currently rates as low hazard fire potential. Low hazard potential is the desired condition that best allows, safe, efficient firefighting, provides least cost option and achieves the best results with regards to fire effects (Table 44); see Measure #3 for all Action Alternatives.

Approximately 36% of the project area has extreme fire hazard at 97th percentile weather and fuel conditions. Approximately 38% of the 19,773 acres of ponderosa pine dominated stands rates as extreme fire hazard (7,577 acres). Extreme fire hazard equates to high flame lengths and varying degrees of crown fire where suppression efforts become ineffective. Given assumptions made from best available science, extreme, and even moderate and high fire hazard would be damaging to valued stand characteristics.

In order to measure fire risk from random ignition, a measure of burn probability is used. Burn probability is an additional output to FlamMap and is a part of the minimum travel time fire growth model, and used as an indicator of potential fire spread rates, i.e. landscape attributes, like fuel conditions. Fuel conditions can contribute to higher spread rates resulting in a higher burn probability. High burn probabilities can be related to the sizes of fires that occur on a given landscape. Under the same conditions, large fires produce higher probabilities of spread than small fires. Since fire size is a function of the gross spread rate and duration of the fire, treatments or conditions that reduce the spread rate will lower the burn probability (Finney et al. 2006).

Burn probability was calculated within the model using the same 97th percentile fuel and wind conditions from Lava Butte and Bend Watershed RAWS, as well as with 1,000 random ignitions and an 8 hour burn duration across the entire analysis area, which is approximately a 1.5 mile buffered area surrounding the West Bend project area. A larger analysis area for the purpose of burn probability allows the model to consider ignitions from outside the West Bend area and model that potential without bias. Table 45 shows the existing condition's burn probability for the project area. Figure 39 is a map of the burn probability spatially across the existing condition.

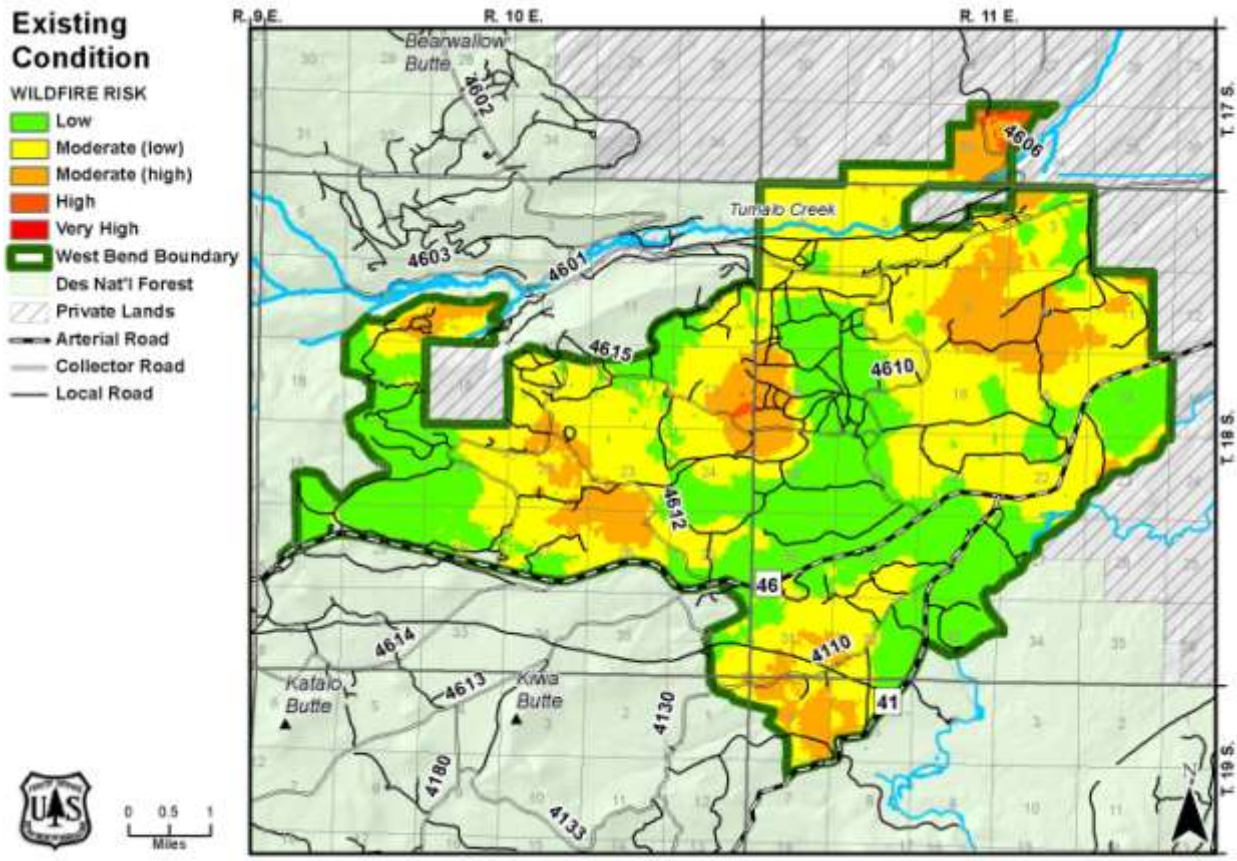
Table 45: Alternative 1 (No Action) – Wildfire Risk Rating as Measured by Burn probability within the West Bend Project Area.

Wildfire risk rating	Burn probability classification	Amount of Acres*
Low	1	9,443
Moderate (low)	2	12,104
Moderate (high)	3	3,889
High	4	218
Very High	5	33

*There is a difference of 9 acres between the total acres for the project (25,696 acres) and the total analysis acres for existing condition (25,687 acres), these acres represent minute pieces of ground that get dropped during GIS analysis (related to pixel size of data) and represent an analysis error of less than 0.1%.

Table 45 shows that relative to the entire analysis area (an area that includes approximately a mile and a half around West Bend), the project is predicted to have moderate chances (classification of 2 to 3) for large fires across the majority of the area (15,993 acres). Figure 39 is a map of the wildfire risk rating from random ignition for the existing condition across the analysis area. Looking at Figure 39, a large area exhibiting low wildfire risk (green) from random ignition near the middle of the project area is due to existing recent treatments in the area (see Tables 26 and 27). The large area exhibiting low wildfire risk from random ignition at the western end of the project area is not due to any recent treatments (such as listed in Tables 26 and 27) , but can be attributed more to its location in the project area relative to modeled west winds (upwind). Any of the random ignitions modeled in this area would have burned east with the modeled west wind, therefore reducing burn probabilities in the local upwind area. The large area of existing recent treatments (near the middle of the project area) currently shows their effectiveness in reducing risk to adjacent and primarily downwind areas. This can be seen with the predicted moderate ratings that dominate the rest of the project area.

Figure 39: Alternative 1 (Existing Condition) - Wildfire Risk



Summary of Overall Stand Condition

Across the two 10th Field HUCs, there are more acres, with regard to stand condition, outside their historic range of variability than within. The majority of acres (more than 60%) outside their HRV are within ponderosa pine PAG/fire regime I. The other approximate 40% of the acres outside their HRV are in mixed conifer/fire regime III, lodgepole pine/fire regime IV and fir/mountain hemlock/fire regime V. Acres that currently remain within their HRV need a continued form of disturbance to maintain their current historic condition. Frequency of disturbance for acres within HRV depends on variables that include, but may not be limited to; fire regime classification, timing of last disturbance, type of previous disturbance and type of introduced disturbance. Disturbances could include but may not be limited to; grazing, wildfire, prescribed fire and vegetation management like thinning and mowing.

Very few acres fall within the HRV. Those within the HRV are a result of fire's influence. The past century of fire exclusion has precluded most acreage from being within the HRV. Management activities have also been a major influence to individual stands and their proximity to HRV.

The history specific to the West Bend planning area is really no different from its 10th field HUCs. Fire exclusion and management activities have been large influences on the current stand conditions. Fire hazard modeling predicts extreme fire hazard for over one-third of the area. Fire risk modeling shows that previous treatments within West Bend have reduced burn probabilities, but many areas with moderate risk potential still exist.

Desired Conditions and Related Strategies

The landscape within the project area should display a mosaic of strategically placed areas that are based on the principles of Fire Resilient Forests as shown in Table 46 (Agee 2002).

Table 46: Principles of Fire Resilient Forests (Agee 200; Hessburg & Agee 2003).

Principles	Effects	Advantage	Concerns
Reduce surface fuels	Reduce potential flame length	Control easier, less torching[1]	Surface disturbance, less with fire than other techniques
Increase height to live crown	Requires longer flame length to begin torching	Less torching	Opens understory, may allow surface wind to increase[2]
Decrease crown density	Makes tree-to-tree crown fire less probable	Reduces crown fire potential	Surface wind may increase and surface fuels may be drier[2]
Keep larger trees	Thicker bark and taller crowns	Increases survivability of trees	Removing smaller trees is economically less profitable

[1] Torching is the initiation of crown fire.
[2] Where thinning is followed by sufficient treatment of surface fuels, the overall reduction in expected fire behavior and fire severity usually outweigh the changes in fire weather factors such as wind speed and fuel moisture (Weatherspoon 1996).

The principles are designed to reduce fire behavior potential, aid in the suppression of wildland fire (i.e. provide defensible space), and increase protection to valuable resources on forest lands. Following these principles will improve fire-resilience in ponderosa pine ecosystems by (in sequence); reducing surface fuels, removing ladder fuels, leaving large, fire resistant trees and spacing tree crowns. These conditions can be achieved with a variety of methods including prescribed burning, mowing, pruning, and thinning.

Those areas managed for reduced fire behavior potential would include a number of associated desired conditions. The structures of stands desired would be where crown bulk density and the continuity of the forest canopy could not sustain a crown fire occurrence. Trees within stands would have a canopy base height well enough above shrub cover in order to reduce potential for crown fire initiation. The shrub layer would be maintained at a height that would lower flame lengths to below the four foot Forest Service standard for direct attack by handline and reduce the potential for crown fire initiation. Within these areas across the landscape, defensible space of at least 500 feet wide (as per the CWPPs) on either side of critical transportation routes would be a working condition for suppression forces, safe egress for the public, as well as a potential fuel break to the fire. Fuel model 161 is a timbered fuel model that exemplifies the fuel characteristics conducive to low fire behavior and successful suppression by direct attack of hand crews. Fuel model 161 would be considered the desired condition for the area. Fuel model 141, a low fuel loading shrub model also conducive to low fire behavior, would be an acceptable desired condition for areas where underburning is not possible. In addition to lowering fire behavior, to best enhance stand resiliency it is also a desired condition for this area 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.

Strategies Related to the Desired Conditions

Given the existing condition and desired condition contained in the management direction previously mentioned, the following strategies have been developed to move toward the desired future condition and to help direct treatment types and locations:

- **Defensible Space (fuel break/safety corridor):** Road systems allow ground suppression forces (engines, crews and equipment) to access wildfires. Use of major roads in a defensible space (500 foot wide) is recommended, especially in the WUI where public safety and evacuation is of high concern. This strategy also allows for safe ingress/egress to and from a fire for firefighters. It is also a strategy that ties in with the E/W Deschutes County CWPP's goals for Federal lands.

When fuel conditions allow surface fires to have high intensities and get into the canopies of the trees, contributing to extreme fire behavior (torching, crowning and long range spotting), direct attack by ground forces becomes ineffective. Wildland fires under these conditions will cross any road system with such intensity that suppression forces have little chance of containing the fire from the road. Retardant alone will only slow a wildfire for a short period of time. Suppression forces need to quickly utilize the effect of the retardant to contain a wildfire. Roads provide a good area for retardant to be utilized by suppression forces. During recent wildfires on the forest, rural fire engines have responded to aid in the suppression effort. These large, low clearance engines cannot operate on most local forest roads due to narrow road widths and uneven, unpaved road surface conditions.

By reducing crown densities through thinning and reducing surface fuels and ladder fuels through either mechanical shrub treatment (mowing), pruning, underburning, piling slash and burning the piles within the fuel break, fire behavior would be reduced to primarily a surface fire that suppression forces will have better ability to control. Thinning of dense canopies allows retardant to be more effective by getting to surface fuels without being caught in the canopy. Snags should not be retained near the roads (within a tree length) that remain open to the public and down wood or slash piles should not be retained within 200 feet of roads or boundaries with private ownership to limit falling snags, ember production and spotting.

- **Restoration of historical fire regimes in ponderosa pine ecosystems:** The absence of fire over the last 100 years combined with the development of shrubs and dense thickets of regeneration in the understory has placed the ponderosa pine stands at high risk of stand replacing wildfire. Reintroduction of fire in these ponderosa pine type stands would be used as needed to achieve the desired conditions. 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 defend adjacent private lands and help preserve the ponderosa pine stand type. When prescribed fire is used every 8-15 years, depending on fuel accumulations, these areas should regenerate ponderosa pine slowly through time as they did historically (Agee 1993). Related prescribed burning should keep naturally regenerated lodgepole pine and white fir in low numbers through time. Not only does prescribed fire reduce wildfire severity, but when a wildfire burns through a site previously burned under prescription, fire suppression costs were also less compared to adjacent land where fire had been excluded (Moghaddas 2006). 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 residual stands or where retention of biomass and soil organic carbon and nitrogen is considered crucial.

- **Fuel reduction and discontinuous surface fuels:** Areas with existing dead and down material, dense stands of trees, dense shrubs and heavy needlecast can create extremely hazardous conditions. When these conditions exist over large areas 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 Landscapes Fuel Treatment Patterns for Modifying Fire Growth and Behavior*. The paper presents the idea that strategically placed fuel treatments could achieve much greater results at minimizing large fire growth than randomly placed fuel treatments, particularly when only a percentage of the area could be treated. The idea suggests that when treating just a percentage of the total 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 smaller amount of acres within a landscape, even when the treatments are strategically placed, would provide the same level of protection or restoration benefits 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.

- **Thinning to reduce crown fire susceptibility and long range spotting:** Crowning fires are some of the most intense wildfires and usually produce long range spotting that hampers control efforts. Dense stands of timber support independent crown fires allowing fire to burn through the canopy of the trees independent of the surface fire. Torching and crowning, with support of the surface fire, is also a common problem during wildfires in denser stands of timber. Breaking up the connectivity of the timber canopy through thinning greatly decreases the chance of an active or passive crown fire, thus reducing long range spotting, resistance to control, and damage to the stand. By maintaining stands at crown bulk densities of less than 0.10 kg/m^3, active or independent crown fire activity can be limited (Agee 1996). Thinning from below, leaving dominant and co-dominant trees with thick bark and high crowns significantly changes the potential for fire to move from surface up into the tree crowns (Fitzgerald 2002). Thinning from below most effectively alters fire behavior by reducing crown bulk density, increasing crown base height, and changing species composition to lighter crowned and fire-adapted species (Graham et al. 1999).

Elements used to Describe Effects of the Alternatives

Fire Behavior

Fire behavior is the manner in which fire reacts to topography, weather, and fuels (DeBano et al. 1998). These three elements comprise the fire environment, the surrounding conditions, influences and modifying forces that determine fire behavior. Modifying any one of these elements has a direct result on fire behavior, which is basically described by flame length and rate of spread. Favorable conditions for crown fires include heavy accumulations of dead and down wood and litter, conifer reproduction and other ladder fuels like shrubs, and a continuous conifer tree forest (Rothermel 1991).

The greater the fuel loading, the more intense a fire is likely to burn (DeBano et al. 1998). Conversely, a reduction in fuel loading can limit a fire's intensity. Fuel characteristics affecting fire behavior are vegetative density, species composition, amount of surface fuel, arrangement of fuels, and moisture content (Rothermel 1983). Fuels contribute to the rate of spread of a fire, the intensity/flame length of the fire, how long a fire is held over in an area, and the size of the burned area (Rothermel 1983).

Treatments that reduce surface fuel loads have been shown to decrease fire behavior and severity (Graham et al. 1999; Pollet and Omi 1999). Van Wagtendonk (1996) found in fire simulations that a reduction in fuel loads decreased subsequent fire behavior, increased fireline control possibilities and decreased fire suppression costs.

Intensive forest management that involves the creation of activity fuels (slash) can increase fire behavior conditions such as rate of spread and flame length. However, treatment of slash (i.e. burning, chipping, removal, isolation) will reduce fire behavior and fire intensity (Omi and Martinson 2002). Graham et al. (1999) reports that thinning from below and intermediate tree harvest can effectively alter fire behavior by reducing crown bulk density and ladder fuels, but will not reduce crown fire potential unless tree densities are substantially reduced. The same scientific document also states that all intermediate treatments should be accompanied by surface fuel modification, and the most success is achieved when using prescribed fire for such treatments.

There are three types of fuels that affect fire behavior; fine fuels such as grass or forbs, small woody fuels less than three inches in diameter and large woody fuels greater than three inches in diameter. Fine fuels are the major contributors to fire spread, carrying the ignition and flaming front of a fire (Rothermel 1983). They are especially influential to fire's rate of spread and intensity because they lose their moisture faster, therefore igniting easier and burning more readily (Agee 1993). Without these fine fuels, many fires will not get large, although there are exceptions. However, eliminating fine fuels

entirely from the landscape is neither possible nor desirable. Fine fuels are constantly being produced from needlecast or deciduous leaf fall and dying and falling branches. Under a frequent fire regime it will be more possible to maintain fine fuels at lower levels and various patch sizes than under a less frequent fire regime, decreasing fire intensities and decreasing the areas resistance to control.

In order to analyze and compare the effects of alternatives, as they relate to fuels management, the fire behavior conditions of flame length and potential fire type have been combined and are represented as the potential wildfire hazard. Burn probability will also be analyzed as an indicator of wildfire risk (potential fire spread rates, i.e. landscape attributes, like fuel conditions, that contribute to higher spread rates result in a higher burn probability).

Fire Effects to Ponderosa Pine

Fire damage to the crown and bole influences a tree's probability of surviving fire. Previous studies have consistently ranked crown damage, usually crown scorch or consumption, or a combination, as important to predicting post-fire mortality of ponderosa pine trees (Dieterich 1979; Wyant et al. 1986; Saveland and Neuenschwander 1990; Stephens and Finney 2002; Wallin et al. 2003; McHugh and Kolb 2003; McHugh et al. 2003).

Most mortality models developed for mixed conifer and ponderosa pine forests have used variables that characterize above-ground damage from fire (scorch height, bark char height, percent crown volume scorched). These variables are related to flaming combustion and fireline intensity (Stephens and Finney 2002). Probability of mortality can be modeled using scorch heights that have been predicted based on tree size, flame length and fire conditions.

In order to show potential fire effects to ponderosa pine, predicted flame lengths for each size class of tree is analyzed and can be compared to tables predicting probability of mortality, based on associated scorch heights.

Smoke

Particulate matter can be hazardous to human health, create poor visibility conditions and, in general, be a nuisance. The health effects of smoke to people can range from irritation of the eyes and respiratory tract to more serious disorders that include asthma, bronchitis, reduced lung function, and premature death. Airborne particles are respiratory irritants, high concentrations can cause persistent cough, phlegm, wheezing, and physical discomfort when breathing. Particulate matter can also alter the body's immune system and affect removal of foreign materials from the lung like pollen and bacteria (NWCG 2001). Haze caused by wildfire can also add to other sources of haze and affect scenic visibility. Nuisance smoke is defined by the US Environmental Protection Agency (EPA) as the amount of smoke in the ambient air that interferes with a right or privilege common to members of the public, including the use or enjoyment of public or private resources (US EPA 1990). Nuisance smoke includes complaints of loss of visibility, odors, vehicle accidents due to lack of visibility, and eye and nose irritation. Although the vast majority of prescribed burns occur without negative smoke impact, wildland fire smoke can be a problem anywhere in the country (NWCG 2001).

In order to analyze and compare the effects of alternatives as they relate to smoke management, potential smoke emissions from pile burning, underburning, and wildfire have been modeled. Smoke emissions from acres of pile burning and underburning for each alternative is compared to smoke emissions from a potential wildfire burning across the largest acreage of treatment proposed.

Alternative 1 (No Action)

Direct and Indirect Effects

Measure 1: Acres of project area falling within each fire hazard class. Fire hazard being represented by a matrix of both flame length potential and crown fire potential

With no management activities occurring, more acres would transition from low and moderate fire hazard towards high and extreme fire hazard. Currently a predicted 14,772 acres (57%) (Table 45, Figure 38) exhibiting low wildfire hazard would naturally transition over the next 20 years, due to tree and shrub growth to either a moderate or high fire hazard category. The remaining 43% of acres within the West Bend planning area are predicted to exhibit moderate to extreme fire hazard. Moderate flame lengths (4-8 feet) may make direct attack of a wildfire under the stated conditions possible with a bulldozer, however the damage that bulldozers can make while fighting a fire is not always desirable and costs are increased. Flame lengths of over 8 feet (High and Extreme fire behavior) cannot be safely suppressed by direct attack of any type of ground resources. Other forms of suppression, like indirect attack, would have to be considered, which could also increase the amount of damage and cost. The resulting crown scorch from 4 foot and higher flame lengths would mean more mortality in those areas than in other areas where less than 4 foot flame lengths are predicted. These fuel conditions that would support moderate to extreme fire hazard would also continue to transition; fuel loadings would further increase and shrub heights would increase resulting in higher fire hazard than the already predicted moderate to extreme fire hazard.

The effect of Alternative 1 (No Action) would be a continued decrease in stand resiliency to wildfire across the entire project area over time. The only way that fuels reduction would occur is with a wildfire that under the no action alternative could be intense with extreme fire hazard over half the project area, making suppression difficult and dangerous, jeopardizing public safety, leading to unwanted resource damage and resulting in extensive tree mortality across the project area.

Measure 2: Acres of project area falling within each fire risk class. Fire risk being represented by burn probability

With no management activities occurring, wildfire risk would not improve (Table 45 and Figure 39 for current wildfire risk condition). Fuel loadings would continue to increase, as well as shrub heights. Increased fuel loadings and shrub heights translate to higher burn probabilities. Higher burn probabilities predict larger fires on the landscape over time, increasing risk of wildfire. Any fuel reduction that would occur under this alternative would be from a wildfire; which depending on the area of which the wildfire occurs could be hazardous to both firefighter and public safety, as well as to valuable resources and stand characteristics. The effect of Alternative 1, the no action alternative, would be an increase in risk of wildfire across the entire project area over time.

Measure 3: Number of ponderosa pine trees by size class affected by predicted flame lengths

In order to show potential fire effects from the no action alternative, flame length and tree data was analyzed. Probability of mortality has been calculated and analyzed for each size class. Probability of mortality percentages calculated for this analysis is based on a function of scorch height. Scorch heights of ponderosa pine are predicted using DBH and flame length, therefore Table 47 shows probability of mortality based on DBH and flame length. Table 47 focuses on the 7" to 14" dbh tree size class to illustrate the relationship between tree diameter at breast height, flame length, and mortality.

Table 47: Probability of Mortality in Ponderosa Pine by DBH and Flame Length (%)

Tree DBH (in)	Flame Length (feet) [1]							
	1	2	3	4	5	6	7	8
7	1.7	2.6	6.2	20.8	86.9	100	100	100
8	.6	1	2.4	8.1	33.6	100	100	100
9	.3	.4	.9	3.1	13	60.7	100	100
10	.1	.2	.4	1.2	5	23.5	100	100
11	.04	.06	.1	.5	2	9.1	47.2	100
12	.01	.02	.05	.2	.8	3.5	18.3	100
13	.01	.01	.02	.07	.3	1.4	7.1	41.7
14	0	0	.01	.03	.1	.5	2.7	15.9

1. Probability: Green = Low; Yellow = Moderate; Red = High

All diameters within this size class survive reasonably well when flame lengths are <4'. As flame lengths increase so does the mortality rate, especially in the smaller diameter trees. Trees in the size classes less than 7" DBH are not included in this mortality analysis because of their inherent vulnerability to scorch and it's assumed that flame lengths in the 0–4' range will generally cause high mortality in these size classes of ponderosa pine. At the higher end of the diameter spectrum is ponderosa pine greater than 14" DBH. Larger diameter pine is not further analyzed and is assumed to have a high survival rate with flame lengths up to 8'.

Table 48 shows the number of trees that fall within any action alternative unit by size class and predicted flame length under 97th percentile wildfire conditions, assuming no action would be taken as a part of Alternative 1. The predicted flame lengths for each size class of tree can be compared to the probability of mortality shown in Table 47.

Table 48: Predicted Flame Lengths for Each Size Class of Ponderosa Pine and Estimated Number of Trees in that Size Class under No Action Alternative.

Size Class(DBH)	Flame Length (feet)	Alternative 1 (# of trees)*
0-5"	0-4	69,957
	4-8	6,026
	8-11	10,786
	11+	65,873
5"-9"	0-4	111,484
	4-8	3,711
	8-12	7,570
	12+	97,021
9"-21"	0-4	527,198
	4-8	5,621
	8-12	7,590
	12+	337,613
21+"	0-4	75,716
	4-8	349
	8-12	344
	12+	33,668

*Alternative 1 (no action) # of trees is based on the number of trees within each polygon assumed to be ponderosa pine and proposed for treatment for each of the alternatives. The number of trees representing existing condition (and the no action) changes little across the alternatives and differences fall within less than 0.0001% of each other. Therefore, this table assumes the same number of trees regardless of action alternative.

Measure 4: Production of Particulate Matter (PM) 10 & 2.5

In order to determine the differences in particulate matter released during wildfire compared to prescribed fire or pile burning for either the existing condition/no action alternative or the three action alternatives, an analysis was done in the computer models FOFEM and Consume 3.0. The effects on air quality (Table 49) would occur when higher quantities of PM_{10} and $PM_{2.5}$ are released when inevitable wildfire comes through the project area. These quantities of particulate matter are much higher than what would be released under prescribed fire conditions. This can be attributed to the fact that weather conditions are usually windier, hotter and drier in the summer and in the case of a wildfire a greater amount of surface and canopy fuels are consumed.

Table 49: Estimated Smoke Emissions from a Wildfire under Extreme Conditions Compared to Prescribed Fire Conditions

Fire condition	Pounds PM_{10}/1 Acre Fuel Consumed	Pounds $PM_{2.5}$/1 Acre Fuel Consumed
Wildfire	342 – 1,192	289 – 1,010
Prescribed Fire	223 – 691	189 – 585
Pile burning	100 – 280	80 – 240

Emissions from a wildfire on one acre are approximately 1.0-1.2 times that of the emissions from one acre each of both prescribed fire and pile burning. So even where both pile burning and prescribed underburning were to occur on the same acre, emissions would be less from proposed treatment than what would occur from a wildfire on the same acre. An additional consideration to comparing emissions from treatment versus wildfire is that emissions from multiple treatments occur over a lengthened course of time, compared to a wildfire where emissions are released all at once. Essentially, emissions from treatments would be less, would occur under more favorable weather conditions for dispersal, and would occur over a longer period of time than a wildfire.

Smoke from wildfires within the project area would impact the communities of Bend, Sunriver, and possibly Redmond because the smoke would be a result of a wildfire that most likely would not be occurring under optimal smoke dispersion conditions. It is possible that the air quality within the Three Sisters Wilderness, a Class 1 Airshed would be adversely affected. Recreational sites in and around the West Bend area, like Phil's Trailhead and the Deschutes River could also be adversely impacted by smoke when tourism and recreation are at their highest.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

Measure 1: Acres of project area falling within each fire hazard class. Fire hazard being represented by a matrix of both flame length potential and crown fire potential

The wildfire hazard for post-Alternative 2 treatment conditions was predicted using the modeling methods described in the Analysis Methods section. The resulting predicted wildfire hazard for post-Alternative 2 conditions is shown and compared to the existing condition in Table 50. Refer to Figure 40 for predicted wildfire hazard for post-Alternative 2 treatment conditions.

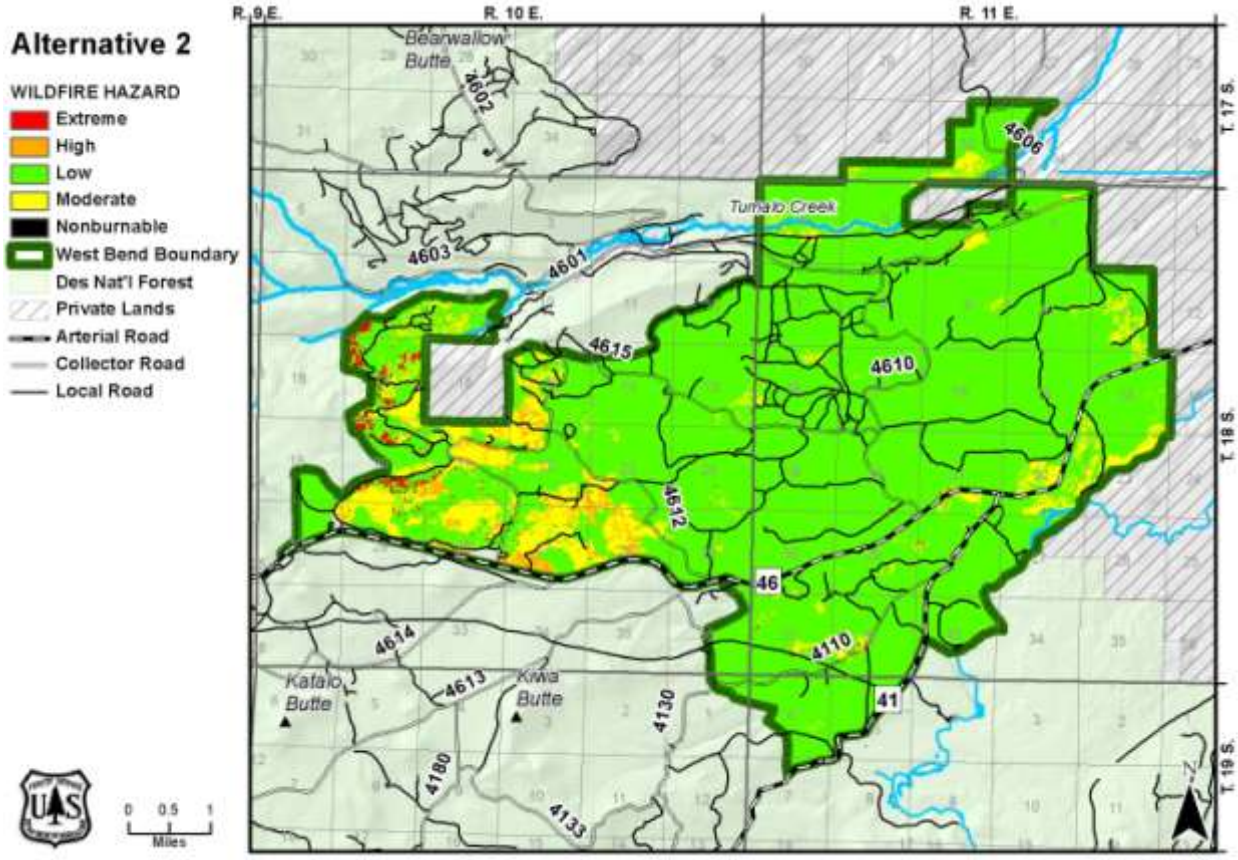
Table 50: Alterative 2 – Hazard Ratings and Acreage

HAZARD	Alternative 2 Acres*	Existing Condition Acres*
Low	22,463	14,772
Moderate	2,661	661
High	349	932
Extreme	233	9,317

*There is a difference of 9 acres between the total acres for the project (25,696 acres) and the total analysis acres for Alternative 2 (25,705 acres), these acres represent minute pieces of ground that gets added during GIS analysis (related to pixel size of data) and represent an analysis error of less than 0.1%.

Treatments proposed in Alternative 2 would result in 9,084 acres being moved from an existing condition hazard rating of 'Extreme' to a lower hazard rating. A majority of those acres with Alternative 2 treatments are moved to a hazard rating of 'Low.' This is a substantial change in fire behavior. This change would allow direct attack with hand crews of a wildfire under 97th percentile conditions on 22,463 acres of the West Bend project area. Direct attack on these low hazard acres allows unwanted fires to be contained at smaller fire sizes, thereby protecting forest values on those acres. In addition, 18,537 acres of the total acres rating as low are in the ponderosa pine dominated stands (compared to 11,387 low hazard ponderosa pine acres in the existing condition). In ponderosa pine, a rating of low would allow for safe, efficient firefighting, in the event of wildfire. It would also allow for continued care of these stands with prescribed fire with minimal damage and minimal cost. District experience and field reviews have shown that vegetation management activities such as thinning followed by mowing and prescribed fire have the beneficial effect of reducing fire intensity and fire behavior for an average of 15 years, perhaps longer depending on location and treatment intensity.

Figure 40: Alternative 2 – Wildfire Hazard Rating



There are areas of proposed treatment for silvicultural benefit where the treatment of activity-created fuels is to lop and scatter the created fuels and allow them to break down over time. In most areas, the previously moderate to extreme hazard remains moderate to extreme hazard in the relative short term. There is no predicted benefit to fuels management, but also no predicted cost to wildfire hazard. Any areas of extreme hazard remaining post treatment under Alternative 2 within the West Bend planning

area (233 acres) are areas proposed to remain untreated. Under Alternative 2, any areas of moderate to high hazard remaining within the West Bend planning area (3,010 acres) are predominately either areas proposed to remain untreated or are areas that under existing conditions rate high to extreme and proposed treatments have reduced hazard but not entirely to a low hazard. There are portions of a few units (primarily units 272, 316, 325, 324, 289 and 337) where proposed treatment of lop and scatter adds fuel loading to existing fuels and increases hazard from an existing low hazard to a moderate hazard post-treatment. These units of increased hazard total 201 acres, so areas of increased hazard represent less than 201 acres since parts of these units have existing conditions of moderate to extreme hazard. Areas where lop and scatter are proposed are in stands of lodgepole pine and are proposed for areas of lower priority for fuels management.

There may or may not be a period of time, typically ranging from 3 to 18 months, between non-commercial thinning and consumption of the fuels resulting from the non-commercial thin where resultant fuels are allowed to cure in order to allow for maximum potential consumption. During this short period of time, potentially increased fuel loading may result in an increased fire hazard. Upon consumption of the resultant fuels, the fuel hazard would be decreased to a fuel hazard equal to or reduced to that of pre-non-commercial thin conditions.

Any proposed thinning where slash is treated, mowing and underburning for Alternative 2 in the scenic view allocation reduce fire hazard to a low hazard rating. Areas within the scenic view allocation have also been defined as priority areas to treat by the E/W Deschutes County and Greater Bend CWPPs. Reducing fire hazard to a low hazard rating would meet the CWPPs desire for reducing fuel loads to that which can produce flame lengths of less than four feet. Four foot flame lengths generally allow fire suppression resources to safely and efficiently attack the fire at the head with hand tools. There are proposed treatments beyond the 500 feet road corridor identified as priority for fuels hazard treatment under the CWPP guidance that may not reduce the fuels or fire hazard. These areas within scenic views where fire hazard is not reduced are primarily areas where there is a silvicultural benefit to thinning and lop and scatter is the proposed method for handling created slash. These areas are the same areas that have already been identified and effects discussed.

Measure 2: Acres of project area falling within each fire risk class. Fire risk being represented by burn probability

Burn probability, as an indicator of wildfire risk, was modeled and calculated for Alternative 2 in the same fashion as the burn probability for Alternative 1 (No Action). Table 51 compares the burn probability for Alternative 2 with the burn probability of the existing condition (Figure 41).

Table 51: Alternative 2 – Wildfire Risk Rating as Measured by Burn Probability

Wildfire risk	Alternative 2 Acres*	Existing Condition Acres*
Low	22,428	9,443
Moderate (low)	2,719	12,104
Moderate (high)	533	3,889
High	7	218
Very High	0	33

*There is a difference of 9 acres between the total acres for the project (25,696 acres) and the total analysis acres for alternative 2 (25,687 acres), these acres represent minute pieces of ground that get dropped during GIS analysis and represent an analysis error of less than 0.1%.

When comparing the wildfire risk of Alternative 2 with the wildfire risk for the existing condition, it can be seen that treatments proposed under Alternative 2 would lower the risk substantially across the treatment area. All but 7 acres of the project area with a risk of 'High' to 'Very High' are reduced to a classification of 'Moderate (high)' or lower. The majority of those acres were brought down to at least the 'Moderate (low)' level. Still more acres within the project area were reduced from their previous

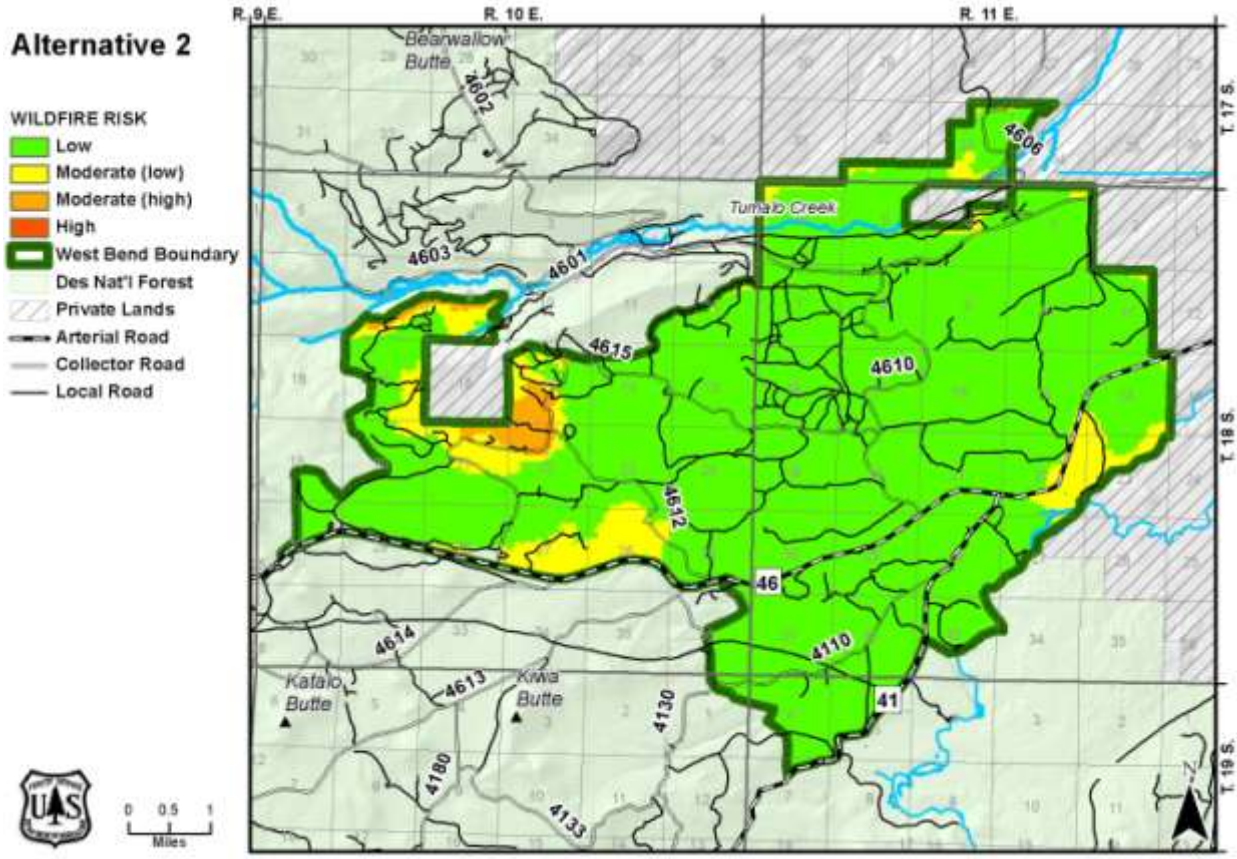
'Moderate (high)' and 'Moderate (low)' acres to a 'Low' risk, with 'Low' risk acres totaling 22,428 post-treatment out of the entire 25,696 acre project area.

The reduction of wildfire risk shown in Table 51 is a considerable reduction (22,428 acres in low risk class compared to 9,443 under existing condition). This reduction in wildfire risk means that with Alternative 2 actions, a considerable amount of work would be done to slow fire's forward rate of spread and increase firefighter's abilities to suppress the fire. Spatially, Figure 41 shows that with proposed treatments under Alternative 2, risk to urban interface values at the eastern end of the project area, with the exception of private lands not proposed to be treated in this project would be effectively reduced to a low rating. In addition, risk to large portions of the west and central portions of the project area, including ponderosa-pine dominated stands would be effectively reduced to a low rating.

Areas where wildfire risk is not predicted to be reduced under this Alternative 2 is due to either 1) the current conditions on private lands that will not be treated increase the risk for adjacent areas, or 2) lop and scatter treatments proposed in West Bend create conditions where predicted fire behavior remains moderate.

There may or may not be a period of time, typically ranging from 3 to 18 months, between non-commercial thinning and consumption of the fuels resulting from the non-commercial thin where resultant fuels are allowed to cure in order to allow for maximum potential consumption. During this short period of time, potentially increased fuel loading may result in an increased fire hazard. Upon consumption of the resultant fuels, the fuel hazard would be decreased to a fuel hazard equal to or reduced to that of pre-non-commercial thin conditions.

Figure 41: Alternative 2 – Wildfire Risk Map



Measure 3: Number of ponderosa pine trees by size class affected by predicted flame lengths

The number of trees, by size class, affected by predicted flame lengths from a wildfire burning through West Bend post-Alternative 2 treatments have been analyzed in the same way as the No Action Alternative. Probability of mortality has been calculated and analyzed for each size class. Probability of mortality percentages calculated for this analysis is based on a function of scorch height. Scorch heights of ponderosa pine are predicted using dbh and flame length, therefore Table 52 shows probability of mortality based on dbh and flame length. Table 52 focuses on the 7" to 14" dbh tree size class to illustrate the relationship between dbh, flame length, and mortality.

Table 52: Probability of Mortality in Ponderosa Pine by dbh and Flame Length (%)

Tree DBH (in)	Flame Length (feet)[1]							
	1	2	3	4	5	6	7	8
7	1.7	2.6	6.2	20.8	86.9	100	100	100
8	.6	1	2.4	8.1	33.6	100	100	100
9	.3	.4	.9	3.1	13	60.7	100	100
10	.1	.2	.4	1.2	5	23.5	100	100
11	.04	.06	.1	.5	2	9.1	47.2	100
12	.01	.02	.05	.2	.8	3.5	18.3	100
13	.01	.01	.02	.07	.3	1.4	7.1	41.7
14	0	0	.01	.03	.1	.5	2.7	15.9

1 Probability: Green = Low; Yellow = Moderate; Red = High

Table 53 compares treatment effects to predicted flame lengths for each size class in ponderosa pine units for Alternative 2 and existing condition (no action). For a fair comparison, the existing condition data was clipped to the same polygons representing proposed treatments under Alternative 2. Flame length has been classified into pre-identified classes. The tree data reports individual trees by size, which is then classified into the size classes shown in the table.

Table 53: Alternative 2 – Treatment Effects to Predicted Flame Lengths for Each Size Class of Ponderosa Pine

Size Class (DBH)	Flame Length (feet)	Alternative 2 (# of trees)	Existing Condition (# of trees)
0-5"	0-4	151,904	69,957
	4-8	689	6,026
	8-11	16	10,786
	11+	33	65,873
5"-9"	0-4	218,948	111,484
	4-8	762	3,711
	8-11	20	7,570
	11+	56	97,021
9"-21"	0-4	875,730	527,198
	4-8	2,157	5,621
	8-11	12	7,590
	11+	123	337,613
21+"	0-4	109,768	75,716
	4-8	283	349
	8-11	1	344
	11+	25	33,668

After Alternative 2 treatments, the number of trees that are affected by flame lengths less than 4 feet in all tree size classes has been increased significantly. Over 300,000 trees of 9-21" DBH would move from being effected by flame lengths of over 11 feet to being effected by flame lengths of less than 4 feet. The

probability of mortality table indicates that this would significantly reduce the chance of mortality for residual trees post-treatment. The number of trees across all size classes that are effected by flame lengths in the 4-8' range post-treatment has also been significantly reduced relative to the existing condition.

Measure 4: Production of Particulate Matter (PM) 10 & 2.5

The amount of particulate matter emitted due to underburning and pile burning within Alternative 2 are shown in Table 54. The total tons of particulate matter shown in Table 54 were calculated by multiplying the smoke emissions (converted from pounds to tons) per acre for a prescribed fire for both PM_{10} and $PM_{2.5}$ (predicted in FOFEM) by the number of net acres that would be prescribed underburned (17,320 acres). Then, the fuels consumed during pile burning depending on species of slash within piles were estimated in total tons per acre in the USFS software Consume 3.0 (page 121, general assumptions). The smoke emissions (converted from pounds to tons) from the fuel consumption that Consume estimated for both PM_{10} and $PM_{2.5}$ were then multiplied by the number of net acres that would be piled and burned (7,567 acres). Emissions from prescribed underburning and all pile burning are shown separately in Table 52 since emissions from each would occur as separate events, emitting particulate matter at different times. The emissions from Alternative 2 could be less than what is shown here, if any of the material produced during treatment can be utilized for biomass, as anticipated.

For comparison, to calculate the tons of PM_{10} and $PM_{2.5}$ emitted from a wildfire, the smoke emissions (converted from pounds to tons) per acre for a wildfire in both ponderosa pine, white fir/ponderosa pine and lodgepole pine were multiplied by the largest acreage of treatment proposed in each (16,434 acres of ponderosa, 2,713 acres of white fir/ponderosa, 205 acres of lodgepole). Table 54 shows that an average wildfire would produce almost one and three quarter times as much emissions for both PM_{10} and $PM_{2.5}$ as the proposed treatments in Alternative 2. Emissions from a wildfire could be even more relative to activity emissions, if any of the material produced during treatment can be utilized for biomass, as anticipated.

Table 54: Alternative 2 - Estimated Smoke Emissions from Prescribe Fire Treatments Compared to the Same Amount of Acres Consumed Under Wildfire Conditions without Treatment

Burn type	Acres	Tons PM_{10}	Tons $PM_{2.5}$
Alternative 2 – prescribed underburning	17,320	2,189	1,855
Alternative 2 – pile burning	7,567	477	399
Wildfire without treatment	19,352	4,539	3,839

Burning would be conducted in compliance with National Ambient Air Quality Standards and under the Oregon Smoke Management Plan. Burning would only be conducted when prevailing and predicted wind patterns would result in negligible effects to Bend, LaPine, Sunriver, 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 to adjacent communities while having no visible effects to the Class 1 Airshed (Three Sisters Wilderness). This is because the Three Sisters Wilderness area is higher in elevation and located four to six miles west/northwest of the West Bend project area. The winds most favorable to accomplish the work of underburning in this area would generally be winds with a strong southerly or northerly component and would result in minimal potential for impacts to the airshed.

On burn days, persons responsible for burning operations modify ignitions patterns and mop-up procedures to consider the effects to the Class 1 Airshed and smoke sensitive areas. Monitoring is done by the State Forester to ensure compliance with the smoke management program to determine effectiveness of smoke management procedures. Other monitoring techniques include posting personnel as lookouts (Lava Butte Lookout) on burn days. If a certain threshold is reached where

additional particulate release is undesired, firing operations are ceased and immediate mop-up procedures initiated.

In contrast to Alternative 1, fuel treatments under Alternative 2 would reduce potential wildfire size per occurrence and emissions produced in the treated units of the project area. Under extreme fire behavior conditions, the remaining untreated dense stands and areas of excessive fuel loading could burn intensely and produce unwanted amounts of smoke in addition to the predicted amounts of smoke for Alternative 2. There would be some dust created during the dry season from the proposed mechanical operations under this alternative, mainly from logging operations within project units. The amount of dust actually created would be minimal due either to dust abatement which includes watering dirt roads identified for hauling or by operating under winter logging conditions.

Alternative 3

Direct and Indirect Effects

Measure 1: Acres of project area falling within each fire hazard class. Fire hazard being represented by a matrix of both flame length potential and crown fire potential

The wildfire hazard for post-Alternative 3 treatment conditions was predicted using the modeling methods described in the Analysis Methods. The resulting predicted fire hazard for post-Alternative 3 conditions is shown and compared to the existing condition, as well as Alternative 2 in Table 55. See also Figure 42 for a map of predicted wildfire hazard for post-Alternative 3 treatment conditions.

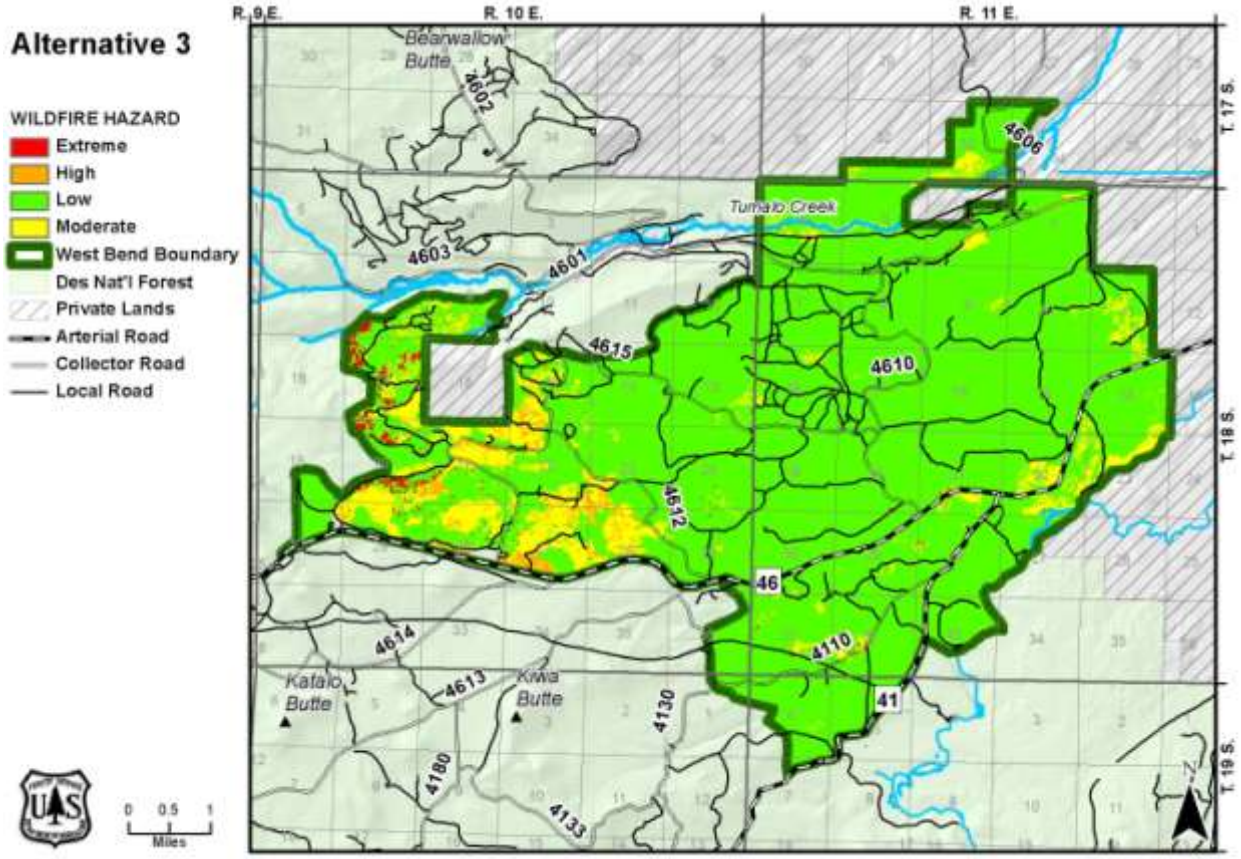
Table 55: Alternative 3 – Hazard Ratings and Acreage

HAZARD	Alternative 3 Acres*	Existing Condition Acres*	Alternative 2 Acres*
Low	22,440	14,772	22,463
Moderate	2,705	661	2,661
High	326	932	349
Extreme	234	9,317	233

*There is a difference of 9 acres between the total acres for the project (25,696 acres) and the total analysis acres for Alternative 3 (25,705 acres), these acres represent minute pieces of ground that gets added during GIS analysis (related to pixel size of data) and represent an analysis error of less than 0.1%.

Treatments proposed in Alternative 3 would result in 9,083 acres being moved from an existing condition hazard rating of ‘extreme’ to a lower hazard rating. A majority of those acres with Alternative 3 treatments are moved to a hazard rating of ‘low.’ This is a substantial change in fire behavior. Relative to Alternative 2, there is only a difference of one acre less of extreme hazard in Alternative 3. The one acre of ‘extreme’ hazard is an acre in unit 204 under Alternative 2 that is proposed to be treated and is proposed to not be treated in Alternative 3. The 23 acre decrease of ‘high’ hazard to ‘Moderate’ in Alternative 3 relative to Alternative 2 is largely due to the analysis process and its limitations as stated in the methods section and the two alternatives may be considered to have no difference in relation to ‘high’ hazard. There are more acres ‘low’ to ‘moderate’ hazard in Alternative 3 relative to Alternative 2 on 23 acres. There are a few units where proposing to girdle the overstory trees in Alternative 3 results in no change to the canopy relative to the harvest of the overstory proposed in Alternative 2 (units 266 and 277). Unit 204 is also proposed to be dropped from treatment under Alternative 3, resulting in no change in its hazard rating of moderate.

Figure 42: Alternative 3 – Wildfire Hazard



The change from proposed treatments under Alternative 3 would allow direct attack with hand crews of a wildfire under 97th percentile conditions on 22,440 acres of the project area. Direct attack on these low hazard acres allows unwanted fires to be contained at small fire sizes, thereby protecting forest values on those acres. In addition, 18,534 acres of the total acres rating as low are in the ponderosa pine dominated stands (compared to 11,387 low hazard ponderosa pine acres in the existing condition). In ponderosa pine, a rating of low would allow for safe, efficient firefighting, in the event of wildfire. It would also allow for continued care of these stands with prescribed fire with minimal damage and minimal cost.

There are areas of proposed treatment for silvicultural benefit where the treatment of activity-created fuels is to lop and scatter the created fuels and allow them to break down over time. In these areas, the previously extreme hazard remains an extreme hazard in the relative short term. There is no predicted benefit to fuels management, but also no predicted cost to wildfire hazard. These areas where lop and scatter are proposed are in stands of lodgepole pine and are proposed for areas of lower priority for fuels management.

Any areas of extreme hazard remaining post treatment under Alternative 3 within the West Bend planning area (234 acres) are areas proposed to remain untreated. Under Alternative 3, any areas of moderate to high hazard remaining within the West Bend planning area (3,101 acres) are predominately either areas proposed to remain untreated or are areas that under existing conditions rate high to extreme and proposed treatments have reduced hazard but not entirely to a low hazard. There are portions of a few units (primarily units #272, 316, 325, 324, 289 and 337) where proposed treatment of lop and scatter adds fuel loading to existing fuels and increases hazard from an existing low hazard to a

moderate hazard post-treatment. These units of increased hazard total 201 acres, so areas of increased hazard represent less than 201 acres since parts of these units have existing conditions of moderate to extreme hazard. Areas where lop and scatter are proposed are in stands of lodgepole pine and are proposed for areas of lower priority for fuels management.

Any proposed thinning where slash is treated, and surface fuels are mowed and/or underburned for Alternative 3 in the scenic view allocation reduce fire hazard to a low hazard rating. Areas within the scenic view allocation have also been defined as priority areas to treat by the E/W Deschutes County and Greater Bend CWPP. Reducing fire hazard to a low hazard rating would meet the CWPPs desire for reducing fuel loads to that which can produce flame lengths of less than four feet. Four foot flame lengths generally allow fire suppression resources to safely and efficiently attack the fire at the head with hand tools. There are proposed treatments beyond the 500 feet road corridor identified as priority for fuels hazard treatment under the CWPP guidance that may not reduce the fuels or fire hazard. These areas within scenic views where fire hazard is not reduced are primarily areas where there is a silvicultural benefit to thinning and lop and scatter is the proposed method for handling created slash. In these areas, the previously extreme hazard remains an extreme hazard in the relative short term. There is no predicted benefit to fuels management, but also no predicted cost to wildfire hazard. These areas where lop and scatter are proposed are in stands of lodgepole pine and are proposed for areas of lower priority for fuels management.

There may or may not be a period of time, typically ranging from 3 to 18 months, between non-commercial thinning and consumption of the fuels resulting from the non-commercial thin where resultant fuels are allowed to cure in order to allow for maximum potential consumption. During this short period of time, potentially increased fuel loading may result in an increased fire hazard. Upon consumption of the resultant fuels, the fuel hazard would be decreased to a fuel hazard equal to or reduced to that of pre-non-commercial thin conditions.

Measure 2: Acres of project area falling within each fire risk class. Fire risk being represented by burn probability

Wildfire risk, measured as burn probability was modeled and calculated for Alternative 3 in the same fashion as the burn probability for the existing condition (no action alternative) and as described in the Analysis Methods section. Table 56 compares the wildfire risk for Alternative 2 with the wildfire risk of the existing condition and Alternative 3.

Table 56: Alternative 3 – Wildfire Risk Rating as Measured by Burn Probability

Wildfire risk	Alternative 3 Acres*	Existing Condition Acres*	Alternative 2 Acres*
Low	22,140	9,443	22,428
Moderate (low)	2,708	12,104	2,719
Moderate (high)	657	3,889	533
High	171	218	7
Very High	11	33	0

* There is a difference of 9 acres between the total acres for the project (25,696 acres) and the total analysis acres for alternative 2 (25,687 acres), these acres represent minute pieces of ground that get dropped during GIS analysis and represent an analysis error of less than 0.1%.

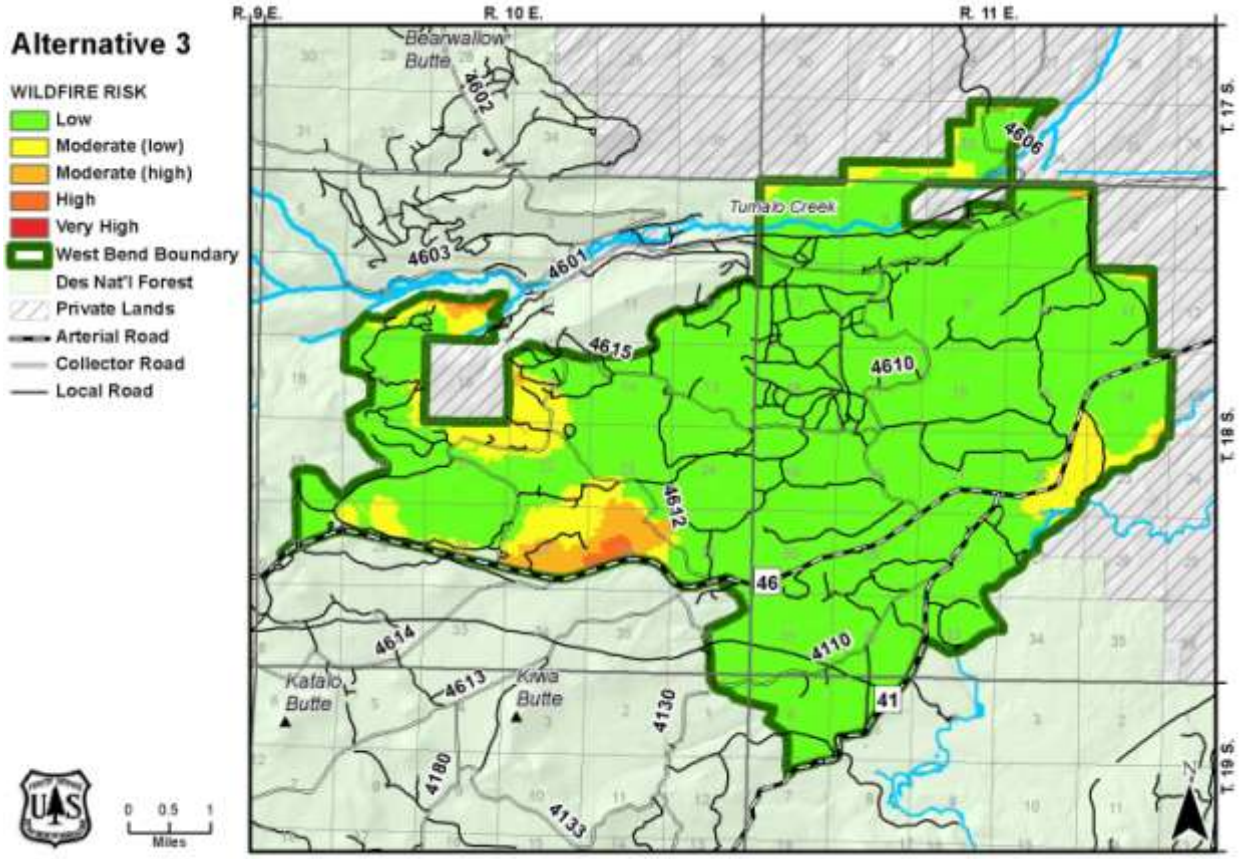
When comparing Alternative 3's wildfire risk with the wildfire risk for the existing condition, it can be seen that treatments proposed under Alternative 3 would lower the risk substantially across the treatment area. Under Alternative 3 actions, wildfire risk of 'High' to 'Very High' was reduced by 69 acres to a lower risk rating when compared to existing condition. The 3,232 acres of existing condition acres that rated as 'Moderate (high)' shifted to a risk rating of either 'Moderate (low)' or 'Low' with

Alternative 3 actions. Under Alternative 3 actions, an additional 12,697 acres is modeled to have a risk rating of 'Low' relative to the existing condition. In addition, 9,443 acres currently rated as 'Low' risk in the existing conditions would remain 'Low' under actions taken in Alternative 3 to maintain their current low risk quality. A total of 22,148 acres of the 25,696 acre project are predicted to rate as 'Low' with Alternative 3 actions.

The reduction of wildfire risk, Table 56, is a considerable reduction. This reduction means that with Alternative 3 actions, a considerable amount of work would be done to slow fire's forward rate of spread and increase firefighter's abilities to suppress the fire. Spatially, Figure 43 shows that with proposed treatments under Alternative 3, risk to urban interface values at the eastern end of the project area, with the exception of private lands not proposed to be treated in this project would be effectively reduced to a low rating. In addition, risk to large portions of the west and central portions of the project area, including ponderosa-pine dominated stands would be effectively reduced to a low rating. When comparing Alternative 3 post-treatment wildfire risk to that of Alternative 2, areas of risk reduction remain largely the same. Areas where risk reduction has not been entirely reduced are due to comparable reasons for both alternatives; either current conditions on private lands not proposed to be treated under this project increase risk for adjacent areas, or lop and scatter treatments proposed in West Bend create conditions where predicted fire behavior remains moderate.

There may or may not be a period of time, typically ranging from 3 to 18 months, between non-commercial thinning and consumption of the fuels resulting from the non-commercial thin where resultant fuels are allowed to cure in order to allow for maximum potential consumption. During this short period of time, potentially increased fuel loading may result in an increased fire hazard. Upon consumption of the resultant fuels, the fuel hazard would be decreased to a fuel hazard equal to or reduced to that of pre-non-commercial thin conditions.

Figure 43: Alternative 3 – Wildfire Risk



Measure 3: Number of ponderosa pine trees by size class affected by predicted flame lengths

The number of trees by size class affected by predicted flame lengths from a wildfire burning through West Bend post-Alternative 2 treatments has been analyzed in the same way as the No Action Alternative (see Analysis Methods). Probability of mortality has been calculated and analyzed for each size class. Probability of mortality percentages calculated for this analysis is based on a function of scorch height. Scorch heights of ponderosa pine are predicted using dbh and flame length, therefore Table 57shows probability of mortality based on dbh and flame length. Table 57 focuses on the 7" to 14" tree size class to illustrate the relationship between tree diameter at breast height (DBH), flame length, and mortality.

Table 57: Probability of Mortality in Ponderosa Pine by dbh and Flame Length (%)

Tree DBH (in)	Flame Length (feet)[1]							
	1	2	3	4	5	6	7	8
7	1.7	2.6	6.2	20.8	86.9	100	100	100
8	.6	1	2.4	8.1	33.6	100	100	100
9	.3	.4	.9	3.1	13	60.7	100	100
10	.1	.2	.4	1.2	5	23.5	100	100
11	.04	.06	.1	.5	2	9.1	47.2	100
12	.01	.02	.05	.2	.8	3.5	18.3	100
13	.01	.01	.02	.07	.3	1.4	7.1	41.7
14	0	0	.01	.03	.1	.5	2.7	15.9

1. Probability: Green = Low; Yellow = Moderate; Red = High

Table 58 compares treatment effects to predicted flame lengths for each size class in ponderosa pine units for Alternative 3 and existing condition (no action). For a fair comparison, the existing condition data was clipped to the same polygons representing proposed treatments under Alternative 2. Flame length has been classified into pre-identified classes as described in Table 43. The tree data reports individual trees by size, which is then classified into the size classes shown in the table.

Table 58: Alternative 3 – Treatment Effects to Predicted Flame Lengths for Each Size Class of Ponderosa Pine

Size Class(DBH)	Flame Length(feet)	Alternative 3 (# of trees)	Existing (# of trees)
0-5"	0-4	151,900	69,957
	4-8	693	6,026
	8-11	16	10,786
	11+	33	65,873
5"-9"	0-4	218,945	111,484
	4-8	765	3,711
	8-12	20	7,570
	12+	56	97,021
9"-21"	0-4	875,718	527,198
	4-8	2,167	5,621
	8-12	12	7,590
	12+	125	337,613
21+"	0-4	109,765	75,716
	4-8	286	349
	8-12	1	344
	12+	25	33,668

After Alternative 3, common to all action alternative treatments, the number of trees that are affected by flame lengths less than 4 feet in all tree size classes has been increased significantly. Over 300,000 trees of 9-21" DBH would move from being effected by flame lengths of over 11 feet to being effected by flame lengths of less than 4 feet. The probability of mortality table indicates that this would significantly reduce the chance of mortality for residual trees post-treatment. The number of trees across all size classes that are effected by flame lengths in the 4-8' range post-treatment has also been significantly reduced relative to the existing condition.

Measure 4: Production of Particulate Matter (PM) 10 & 2.5

The amount of particulate matter emitted due to underburning and pile burning within Alternative 3 are shown in Table 59. The total tons of particulate matter shown in Table 59 were calculated by multiplying the smoke emissions (converted from pounds to tons) per acre for a prescribed fire for both PM_{10} and $PM_{2.5}$ (predicted in FOFEM) by the number of net acres that would be prescribed underburned (17,320 acres). Then, the fuels consumed during pile burning depending on species of slash within piles were estimated in total tons per acre in the USFS software Consume 3.0 (see analysis assumptions section). The smoke emissions (converted from pounds to tons) from the fuel consumption that Consume estimated for both PM_{10} and $PM_{2.5}$ were then multiplied by the number of net acres that would be piled and burned (7,413 acres). Emissions from prescribed underburning and all pile burning are shown separately in Table 59 since emissions from each would occur as separate events, emitting particulate matter at different times. The emissions from Alternative 3 could be less than what is shown here, if any of the material produced during treatment can be utilized for biomass, as anticipated.

For comparison, to calculate the tons of PM_{10} and $PM_{2.5}$ emitted from a wildfire, the smoke emissions (converted from pounds to tons) per acre for a wildfire in both ponderosa pine, white fir/ponderosa pine and lodgepole pine were multiplied by the largest acreage of treatment proposed in each (16,462 acres

of ponderosa, 2,683 acres of white fir/ponderosa, 205 acres of lodgepole). Table 59 shows that an average wildfire would produce almost one and three quarter times as much emissions for both PM_{10} and $PM_{2.5}$ as the proposed treatments in Alternative 2. Emissions from a wildfire could be even more relative to activity emissions, if any of the material produced during treatment can be utilized for biomass, as anticipated.

Table 59: Alternative 3 - Estimated Smoke Emissions from Prescribed Fire Treatments Compared to the Same Amount of Acres Consumed Under Wildfire Conditions without Treatment

Burn type	Acres	Tons PM_{10} Acres)	Tons $PM_{2.5}$ Acres
Alternative 3: prescribed underburning*	17,310	2,178	1,846
Alternative 3: pile burning	7,413	467	391
Wildfire without treatment	19,350	4,526	3,828

Burning would be conducted in compliance with National Ambient Air Quality Standards and under the Oregon Smoke Management Plan. Burning would only be conducted when prevailing and predicted wind patterns would result in negligible effects to Bend, LaPine, Sunriver, 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 to adjacent communities while having no visible effects to the Class 1 Airshed (Three Sisters Wilderness). This is because the Three Sisters Wilderness area is higher in elevation and located four to six miles west/northwest of the West Bend project area. The winds most favorable to accomplish the work of underburning in this area would generally be winds with a strong southerly or northerly component and would result in minimal potential for impacts to the airshed.

On burn days, persons responsible for burning operations modify ignitions patterns and mop-up procedures to consider the effects to the Class 1 Airshed and smoke sensitive areas. Monitoring is done by the State Forester to ensure compliance with the smoke management program to determine effectiveness of smoke management procedures. Other monitoring techniques include posting personnel as lookouts (Lava Butte Lookout) on burn days. If a certain threshold is reached where additional particulate release is undesired, firing operations are ceased and immediate mop-up procedures initiated.

In contrast to Alternative 1, fuel treatments under Alternative 3 would reduce potential wildfire size per occurrence and emissions produced in the treated units of the project area. Under extreme fire behavior conditions, the remaining untreated dense stands and areas of excessive fuel loading could burn intensely and produce unwanted amounts of smoke in addition to the predicted amounts of smoke for Alternative 3. There would be some dust created from the proposed mechanical operations under this alternative, mainly from logging operations within project units. The amount of dust actually created would be minimal due to dust abatement which includes watering dirt roads identified for hauling.

Alternative 4

Direct and Indirect Effects

Measure 1: Acres of project area falling within each fire hazard class. Fire hazard being represented by a matrix of both flame length potential and crown fire potential

The wildfire hazard for post-Alternative 4 treatment conditions was predicted using the modeling methods described in the Analysis Methods section. The resulting predicted wildfire hazard for post-Alternative 4 conditions is shown and compared to the existing condition in Table 60. See also Figure 44 for a map of predicted wildfire hazard for post-Alternative 4 treatment conditions.

Table 60: Alternative 4 - Hazard Ratings and Acreage

Hazard	Alternative 4 Acres*	Existing Condition Acres*	Alternative 2 Acres*	Alternative 3 Acres*
Low	22,371	14,772	22,463	22,440
Moderate	2,775	661	2,661	2,705
High	326	932	349	326
Extreme	234	9,317	233	234

*There is a difference of 10 acres between the total acres for the project (25,696 acres) and the total analysis acres for Alternative 4 (25,706 acres), these acres represent minute pieces of ground that gets added during GIS analysis (related to pixel size of data) and represent an analysis error of less than 0.1%.

Treatments proposed in Alternative 4 would result in 9,083 acres being moved from an existing condition hazard rating of 'Extreme' to a lower hazard rating. A majority of those acres with Alternative 4 treatments are moved to a hazard rating of 'Low.' This change would allow direct attack with hand crews of a wildfire under 97th percentile conditions on 22,371 acres of the West Bend project area. This is a substantial change in fire behavior. Alternative 4 post-treatment fire hazard potential most closely resembles Alternative 3 post-treatment fire hazard potential. Alternative 4 has the same differences from Alternative 2 as Alternative 3. Relative to Alternative 2, there is only a difference of one acre less of extreme hazard in Alternative 4. The one acre of 'Extreme' hazard is an acre in unit 204 under Alternative 2 that is proposed to be treated and is proposed to not be treated in Alternative 4. The 23 acre decrease of 'High' hazard to 'Moderate' in Alternative 4 relative to Alternative 2 is largely due to the analysis process and its limitations as stated in the methods section and the two alternatives may be considered to have no difference in relation to 'High' hazard. There are more acres 'Low' to 'Moderate' hazard in Alternative 4 relative to Alternative 2 on 23 acres. There are a few units where proposing to girdle the overstory trees in Alternative 4 results in no change to the canopy relative to the harvest of the overstory proposed in Alternative 2 (units 266 and 277). Unit #204 is also proposed to be dropped from treatment under Alternative 4, resulting in no change in its hazard rating of moderate. Relative to Alternative 3, there is 69 less acres of 'Low' hazard potential for Alternative 4 post-treatment conditions. This difference can be attributed to treatment being proposed under Alternative 3 in units 110 and a small part of unit 114. These proposed treatments are dropped under Alternative 4.

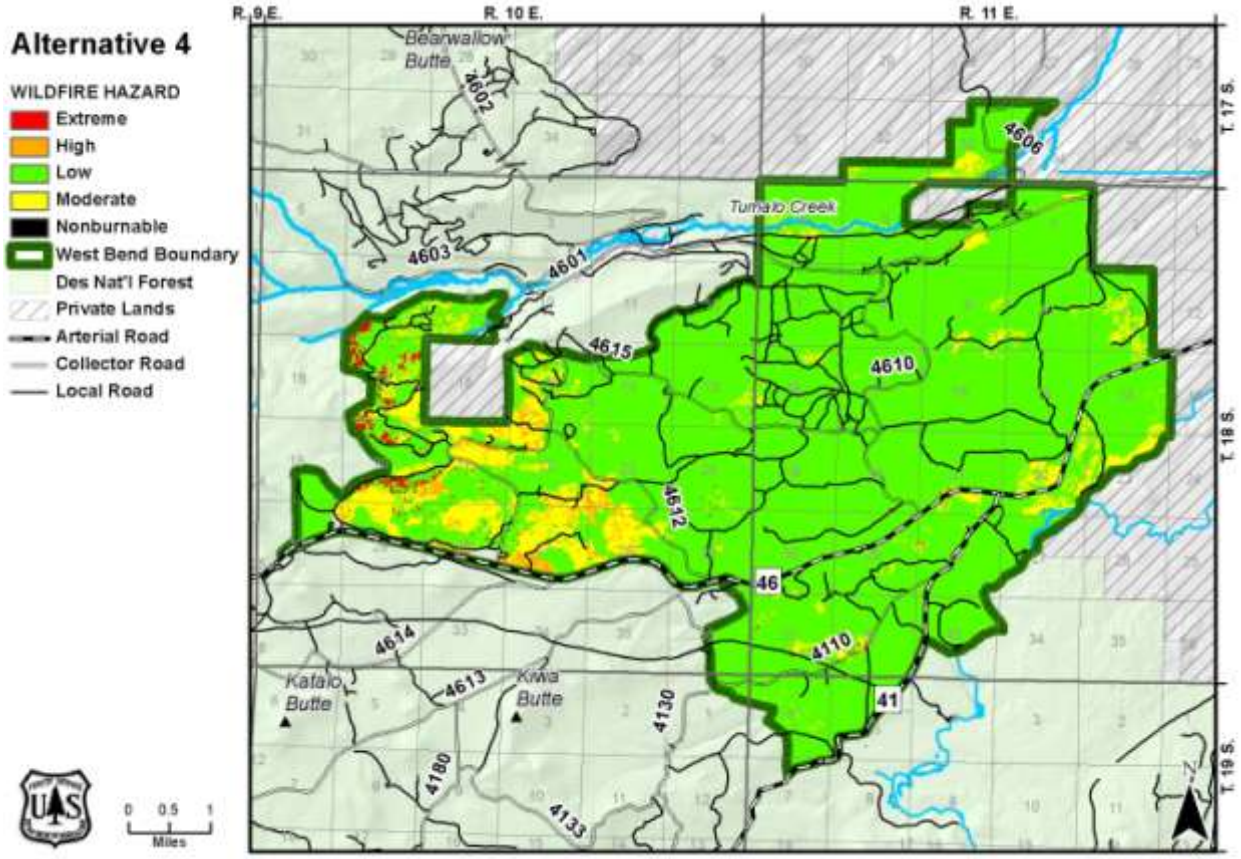
The change from proposed treatments under Alternative 4 would allow direct attack with hand crews of a wildfire under 97th percentile conditions on 22,371 acres of the West Bend project area. Direct attack on these low hazard acres allows unwanted fires to be contained at small fire sizes, thereby protecting forest values on those acres. In addition, 18,463 acres of the total acres rating as low are in the ponderosa pine dominated stands (compared to 11,387 low hazard ponderosa pine acres in the existing condition). In ponderosa pine, a rating of low would allow for safe, efficient firefighting, in the event of wildfire. It would also allow for continued care of these stands with prescribed fire with minimal damage and minimal cost.

There are areas of proposed treatment for silvicultural benefit where the treatment of activity-created fuels is to lop and scatter the created fuels and allow them to break down over time. In most areas, the previously moderate to extreme hazard remains moderate to extreme hazard in the relative short term. There is no predicted benefit to fuels management, but also no predicted cost to wildfire hazard.

Any areas of extreme hazard remaining post treatment under Alternative 4 within the West Bend planning area (234 acres) are areas proposed to remain untreated. Under Alternative 4, any areas of moderate to high hazard remaining within the West Bend planning area (3101 acres) are predominately either areas proposed to remain untreated or are areas that under existing conditions rate high to extreme and proposed treatments have reduced hazard but not entirely to a low hazard. There are portions of a few units (primarily units 272, 316, 325, 324, 289 and 337) where proposed treatment of lop and scatter adds fuel loading to existing fuels and increases hazard from an existing low hazard to a moderate hazard post-treatment. These units of increased hazard total 201 acres, so areas of increased hazard

represent less than 201 acres since parts of these units have existing conditions of moderate to extreme hazard. Areas where lop and scatter are proposed are in stands of lodgepole pine and are proposed for areas of lower priority for fuels management.

Figure 44: Alternative 4 – Wildfire Hazard



Any proposed thinning where slash is treated, mowing and underburning for Alternative 4 in the scenic view allocation reduce fire hazard to a low hazard rating. Areas within the scenic view allocation have also been defined as priority areas to treat by the E/W Deschutes County and Greater Bend CWPP. Reducing fire hazard to a low hazard rating (Table 60 would meet the CWPPs desire for reducing fuel loads to that which can produce flame lengths of less than four feet. Four foot flame lengths generally allow fire suppression resources to safely and efficiently attack the fire at the head with hand tools. There are proposed treatments beyond the 500 foot road corridor identified as priority for fuels hazard treatment under the CWPP guidance that may not reduce the fuels or fire hazard. These areas within scenic views where fire hazard is not reduced are primarily areas where there is a silvicultural benefit to thinning and lop and scatter is the proposed method for handling created slash. These areas are the same areas that have already been identified and effects discussed.

There may or may not be a period of time, typically ranging from 3 to 18 months, between non-commercial thinning and consumption of the fuels resulting from the non-commercial thin where resultant fuels are allowed to cure in order to allow for maximum potential consumption. During this short period of time, potentially increased fuel loading may result in an increased fire hazard. Upon consumption of the resultant fuels, the fuel hazard would be decreased to a fuel hazard equal to or reduced to that of pre-non-commercial thin conditions.

Measure 2: Acres of project area falling within each fire risk class. Fire risk being represented by burn probability

Wildfire risk, measured as burn probability was modeled and calculated for Alternative 3 in the same fashion as the burn probability for the existing condition (no action alternative) and as described in the Analysis Methods section. Table 61 compares the wildfire risk for Alternative 4 with the wildfire risk of the Alternatives 1-3.

Table 61: Alternative 4 – Wildfire Risk Rating as Measured by Burn Probability

Wildfire risk	Alternative 4 Acres*	Alternative 1 Acres*	Alternative 2 Acres*	Alternative 3 Acres*
Low	22,358	9,443	22,428	22,140
Moderate (low)	2,431	12,104	2,719	2,708
Moderate (high)	882	3,889	533	657
High	15	218	7	171
Very High	0	33	0	11

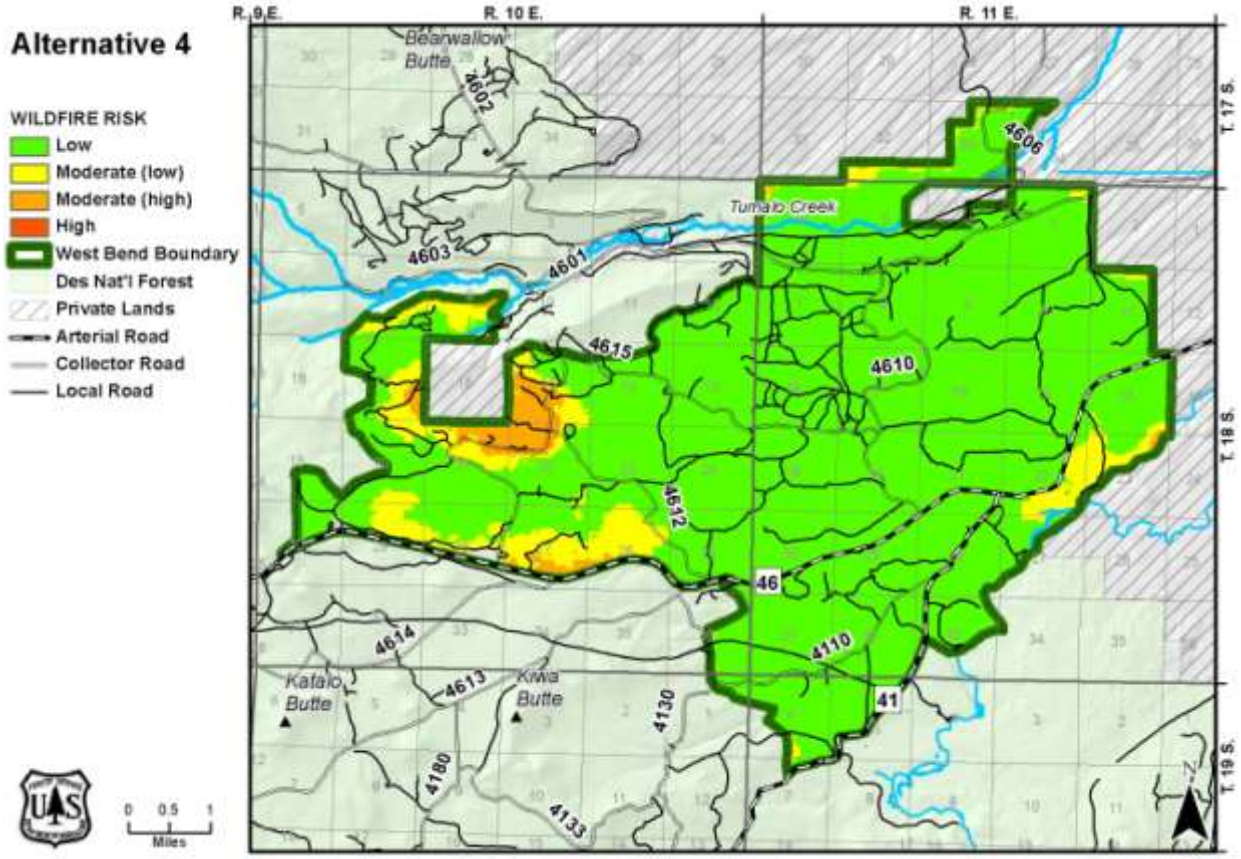
* There is a difference of 10 acres between the total acres for the project (25,696 acres) and the total analysis acres for Alternative 4 (25,686 acres), these acres represent minute pieces of ground that get dropped during GIS analysis and represent an analysis error of less than 0.1%.

When comparing the wildfire risk of Alternative 4 with the wildfire risk for Alternative 1 (no action alternative), it can be seen that treatments proposed under Alternative 4 would substantially lower the risk across the treatment area. Under Alternative 4 actions, wildfire risk of 'High' to 'Very High' was reduced by 236 acres to a lower risk rating, when compared to Alternative 1. The 3,007 acres of Alternative 1 acres that rate as 'Moderate (high)' shifted to a risk rating of either 'Moderate (low)' or 'Low' with Alternative 3 actions. Under Alternative 4 actions, an additional 12,915 acres is modeled to have a risk rating of 'Low' relative to the existing condition. In addition, 9,443 acres currently rated as 'Low' risk in the existing conditions would remain 'Low' under actions taken in Alternative 3 to maintain their current low risk quality. A total of 22,358 acres of the 25, 696 acre project are predicted to rate as 'Low' with Alternative 4 actions.

The reduction of wildfire risk shown in Table 61 is a considerable reduction. This reduction in wildfire risk means that with Alternative 4 actions, a considerable amount of work would be done to slow fire's forward rate of spread and increase firefighter's abilities to suppress the fire. Spatially, Figure 45 shows that with proposed treatments under Alternative 4, risk to urban interface values at the eastern end of the project area, with the exception of private lands not proposed to be treated in this project, would be effectively reduced to a low rating. In addition, risk to large portions of the west and central portions of the project area, including ponderosa-pine dominated stands would be effectively reduced to a low rating. Areas where wildfire risk is not predicted to be reduced for this alternative is due either to: 1) current conditions on private lands not proposed to be treated under this project increases the risk for adjacent areas, or 2) lop and scatter treatments proposed in West Bend create conditions where predicted fire behavior remains moderate.

There may or may not be a period of time, typically ranging from 3 to 18 months, between non-commercial thinning and consumption of the fuels resulting from the non-commercial thin where resultant fuels are allowed to cure in order to allow for maximum potential consumption. During this short period of time, potentially increased fuel loading may result in an increased fire hazard. Upon consumption of the resultant fuels, the fuel hazard would be decreased to a fuel hazard equal to or reduced to that of pre-non-commercial thin conditions.

Figure 45: Alternative 4 – Wildfire Risk



Measure 3: Number of trees by size class effected by predicted flame lengths

The number of trees by size class affected by predicted flame lengths from a wildfire burning through West Bend post-Alternative 2 treatments has been analyzed in the same way as the Alternative 1 (see Analysis Methods). The probability of mortality has been calculated and analyzed for each size class. Probability of mortality percentages calculated for this analysis is based on a function of scorch height. Scorch heights of ponderosa pine are predicted using dbh and flame length, therefore Table 62 shows probability of mortality based on dbh and flame length. Table 62 focuses on the 7" to 14" tree size class to illustrate the relationship between tree diameter at breast height (dbh), flame length, and mortality.

Table 62: Alternative 4 – Probability of Mortality in Ponderosa Pine by Dbh and Flame Length (%)

Tree DBH (in)	Flame Length (ft)							
	1	2	3	4	5	6	7	8
7	1.7	2.6	6.2	20.8	86.9	100	100	100
8	.6	1	2.4	8.1	33.6	100	100	100
9	.3	.4	.9	3.1	13	60.7	100	100
10	.1	.2	.4	1.2	5	23.5	100	100
11	.04	.06	.1	.5	2	9.1	47.2	100
12	.01	.02	.05	.2	.8	3.5	18.3	100
13	.01	.01	.02	.07	.3	1.4	7.1	41.7
14	0	0	.01	.03	.1	.5	2.7	15.9

1. Probability: Green = Low; Yellow = Moderate; Red = High

Table 63 compares treatment effects to predicted flame lengths for each size class in ponderosa pine units for Alternative 4 and existing condition (no action). For a fair comparison, the existing condition data was clipped to the same polygons representing proposed treatments under Alternative 4. The tree data reports individual trees by size, which is then classified into the size classes shown in the table.

Table 63: Alternative 4 - Treatment effects to predicted flame lengths for each size class of ponderosa pine

Size Class (DBH)	Flame Length (feet)	Alternative 4 (# of trees)	Existing (# of trees)
0-5"	0-4	151,598	69,956
	4-8	993	6,026
	8-11	16	10,786
	11+	33	65,872
5"-9"	0-4	218,667	111,484
	4-8	1,042	3,711
	8-11	20	7,570
	11+	56	97,021
9"-21"	0-4	874,776	527,198
	4-8	3,092	5,621
	8-11	12	7,588
	11+	125	337,605
21+"	0-4	109,489	75,710
	4-8	555	349
	8-11	1	344
	11+	25	33,667

After Alternative 4, common to all action alternative treatments, the number of trees that are affected by flame lengths less than 4 feet in all tree size classes has been increased significantly. Over 300,000 trees of 9-21" dbh would move from being effected by flame lengths of over 11 feet to being effected by flame lengths of less than 4 feet. The probability of mortality table indicates that this would significantly reduce the chance of mortality for residual trees post-treatment. The number of trees across all size classes that are effected by flame lengths in the 4-8' range post-treatment has also been significantly reduced relative to the existing condition.

Measure 4: Production of Particulate Matter (PM) 10 & 2.5

The amount of particulate matter emitted due to underburning and pile burning within Alternative 4 are shown in Table 64. The total tons of particulate matter shown in Table 64 were calculated by multiplying the smoke emissions (converted from pounds to tons) per acre for a prescribed fire for both PM_{10} and $PM_{2.5}$ (predicted in FOFEM) by the number of net acres that would be prescribed underburned (17,077 acres). Then, the fuels consumed during pile burning depending on species of slash within piles were estimated in total tons per acre in the USFS software Consume 3.0. The smoke emissions (converted from pounds to tons) from the fuel consumption that Consume estimated for both PM_{10} and $PM_{2.5}$ were then multiplied by the number of net acres that would be piled and burned (6,532 acres). Emissions from prescribed underburning and all pile burning are shown separately in Table 64, page 154 since emissions from each would occur as separate events, emitting particulate matter at different times. The emissions from Alternative 4 could be less than what is shown here, if any of the material produced during treatment can be utilized for biomass, as anticipated.

For comparison, to calculate the tons of PM_{10} and $PM_{2.5}$ emitted from a wildfire, the smoke emissions (converted from pounds to tons) per acre for a wildfire in both ponderosa pine, white fir/ponderosa pine and lodgepole pine were multiplied by the largest acreage of treatment proposed in each (16,168 acres of ponderosa, 2,680 acres of white fir/ponderosa, 205 acres of lodgepole). Table 64shows that an

average wildfire would produce almost one and three quarter times as much emissions for both PM_{10} and $PM_{2.5}$ as the proposed treatments in Alternative 4. Emissions from a wildfire could be even more relative to activity emissions, if any of the material produced during treatment can be utilized for biomass, as anticipated.

Table 64: Alternative 4 – Estimated Smoke Emissions from Prescribed Fire Treatments Compared to Same Acres Consumed Under Wildfire Conditions without Treatment

Burn type	Acres	Tons PM_{10}	Tons $PM_{2.5}$
Alternative 4: prescribed underburning*	17,077	2,153	1,824
Alternative 4: pile burning	6,532	424	356
Wildfire without treatment	19,053	4,475	3,783

Burning would be conducted in compliance with National Ambient Air Quality Standards and under the Oregon Smoke Management Plan. Burning would only be conducted when prevailing and predicted wind patterns would result in negligible effects to Bend, LaPine, Sunriver, 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 to adjacent communities while having no visible effects to the Class 1 Airshed (Three Sisters Wilderness). This is because the Three Sisters Wilderness area is higher in elevation and located four to six miles west/northwest of the West Bend project area. The winds most favorable to accomplish the work of underburning in this area would generally be winds with a strong southerly or northerly component and would result in minimal potential for impacts to the airshed.

On burn days, persons responsible for burning operations modify ignitions patterns and mop-up procedures to consider the effects to the Class 1 Airshed and smoke sensitive areas. Monitoring is done by the State Forester to ensure compliance with the smoke management program to determine effectiveness of smoke management procedures. Other monitoring techniques include posting personnel as lookouts (Lava Butte Lookout) on burn days. If a certain threshold is reached where additional particulate release is undesired, firing operations are ceased and immediate mop-up procedures initiated.

In contrast to Alternative 1, fuel treatments under Alternative 4 would reduce potential wildfire size per occurrence and emissions produced in the treated units of the project area. Under extreme fire behavior conditions, the remaining untreated dense stands and areas of excessive fuel loading could burn intensely and produce unwanted amounts of smoke in addition to the predicted amounts of smoke for Alternative 4. There would be some dust created from the proposed mechanical operations under this alternative, mainly from logging operations within project units. The amount of dust actually created would be minimal due to dust abatement which includes watering dirt roads identified for hauling.

Cumulative Effects for Alternative 2 (Proposed Action), Alternative 3 and Alternative 4

Measure 1: Acres of project area falling within each fire hazard class. Wildfire hazard being represented by a matrix of both flame length potential and crown fire potential

Measure 2: Acres of project area falling within each fire risk class. Wildfire risk being represented by burn probability

Measure 3: Number of ponderosa pine trees by size class affected by predicted flame lengths

Stand and fuel conditions from any past treatments or fires within the West Bend planning area were either reflected in the satellite imagery of 2004 or were a part of the update of the satellite imagery, and so therefore the cumulative effects for wildfire hazard, risk and effects of these treatments/fires along

with any proposed treatments in the West Bend project can be referenced in the Direct and Indirect Effects for each alternative.

Modeling of wildfire risk (see Measure #2-Wildfire Risk for all Action Alternatives) shows an influence of current conditions on private lands within the project area. Random ignitions started by the model on private lands are spreading in such a way to increase wildfire risk within the project area downwind from private lands due to current tree and fuels data from the forest satellite imagery data. There are no known significant management actions that have occurred on private lands since 2004 (that would update the satellite imagery data). Therefore, the modeling is considered current and any increased risk to wildfire risk is captured as part of the Direct and Indirect Effects. Current known management actions on private lands that would either increase or decrease hazard or risk are actions that would not be significant to the West Bend Project Area. Any known actions on private lands are focused primarily on structure protection and fuels treatment directly surrounding structures.

Experience with fire suppression in Central Oregon shows that unless treated acres are in the immediate vicinity (less than 0.25 miles) they would have no effect on fire behavior within the project area. Any fire behavior effect from treated acres of these recent activities within a 0.25 mile of West Bend are accounted for in the simulation modeling of predicted fire behavior for the alternative, and are therefore accounted for in the data analysis and reporting of Direct and Indirect fire hazard effects for each alternative. Past and ongoing treatments in the areas outside of 0.25 mile of the West Bend project area may or may not reduce fire behavior to a low rating, but any work that treats/reduces surface fuels will lower the susceptibility across the landscape for uncharacteristic wildfire. Refer to Table 26, page 72 and Table 27, page 73 for past, ongoing and reasonably foreseeable actions.

Measure 4: Production of Particulate Matter (PM) 10 and 2.5

All burning activities 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. Burning activities on Federal lands near, but not within, the West Bend project area is also subject to the same restrictions, requirements, and regulations, so would not have any additive effect on air quality within Central Oregon.

3.5 Wildlife – Threatened, Endangered, and Sensitive Species

3.5.1 Introduction

A biological evaluation (BE) was completed describing the effects to threatened, endangered and sensitive (TES) fauna species associated with the West-Bend project area on the Deschutes National Forest.

A Joint Aquatic and Terrestrial Biological Assessment (BA) for Federal Lands within the Deschutes and John Day River Basins Administered by the Deschutes National Forests was completed for 2010- 2013 projects. Known as the Programmatic BA, it established project design criteria to simplify and reduce consultation with U.S. Fish and Wildlife Service (USFWS) for 2010 and future projects. The goal for the forests is to fully implement the criteria to achieve conservation and recovery objectives of federally listed, proposed, and candidate species. Project design criteria are to be used as sideboards and a filter for our planning process. Criteria focus on habitat alteration and disturbance effects. Applicable criteria are documented in the biological evaluation process used for individual project alternative analysis and effects determinations on threatened, endangered, proposed, and candidate species.

One threatened species, designated critical habitat, and eight sensitive species, and/or their habitats are known or suspected to occur within the project area. The following is a summary of the findings of the biological assessment/evaluation on the effects of the proposed alternatives.

Table 65: Summary of key findings for threatened, endangered, or sensitive species analyzed in the Biological Evaluation.

Species	Federal and Forest Classification	Habitat	Finding
Northern Spotted Owl	Threatened, MIS	Old growth mixed conifer forests	May Affect, but not likely to Adversely Affect
Northern Spotted Owl Critical Habitat			May Affect, but not likely to Adversely Affect
Gray Wolf	Endangered, Sensitive	Any forest PAG	No Effect
Lewis' Woodpecker	Sensitive, MIS	Open snag habitat or burned forests	May Impact
White-headed Woodpecker	Sensitive, MIS	Large, open ponderosa pine	May Impact
Horned Grebe	Sensitive, MIS	Lakes	
Pacific Fisher	Candidate, Sensitive	Mixed, complex forest	No Impact
Crater Lake Tightcoil	Sensitive	Riparian, perennial wet areas	No Impact
Evening Fieldslug	Sensitive	Perennial wet meadows	No Impact
Johnson's Hairstreak	Sensitive	Coniferous forests with mistletoe	May Impact

3.5.2 Methods and Assumptions

Habitat Analysis, Viable Ecosystems Model, Geographic Information System

Habitat for the various species was determined by the Viable Ecosystems Model (Viable). The Geographic Information System (GIS) program ArcMap was used to overlay this habitat with the action alternative associated with the West-Bend project area to determine and illustrate the amount of habitat that is likely to be manipulated and quantify decreases or increases in habitat quality for species.

Viable was not able to map habitat for riparian, special habitat, or niche species. Riparian species select for riparian vegetation or other characteristics found adjacent to streams and water bodies. This information was not available in a GIS map. Riparian buffers were used as a surrogate for riparian habitat. Riparian habitat may be over-estimated as riparian habitat characteristics are not likely to occur within the entire buffer distance and not every waterbody may contain suitable habitat for each species.

Mapped special habitats on the Deschutes National Forest include hardwoods, alpine meadows, meadow, alpine shrubs, mesic shrubs, rock, xeric shrublands (scablands), and caves. Special habitat information is available as separate layers in GIS for each forest. As with the riparian habitat, habitat may be over-estimated as each area mapped may not contain suitable habitat for each species within the entire mapped area. However, acres of special habitats were used as a means of comparison between the alternatives.

Viable Ecosystems Model

The Ochoco and Deschutes Viable Ecosystems Management Guide (VEMG) was developed to classify vegetation on a landscape basis. "The Viable Ecosystem model provides a process to apply ecosystem management concepts to project level planning. This system compares existing vegetation with site potential. The model focuses on relationships between combinations of vegetation structure and species composition, and habitat requirements for animals, insects and plants. Viable Ecosystems is a useful tool for cumulative effects analysis of broad scale changes in vegetation at a subwatershed to Forest-wide scale and subsequent changes in animal, insect or plant communities."

Viable stratifies the environment along a gradient of size, structure, species composition, and relative tree density. The various classifications are then linked to wildlife habitat requirements. For example, a classification with a value of 56152 is white fir (56), early seral (1), medium/large structure (5), and low density (2) and would typically have a single story (low density) dominated by ponderosa pine (early seral in white fir) 21" dbh or greater (medium/large structure). This provides nesting habitat for white-headed woodpeckers. A value of 56351 would equate to white fir (56), late seral (3), medium/large structure (5), and high density (1) and would be a multi-storied stand dominated by white fir 21" dbh or greater and provide habitat for pileated woodpeckers. All values that provide habitat for species were used. In addition to the mixed conifer value of 56152 using the white-headed woodpecker example, any seral stage dominated by ponderosa pine, medium/large structure, and low density would provide similar open ponderosa pine habitat and was used in determining amounts of white-headed woodpecker habitat across the Deschutes National Forest.

The 2002 satellite imagery layer was used to develop the vegetation layer to run in the Viable Ecosystem Model. Data is mapped on a 30 meter pixel grid, meaning the map is divided up on a 30 meter grid and that every 30 meter square (pixel) is assigned a value (i.e. 56351) that relates to a stratum of size, structure, tree species composition, and relative tree density. Criteria used (vegetation, seral state, structure, and density) to determine habitat for each species is described in the existing condition of each species. The forest activity data base "FACTS" was used to determine actions that potentially altered habitat since 2002. Existing conditions include past actions such as timber sales. Presenting information in this way and including those current and foreseeable future actions in cumulative effects is the most informative for the decision maker.

GIS Analysis and ArcMap

A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. The information can be related to visual data (maps), tabular data (tables, spreadsheets, or data bases) and used to run models (create new data set from existing data based on criteria or specific conditions).

ArcMap is a component of the ArcGIS program. The client software developed by Economic and Social Research Institute (ESRI) was used for the processing and presentation of GIS data.

Gradient Nearest Neighbor (GNN)

GNN maps consist of 30 meter pixel (grid) maps with associated data (tree size, density, snag density, canopy cover, percent down wood cover, etc.). The maps used for this analysis were developed by the Landscape Ecology, Modeling, Mapping, and Analysis (LEMMA) team as part of the GNNPAC Pacific States Forest Vegetation Mapping project. This project involves developing detailed maps of existing forest vegetation across all land ownerships in the Pacific Coast States (Oregon, Washington, and parts of California). It is being conducted by the LEMMA team (Pacific Northwest Research Station (PNW) and Oregon State University at the Corvallis Lab, in close collaboration with the Western Wildlands Environmental Threats Assessment Center, the Interagency Mapping and Assessment Project (IMAP), Northwest Forest Plan Effectiveness Monitoring, the Remote Sensing Applications Center, and Forest Inventory and Analysis at the PNW Research Station.

The process to create the maps involves using gradient imputation (Gradient Nearest Neighbor, or GNN). GNN uses many variables on a gradient along with satellite imagery to assign data from known field plots to pixels with no data that have the same satellite imagery signature (i.e. it "looks" the same to the computer). The species-size GNN model was used in the West-Bend analysis. This model uses species composition and stand structure as components for developing maps. Accuracy of the modeling depends on how "like" pixels match up based on numerous variables. Generally speaking, forest types that had more samples like white-fir were more accurate than those with fewer samples like mountain mahogany (Ohman et al. 2008). Information on GNN accuracy, the LEMMA group, IMAP and the GNNPac project is available at the project website: http://www.fsl.orst.edu/lemma/gnnpac.

3.5.3 Evaluation Criteria and Comparison Measures

Evaluation criteria are developed to illustrate the effects to wildlife and how those effects differ by alternative. In this analysis, changes to vegetation structure on the landscape from the existing condition to the desired future condition will be measured. Using consistent units of measure allows the major impacts to be easily understood and compared, providing the Decision Maker the necessary data to make an informed decision.

Units of Measure

Suitable habitat for each wildlife species analyzed in this document has been quantified for the project area, the watershed, and at the Forest level. The following measure will be used to evaluate the impacts and associated effects of the planned activities: Acres of potential suitable habitat as calculated by Viable located within the West-Bend Project Area and at the Forest level to complete a cumulative effects analysis for each species.

Analysis

An analysis was conducted for each species to calculate the acres of habitat impacted by alternative. The following will outline the steps taken to calculate the acres of residual habitat as well as explain the rationale used.

Potentially suitable habitat was overlaid with the project area to quantify the existing condition for each species. Potentially suitable habitat was then over laid for each action alternative to determine where each action alternative had the potential to affect species habitat. A discussion following the analysis will determine the extent of affects to species over space and time. This discussion will determine if effects are "negative or beneficial" and the duration of time the effect will last to that particular species or its habitat.

ACE Model (Action/Change/Effect)

The long-term sustainability of forest ecosystems and wildlife habitat is dependent on a variety of factors, but for the purpose and need of this project it was identified that due to fire suppression and existing conditions from past management, stands are over-stocked and outside the Historic Range of Variability (HRV). HRV is used to determine the desired future condition for wildlife habitat as it relates to each Plant Association group, and what management action is needed for departure from the existing condition to continue to promote future wildlife habitat. Forest thinning and fuels reduction treatments are the two main treatment types that will occur to move stands toward HRV and have the potential to impact existing wildlife habitat in the short-term. Removal of habitat from these management activities could directly or indirectly affect wildlife species and their habitat. An evaluation of the potential effects to wildlife species will be completed for the project to determine if these effects are negative or beneficial.

Duration and Degree of Impacts (Short-Term vs. Long-Term)

Under each action alternative, the project will primarily manipulate vegetation through a variety of thinning techniques. However, stands may also be treated by use of prescribed natural fire or a combination of thinning and prescribed natural fire. In addition, some treatments may not directly impact habitat, but could cause disturbance through equipment operation or smoke from prescribed fire. Effects of these treatments to habitat will be assessed on short-term and long-term impacts. Stand Density Index (SDI) is used to measure the risk of a stand's susceptibility to insect and disease as a result of densification. From the initial density reduction treatment, effects from the reduction occur roughly over a 30 year period. After 30 years stands begin to put on basal area growth, height, and begin to recruit new trees into the stands increasing SDI (Personal Communication, Pete Powers, District Silviculturist). To standardize the length of time when referencing short-term and long-term impacts to wildlife habitat from forest thinning, short-term impacts are $\leq$ 30 years and long-term impacts are those that will occur $\geq$ 30years.

Bounding Spatial and Temporal Changes within the Zone of Influence

For this project proposal, activity area boundaries are considered to be the smallest identified area where the potential direct and indirect effects from different management practices could occur. The project area proposes treatments to ponderosa pine, mixed conifer, and lodgepole pine stands within Northwest Forest Plan lands and Eastside Screens on the Bend-Ft. Rock Ranger District. The discussion of wildlife cumulative effects will be focused on the units proposed for treatments and their incremental impacts in combination with past, present and reasonably foreseeable projects within the two 10th field watersheds ("zone of influence"),North Unit-Diversion Dam and Tumalo watersheds (referred to as the "The Watershed"). FS lands will be analyzed within the "zone of influence." The EIS contains a list of past, present and reasonably foreseeable future projects within the watersheds which have the potential to contribute to cumulative effects. However, habitat for each identified species associated with the project area will be discussed on a Forest wide basis to address species viability.

3.5.4 Threatened and Endangered Species

The Biological Evaluation was prepared in compliance with the requirements of Forest Service Manual (FSM 2630.3, FSM 2670-2671, FSM WO Amendments 2600-95-7, and the Endangered Species Act (ESA) of 1973. Those species thought to occur presently or historically on the Deschutes National Forest and analyzed in the BE include the northern spotted owl (*Strix occidentalis*), northern spotted owl critical habitat, and the gray wolf (*Canis lupus*).

Northern Spotted Owl, Federal Threatened, MIS – Affected Environment

In June 1990 the northern spotted owl was listed as threatened throughout its range. The FWS completed a five year review of the status of the owl. They concluded a change in the classification of the northern spotted owl was not warranted (USDI 2004). A report by Sustainable Ecosystems Institute (SEI) was prepared for the U.S. Fish and Wildlife Service to evaluate the scientific materials currently

available on the northern spotted owl (Courtney et al. 2004). This report compared risks faced by the northern spotted owl in 2004 with those at the time of listing in 1990 under the Endangered Species Act. The SEI report incorporated the "Status and Trends in Demography of Northern Spotted Owls" (Anthony et al. 2004) report on northern spotted owl populations within the range of the Northwest Forest Plan. Some key results of the SEI report are:

- The report confirms and supports findings on habitat associations as known at the time of listing (1990): that spotted owls typically need some late-successional habitat and that other habitat components are also important in some parts of their range.
- The conservation needs of the northern spotted owl – late-successional forests and connectivity between them – have not substantially changed.
- The risks currently faced by the northern spotted owl are significant, comparable in magnitude to those faced by the species in 1990, and have the potential to increase.
- The best available data, although limited, suggest that timber harvest has decreased greatly since the time of listing and that a major cause of habitat loss on federal lands is fire.
- Major threats to northern spotted owls at this time include effects of past and current harvest, loss of habitat to fire, West Nile virus, and barred owls.

The Final Recovery Plan (USFWS 2011) builds upon the Final Draft Recovery Plan (USDI 1992b), the NWFP (USDA 1994a), and the previous status reviews. This plan relies on federal lands to provide the major contribution for recovery. Three main threats were identified: competition with barred owls, loss of suitable habitat as a result of timber harvest and fire, and loss of amount and distribution of suitable habitat as a result of past activities and disturbances. The Recovery Plan recognized the need to manage entire landscapes in the dry forests and that active management is needed to create more fire resilient and fire resistant forests. Special management considerations or protection may be required in the East Cascades to address the effects of past activities associated with Euro-American settlement, such as timber harvest, livestock grazing, fire suppression, and fire exclusion, that have substantially altered the inland northwest, modifying the patterns of vegetation and fuels and subsequent disturbance regimes to the degree that contemporary landscapes no longer function as they did historically. This has affected not only the existing forest and disturbance regimes, but the quality, amount, and distribution of spotted owl habitat on the landscape. In order to preserve the essential physical or biological features, dynamic, disturbance-prone forests should be managed in a way that promotes spotted owl conservation, responds to climate change, and restores dry forest ecological structure, composition, and processes including wildfire and other disturbances. The following restoration principles may be required in dry forests:

1. Conserve older stands that contain the conditions to support spotted owl occupancy or high value owl habitat
2. Emphasize vegetation management treatments outside spotted owl territories or highly suitable habitat
3. Design and implement restoration treatments at the landscape level
4. Retain and restore key structural components, including large and old trees, large snags, and downed logs
5. Retain and restore heterogeneity within stands
6. Retain and restore heterogeneity among stands
7. Manage road to address fire risk
8. Consider vegetation management objectives when managing wildfires where appropriate.

Coordinated and strategic efforts that link individual projects to the larger objectives of restoring landscapes while conserving and recovering spotted owl habitat are needed.

Critical habitat was revised in 2013 after the 2008 Critical Habitat designation was challenged in court. The Service encourages land managers to consider implementation of forest management practices recommended in the Revised Recovery Plan to restore natural ecological processes where they have been disrupted or suppressed and the application of "ecological forestry" management practices within critical habitat to reduce the potential for adverse impacts associated with commercial timber harvest when such harvest is planned within or adjacent to critical habitat. In sum, the Service encourages land managers to consider the conservation of existing high quality northern spotted owl habitat, the restoration of forest ecosystem health, and the ecological forestry management practices recommended in the Revised Recovery Plan that are compatible with both the goals of spotted owl recovery and Standards and Guidelines of the Northwest Forest Plan.

In fire-prone forests east of the Cascade crest, it is recognized vegetation and fuels management may be appropriate both within and outside designated critical habitat where the goal of such treatment is to conserve natural ecological processes or restore them (including fire) where they have been modified or suppressed.

Physical and biological features are essential to the conservation of the species and may require special management considerations or protection. Physical or biological elements of habitat include but are not limited to (50 CFR Part 17 p. 71897):

- Space for individual and population growth and for normal behavior
- Food, water, air, light, minerals, or other nutritional or physiological requirements
- Cover or shelter
- Sites for breeding, reproduction, and rearing (or development) of offspring
- Habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species

Habitat

Spotted owls are primarily inhabitants of old growth and mature forests. Suitable spotted owl habitat contains adequate quantities of dead and down woody material, decadent trees, a medium to high crown closure, multiple layers in the overstory, and trees at least 200 years old or greater than 32 inches dbh (USDA 1990b). Nesting, roosting, and foraging (NRF) habitat for the northern spotted owl on the Deschutes National Forest includes stands of mixed conifer, ponderosa pine with white fir understories, and mountain hemlock with subalpine fir. Suitable nest sites are generally in cavities in the boles of either dead or live trees. Platform nests may also be used (but more rarely), which include abandoned raptor nests, broken treetops, mistletoe brooms, and squirrel nests. Relatively heavy canopy habitat with a semi-open understory is essential for effective hunting and movement (USDA 2003a).

Edge effects from large forest openings may adversely impact the microhabitat conditions necessary for suitable owl habitat as well as contribute to increasing the risk to spotted owls imposed by predators or to competition from the barred owl (*Strix varia*). Spotted owls will use younger, managed forests provided that key habitat components are available. These younger forests provide dispersal habitat for owls and foraging habitat if near nesting or roosting areas.

Prey

Habitat conditions that support good populations of northern flying squirrels (*Glaucomys sabrinus*), western red-backed voles (*Clethrionomys californicus*), and other nocturnal or crepuscular small mammals, birds, and insects are essential to supporting spotted owls. An analysis of local spotted owl pellets showed the primary prey species is the northern flying squirrel with red-backed vole, bushy-tailed woodrat (*Neotoma cinerea*), western pocket gopher (*Thomomys mazama*), Douglas squirrel (*Tamiasciurus hudsonicus*), snowshoe hare (*Lepus americanus*), voles (*Microtus* spp.), mice (*Peromyscus* spp.), and insects as secondary prey items.

The northern flying squirrel was found to be the most important prey species for the spotted owl in 16 of 17 studies analyzed for the SEI Report (Courtney et al. 2004). It was once thought to be old growth dependent but several studies have shown that densities were similar in both young and old forests, especially if old forest legacies (e.g. large decaying logs) and well-developed understories were present (Rosenberg and Anthony 1992; Carey 1995; Waters and Zabel 1995; Carey et al. 1997; Carey 2000; Carey et al. 2002; Ransome and Sullivan 2003). Den sites have been documented in cavities in live and dead old growth trees, stick nests, moss nests, cavities in branches of fallen trees, decayed stumps, and suppressed young trees (Carey et al. 1997). Mychorrizal and epigeous fungi, in particular truffles, are an important food source for flying squirrels (Maser et al. 1985; Waters and Zabel 1995; Waters et al. 2000; Carey et al. 2002; Lehmkuhl et al. 2004; and Lehmkuhl et al. in draft, 2004) but where winter snow levels are deeper, as seen in eastside habitats more often, other foods become important like lichens (Thysell et al. 1997; Rosentreter et al. 1997; and Lehmkuhl et al. in draft, 2004).

While few studies exist for the southern red-backed vole (*C. gapperi*), a species found on the east slope of the Cascades, information does exist for the California or western red-backed vole (*C. californicus*). Patterns of abundance associated with stand age have been inconsistent. Some studies indicate voles are more highly associated with old growth or mature stands (Rosenberg et al. 1994) while others have found no difference of vole abundance between young and older forests, but stands selected were mostly naturally regenerated from wildfire (Aubry et al. 1991). The presence of down woody material seems to be important in some aspects. Tallmon and Mills (1994) found that 98% of recorded observations coincided with down logs even though only 7% of the area was covered with logs. In addition, this study reported that more decayed logs were selected for. This may have to do with increased moisture levels and the increased presence of mychorrizal fungi, a major food source. However, the presence of down woody material is not always an indicator of use. Mills (1995) found that even though down wood was present in adequate amounts, it did not predict the distribution of voles but the presence of hypogeous sporocarps, did predict distribution. Rosenberg et al. (1994) also found this species highly associated with deep organic soils, another predictor of fungi occurrence.

Bushy-tailed woodrats are also an important prey species but these species may have a patchy distribution due to specific habitat requirements. They typically inhabit boulder outcrops or talus slopes (Smith 1997). The number of suitable den sites may limit population density and appear to be climate dependent (Carey et al. 1999). Densities increase in stream-side areas associated with boulders and consistently occupy old, natural stands but are absent from young managed (35-80 years) stands (Carey et al. 1999).

Nesting, Roosting, Foraging Habitat (NRF) and Dispersal Habitat

For the northern spotted owl, physical or biological features essential to the conservation of the species are forested areas that are used or likely to be used for nesting, roosting, foraging, and dispersing. The specific characteristics or components that comprise these features include, for example, specific ranges of forest stand density and tree size distribution, coarse wood debris, and specific resources, such as food, nest sites, cover, and other physiological requirements of spotted owls and considered essential to the conservation of the species.

The Deschutes National Forest is located on the east slope of the Cascade Mountains in Central Oregon. This region is dominated by mixed conifer and ponderosa pine (Pinus ponderosa) forests at mid to lower elevations and by true fir forests at higher elevations. Forests in this region are highly fragmented due to logging and wildfires and a variety of natural factors (poor soils, lava flows, high fire frequencies, high elevations) (USDA 1993). Wildfires played a major role in shaping the forests of this region before large scale fire suppression. Fire suppression efforts in the last several decades have resulted in shifts in tree species composition and accumulations of fuel. These changes may have made forests more susceptible to uncharacteristic fires and large scale insect and disease outbreaks. Protection of

late-successional forests in this area must consider risk reduction in order to sustain forest conditions (USDA 1993).

Fire exclusion has altered the species composition and structure of many Mixed Conifer Dry (MCD) stands, consequently spotted owl nesting, roosting, and foraging (NRF) habitat may exist today in sites that did not historically provide habitat. Conversely, many of the stands that historically were NRF habitat have been harvested and no longer provide habitat. Many of the forest sites that contain MCD do not have the vegetative site potential to sustain NRF habitat characteristics over the long-term (100+ years). Generally Mixed Conifer Wet (MCW) and MCD (on north aspects) plant associations have the site potentials and environmental conditions that are expected to sustain NRF habitat. Over the past 5 to 20 years, many of the overstocked "out of balance" MCD stands experienced heavy mortality from the spruce budworm epidemic. Loss of canopy layer and live tree canopy closure reduced the quality of habitat for spotted owls in these stands. Subsequently, large uncharacteristic stand replacement wildfires occurred in the high mortality areas from the insect outbreak. This loss from wildfire, in combination with habitat loss from management activities, has resulted in few acres of suitable habitat, unevenly distributed across the landscape.

Dispersal habitat was defined by the Interagency Scientific Committee (USDA 1990) as stands with an average dbh of 11 inches and a 40% canopy cover. Those conditions are not biologically possible in all eastside plant association groups. The Deschutes National Forest conveyed a Science Team of experts on local conditions to determine plausible definitions of dispersal habitat. The team developed a process by which local biological knowledge of sites would be used to describe dispersal habitat (USDA 1996). The following criteria have been used to define dispersal habitat on the Deschutes National Forest for various projects:

Table 66: Dispersal Habitat Definitions.

Plant Association Group	Stand Criteria Average dbh, Percent Canopy Cover
Mixed Conifer Wet	11" dbh, 40% CC
Mixed Conifer Dry	11" dbh, 30% CC
Ponderosa Pine	11" dbh, 30% CC
Lodgepole Pine	7" dbh, 30% CC
Mountain Hemlock	7" dbh, 30% CC

Dispersal habitat provides avenues for juvenile and non-territorial spotted owls to move across the landscape. This habitat does not provide all the habitat components necessary for occupation and is used for short durations of time. Dispersal habitat was quantified for the West-Bend project area and spatially identified. A dispersal habitat retention strategy was identified to provide movement opportunities for dispersing spotted owls through the West-Bend project area.

- **Nesting and Roosting Habitat**
  - Provides structural features for nesting protection from adverse weather conditions and cover to reduce predation risks for adults and young
  - Nest stands include:
    - Moderate to high canopy cover (60 to >80%)
    - Multi-layered, multi-species canopy with large (>30"dbh) overstory trees
    - High incidence of large trees with various deformities
    - Large snags
    - Large accumulations of fallen trees and other woody debris

        - Sufficient open space below canopy to fly
    - Studies have shown nest stands tend to have greater tree basal area, number of canopy layers, density of broken top trees, number or basal area of snags, and volume of logs
    - Spotted owls consistently occupy stands having a high degree of canopy cover that may provide thermoregulatory benefits
    - They use the same habitat for both nesting and roosting

- **Foraging Habitat**
    - Varies widely across the range in accordance with ecological conditions and disturbance regimes that influence vegetation structure and prey species distributions
    - Select older forests in greater proportion than their availability at the landscape scale but will forage in younger stands and brushy openings with high prey densities
    - Positively associated with tree height diversity, canopy cover, snag volume, density of snags >20"dbh, density of trees >31"dbh, and volume of woody debris in the West Cascades
    - East Cascades – similar to what's used in West Cascades but can also have lower mean tree sizes (16-22" dbh)
        - Stands dominated by Douglas-fir, white fir/Douglas-fir, or grand fir/Douglas-fir preferred
        - Stands dominated by ponderosa pine are generally avoided

- **Non-breeding and Dispersal Habitat**
    - Provides important linkage function among blocks of nesting habitat both locally and over the owl's range
    - At a minimum – stands with adequate tree size and canopy cover to provide protection from avian predators and at least minimal foraging opportunities

Mapped NRF habitat was identified within the West-Bend project area. During the field seasons of 2010 through 2011 field reconnaissance was completed to determine accuracy. Upon further review, very few of the mapped NRF stands provided the large tree vertical structure and upper level canopy cover to provide NRF habitat. In addition, many of the stands contained varying amounts of mortality or dying trees from insects, and disease which also reduced canopy closure. Field verified NRF habitat is primarily associated with the upper elevation mixed conifer wet stands on the west side of the project area.

A secondary strategy was implemented in the West-Bend project area to identify stands that did not have the large trees structure to provide nesting habitat, but had understory canopy closures and enough residual large wood habitat to provide foraging habitat. These stands were primarily associated with the mixed conifer PAG on north facing slopes and were identified as connectivity stands, providing security for foraging as birds moved through the project area.

Home Ranges

USFWS requirements regarding a "take" situation exists where there is less than 40% (1,158 acres) NRF habitat within a 1.2 mile home range, or 50% (493 acres) NRF habitat within a 0.7 mile radius because of the tenuous nature of an owl's existence at those habitat levels. More recently, information became available suggesting the need to adjust the core area size from a 0.7 mile radius to a 0.5 mile radius (USDA and USDI 2008). Therefore, 50% (250 acres) of NRF habitat within a 0.5 mile radius is the current threshold replacing the 0.7 mile radius threshold.

Currently, 1of 27 home ranges have sufficient NRF habitat within the 1.2 mile home range while 6 of 27 home ranges have sufficient NRF habitat within the 0.5 mile radius on the Deschutes National Forest.

Recent post-fire and insect assessments have shown some spotted owl home ranges are no longer capable of providing adequate suitable habitat for occupancy. Currently, 27 home ranges are considered to be capable of providing habitat for owls (i.e. viable). Seventeen home ranges were heavily impacted by fires occurring in 2002 through 2008 and habitat was lost. These sites are no longer considered viable, according to the Programmatic BA.

Viability of existing home ranges is based on the occupancy history, habitat quality and the amount and arrangement of suitable habitat remaining within each home range after disturbance events.

Prior to the fires starting in 2002 on the Deschutes National Forest, occupancy had not been documented for many home ranges several years prior to these disturbance events. Habitat quality had diminished greatly within many of home ranges on the Forest due to mortality from over-stocked stands resulting from fire suppression. These types of conditions led to wide-scale mortality from insect and disease outbreaks in the late 1980s and early 1990s, especially on the Bend-Ft. Rock Ranger District. The fires of 2002 through 2008 further fragmented poor habitat conditions. Many home ranges impacted by the fires have very little habitat remaining. The spatial arrangement of the remaining habitat was assessed to determine patch size, distance to other forested areas (connectivity), as well as the amount of stand replacement fire within each home range.

Owls on the Deschutes National Forest have routinely nested and reproduced in home ranges where suitable habitat within the home range is less than the identified threshold for "take" (i.e. 1,158 acres within 1.2 miles and/or 250 acres within 0.5 miles).

Spotted owl surveys were completed to protocol (Version 1.0 February 2010), and responses were detected. One pair of spotted owls was located within ½ mile west of the project area within marginally suitable NRF habitat but no nest sites were confirmed. An activity center was mapped and a .5 mile radius was delineated around the activity center. Responses from individual birds were document within the project area, but no new nests were identified. These detections were identified within stands that did not contain NRF characteristics. However, although these stands were unsuitable as NRF, they were excluded from treatment and utilized within the connectivity strategy as dispersal habitat.

Late Successional Reserves

The Habitat Conservation Area (HCA) network strategy was identified by the ISC (USDA 1990), then adopted and refined by the Draft Final Recovery Plan (USDI 1992a) as Designated Conservation Areas (DCAs). The network strategy was refined in the Forest Ecosystem Management Team Report (FEMAT) (USDA 1993) as LSRs prior to the Record of Decision (ROD) for the NWFP. The strategy and its standards and guidelines for managing late-successional forests were intended to be the basis for the long-term conservation of northern spotted owls and other species associated with old- growth coniferous forests. This reserve network was designed to protect late-successional forest species where habitat conditions are relatively intact and provide for the recovery of late-successional forest habitat where habitat is extremely limited. There are no LSRs within the West Bend project area.

Critical Habitat Units

Critical habitat is defined in section 3 of the Act as (50 CFR Part 17 p. 71896):

- The specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features
  - Essential to the conservation of the species and
  - That may require special management considerations or protection and

- Specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Critical habitat receives protection under Section 7 of ESA through prohibition against federal agencies for carrying out, funding, or authorizing the destruction or adverse modification of critical habitat. Critical habitat is based on primary constituent elements of habitat (PCEs) (Fed Reg 2013).

The Deschutes National Forest lies primarily in Critical Habitat Unit 7, East Cascades North. In addition, there is a small portion of Critical Habitat Unit 6, West Cascades South occurring on the southern end of the forest. Unit 6 is comprised of six subunits while Unit 7 is comprised of 9 subunits. Subunit WCS 5, West Cascades South 5 and Subunits ECN 8 (East Cascades North 8) and ECN 9 (East Cascades North 9) occur on forest.

A very small portion of the northeast corner of CHU Subunit ECN 9 is associated with the West-Bend project area.

Summary of Existing Condition

Table 67 summarizes the total acres of NRF, Foraging, and Dispersal habitat with the West-Bend project area outside the CHU. In addition, the table also summarizes the total acres of CHU associated with the project area, and the total acres of NRF and Dispersal habitat within the portion of the CHU associated with the project area.

Table 67: Acres by allocation associated with the West-Bend Project Area

Acres of NRF within West-Bend	Acres of Foraging within West-Bend	Acres of Dispersal within West-Bend	Acres of CHU within West Bend	Acres of NRF in CHU	Acres of Dispersal in CHU	Acres of LSR within West Bend
383	241	5,587	333	0	28	0

Northern Spotted Owl - Environmental Consequences

No Action - Continued Ecological Trends

There are no direct or indirect impacts associated with the No Action Alternative. Under the No Action Alternative, no treatments will be prescribed within West-Bend project area (17,192 acres). However, the "ecological trend" in the short-term is that these stands would continue to remain suppressed and at risk of a stand-replacing wildfire. Development of future old growth within ponderosa pine and mixed conifer stands would be prolonged and the old trees within the stands would continue to be stressed, decreasing their longevity. However, stands would continue to provide habitat for wildlife species. In the long-term, if a stand replacing wildfire or insect outbreak hasn't occurred, the stands containing disease would continue to die and the multi-storied structure would diminish along with any remnant old growth trees. As a result, NRF and connectivity habitat for the northern spotted owl will continue to diminish as the overstory canopy's become more open making the species more susceptible to predation. Due to stand densities within the project area and increases in mortality overtime, the risk of large scale stand replacing fire across the West-Bend project area also increases over time, potentially impacting spotted owl habitat as well as adjacent home ranges.

Potential fire hazard for the existing condition/no action of the West Bend Planning area has been predicted by using a number of state of the art tools. Remote sensing satellite imagery from 2004 was updated using ArcFuels (Ager et al. 2011) to reflect activities accomplished since 2004. The data was then analyzed in the computer model FlamMap (v. 3.0) under specific weather conditions. FlamMap, a fire behavior mapping and analysis program that computes fire behavior characteristics (rates of spread, flame length, crown fire potential, etc.) over an entire landscape, was used to determine the existing

stand condition's potential fire hazard. FlamMap is a state of the art tool used by many researchers and modelers (Finney 2006; Stratton 2004; Ager, Finney & McMahon 2006; Gercke & Stewart 2006; Opperman et al. 2006; Ager et al. 2006; Yohay et al. 2009; Krasnow et al. 2009; Arca et al. 2007; Stratton 2006; Knight & Coleman 1993). FlamMap output lends itself well to landscape comparisons (e.g. pre- and post-treatment effectiveness) and for identifying hazardous fuel and topographic combinations, thus aiding in prioritization and assessments (Stratton 2004). Although the (modeling) approach has limitations, model outputs yield useful information for planning, assessing, and prioritizing fuel treatments (Stratton 2004). The data inputs necessary for FlamMap include aspect, slope, elevation, fuel model, canopy height, canopy base height, crown bulk density, and crown class. Specific wind and fuel conditions used for running the model may be referenced in the fuels section of the EIS. Under the No Action Alternative approximately 9,317 acres or 36% of the project area is predicted to be at extreme hazard. An additional 1593 acres or 6% of the project area is predicted to be at moderate to high hazard. Fire effects analysis and best available science supports that moderate to high hazard potential would be damaging to valued stand characteristics; extreme hazard with high flame lengths and varying degrees of crown fire would be most damaging.

The extreme hazard and high hazard areas are both directly associated with the spotted owl NRF, connectivity habitat, and dispersal.

Common to All Action Alternatives 2-4: **Direct and Indirect Effects**

NRF and Connectivity Habitat

Implementation of the Action Alternatives will not remove NRF habitat within the project area. In addition foraging habitat will remain untreated to provide connectivity to NRF habitat within and adjacent to the project area. Although NRF will not be removed, treatments are designed to reduce fuel densities around NRF and foraging habitat. To achieve this, thinning from below will occur in mixed conifer stands, removing concentration of dead lodgepole pine created by mountain pine beetle outbreaks occurring over the last 6 to 8 years. Treatment will break up fuel continuity in an east to west fashion reducing the fire hazard to the existing spotted owl habitat.

The FlamMap hazard assessment conducted for Alternative 2 shows a reduction in extreme hazard by 98% of the existing condition hazard to 233 acres. For all hazard classes shown to be damaging to valued stand characteristics- moderate, high and extreme hazard, hazard in these classes was reduced by 7667 acres or by 70% of the existing condition hazard. Alternative 3 shows a reduction in extreme hazard by 98% of the existing condition hazard to 234 acres. For all hazard classes shown to be damaging to valued stand characteristics- moderate, high and extreme hazard, hazard in these classes was reduced by 7645 acres or by 70% of the existing condition hazard. Alternative 4 shows a reduction in extreme hazard by 98% of the existing condition hazard to 234 acres. For all hazard classes shown to be damaging to valued stand characteristics- moderate, high and extreme hazard, hazard in these classes was reduced by 7575 acres or by 69% of the existing condition hazard.

Late-Successional Reserves

No LSRs occur within the West Bend project area. Therefore implementation of the Action Alternatives will not cause any direct or indirect affect to spotted owl habitat within LSRs.

Critical Habitat Units

Approximately 333 acre of CHU Subunit ECN 9 is associated with West-Bend project area. The portion of the project area associated is occurs within the north east corner of the CHU along the eastern boundary of the range of the spotted owl. The forest type associated with the CHU is second growth ponderosa pine that are approximately 60 to 80 years old. Very limited habitat exists within 333 acres due to stand type and habitat composition. Approximately 28 acres of dispersal habitat exists within the area. Under all action alternatives, the 28 acres of dispersal habitat will be thinned. Although a fully

stocked stand of ponderosa pine will exist post thinning, canopy closure will be reduced and would not maintain a sufficient level to provide dispersal habitat in the short-term. However, treatments will promote the development of late and old structure (LOS) ponderosa pine providing highly suitable and more fire resilient stands of future dispersal habitat. The project area is associated with approximately 1% of the CHU Subunit and the total amount of dispersal habitat treated is far less than 1%. Treatments associated with the CHU are minimal and will not affect its function.

Home Ranges/Activity Centers

One activity center exists within the CHU and occurs approximately .5 miles west and outside the project boundary. No home ranges or activity centers exist within the project area. The project does not propose treatment of any primary constituent habitat elements as previously defined within the activity center.

Alternative 2: Proposed Action -

Direct and Indirect Effects

Dispersal Habitat

As discussed earlier, dispersal habitat may not contain NRF habitat for the spotted owl, but provides avenues for juvenile and non-territorial spotted owls to move across the landscape. This habitat does not provide all the habitat components necessary for occupation and is used for short durations of time.

Under Alternative 2, a strategy was developed to reduce the risk of insects, disease and stand replacing fire to promote the maintenance and development of LOS stands within the West-Bend project area. This alternative proposes to thin and reduce disease across the entire project area, restoring ponderosa pine to historic levels within mixed conifer stands, and reducing stand densities across the project area to greatly reduce the threat of stand replacing fire. A connectivity strategy was developed to provide dispersal opportunities in a north to south continuum throughout out the project area. Suitable NRF and roosting/foraging habitat is limited within the project area, due to the limited amount of mixed conifer habitat. In addition the mixed conifer habitat that does exist contains large amounts of mortality in the white-fir and lodgepole pine due to insect and disease. The connectivity strategy provides dispersal habitat on a stand level basis to connect the small amount of NRF and roosting/foraging habitat to suitable habitat outside the project.

There is approximately 5,587 acres of dispersal habitat within the project area and is not associated with any CHU. Although this alternative proposes to treat dispersal habitat within the mixed conifer wet PAGs, approximately 20% of these stands will be left untreated to provide dispersal habitat. In addition, within mixed conifer dry and ponderosa pine PAGs, 15% of these stands will also be left untreated to retain dispersal habitat to provide movement across the project area. Of the 5,587acres of dispersal habitat within the project area, under Alternative 2 approximately 2,369 acres of dispersal habitat will be treated. Treatments to dispersal habitat will maintain full stocked stands post treatment, however treatment will reduce canopy closure to a level unsuitable for dispersal habitat in the short-term. However treatment will promote LOS habitat in these forest types, promoting a more fire, insect, and disease resilient stands in the long-term creating higher quality dispersal habitat. The project will retain approximately 3,246 acres or 58% of the existing dispersal habitat in a north to south continuum to provide opportunities for spotted owl dispersal.

The FlamMap hazard assessment conducted for Alternative 2 shows a reduction in extreme hazard by 98% of the existing condition hazard to 233 acres. For all hazard classes shown to be damaging to valued stand characteristics- moderate, high and extreme hazard, hazard in these classes was reduced by 7667 acres or by 70% of the existing condition hazard.

Alternative 2 is the most thorough approach to reducing the risk of insects, disease, and stand replacing wildfire but does not provide the greatest amount of habitat diversity.

Alternatives 3 and 4: Direct and Indirect Effects

Dispersal Habitat

The same connectivity strategy developed for Alternative 2 to provide dispersal opportunities in a north to south continuum throughout out the project area was also applied during the development of Alternative 3 and 4. Similarly none of the dispersal habitat associated with treatments occur within any CHU. These alternatives also identified suitable NRF and roosting/foraging habitat as limited within the project area, due to the small amount of mixed conifer habitat. The issue of mixed conifer mortality in the white-fir and lodgepole pine due to insects and disease was also addressed in this alternative. The connectivity strategy for Alternative 3 and 4 objectives continues to provide dispersal habitat on a stand by stand level to connect the small amounts of NRF and foraging habitat to suitable habitat outside the project.

However, Alternative 3 and 4 reflect changes identified from scoping. These alternatives were developed to address the key issues of variability of thinning on the landscape and goshawk habitat management (which also provide habitat for other interior forest species). These alternatives are the most proactive approach to providing a diversity of residual wildlife habitat across the project area through variable density thinning.

To provide variability in thinning densities on the landscape, and promote viable long-term habitat goshawk and other interior forest species, a thinning prescription was developed to provide varying stand densities between 60 and 80 square feet of basal area surrounding 2 inactive goshawk nest cores. The thinning prescriptions were designed in a radiating fashion, where stands closest to the nest core were denser, and the stands associated with the nest core were left untreated. Stands containing spotted owl dispersal habitat were also utilized to diversify stand densities and habitats across the project area. The dispersal stands typically provide the largest trees and were the densest stands, so were at the highest risk of losing LOS habitat. These treatments provided the best opportunities to create better connectivity across the project area in a north to south continuum in the short-term. The objective of the goshawk treatments are to provide variability in stands thinned from below with the objective of reducing the risk of insect, disease, and stand replacing wildfire, while promoting the development of LOS habitat. These treatments will provide contiguous stands of suitable interior forest habitats in the long-term. As a result, in the short-term a better distribution of residual dispersal habitat is retained for the spotted owl and in the long-term these alternatives will potentially provide areas of more fire resistant dispersal habitat, due to reduction in white-fir and lodgepole pine and the development of LOS ponderosa pine to these stands. These alternatives still address reducing the risk of insects, disease, and stand replacing fire, but do a better job of strategically retaining residual habitat across the project area, as well as potentially promoting better long-term dispersal habitat through the thinning s designed to enhance goshawk habitat.

Similar to Alternative 2, within the mixed conifer wet PAGs, Alternative 3and 4 retain approximately 20% of these stands untreated to provide dispersal habitat. Within mixed conifer dry and ponderosa pine PAGs, 15% of these stands will also be left untreated to retain dispersal habitat to provide movement across the project area. In addition, throughout the project area residual stands of dispersal habitat were left where they did not interfere with the hazardous fuels strategy. Of the 5,587 acres of dispersal habitat within the project area, under Alternative 3 and 4 approximately 2,320 acres of dispersal habitat will be treated. Treatments to dispersal habitat will maintain full stocked stands post treatment, however treatment will reduce canopy closure to a level unsuitable for dispersal habitat in the short-term. However treatment will promote LOS habitat in these forest types, promoting a more fire, insect, and disease resilient stands in the long-term creating higher quality dispersal habitat. In addition, Alternative 3 and 4 will leave varying densities between 40 and 80 square feet of basal area across the project area. Although treatment will reduce canopy cover making some stand unsuitable dispersal habitat, due to the spatial arrangement of these stands, those stands maintaining 80 square feet of basal

area could continue to provide dispersal habitat from the maintenance of higher canopy closures and their adjacency to untreated stands. The project will retain approximately 3,295 acres or 59% of the existing dispersal habitat in a north to south continuum to provide opportunities for spotted owl dispersal.

The FlamMap hazard assessment conducted for Alternative 3 shows a reduction in extreme hazard by 98% of the existing condition hazard to 234 acres. For all hazard classes shown to be damaging to valued stand characteristics- moderate, high and extreme hazard, hazard in these classes was reduced by 7645 acres or by 70% of the existing condition hazard. Alternative 4 shows a reduction in extreme hazard by 98% of the existing condition hazard to 234 acres. For all hazard classes shown to be damaging to valued stand characteristics- moderate, high and extreme hazard, hazard in these classes was reduced by 7575 acres or by 69% of the existing condition hazard. Through both alternatives hazard reduction is similar in both Alternative 3 and 4.

Cumulative Effects Common to All Action Alternatives 2-4:

Nesting Roosting and Foraging Habitat outside CHU

Cumulatively none of the action alternatives propose to treat any NRF habitat within the West-Bend project area. Therefore the West-Bend project does not contribute to any negative cumulative effects to the spotted owl or its habitat within the Watershed or across the Deschutes National Forest. NRF habitat across the Forest will not be reduced, and will not reduce connectivity between CHU's as a result of the West-Bend project. However, treatments will be completed to reduce the risk of losing the existing NRF and roosting/foraging habitat in the project area to stand replacing fire. Treatment will be beneficial to the long-term maintenance of existing spotted owl habitat and the connectivity it provides to across the landscape.

Table 68: Total Acres of NRF within the Watershed and changes by Alternative

Watershed NRF Acres	Alternative 2	Alternative 3	Alternative 4
3,249	3,249	3,249	3,249

Table 69: Total Acres of NRF Forest Wide and changes by Alternative

Forest Wide NRF Acres	Alternative 2	Alternative 3	Alternative 4
73,782	73,782	73,782	73,782

Late-Successional Reserves

No LSRs occur within the West Bend project area. Therefore, cumulatively the implementation of the Action Alternatives will not contribute to any negative effects to spotted owl habitat within any LSRs across the Deschutes National Forest.

Critical Habitat Unit ECN 9

NRF

Two ongoing projects occur in the CHU, the EXF and Five Buttes vegetation management project. The Five Buttes vegetation management project occurs on the Crescent Ranger District and EXF occurs on the Bend/Ft. Rock Ranger District. The EXF project does not propose the removal of any NRF habitat within the CHU. Cumulatively, none of the action alternatives associated with the West-Bend project proposes treatments to NRF habitat within the Critical Habitat Unit. Therefore the West-Bend project does not contribute to any negative cumulative effects to NRF habitat associated with CHU's or across the Deschutes National Forest.

The following Table 70 is a summary of cumulative effects to NRF habitat within Critical Habitat Unit ECN 9 across the Deschutes National Forest.

Table 70: Accounting of total acres and current NRF acres in the Critical Habitat Unit ECN 9 removed by the West-Bend project within the Deschutes National Forest.

2013 CHU Subunit	Total Acres	Total NRF Acres in CHU Unit	Total NRF Acres Removed	% of ECN 9
ECN 9	155,405	24,342	0	0

Dispersal

Two ongoing projects occur in the CHU, the EXF and Five Buttes vegetation management project. The Five Buttes vegetation management project occurs on the Crescent Ranger District and EXF occurs on the Bend/Ft. Rock Ranger District. The EXF projects will thin and remove approximately 280 acres of dispersal habitat. Cumulatively, the action alternative will thin and remove approximately 28 acres of dispersal habitat from the CHU. Cumulatively there will be a total of 308 acres of dispersal removed from thinning within CHU ECN 9.

The following Table 71 is a summary of cumulative effects to Dispersal habitat within Critical Habitat ECN 9 within the Deschutes National Forest.

Table 71: Accounting of total acres and current NRF acres in the Critical Habitat Unit ECN 9 within the Deschutes National Forest.

2013 CHU Subunit	Total Acres	Total Dispersal Acres in CHU ECN 9	Total Acres of Dispersal Removed	% of ECN 9
ECN 9	155,405	75,820	308	1%

Physical and Biological Features/ Primary Constituent Elements (PCE)

In general, the proposed treatments are designed to promote and the development of ponderosa pine as a result of thinning from below.

The proposed treatments will promote a forest type that generally does not support spotted owl NRF habitat (i.e. ponderosa pine habitat). In supporting a ponderosa pine habitat type, the treatments are designed in a manner that will reduce multi-storied stands with high canopy closures (e.g. commercial thinning), and reduce ground cover (shrubs and downed log densities) through mowing and underburning.

In regards to specific PCEs, the project area will retain the largest trees (although ponderosa pine is generally favored over white fir and lodgepole pine), and snags will be retained where not a safety hazard. Mowing and underburning are proposed for all of the active treatment units, thus some downed woody debris will be lost.

Only 333 acres of the West-Bend project area is associated with ECN 9 and proposes to thin 28 acres of second growth ponderosa pine, which provides dispersal habitat, along the eastern edge of the CHU. The associated treatment are so small in scope and scale, and is associate with 1% of the entire CHU, The reduction of the 28 acres of dispersal habitat from thinning will not affect the function of the CHU.

Home Range/Activity Center

Cumulatively, none of the action alternatives propose treatments to any PCEs associated with any spotted owl home range or activity center. Therefore the West-Bend project does not contribute to any negative cumulative effects to any spotted owl home range or activity center across the Deschutes National Forest.

Dispersal Habitat Outside of CHU

Cumulatively, Alternative 2 proposes to treat greatest amount of dispersal habitat within the watershed reducing dispersal habitat by approximately 2,369 acres while Alternative 3 and 4 propose to reduce approximately 2,320 acres of habitat. Each alternative provides a strategy for dispersal habitat to move dispersing owl through the project area in a north to south continuum. The dispersal strategy maintains adequate connectivity for dispersing birds linking the project to suitable habitat north and south of the project area. Overall, there will be a 9% reduction in dispersal habitat as a result of Alternative 2, 3, and 4. The reduction is insignificant compared to the benefits of fuels reduction protecting the existing NRF habitat within the project area.

Table 72: Total Acres of Dispersal Habitat within the watershed and changes by Alternative

Watershed Dispersal Acres	Alternative 2	Alternative 3	Alternative 4
23,240	20,871	20,920	20,920

Cumulatively, the Sparky vegetation management project is the only project in the watershed that is ongoing with proposed treatments to dispersal habitat. The Sparky project is approximately 172 acres.

Determination

The Action Alternatives do not propose treatment to NRF habitat, NRF habitat within LSRs, or NRF within home ranges. All action alternatives maintain connectivity throughout the project area providing connections to viable NRF habitat. In addition, in the short-term all action alternatives propose to reduce the risk of insects, disease, and stand replacing fire. However, alternative 3 and 4 are the most responsive in moving mixed conifer stands towards HRV and provides the greatest opportunities in maintaining and developing future dispersal habitat. Treatments proposed under Alternative 2 proposes the greatest reduction in the threat of stand replacing fire, but does not maintain or improve habitat variability throughout the project area. Implementation of Alternatives 2, 3, and 4 "May Effect, but are not likely to Adversely Affect" the spotted owl and their habitat.

Critical Habitat Units

The project area is associated with approximately 333 acres of Critical Habitat Subunit ECN 9. Approximately 28 acres of dispersal habitat will be removed through thinning. Treatments will occur along the northeastern boundary of the CHU and are associated with ponderosa pine forest type. Treatments will occur in young second growth stands, and although dispersal habitat will be removed through thinning, treatment will promote the long-term development of more fire resilient stands and future dispersal habitat containing LOS stands. The West-Bend project will affect far less than 1% of the total dispersal habitat within ECN 9 and there will not affect the function of the CHU. Implementation of Alternatives 2, 3, and 4 "May Effect, but are not likely to Adversely Affect" Critical Habitat Subunit ECN 9.

Communication with U.S. Fish and Wildlife Service

A Level 1 field review of the project area to discuss treatment and habitat connectivity strategies were conducted during the field season FY2011, where concurrence was reached on proposed treatments. A level 1 meeting occurred to discuss 2013 Critical Habitat and informal consultation, A Biological

Assessment was submitted for concurrence. No further communication with U.S. Fish and Wildlife Service is recommended.

Mitigation Measures

If a new nest site is discovered within the project area, a seasonal restriction from March 1 to September 30 within ¼ mile of an active nest site will be implemented.

Consistency

Implementation of the West Bend project is consistent with the Deschutes Land and Resource Management Plan as amended by the Northwest Forest Plan 1994, the Deschutes National Forest Late-Successional Reserve Assessment, and 2013 Critical Habitat Rule. It is also consistent with recovery actions listed in the Final Recovery Plan for the spotted owl.

Gray Wolf, Federal Endangered, Sensitive – Affected Environment

The gray wolf occurs in a wide variety of habitats. They prefer forested habitats with some open areas such as river valleys and meadows for hunting prey including pronghorn, deer and elk, and smaller mammals. Wolf packs (usually 5-10 animals) can have very large territories up to 400 square miles or larger. Key wolf habitat components identified in the 1987 Wolf Recovery Plan (USDI FWS 1987) are: 1) a sufficient, year-round prey base of ungulates and alternative prey, 2) suitable and somewhat secluded denning and rendezvous sites, and 3) sufficient space with minimal exposure to humans. Den sites are excavated areas in the soil but wolves will also use hollow logs, beaver lodges, the base of hollow trees, pit excavations, and rock caves, usually near water. Rendezvous sites are the activity sites used by wolves after the denning period and prior to the nomadic hunting period of fall and winter. They are often in open grassy areas near water or at forest edges.

In Oregon, the gray wolf is listed as Federally Endangered in areas west of Highways 395, 78 and 95 which includes the Deschutes. A single male gray wolf was documented dispersing through the Deschutes National Forest in 2011; it subsequently traveled south into California. Wolves could potentially use the West-Bend project area for dispersal and hunting. The project area does not likely contain habitat requirements for denning or rendezvous sites, and no packs and reproduction is known to occur.

Grey Wolf - Environmental Consequences

Alternative 1 - No Action

There are no direct or indirect impacts associated with the No Action Alternative. Under the No Action Alternative, no treatments will be prescribed within West-Bend project area (25,696 acres). However, the "ecological trend" in the short-term is that these stands would continue to remain suppressed and at risk of a stand-replacing wildfire. Development of future old growth within ponderosa pine and mixed conifer stands would be prolonged and the old trees within the stands would continue to be stressed, decreasing their longevity. However, stands would continue to provide habitat for ungulate populations that provide the main prey base for the gray wolf. In the long-term, if a stand replacing wildfire or insect outbreak hasn't occurred, the stands containing disease would continue to die and the multi-storied structure would diminish along with any remnant old growth trees, providing a very discontinuous overstory and lacking suitable cover and forage across the project area for ungulates.

Action Alternatives Direct and Indirect Effects

Common to All Action Alternatives 2-4

All action alternatives provide some level of thinning, mowing and burning in the West-Bend project area. Thinning will open up stands reducing crown closure, promoting the development of herbaceous

plants in these areas. Thinning treatments have the potential to provide a future forage base to prey species of the wolf, such as snowshoe hare, deer, and elk. The following Table displays the total acres of thinning from below and fuels treatments that will enhance habitat for grey wolf prey by alternative.

Table 73: Acres of thinning and fuels treatments by alternative

Alt. 2	Alt. 3	Alt. 4
18,790	18,550	18,550

Determination

All action alternatives have the potential to enhance habitat for gray wolf. There are no negative effects associated with the alternatives. Implementation of Alternatives 2, 3, and 4 will have **"No Effect"** to the gray wolf and their habitat.

Communication with U.S. Fish and Wildlife Service

No consultation with the U.S. Fish and Wildlife Service is required for the Deschutes until it has been confirmed that wolves are reproducing on the Deschutes or that a pack has been established. No further communication with U.S. Fish and Wildlife Service is recommended.

Consistency

Implementation of the West-Bend project is consistent with the Deschutes Land and Resource Management Plan as amended by the Northwest Forest Plan 1994, the Deschutes National Forest Late-Successional Reserve Assessment.

3.5.5 Regional Forester's Sensitive Species

Species classified as sensitive by the Forest Service are to be considered by conducting biological evaluations (BE) to determine potential effects of all programs and activities on these species (FSM 2670.32). The BE is a documented review of Forest Service activities in sufficient detail to determine how a proposed action may impact sensitive wildlife species, and to comply with the requirements of the Endangered Species Act.

The Forest Service Region 6 Sensitive Species List (USDA 2011) was reviewed for species that may be present on the Deschutes National Forest. After a review of records, habitat requirements, and existing habitat components, it was determined the following sensitive animal species have habitat or are known to occur in the project area and will be included in this analysis Table 74. Those species shown not to occur or have habitat in the project area will not be addressed any further in this document:

Table 74: Sensitive Species Summary for the Deschutes National Forests and the West-Bend Project area. **Species in bold are analyzed further.**

Species	Status	Habitat	Presence on the Deschutes NF	Presence and/or habitat occurs in the West-Bend project area
Northern Bald Eagle	Regional Forester Sensitive, Management Indicator Species (MIS)	Lakeside with Large Trees	Documented	No
Bufflehead (*Bucephala albeola*)	Regional Forester Sensitive	Lakes, Snags	Documented	No
Harlequin Duck (*Histrionicus histrionicus*)	Regional Forester Sensitive, MIS	Rapid Streams, Large Trees	Documented	No
Tricolored Blackbird (*Agelaius tricolor*)	Regional Forester Sensitive	Lakeside, Bullrush	Documented	No
Yellow Rail (*Coturnicops noveboracensis*)	Regional Forester Sensitive	Marsh	Documented	No
Greater (Western) Sage Grouse (*Centrocercus urophasianus phaeios*)	Federal Candidate, Regional Forester Sensitive	Sagebrush Flats	Documented	No
American Peregrine Falcon (*Falco peregrinus anatum*)	Regional Forester Sensitive, MIS	Riparian, Cliffs	Documented	No
Lewis' Woodpecker (*Melanerpes lewis*)	**Regional Forester Sensitive, MIS**	**Open snag habitat or burned forests**	**Documented**	**Yes**
White-headed Woodpecker (*Picoides albolarvatus*)	**Regional Forester Sensitive, MIS**	**Large, open ponderosa pine**	**Documented**	**Yes**
Northern Waterthrush (*Seiurus noveboracensis*)	Regional Forester Sensitive	Wooded swamps, bogs, and rivers bordered by willow and alder	Documented	No
Horned Grebe (*Podiceps auritus*)	**Regional Forester Sensitive, MIS**	**Lakes**	**Suspected**	**Yes**
Tule White-fronted Goose (*Anser albifrons elgasi*)	Regional Forester Sensitive, MIS	Large rivers, marsh/lake side habitat with emergent vegetation	Documented	No
Pacific Fisher (*Martes pennanti*)	**Federal Candidate, Regional Forester Sensitive**	**Mixed, Complex**	**Documented**	**Yes**
California Wolverine	Federal Candidate, Regional Forester	Montane mixed conifer, High	Suspected	No

Species	Status	Habitat	Presence on the Deschutes NF	Presence and/or habitat occurs in the West-Bend project area
(*Gulo gulo*)	Sensitive, MIS	Elevation		
Townsend's Big-eared Bat (*Corynorhinus townsendii*)	Regional Forester Sensitive, MIS	Caves	Documented	No
Pallid Bat (*Antrozous pallidus*)	Regional Forester Sensitive	Canyons, cliffs, caves, and buildings	Suspected	No
Spotted Bat (*Euderma maculatum*)	Regional Forester Sensitive	Canyons, cliffs, caves, and buildings	Suspected	No
Fringed Myotis (*Myotis thysanodes*)	**Regional Forester Sensitive**	**Canyons, cliffs, caves, buildings, and large snags**	**Documented**	**Yes**
Oregon Spotted Frog (*Rana pretiosa*)	Federal Candidate, Regional Forester Sensitive	Shallow lakes, and ponds	Documented	No
Columbia Spotted Frog (*Rana luteiventris*)	Regional Forester Sensitive	Shallow lakes, and ponds	Documented	No
Crater Lake Tightcoil (*Pristiloma arcticum crateris*)	**Regional Forester Sensitive**	**Riparian, perennial wet areas**	**Documented**	**Yes**
Evening Field Slug (*Deroceras hesperium*)	**Regional Forester Sensitive**	**Perennial wet meadows**	**Suspected**	**Yes**
Silver-bordered Fritillary (*Boloria selene atrocostalis*)	Regional Forester Sensitive	Open riparian bogs and marshes	Suspected	No
Johnson's Hairstreak (*Mitoura johnsoni*) (*Callophrys johnsoni*)	**Regional Forester Sensitive**	**Coniferous forests with mistletoe**	**Documented**	**Yes**
Western Bumblebee (*Bombus occidentalis*)	Regional Forester Sensitive	Forest edges, gardens, near houses and urban areas	Documented	Potentially

Species Not Analyzed Further

Implementation of any of the alternatives would have **no impact** on the following species because habitat does not occur within the project area: bald eagle, buffleheads, harlequin ducks, tri-colored blackbird, yellow rail, northern waterthrush, horned grebes, western sage grouse, American peregrine falcon, tule white-fronted geese, wolverine, Townsend's big-eared bat, pallid bats, spotted bats, fringed

myotis, Oregon and Columbia spotted frogs, silver-bordered fritillary, and western bumblebee. For more specific discussion regarding habitat for these species refer to the Wildlife Biological Evaluation.

Lewis' Woodpecker – Existing Condition

Formerly widespread, this species is common year-round only in the white oak ponderosa pine belt east of Mt. Hood. Habitat for the Lewis' woodpecker, a migrant in this part of its range, includes old-forest, single-storied ponderosa pine. Burned ponderosa pine forests created by stand-replacing fires provide highly productive habitats as compared to unburned pine (Wisdom et al. 2000). Lewis' woodpeckers feed on flying insects and are not strong cavity excavators. They require large snags in an advanced state of decay that are easy to excavate, or they use old cavities created by other woodpeckers. Nest trees generally average 17 to 44 inches (Saab and Dudley 1998, Wisdom et al. 2000). Known breeding has been documented in low numbers along Why-chus Creek (Marshall et al. 2003) and in recent burned areas across the Deschutes.

In evaluating landscape predictor variables for the Lewis's woodpecker, Saab et al. (2002) found a negative relation to burned ponderosa pine/Douglas-fir stands with high crown closure (>70%) but was positively associated with low snag densities overall. However, although it selects for more open stands, this species selected nest sites with higher densities of large snags (≥20"dbh) (Saab and Dudley 1998). Lewis' woodpeckers are different than other woodpeckers. They are aerial insectivores during the breeding season and use lower densities of smaller snags but rely more heavily on large snags (Saab and Dudley 1998). Habitat for Lewis' woodpecker will increase 5-10 years after in fire areas as smaller snags fall.

The Lewis' woodpecker is declining throughout its range. Threats to this species include the loss of suitable habitat, competition for nest trees, and effects of pesticides on insects.

Habitat for the Lewis' woodpecker occurs sparingly throughout the Deschutes National Forests in the following plant associations – lodgepole pine, ponderosa pine, Douglas-fir, and white fir in open stands where average tree size is 15"dbh or greater. Approximately 3,535 acres of habitat currently exist within the West-Bend project area. Cumulatively 4,626 acres exist within the watershed and 85,015 acres across the Deschutes National Forest. The following Table 75 summarizes these acreages.

No known nest sites or sighting are present within the project area.

Table 75: Lewis Woodpecker habitat within the West-Bend project area, Watershed, and across the Deschutes National Forest.

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
3,535 acres	4,626 acres	85,015 acres

Lewis' Woodpecker – Environmental Consequences

Alternative 1 (No Action) Continued Ecological Trend

Potential fire hazard for the existing condition/no action of the West Bend Planning area has been predicted by using a number of state of the art tools. Remote sensing satellite imagery from 2004 was updated using ArcFuels (Ager et al. 2011) to reflect activities accomplished since 2004. The data was then analyzed in the computer model FlamMap (v. 3.0) under specific weather conditions. FlamMap, a fire behavior mapping and analysis program that computes fire behavior characteristics (rates of spread, flame length, crown fire potential, etc.) over an entire landscape, was used to determine the existing stand condition's potential fire hazard. FlamMap is a state of the art tool used by many researchers and

modelers (Finney 2006; Stratton 2004; Ager, Finney & McMahon 2006; Gercke & Stewart 2006; Opperman et al. 2006; Ager et al. 2006; Yohay et al. 2009; Krasnow et al. 2009; Arca et al. 2007; Stratton 2006; Knight & Coleman 1993). FlamMap output lends itself well to landscape comparisons (e.g. pre- and post-treatment effectiveness) and for identifying hazardous fuel and topographic combinations, thus aiding in prioritization and assessments (Stratton, 2004). Although the (modeling) approach has limitations, model outputs yield useful information for planning, assessing, and prioritizing fuel treatments (Stratton 2004). The data inputs necessary for FlamMap include aspect, slope, elevation, fuel model, canopy height, canopy base height, crown bulk density, and crown class. Specific wind and fuel conditions used for running the model may be referenced in the fuels section of the EIS.

Due to stand densities within the project area and increases in mortality overtime, the risk of large scale stand replacing fire across the West-Bend project area also increases over time, potentially impacting high density stands. In the short-term, an event like this could provide some nesting and foraging habitat but the majority of the areas would not. Since these stands are predominantly 60-80 year old second growth ponderosa pine, snags recruited from the fire would be small with an average diameter of 14 inches. Since the majority of burned trees would be small diameter most of the fire killed trees would fall in the first 10 years and the many areas would be void of nesting habitat nesting habitat in the long-term. If nesting habitat existed it would be limited on the landscape.

No Action Alternative approximately 9,317 acres or 36% of the project area is predicted to be at extreme hazard. An additional 1,593 acres or 6% of the project area is predicted to be at moderate to high hazard. Fire effects analysis and best available science supports that moderate to high hazard potential would be damaging to valued stand characteristics; extreme hazard with high flame lengths and varying degrees of crown fire would be most damaging.

Overall, high stand densities will result in a decrease in tree vigor among all size classes. The most significant effect of high stand densities will be the gradual loss of the existing historic large-tree component/nesting habitat which is likely to occur at a much higher rate than if stand densities were reduced to more healthy levels.

Areas that currently provide suitable Lewis habitat will persist in the short-term, since this species prefers open ponderosa pine stands or post fire environments. Without the treatments prescribed to thin from below within multi-storied ponderosa pine and mixed conifer stand, stand densities will reduce the longevity of residual old growth and large trees structure that occurs in these stands. In the long-term, available nest trees will be limited and the future development of larger nesting trees will be prolonged. In high density stands of second growth ponderosa pine containing mistletoe, in the short-term the mistletoe will reduce the resiliency of these stands against bark beetle attack. In the long-term, the second growth stands will likely contain bark beetle outbreaks and high densities of small snags will occur within the project area, and lack the recruitment of large tree structure over time, limiting suitable nesting habitat.

Action Alternatives - Direct and Indirect Impacts

Effect Common to Alternatives 2, 3, and 4

Thinning From Below (HTH), Skid and Deck

Under this proposed treatment type, all three action alternatives prescribe thinning from below to Lewis' woodpecker habitat. The habitat exists as second growth ponderosa pine stands in an advanced stage of development where the majority of trees are reaching maturity or are over-mature. In addition, treatments will thin regeneration harvest units that contain individual large old-growth ponderosa pine left as seed trees that occur at very low densities. These treatments will thin these stand reducing stand densities, minimizing the risk of mountain pine beetle outbreaks, and stand replacing fire. This treatment aids in the maintenance of large trees by reducing their susceptibility to fire and insects while

reducing competition for space and nutrients. Thinning decreases stand densities and allows for faster growth of residual trees while reducing risk of stand replacing fire (removal of ladder fuels). Due to density reduction in the understory, stands will be more open accelerating the development of LOS ponderosa pine and the recruitment of large snags over the next 30+ years.

Prescribed Fire (Burn)

Primary and secondary treatments include mowing and burning. Mowing is designed to reduce shrub densities that contribute to ladder fuels and breakdown residual thinning slash. Similarly, burning is also designed to reduce shrub densities and thinning slash that contributes to ladder fuels, but as a result of the burning there is the risk of losing existing large snags that provide nesting habitat. In addition, through burning operations additional snags could potentially be recruited to provide nesting habitat in the short-term. Primary treatments that only identify burning will not receive any thinning, but within the HTH and Skid and Deck units, the secondary treatments will implement mowing and/or burning. There is no difference in effect to habitat as a result of either treatment both treatments have the potentially to recruit snags from burning operations providing habitat in the short-term for Lewis' woodpecker.

See the DecAid snag and down wood analysis in the following section and in Appendix F for a summary of the dead wood habitat assessment.

Table 76: Total Acres of Lewis' Woodpecker Habitat Associated with Each Treatment Type by Alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	2,060	2,066	1,708
Skid & Deck	787	787	665
Burn	286	1073	690
Total Acres Affected	**3,133**	**3,927**	**3,064**

Affects to Lewis' woodpecker habitat are similar under Alternative 2, 3 and 4. The outcome or long-term benefits to habitat as a result of the effects of each treatment type is also similar across all action alternatives. Under Alternatives 3 and 4, treatments were developed to address the Key Issue of promoting diversity and variability of thinning on the landscape; however Alternative 4 also addresses the Key Issue of treating thermal cover for both deer and elk. Alternative 4 reduces the overall acres of thinning to ponderosa pine stands, but increases the acres of burning to address the need for fuels treatments in the ponderosa pine community. Overall the total acres treated under Alternative 4 has been reduced, leaving stocking levels high than those in Alternative 3 and 4. Although thinning and prescribed fire will occur with Lewis woodpecker habitat it is greatly reduced under Alternative 4, therefore leaving stand more highly susceptible to beetle attacks, disease, and stand replacing fire. It will also prolong the development of LOS stands that provide the large tree structure needed by the Lewis' woodpecker. These changes are reflected in Table 76.

In the short-term, Alternative 4 affects the fewest acres of habitat of the three alternatives. However, in the long-term Alternative 4 treatments do not promote the development of fire resistant ponderosa pine stands leaving the stand over stacked and at risk of crown fire. The longevity of existing habitat will diminish in the short-term, and as a result will produce stands that continue to remain susceptible to disease, insect infestation, and wildfire. Although Alternatives 2 and 3 do the best to address the risk of insect disease, and stand replacing fire, Alternative 3 does the best to promote burning and mowing to maintain existing open ponderosa pine stands that do not need thinned. Alternative 3 will promote Lewis' woodpecker habitat by using prescribed fire to create individual fire killed trees which these woodpeckers prefer for nesting, while maintaining habitat continuity across the project area, and

promoting the development of future fire resistant stands of LOS ponderosa pine containing nesting habitat. Treatments prescribed under Alternative 3 will promote heterogeneity in these stands, retaining the largest trees in the stands providing a mosaic of tree densities. Residual trees will contain a variety of size classes providing residual foraging habitat as well as maintaining late and old structure to provide nesting habitat where it exists. Although Alternative 4 will not focus on ponderosa pine development to maintain and develop more fire resilient stands in the future. Alternative 4 will not effectively treat stand leaving stand in a suppressed state prolonging the development of future LOS habitat and minimizing the amount of suitable Lewis Woodpecker habitat on landscape.

Overall, approximately 3,133 acres of Lewis' woodpecker reproductive habitat are associated with treatments identified under Alternative 2, approximately 3,927 acres under Alternative 3, and approximately 3,064 under Alternative 4. Treatments will not target the removal of large trees or snags and therefore will not impact habitat in the short-term, Burning associated with treatments could potentially recruitment some large snags providing nesting habitat in the short-term. The goal of the project is to promote and enhance LOS ponderosa pine habitat within stands identified as Lewis' woodpecker habitat. Approximately 15% of the project area is associated with Lewis' woodpecker habitat treatments.

Cumulative Effects

The following direct and indirect effects contribute to cumulative effects. These treatments will not intentionally remove any currently suitable nesting habitat, and residual foraging habitat will be enhance as a result of thinning associated with ponderosa pine stands. Although Alternative 2, 3, and 4 all propose treatments within currently suitable Lewis' woodpecker reproductive habitat, no alternative proposes the removal of snags that could potentially provide nesting habitat. However, due to the prescribe fire associated with these treatments; there is the chance that existing trees could be lost during burn operations. In addition, under all action alternatives, snag recruitment from prescribed burn operations is also likely in the short-term. In the long-term, all action alternatives will enhance nesting and foraging habitat in these stands as well as promote the development of long-term LOS habitat promoting the long-term sustainability of future habitat on the landscape.

Within the watershed, the direct and indirect effects associated with the West-Bend project, combined with the following ongoing and reasonably foreseeable vegetation management projects in Table 77 contribute to cumulative effects for Lewis' woodpecker and its habitat.

Table 77: Ongoing and Future Foreseeable Projects Contributing to Cumulative Effects

Project	Status	Acres
Fry timber sale and fuels treatment	Ongoing/Planned	106 acres surrounded by project on north end. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest and understory treatments completed, Fuels treatments remaining.
Jet Timber Sale part of West Tumbull project	Ongoing/Planned	Within the watershed 584 acres in Skyliners road upper community. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest continuing Understory treatments and fuels treatments remaining.
East Tumbull HFRA Project (Net T.S., Set T.S., NT7)	Ongoing/Planned	Within project east 1/3 of West Bend Project. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest finished, understory treatments for fuels remaining.
Feline timber sale	Ongoing	147 acres within project area. Tee harvest and understory treatments finished. Fuels treatments remaining.

Mortality of snags in ponderosa pine habitat during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags < 15 cm dbh and showed evidence of woodpecker foraging use in southeastern Arizona. Several studies showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988; Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for snags, presumably because the trees that did not burn during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988; Bagne et al. 2008). Prescribed burning associated with the project as well as ongoing and reasonably foreseeable project could reduce snag within the watershed, however due to the majority of habitat existing as 60 to 80 year old black bark ponderosa pine stand, very few snags exist within the habitat. Therefore, treatment could be beneficial by recruiting snag habitat for the Lewis' woodpecker.

There is 4,626 acres of Lewis' woodpecker reproductive habitat within the watershed. Considered as a whole, the list of ongoing and foreseeable projects associated with Table 77 and the treatments associated with the West-Bend project, will treat approximately 4,211 acres of the total reproductive habitat in the watershed, or 91% of the total. There is approximately 85,015 acres of reproductive habitat across the Deschutes National Forest. Cumulatively these projects are associated with approximately 5% of the Lewis' woodpecker habitat across the Deschutes National Forest.

Determination

Implementation of the West-Bend project will not intentionally remove snags that could provide nest trees. Treatment will result in a long-term benefit to suitable habitat on the Deschutes National Forests for the Lewis' woodpecker because treatments will not remove existing large snags and trees and will promote the future development of LOS ponderosa pine that provides high quality habitat There is the potentially to indirectly impact nesting habitat from prescribe burning operation, therefore Alternatives 2, 3, and 4 **"May Impact"** the Lewis' woodpecker and its habitat on the Deschutes National Forests.

White-headed Woodpecker, Region 6 Sensitive and MIS – Existing Condition

White-headed woodpeckers are uncommon permanent residents in forests east of the Cascades. They use habitat with large open ponderosa pine, low shrub levels and large snags. Dixon (1995) found white-headed woodpecker densities increased with increasing old-growth ponderosa pine trees and showed a positive association with large ponderosa pine. The white-headed woodpecker is a primary cavity excavator of soft snags. This woodpecker is the only woodpecker species to rely heavily on seeds of ponderosa pine for food (Marshall et al. 2003 p. 364).

A long term study on the white-headed woodpecker occurred on the Deschutes and Winema National Forests from 1997-2004 with several Deschutes study sites occurring in the Metolius Basin area. Frenzel (2000) calculated the mean diameter for white-headed woodpecker nest trees to be 26.2"dbh while Dixon (1995) found similar results (mean diameter of 25.6"dbh). Frenzel (2003) found nests at sites with a high density of large diameter trees had a higher survival rate than nests in recently harvested sites. Unharvested sites or sites with greater than 12 trees per acre >21"dbh had a success rate of 63.1% while nests at previously harvested sites or lower densities of large trees had a success rate of 39.8%. Therefore, white-headed woodpeckers were positively associated with higher densities of large trees. On the Winema National Forest, white-headed woodpeckers were found to be using small-diameter trees, logs in a slash pile and upturned roots (6-13"dbh) where large snags were uncommon (Frenzel 2002).

White-headed woodpeckers roost in ponderosa pine habitats with an average canopy closure of 57.4 ± 1.9% canopy closure (Dixon 1995). In addition, most (65%) roost sites were located on flat ground and found on the lower one-third of the slope or bottom slope (89%) with slopes ranging from 0-40% and an average of 7 ± 1% (Dixon 1995). Roost site elevations ranged from 2900-4311 feet with an average elevation of 3382 ± 39 feet (Dixon 1995).

Snags and live trees used for roosts were greater than snags and live trees found within plots (Dixon 1995). Roost trees diameters averaged 24 ± 1" dbh and ranged from 7 to 45" dbh while heights ranged from 6 to 164 feet and averaged 66 ± 3 feet tall (Dixon 1995). Tree diameter at cavity height ranged from 2 to 30" in diameter and averaged 17 ± 2" dbh while cavity heights averaged 8.6 ± 1 feet tall and ranged from 5.5 to 20 feet (Dixon 1995).

Dixon (1995) found white-headed woodpeckers did not use the same kind of tree for nesting as they did for roosting. Nest trees were typically dead, had broken tops, were shorter in height, contained more cavities, and had a higher percentage of bark present than roost trees. She also found they used different decay stages for nesting than roosting. See Table 78 for a comparison of decay classes used for nesting and roosting found by Dixon (1995).

Table 78: Nest and Roost Tree Decay Class Comparison (Dixon 1995)

Decay Class	Nest Tree Percentage	Roost Tree Percentage
Decay Class 1 (Recently Dead)	25%	11%
Decay Classes 2-3 (Moderately Decayed)	51%	34%
Decay Classes 4-5 (Advanced Decay)	25%	55%

Foraging habitat is usually found in association with nesting habitat. Kozma (2011) surmised because white-headed woodpeckers are primarily bark gleaners and feed on ponderosa pine seeds throughout the winter, large diameter and old-growth ponderosa pine may be more important to white-headed woodpeckers because these trees have a greater bark foraging area, higher insect abundance, and greater and more frequent cone production than smaller trees.

Dixon (1995) found 42% of over 2,000 foraging observations were on branches, 23% on the upper trunk, 22% on the mid-trunk, and 13% on the lower trunk with an average foraging height of 62 feet on large diameter live ponderosa pine trees. Dixon (1995) also showed that white-headed woodpeckers gleaned 35%, fed on cones 31%, pecked 24%, and fed on sap 7% with males foraging slightly higher in trees and feeding on cones more than females.

White-headed woodpeckers do feed on tree sap (Dixon 1995; Kozma 2010) as well as insects and seeds. White-headed woodpeckers are weak excavators and this may explain the use of smaller trees for sap feeding. It may be easier for them to drill wells in thinner bark of smaller ponderosa pine compared to thicker, furrowed bark of larger pine (Kozma 2011).

Table 79: Comparison of Sap and Non-used Trees (Kozma 2010)

Trees	Mean Height (feet)	Height Range (feet)	Mean Diameter (dbh inches)	Diameter Range (dbh inches)
Sap Trees	44	44.6 – 72.5	8.8	2.4 – 14.6
Non-used Trees	54	9.1 – 96.4	12.2	2.0 – 23.3

Threats to this species include increased stand densities in ponderosa pine due to fire suppression, loss of large, old ponderosa pine trees and snags, wildfire, and increased shrub densities. Increased shrub

densities may be factors leading to increased mammalian nest predation and increased risk of avian predation on adults (Frenzel 2000).

Habitat for the white-headed woodpecker occurs sparingly throughout the Deschutes National Forest in the following plant associations –ponderosa pine, Douglas-fir, white fir, and Shasta red fir in open stands where average tree size is 20"dbh or greater. Approximately 8,815 acres of habitat currently exists within the West-Bend project area. Cumulatively approximately 18,319 acres of habitat occurs within the watershed and approximately 198,330 acres of habitat across the Deschutes National Forest.

White-headed woodpecker nest monitoring occurred from 2003 to 2011 with similar treatment types associated with the Metolius Basin project (DNF 2011). The monitoring found that resident birds were not displaced by short-term impacts associated with the implementation of treatments resulting in nests that were successful. In addition, due to density reductions, nests were more successful due to the increase in suitable habitat.

Table 80: White-headed woodpecker reproductive habitat within the West-Bend project area, Watershed, and across the Deschutes National Forest.

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
8,815 acres	18,319 acres	198,330 acres

White-headed Woodpecker – Environmental Consequences

Alternative 1 (No Action) Continued Ecological Trend

Potential fire hazard for the existing condition/no action of the West Bend Planning area has been predicted by using a number of state of the art tools. Remote sensing satellite imagery from 2004 was updated using ArcFuels (Ager et al. 2011) to reflect activities accomplished since 2004. The data was then analyzed in the computer model FlamMap (v. 3.0) under specific weather conditions. FlamMap, a fire behavior mapping and analysis program that computes fire behavior characteristics (rates of spread, flame length, crown fire potential, etc.) over an entire landscape, was used to determine the existing stand condition's potential fire hazard. FlamMap is a state of the art tool used by many researchers and modelers (Finney 2006; Stratton 2004; Ager, Finney & McMahon 2006; Gercke & Stewart 2006; Opperman et al. 2006; Ager et al. 2006; Yohay et al. 2009; Krasnow et al. 2009; Arca et al. 2007; Stratton 2006; Knight & Coleman 1993). FlamMap output lends itself well to landscape comparisons (e.g. pre- and post-treatment effectiveness) and for identifying hazardous fuel and topographic combinations, thus aiding in prioritization and assessments (Stratton 2004). Although the (modeling) approach has limitations, model outputs yield useful information for planning, assessing, and prioritizing fuel treatments (Stratton 2004). The data inputs necessary for FlamMap include aspect, slope, elevation, fuel model, canopy height, canopy base height, crown bulk density, and crown class. Specific wind and fuel conditions used for running the model may be referenced in the fuels section of the EIS. Under the No Action Alternative approximately 9,317 acres or 36% of the project area is predicted to be at extreme hazard. An additional 1593 acres or 6% of the project area is predicted to be at moderate to high hazard. Fire effects analysis and best available science supports that moderate to high hazard potential would be damaging to valued stand characteristics; extreme hazard with high flame lengths and varying degrees of crown fire would be most damaging.

Due to stand densities within the project area and increases in mortality overtime, the risk of large scale stand replacing fire across the West-Bend project area also increases over time, potentially impacting high density stands. In the short-term, an event like this could provide some nesting and foraging habitat but the majority of the areas would not. Since these stands are predominantly 60-80 year old second growth ponderosa pine, snags recruited from the fire would be small with an average diameter of

14 inches. Since the majority of burned trees would be small diameter most of the fire killed trees would fall in the first 10 years and the many areas would be void of nesting habitat nesting habitat in the long-term. If nesting habitat existed it would be limited on the landscape.

Overall, high stand densities will result in a decrease in tree vigor among all size classes. The most significant effect of high stand densities will be the gradual loss of the existing historic large-tree component/nesting habitat which is likely to occur at a much higher rate than if stand densities were reduced to more healthy levels

Areas that currently provide suitable white-headed woodpecker habitat will persist in the short-term, since this species prefers open ponderosa pine stands. Without treatments prescribed to thin from below within multi-storied ponderosa pine and mixed conifer stands, stand densities will reduce the longevity of residual old growth and large tree structure that occurs in these stands. In the long-term, available nest trees will be limited and the future development of larger nesting trees will be prolonged. In high density stands of second growth ponderosa pine containing mistletoe, in the short-term the mistletoe will reduce the resiliency of these stands against bark beetle attack. In the long-term, the second growth stands will likely contain bark beetle outbreaks and high densities of small snags. Therefore there will be a lack of recruitment of large tree structure over time, limiting suitable nesting habitat.

Action Alternatives - Direct and Indirect Impacts

Effects Common to Alternatives 2 (Proposed Action), Alternative 3, and Alternative 4

Thinning From Below (HTH), Skid and Deck

Thinning in suitable reproductive habitat would occur in both second growth ponderosa pine, multi-storied ponderosa pine and mixed conifer dry stands. Thinning (from 9" dbh and up) from below will favor the largest ponderosa pine in pure pine stands. In mixed conifer stands thinning will favor ponderosa pine and healthy white-fir. A basal area of 40 – 80 square feet will remain in each stand. Treatment aids in maintaining large trees by reducing their susceptibility to fire and insects by reducing competition for space and nutrients. Thinning decreases stand densities and allows for faster growth of residual trees while reducing risk of stand replacing fire (removal of ladder fuels). Due to density reduction in the understory, stands will be more open accelerating the development of LOS ponderosa pine and recruiting large snags that the white-headed woodpecker specifically select for nest sites.

Within mixed conifer stands, thinning will favor ponderosa pine focusing removal on smaller diameter white-fir and lodgepole pine. Favoring ponderosa pine will promote a more fire resilient stands in the future, as well as reduce the risk of insects and disease that are common to white-fir and lodgepole pine by reducing the abundance of these species in the stands. Although the treatments promote ponderosa pine, residual green white-fir and lodgepole pin will exist in these stand, they are both short-live species and quickly recruited as snags and nesting habitat in the short-term. In addition, treatments will promote better future nesting and foraging in these stands. Overall residual trees will retain a variety of seral classes providing foraging habitat as well as maintaining late and old structure to provide nesting habitat. Treatments prescribed will promote heterogeneity in these stands, retaining the largest trees and providing mosaic of tree densities.

Prescribed Fire (Burn)

Secondary fuels treatments include mowing and burning to reduce shrub densities and residual thinning in the understory. While mowing will reduce shrub densities in these stands it will also potentially reduce rodent populations, promoting the likelihood of nest success. Similarly burning will also reduce rodent habitat, but will also recruit snags in the short-term providing nesting habitat. Since the majority of these stands are 60 to 80 year second growth ponderosa pine, snags recruited from prescribed burning will range between 14-20 inches dbh. Although these newly created snags are on the small end for nesting, snag densities are low in these stands and very little snags exist over 21inches. Due to the lack

of nest site availability, these newly created small diameter snags may provide the only available nesting habitat in the short-term.

Non-commercial Thinning (PCT)

In addition, some ponderosa pine plantations that contain individual large diameter ponderosa pine provide some foraging habitat for the white-head woodpecker will be thinned. These plantations will be thinned to accelerate development by reducing competition and recruit these trees into the overstory in the long-term. White-headed woodpeckers primarily forage by gleaning insects from under the bark of large ponderosa pine but will also excavate sap wells in second growth or young ponderosa pine (Dixon 1995; Kozma 2010). These treatments will reduce some foraging habitat, but a fully stocked stand will remain after treatment. Treatments are intended to reduce stocking density, to promote the development of overstory stands, and reduce the likelihood of losing these trees to bark beetle infestation. Treatment will retain residual foraging opportunities.

See DecAid snag and down wood analysis in the Wildlife Report for a summary of the dead wood habitat assessment.

The following Table 81 provides a summary of the total treatment acres associated with to suitable white-headed woodpecker habitat by alternative.

Table 81: Total Acres of Reproductive Habitat Associated with Each Treatment Type by Alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	4,338	4,336	3,569
PCT	45	45	36
Skid & Deck	1,037	1,037.69	895
Prescribed Burn	2,304	2,312.68	3,014
Total Acres Affected	**7,726**	**7,732**	**7,516**

Affects to white-headed woodpecker habitat are similar under Alternative 2, 3 and 4. The outcome or long-term benefits to habit as a result of the effects of each treatment type is also similar across all action alternatives. Acres of habitat affected varies based on alternative. Under Alternative 3 and 4, treatments were developed to address the Key Issue of promoting diversity and variability of thinning on the landscape, however Alternative 4 also addresses the Key Issue of treating thermal cover for both deer and elk. Alternative 4 reduces the overall acres of thinning to ponderosa pine stands, but increases the acres of burning to address the need for fuels treatments in the ponderosa pine community. Overall the total acres treated under Alternative 4 have been reduced, leaving stocking levels higher than those in Alternative 3 and 4. Although thinning and prescribed fire will occur within white-headed woodpecker reproductive habitat it is greatly reduced under Alternative 4, leaving stand more highly susceptible to beetle attacks, disease, and stand replacing fire. It will also prolong the development of LOS stands that provide the large tree structure needed by the white-headed woodpecker. These changes are reflected in Table 81.

In the short-term, Alternative 4 affects the fewest acres of habitat of the three alternatives. However, in the long-term treatments do not promote the development of a more fire resistant ponderosa pine and mixed conifer stands. The longevity of existing habitat will diminish in the short-term due to high stand densities and the competition for resources within these stands, as a result stands will remain at a high risk of stand replacing fire and not promote fire resilient stands ponderosa pine within these areas. Although Alternatives 2 and 3 do the best to address the risk of insect disease, and stand replacing fire, Alternative 3 does the best to promote stand level heterogeneity. Alternative 3 promotes habitat diversity due to the variety of basal area stands will be thinned at with the objective of promoting habitat

for a variety of species associated with ponderosa pine and mixed conifer dry PAGs. Alternative 3 will create a landscape mosaic of thinned and un-thinned habitat, maintaining habitat continuity across the project area, while promoting the development of future fire resistant stands of LOS ponderosa pine. Treatments prescribed under Alternative 3 will promote heterogeneity in these stands, retaining the largest trees in the stands providing a mosaic of tree densities. Residual trees will retain a variety of seral classes providing residual foraging habitat as well as maintaining late and old structure to provide nesting habitat where it exists. Although Alternative 2 proposes the most thinning from below within mixed conifer dry and ponderosa pine stands, this alternative will homogenously thin all species. Alternative 4 will not focus on ponderosa pine development to try and develop a more fire resilient stands in the future. White-fir and occasionally lodgepole pine will continue to dominate the mixed conifer stands, although stands will have reduced densities these species are short lived and susceptible to disease and infestation, where longevity of these stands are compromised, limiting the potential to provide long-term white-headed woodpecker habitat.

To assist with promoting diversity and variability on the landscape within the ponderosa pine and mixed conifer dry PAGs, approximately 10% of the ponderosa pine PAG will be left untreated and 15% of the mixed conifer PAG will be left untreated. Residual untreated areas will be left as entire stands and small aggregate patches. These areas will continue to provide foraging opportunities in the short-term, due to high stocking levels small diameter snags will be recruited providing nesting opportunities in the long-term.

Overall, approximately 7,726 acres of white-headed woodpecker reproductive habitat are associated with treatments identified under Alternative 2, approximately 7,732 acres under Alternative 3, and approximately 7,516 under Alternative 4.

Cumulative Effects

The following direct and indirect effects contribute to effects of projects shown in Table 77. These treatments will not intentionally remove any currently suitable nesting habitat, and residual foraging habitat will be retained at the project level and enhanced under each alternative. Although Alternative 2, 3, and 4 all propose treatments within currently suitable white-headed woodpecker reproductive habitat, no alternative proposes the removal of snags that could potentially provide nesting habitat. However, due to the prescribed fire associated with these treatments; there is the chance that existing trees could be lost during burn operations. In the long-term, all action alternatives will enhance nest success in these stands as well as promote the development of long-term LOS habitat promoting the long-term sustainability of future habitat on the landscape. Table 77 is a summary of ongoing and reasonably foreseeable future vegetation management projects that may occur within potentially suitable white-headed woodpecker habitat.

Mortality of snags in ponderosa pine habitat during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags < 15 cm dbh and showed evidence of woodpecker foraging use in southeastern Arizona. Several studies showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988; Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for snags, presumably because the trees that did not burn during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988, Bagne et al. 2008). Prescribed burning associated with the project as well as ongoing and reasonably foreseeable project could reduce snags within the watershed, however due to the majority of habitat existing as 60 to 80 year old black bark ponderosa pine stands, very few snags exist within the habitat. Therefore, treatment could be beneficial by recruiting snag habitat for the white-headed woodpecker.

There is approximately 18,319 acres of white-headed woodpecker reproductive habitat within the Watershed. Considered as a whole, the list of ongoing and foreseeable projects associated with Table 77 and the treatments associated with the West-Bend project, will treat approximately 17,581 acres of the total reproductive habitat in the watershed, or 95% of the total. There is approximately 198,330 acres of reproductive habitat across the Deschutes National Forest. Cumulatively these projects are associated with approximately 8% of the white-headed woodpecker habitat across the Deschutes National Forest.

Determination

Implementation of the West-Bend project will not intentionally remove snags that could provide nest trees. Treatment will result in a long-term benefit to suitable habitat on the Deschutes National Forest for the white-headed woodpecker. There is the potential to indirectly impact reproductive habitat from prescribed burning operations, therefore Alternatives 2, 3, and 4 **"May Impact"** the white-headed woodpecker and its habitat on the Deschutes National Forests.

Pacific Fisher, Federal Candidate, Region 6 Sensitive – Existing Condition

Fisher populations are considered to be extremely low in Oregon, Washington, and parts of the Rocky Mountains. They occur in landscapes dominated by late-successional and mature forests. Fishers have been found to use riparian areas disproportionately to what exists. On the Westside of the Cascades, fishers tend to be associated with low to mid-elevational forests dominated by late-successional and old growth Douglas-fir and western hemlock. However, on the eastside of the Cascades, they occur at higher elevations in association with true firs and mixed conifer forests. They tend to prefer areas with high canopy closure and late-successional forests with relatively low snow accumulations. Critical features of fisher habitat include physical structure of the forest and prey associated with forest structure. Structure includes vertical and horizontal complexity created by a diversity of tree sizes and shapes, light gaps, down woody material, and layers of overhead cover. Major prey species include small to medium sized mammals, birds, and carrion. Porcupine are the best known prey species but fisher will also prey on snowshoe hare, squirrels, mice and shrews (Powell and Zielinski 1994).

Large forest openings, open hardwood forests, and recent clearcuts were found to be infrequently used by fishers in the West (Ruggerio et. al 1994). Fishers have shown an aversion to open areas and this has affected local distributions and can limit population expansion and colonization of unoccupied areas (Coulter 1966; Earle 1978). However, Kelly (1977) found that fishers tended to use recently harvested areas when brush and saplings provided some low overhead cover but these areas were avoided during the winter.

Habitat for the Pacific fisher occurs in very minor amounts on the Deschutes National Forest in the following plant associations – lodgepole pine wet, white fir, Shasta red fir, western hemlock, silver fir, and mountain hemlock in closed stands where average tree size is 20"dbh or greater. Approximately 5 acres of habitat currently exist within the West-Bend project area. Cumulatively approximately 488 acres exists within the watershed and approximately 4,176 acres across the entire Deschutes National Forest. No siting or surveys have occurred for the Pacific fishers within the West-Bend project

Table 82: Pacific fisher habitat within the West-Bend project area, watershed, and across the Deschutes National Forest.

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
5 acres	488 acres	4,176 acres

Pacific Fisher - Environmental Consequences

Alternative 1 (No Action) Continued Ecological Trend

Suitable habitat is very limited within the project area due the minimal amounts of the mixed conifer PAG and the amount of high mortality that occurs within the PAG. Insects and disease will continue in the stand and habitat will diminish due to trees dying and canopy cover diminishing in these areas. However, there are limited opportunities to provide habitat due to site potential to provide the large tree structure and tree stand type that this species needs.

Action Alternatives - Direct and Indirect Impacts

Effects Common to Alternatives 2 (Proposed Action), Alternative 3, and Alternative 4

Identified habitat for the fisher occurs primarily within both the mountain hemlock and lodgepole pine plant association groups and is not associated with any treatment units. The habitat is extremely marginal, due to the fact that the amount of mortality in these PAGs within project area. These areas provide very little canopy closure and therefore provide very poor habitat.

There are no proposed treatments associated with the identified fisher habitat and therefore there are no direct or indirect impacts to fisher as a result of the action alternatives. The following Table 83 shows no change in habitat as a result of each action alternative.

Table 83: Existing habitat and acres of fisher habitat remaining after each alternative.

Acres of suitable fisher habitat in the West-Bend project area.	Alternative 2	Alternative 3	Alternative 4
5 acres	5 acres	5 acres	5 acres

Cumulative Effects

Implementation of action alternatives for the West-Bend project will not result in any direct or indirect adverse effects and therefore, will not result in any cumulative effects for the Pacific fisher and its habitat.

Determination

Implementation of the West-Bend project will not remove suitable habitat on the Deschutes National Forest for the Pacific fisher. Therefore, Alternatives 2, 3, and 4 will have a **"No Impact"** to the Pacific fisher and its habitat on the Deschutes National Forest.

Crater Lake Tightcoil and Evening Fieldslug, Region 6 Sensitive – Existing Condition

"The Crater Lake Tightcoil may be found in perennially wet situations in mature conifer forests, among rushes, mosses and other surface vegetation or under rocks and woody debris within 10 m. of open water in wetlands, springs, seeps and riparian areas, generally in areas which remain under snow for long periods during the winter. Riparian habitats in the Eastern Oregon Cascades may be limited to the extent of permanent surface moisture, which is often less than 10 m. from open water" (Duncan et al. 2003).

"The Evening Fieldslug is associated with perennially wet meadows in forested habitats; microsites include a variety of low vegetation, litter and debris; rocks may also be used as refugia. Little detail is known about exact habitat requirements for the species, due to the limited number of verified sites. However, this species appears to have high moisture requirements and is almost always found in or near herbaceous vegetation at the interface between soil and water, or under litter and other cover in wet

situations where the soil and vegetation remain constantly saturated. Because of the apparent need for stable environments that remain wet throughout the year, suitable habitat may be considered to be limited to moist surface vegetation and cover objects within 30 m. (98 ft.) of perennial wetlands, springs, seeps and riparian areas. Areas with coastal fog may allow the species to occupy habitats farther from open water. Down wood may provide refugia sites for the species that remain more stable during drier periods of the year than the general habitat" (Burke et al 1998).

Threats to Crater Lake tightcoil include activities that compact soils, reduce litter and/or vegetative cover, or impact potential food sources (i.e. livestock grazing, heavy equipment use, ORVs, and camping on occupied habitats). Fluctuations from removal of ground vegetation on ground temperature and humidity may be less extreme at higher elevations and on wetter sites, but no studies have been conducted to evaluate such a theory. These snails appear to occur on wetter sites than general forest conditions, so activities that would lower the water table or reduce soil moisture would degrade habitat (Burke et al. 1999).

Primary threats to the evening field slug are habitat loss from draining and conversion of wet meadows for agricultural, urbanization, grazing, forest management and other uses and from fire. Natural threats may include ingrowth of conifer or hardwood tree and shrub species in historically herbaceous habitats, changes in hydrology that reduce the availability of water in wetlands, and exposure to vertebrate and invertebrate predators (i.e., predatory snails and beetles), especially in locally restricted areas.

Intense fire that burns through the litter and duff layers is devastating to most gastropods, and even light burns during seasons when these animals are active can be expected to have more serious impacts than burns during their dormant periods. Snowmobiling or skiing would impact these snails if snow, over their occupied habitats, is compacted losing its insulative properties and allowing the litter or ground to freeze (Burke et al. 1999).

Habitat for the Crater Lake tightcoil and evening fieldslug includes Class 1, 2, 3, and 4 streams and lake and wetland buffers. Suitable habitat specific to the Crater Lake tightcoil and evening fieldslug has not been mapped at this time as assessments are generally conducted at a project level. Habitat will be over-estimated for this analysis because habitat for this species is only limited to within 10 meters of the water's edge and for this analysis, the entire riparian buffer is included. It also includes water bodies in drier plant associations not known to support the Crater Lake tightcoil.

Approximately 1,382 acres of Crater Lake tightcoil and evening field slug habitat occurs within the West-Bend project area. Approximately 5,044 acres occurs within the watershed and 71,206 acres across the entire Deschutes National Forest (Table 84).

No surveys have occurred in the project area and there are no knows locations.

Table 84: Crater Lake Tightcoil Habitat on the Deschutes National Forest and within the project area.

Riparian Type	West-Bend Project Area	Watershed	Deschutes National Forest
Class 1,2, 3, &4 Stream and Lake Habitat	1,382 acres	5,044 acres	71,206 acres

Environmental Consequences

Alternative 1 (No Action) Continued Ecological Trend

These species are associated with perennially wet areas and therefore are associated with riparian zones. The project is at risk of stand replacing fire, due to the high stand densities, insects, and disease. Due to

these species' dependence on riparian areas, the high density trees and shrubs occur in heavily stocked stands. Throughout the Deschutes National Forest several large-scale stand replacing fires have occurred impacting major riparian zones within the last 11 years. The most recent being the Pole Creek Fire, which burned over 20,000 acres and hundreds of acres of riparian habitat, removing all vegetation that provides mollusk habitat.

Potential fire hazard for the existing condition/no action alternative of the West Bend Planning area has been predicted by using a number of state of the art tools. Remote sensing satellite imagery from 2004 was updated using ArcFuels (Ager et al. 2011) to reflect activities accomplished since 2004. The data was then analyzed in the model FlamMap (v. 3.0) under specific weather conditions. FlamMap, a fire behavior mapping and analysis program that computes fire behavior characteristics (rates of spread, flame length, crown fire potential, etc.) over an entire landscape, was used to determine the existing stand condition's potential fire hazard. FlamMap is a state of the art tool used by many researchers and modelers (Finney 2006; Stratton 2004; Ager Finney & McMahon 2006; Gercke & Stewart 2006; Opperman et al. 2006; Ager et al. 2006; Yohay et al. 2009; Krasnow et al. 2009; Arca et al. 2007; Stratton 2006; Knight & Coleman 1993). FlamMap output lends itself well to landscape comparisons (e.g. pre- and post-treatment effectiveness) and for identifying hazardous fuel and topographic combinations, thus aiding in prioritization and assessments (Stratton 2004). Although the modeling approach has limitations, model outputs yield useful information for planning, assessing, and prioritizing fuel treatments (Stratton 2004). The data inputs necessary for FlamMap include aspect, slope, elevation, fuel model, canopy height, canopy base height, crown bulk density, and crown class. Specific wind and fuel conditions used for running the model may be referenced in the fuels section of the EIS. Under the No Action Alternative, approximately 9,317 acres or 36% of the project area is predicted to be at extreme hazard. An additional 1,593 acres or 6% of the project area is predicted to be at moderate to high hazard. Fire effects analysis and best available science supports that moderate to high hazard potential would be damaging to valued stand characteristics; extreme hazard with high flame lengths and varying degrees of crown fire would be most damaging.

Action Alternatives - Direct and Indirect Impacts

Effects Common to Alternatives 2 (Proposed Action), Alternative 3, and Alternative 4

Implementation of the Action Alternatives will not impact Crater Lake tightcoil or evening fieldslug habitat. Riparian Habitat Conservation Area (RHCA) and Riparian Reserve buffers will be implemented adjacent to existing streams. No treatments, including prescribed burning will occur within these riparian buffers. No reduction in habitat will occur as a result of the implementation of any action alternative (Table 85).

Table 85: Remaining Crater Lake Tightcoil Habitat post treatment by Alternative.

Riparian Type	Existing Condition	Alternative 2	Alternative 3	Alternative 4
Class 1, 2, 3, &4 Stream and Lake Habitat	1,382 acres	1,382 acres	1,382 acres	1,382 acres

Cumulative Effects

Implementation of the Alternatives 2, 3, and 4 for the West-Bend project area will not result in any direct or indirect adverse effects and therefore, will not result in any cumulative effects for the Crater Lake tightcoil and evening fieldslug or their habitat. Total acres of mollusk habitat will not be reduced as a result of any action alternative. Therefore cumulatively across the Watershed and Forest there will

be no adverse impacts to the Crater Lake tightcoil and evening fieldslug as a result of West-Bend project area.

Determination

Implementation of the West-Bend project will not result in a decrease in suitable habitat and therefore will not cause a decline in habitat on the Deschutes National Forest for the Crater Lake tightcoil or evening fieldslug. Therefore, Alternatives 2, 3, and 4 will have a "No Impact" to the Crater Lake tightcoil and its habitat on the Deschutes National Forest.

Johnson's Hairstreak, Region 6 Sensitive – Existing Condition

The Johnson's hairstreak is an uncommon butterfly with a distribution limited to the Pacific Northwest (USFS 2008b). It has been documented from Salem, Eugene, Coos Bay and Medford BLM districts and from the Willamette, Deschutes, Umpqua, Rouge-River/Siskiyou, Fremont-Winema, Umatilla and Wallowa-Whitman National Forests. Most Oregon records (n=52) are from 2000' elevation or greater with the majority from 3500' or more to 5-6000' elevation. They are thought to be late-successional associated because of its dependence upon dwarf mistletoe. Dwarf mistletoes generally increases in incidence and intensity in older stands, however both young and maturing stands host this as well (USFS 2008b).

Larvae feed exclusively on the aerial shoots of dwarf mistletoes (USFS 2008b). Adults sip nectar at available flowers of several species (*Actostaphylos, Ceanothus, Cornus, dandelion, Fragaria, Rorippa,* and *Spraguea*) and nearby water and mud puddles (USFS 2008b). There are several closely related species with overlapping ranges making identification difficult. The Thicket Hairstreak larvae are undistinguishable with those of the Johnson's Hairstreak. Since this species spends so much time in the top of the forest canopy this may limit detection.

Threats to this species includes timber harvest in mistletoe infested areas, large stand replacement fires, Btk (insecticide) use, herbicide use on forage species, and possible hybridization with the Thicket Hairstreak (USFS 2008b).

Habitat occurs throughout the Deschutes National Forest in the following plant associations – lodgepole pine, ponderosa pine, Douglas-fir, white fir, silver fir, western hemlock, and subalpine fir where the average tree size is 15"dbh or greater. Suitable habitat specific to the Johnson's hairstreak has not been mapped at this time in the project area, however mistletoe infestation was used to roughly assess the amount of habitat that occurs in the project area. Field reconnaissance of the project area and a Forest layer that identifies large areas of mistletoe infestation, in conjunction with the Forest PAG map, was used to quantify habitat. Habitat will be over-estimated for this analysis because not all habitats assessed will have mistletoe.

Approximately 197,976 acres across the Deschutes National Forest potentially provide habitat for the Johnson's hairstreak. Within the watershed approximately 76,577 acres were identified as containing dwarf mistletoe infestation in both single-story and multi-story ponderosa pine, mixed conifer, and lodgepole pine stands. These stands have the potential to provide habitat for the Johnson's hairstreak within the watershed. Some of the past regeneration and shelterwood harvests that occurred in the watershed were as a result of the dwarf mistletoe infestation. The objective of these treatments was removing mistletoe in overstory that was infecting the understory trees, referred to as a sterilization harvest. Mistletoe persists in the project areas today occupying approximately infecting 14,545 acres of the West-Bend project area, which may provide habitat for the Johnson's hairstreak (Table 86).

There are no known occurrences of the Johnson's hairstreak within the West-Bend project area.

Table 86: Johnson's hairstreak habitat on the Deschutes National Forest and in the project area.

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
14,545 acres	76,577 acres	197,976 acres

Johnson's Hairstreak – Environmental Consequences

Alternative 1 (No Action)

There are no direct or indirect impacts associated with the No Action Alternative. Under the No Action Alternative, no treatments will be prescribed within West-Bend project area (25,696 acres). However, the "ecological trend" in the short-term is that these stands would continue to remain suppressed and at risk of a stand-replacing wildfire. Development of future old growth within ponderosa pine and mixed conifer stands would be prolonged and the old trees within the stands would continue to be stressed, decreasing their longevity. However, stands would continue to provide habitat for wildlife species. In the long-term, if a stand replacing wildfire or insect outbreak hasn't occurred, the stands containing mistletoe will provide habitat but would continue to die and the multi-storied structure would diminish along with any remnant old growth trees. As a result, habitat for the Johnson's hairstreak would diminish. Due to stand densities within the project area and increases in mortality overtime, the risk of a large scale stand replacing fire across the West-Bend project area increases over time, potentially impacting Johnson's hairstreak habitat.

Potential fire hazard for the existing condition/no action alternative of the West Bend Planning area has been predicted by using a number of state of the art tools. Remote sensing satellite imagery from 2004 was updated using ArcFuels (Ager et al. 2011) to reflect activities accomplished since 2004. The data was then analyzed in the model FlamMap (v. 3.0) under specific weather conditions. FlamMap, a fire behavior mapping and analysis program that computes fire behavior characteristics (rates of spread, flame length, crown fire potential, etc.) over an entire landscape, was used to determine the existing stand condition's potential fire hazard. FlamMap is a state of the art tool used by many researchers and modelers (Finney 2006; Stratton 2004; Ager, Finney & McMahon, 2006; Gercke & Stewart 2006; Opperman et al. 2006; Ager et al. 2006; Yohay et al. 2009; Krasnow et al. 2009; Arca et al. 2007; Stratton 2006; Knight & Coleman 1993). FlamMap output lends itself well to landscape comparisons (e.g. pre- and post-treatment effectiveness) and for identifying hazardous fuel and topographic combinations, thus aiding in prioritization and assessments (Stratton 2004). Although the modeling approach has limitations, model outputs yield useful information for planning, assessing, and prioritizing fuel treatments (Stratton 2004). The data inputs necessary for FlamMap include aspect, slope, elevation, fuel model, canopy height, canopy base height, crown bulk density, and crown class. Specific wind and fuel conditions used for running the model may be referenced in the fuels section of the EIS. Under the No Action Alternative, approximately 9,317 acres or 36% of the project area is predicted to be at extreme hazard. An additional 1,593 acres or 6% of the project area is predicted to be at moderate to high hazard. Fire effects analysis and best available science supports that moderate to high hazard potential would be damaging to valued stand characteristics; extreme hazard with high flame lengths and varying degrees of crown fire would be most damaging.

Action Alternatives - Direct and Indirect Impacts

Effects Common to Alternatives 2 (Proposed Action), Alternative 3, and Alternative 4

Implementation of Alternatives 2, 3, and 4 propose to treat stands containing approximately 10,545 acres of mistletoe. Although all treatments do not specifically target mistletoe, approximately 824 acres specifically identify overstory removal of dwarf mistletoe. The remaining acres will receive thinning from below and prescribed burning. Historically, mistletoe was kept in check through natural fire, but

due to the last 100 years of fire suppression and harvest mistletoe spread to young regenerating stands, and as a result mistletoe has become more prolific across the Deschutes National Forest. Although thinning from below will remove mistletoe from the understory and occasionally in the overstory, it will continue to persist within the treatment units, since the objective is to maintain fully stocked stands. It is expected that prescribed fire will also help reduce the mistletoe infection in the understory. Post treatment mistletoe will continue to occur within 10,545 acres, but where infection is the highest treatment will target mistletoe in those stands, reducing concentration of mistletoe across this area. Therefore, habitat will remain for the Johnson's hairstreak within individual or small groups of trees within the 10, 545 acres of habitat, and occur incidentally throughout the project area.

Table 87 summarizes the acres of potential Johnson's hairstreak habitat removed by alternative.

Table 87: Acres of Johnson's hairstreak habitat proposed for treatment by alternative.

Habitat	Existing Condition	Alternative 2	Alternative 3	Alternative 4
Acres of Dwarf Mistletoe.	14,545 acres	10,545 acres	10,545 acres	10, 545 acres

In general, very little potential habitat is specifically targeted for the removal of mistletoe (824 acres). Although 10, 545 acres of habitat are proposed for treatment containing mistletoe it will continue to persist in these areas. Johnson's hairstreak habitat will continue to occur throughout the project area, but not in concentrated areas.

Cumulative Effects

Implementation of action alternatives for the West-Bend project area will treat approximately 10, 545 acres of habitat that contain concentrations of mistletoe as well as individual occurrences.

Alternatives 2, 3 and 4 combined with the ongoing and reasonably foreseeable future projects in Table 77 will cumulatively treat approximately 20,475 acres or 26% of the habitat within the watershed.

Due to the amount of habitat in the watershed and across the Deschutes National Forest, the site specific nature of the treatments for all action alternatives will result in very minor indirect effects to the Johnson's hairstreak and its habitat. Impacts will be minimal and therefore, there are no adverse cumulative impacts to the Johnson's hairstreak population or its habitat are expected as a result of any action alternative.

Determination

Implementation of the West-Bend project will result in a decrease to suitable habitat to the watershed and the Deschutes National Forests for the Johnson's hairstreak. Therefore, Alternatives 2, 3 and 4 **"May Impact"** the Johnson's hairstreak and its habitat on the Deschutes National Forests.

3.6 Wildlife – Management Indicator Species (MIS) and Other Species of Concern

3.6.1 Introduction

A Wildlife Report was completed describing the impacts to management indicator species (MIS) and species of concern (landbirds and/or NWFP species) associated with the West-Bend project on the Deschutes National Forest. Twenty-one management indicator species on the Deschutes National Forest and/or their habitats are known or suspected to occur within the project area. In addition, 37 landbirds on the Deschutes National Forest and/or their habitats are known or suspected to occur within the project area. The following is a summary of the key findings of the Wildlife Report on the impacts of the proposed alternatives.

- Implementation of Alternatives 2, 3, and 4 is associated with reproductive habitat for 13 management indicator species (MIS) on the Deschutes National Forest but will not contribute to a change in viability for these species.
- Implementation of Alternatives 2, 3, and 4 is associated with the habitat of 11 landbird species on the Deschutes National Forest.
- Implementation of the West-Bend project is consistent with the Standards and Guidelines for the Deschutes Land and Resource Management Plans for MIS.
- Implementation of the West-Bend project is consistent with the biological objectives outlined in the Conservation Strategies for Landbirds of the East-slope Cascades. Treatments were designed to be beneficial to these species by providing viable long-term habitat.

The Zone of Influence for discussion on effects is bounded by the project area for all species except Big Game which is bounded on a subwatershed basis. The area of influence includes overlap with existing conditions such as roads, trails, and past management activities.

This section includes discussion on data used, methods, models, general assumptions, evaluation criteria and a summary of effects. General effects are discussed in this section. General effects cover broad categories of species and those effects that are common to all alternatives including the no action alternative.

Recently completed surveys and historical data were used in determination of species occupancy within the West-Bend project area. Incidental species observations have also contributed to the knowledge of species presence within the project area and/or Bend/Ft. Rock Ranger District. Potentially suitable habitat is considered to be occupied unless surveys or incidental observations have not detected the species.

The long-term sustainability of forest ecosystems and wildlife habitat is dependent on a variety of factors, but for the purpose and need of this project it was identified that due to fire suppression and existing conditions from past management, stands are over-stocked and outside the Historic Range of Variability (HRV). HRV is used to determine the desired future condition for wildlife habitat as it relates to each Plant Association Group, and what management action is needed for departure from the existing condition to continue to promote future wildlife habitat. Forest thinning and fuels reduction treatments are the two main treatment types that will occur to move stands toward HRV and have the potential to impact existing wildlife habitat in the short-term. Removal of habitat from these management activities could directly or indirectly affect wildlife species and their habitat. An evaluation of the potential effects to wildlife species will be completed for the project to determine if these effects are negative or beneficial.

3.6.2 Analysis Methods

Duration and Degree of Impacts (Short-term vs. Long-term)

Under each action alternative, the project will primarily manipulate vegetation through a variety of thinning techniques. However, stands may also be treated by use of prescribed natural fire or a combination of thinning and prescribed natural fire. In addition, some treatments may not directly impact habitat, but could cause disturbance through equipment operation or smoke from prescribed fire. Effects of these treatments to habitat will be assessed on short-term and long-term impacts. Stand Density Index (SDI) is used to measure the risk of a stand's susceptibility to insect and disease as a result of densification. From the initial density reduction treatment, effects from the reduction occur roughly over a 30 year period. After 30 years stands begin to put on basal area growth, height, and begin to recruit new trees into the stands increasing SDI (Personal Communication Brian Tandy District Silviculturist). To standardize the length of time when referencing short-term and long-term impacts to wildlife habitat from forest thinning, short-term impacts are $\leq$30 years and long-term impacts are those that will occur over $\geq$30years.

Bounding Spatial and Temporal Changes within the Zone of Influence

For this project proposal, activity area boundaries are considered to be the smallest identified area where the potential direct and indirect effects from different management practices could occur. The discussion of wildlife cumulative effects will be focused on the units proposed for treatments and their incremental impacts in combination with past, present and reasonably foreseeable projects within the Watershed ("zone of influence"). The project area is associated with two 10th field watersheds, North Unit Diversion Dam-Deschutes River and Tumalo Creek, hereinafter referred to as the "watershed". Only National Forest system lands will be analyzed within the "zone of influence". The EIS contains a list of past, present and reasonably foreseeable future projects within the watershed that has the potential to contribute to cumulative effects. However, habitat for each identified species associated with the project area will be discussed on a forest wide basis to address species viability. Table 26 lists those past projects and activities that have contributed to the existing condition and Table 27 lists ongoing and reasonably foreseeable projects that are considered in the cumulative effects analysis for each species.

Management Indicator Species Analysis

A Forest wide assessment for Management Indicator Species (MIS) identified in the Deschutes National Forest Land and Resource Management Plan (LRMP) was completed in 2012 for the entire Deschutes National Forest (USFS 2012). Suitable habitat for each species was defined as habitat that could potentially be utilized for reproduction. An exception to this is associated with species specific standards and guides within the Deschutes LRMP, not associated with reproductive habitat, although essential to the viability of that species population within its range. An example is, hiding cover standards and guides for mule deer summer range. An assessment was completed for each species based on the amount of potentially suitable habitat that occurs across the Deschutes NF, associated threats, and population trend data where it was available. The assessment used the best available science and guidance such as research found in books, scientific journals, and scientific websites. NatureServe, an international non-profit conservation organization whose mission is to provide the scientific basis for effective conservation action was a major contributor to population trend data. NatureServe and its network of natural heritage programs, including Oregon State Heritage Program, are the leading source for information about rare and endangered species and threatened ecosystems. Their website, http://www.natureserve.org/, compiles historic and current information from The Nature Conservancy and other conservation groups, U.S. government agencies, private sector partnerships, international agencies, and data cooperators. In addition, for those MIS species that are also hunted or furbearing species (e.g. big game, waterfowl, American marten), Oregon Department of Fish and Wildlife provided population trend data for big game, data relative to trapping for marten, and monitoring data for waterfowl. Habitat definitions were developed and modeled for each MIS species. Information from the

species assessments formed the baseline for the West-Bend project. The West-Bend project analysis incorporates by reference those assessments.

Modeling Methodology

Habitat for the various wildlife species was determined using district occurrence data, habitat descriptions found in scientific literature, various data sets, and professional experience. The Viable Ecosystem Model (Viable) was used to determine the live tree component of habitat and formed the basis of acres of existing nesting/denning habitat (Viable Ecosystems Management Guide 1994). For selected species, such as the black-backed woodpecker and American marten, the snag components of habitat were determined using a variety of sources including gradient nearest neighbor (GNN) data and DecAID, as well as Viable. Because of Forest Plan standards for cover and thermal cover requiring trees per acre and height, deer and elk habitat was determined using GNN data.

This section describes each model and/or data set and how they were used separately or in combination with others. While modeling habitats or components generally match conditions known to occur on the ground, modeling does not necessarily match a specific point. It gives conditions that may occur given the assumptions of the model. Since it was used identically, for all alternatives, it provides a basis for comparison.

Viable Ecosystems Model

The Ochoco and Deschutes Viable Ecosystems Management Guide (VEMG) was developed to classify vegetation on a landscape basis. The Viable Ecosystem model provides a process to apply ecosystem management concepts to project level planning. This system compares existing vegetation with site potential. The model focuses on relationships between combinations of vegetation structure and species composition, and habitat requirements for animals, insects, and plants. Viable Ecosystems is a useful tool for cumulative effects analysis of broad scale changes in vegetation at a subwatershed to Forest-wide scale and subsequent changes in animal, insect, or plant communities.

Viable stratifies the environment along a gradient of size, structure, species composition, and relative tree density. The various classifications are then linked to wildlife habitat requirements. The 2002 satellite imagery layer was used to develop the vegetation layer to run in the Viable Ecosystem Model. Data is mapped on a 30 meter pixel grid, meaning the map is divided up on a 30 meter grid and that every 30 meter square (pixel) is assigned a value (i.e. 56351) that relates to a stratum of size, structure, tree species composition, and relative tree density. Criteria used (vegetation, seral state, structure, and density) to determine habitat for each species is described in the existing condition of each species. No major vegetation projects have taken place in the project area since 2002. Existing conditions include past actions such as timber sales which used the Forest "FACTS" database. Presenting information in this way and including those current and foreseeable future actions in cumulative effects is the most informative for the decision maker.

GIS Analysis and ArcMap

A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. The information can be related to visual data (maps), tabular data (tables, spreadsheets, or data bases), and used to run models (create new data set from existing data based on criteria or specific conditions). ArcMap is a component of the ArcGIS program. The client software developed by Economic and Social Research Institute (ESRI) was used for the processing and presentation of GIS data.

Gradient Nearest Neighbor (GNN)

GNN maps consist of 30 meter pixel (grid) maps with associated data (tree size, density, snag density, canopy cover, percent down wood cover, etc.). The maps used for this analysis were developed by the Landscape Ecology, Modeling, Mapping, and Analysis (LEMMA) team as part of the GNNPAC Pacific

States Forest Vegetation Mapping project. This project involves developing detailed maps of existing forest vegetation across all land ownerships in the Pacific Coast States (Oregon, Washington, and parts of California). It is being conducted by the LEMMA team (Pacific Northwest Research Station (PNW) and Oregon State University) at the Corvallis Lab, in close collaboration with the Western Wildlands Environmental Threats Assessment Center, the Interagency Mapping and Assessment Project (IMAP), Northwest Forest Plan Effectiveness Monitoring, the Remote Sensing Applications Center, and Forest Inventory and Analysis at the PNW Research Station.

The process to create the maps involves using gradient imputation (Gradient Nearest Neighbor, or GNN). GNN uses many variables on a gradient along with satellite imagery to assign data from known field plots to pixels with no data that have the same satellite imagery signature (i.e. it "looks" the same to the computer). The species-size GNN model was used in the Rim-Paunina analysis. This model uses species composition and stand structure as components for developing maps. Accuracy of the modeling depends on how "like" pixels match up based on numerous variables. Generally speaking, forest types that had more samples like white-fir were more accurate than those with fewer samples like mountain mahogany (Ohman et al. 2008). Information on GNN accuracy, the LEMMA group, IMAP and the GNNPac project is available at the project website: http://www.fsl.orst.edu/lemma/gnnpac.

DecAID

DecAID is a web-based dataset, it is not a model. It is a synthesis of all of the best available research on dead wood. DecAID does not provide information on all life needs of a given species. It integrates current research/studies on wildlife use of dead wood (snags, down wood, dead portions of live trees) in various habitat types. From this, tolerance levels are generated.

Tolerance level (t.l.) is the percent of the studied population that would use a density of snags or down wood. For example, the following table shows the tolerance levels for white-headed woodpeckers. For a population of 100 individual white-headed woodpeckers, at the 50 percent tolerance level, 50 of them would use habitat with at least 1.7 snags per acre greater than or equal to10 inches in diameter. Basically, the higher the tolerance level, the more assurance that you are providing habitat to meet the needs of more individuals in the population (Mellen et al. 2006).

Tolerance intervals (t.i.) were used to determine habitat levels in the planning area. A tolerance interval includes the range of snag density between tolerance levels. Using the example below, the 30-50 percent tolerance interval would be habitat with more than 0.3 snags per acre and less than or equal to 1.7 snags per acre. The 0-30 percent category is included (where 0 values are actually greater than 0) as it provides habitat for a few individuals. A zero category is included in the analysis showing what acreage does not provide habitat.

Table 88: Example of Tolerance Levels and Intervals developed from DecAID Information

Habitat type and Table used from DecAID: Table PPDF_S/L.sp-22; Species: White-headed Woodpecker									
Minimum DBH	**10"**					**20"**			
Tolerance Level		30%	50%	80%			30%	50%	80%
Snag Density (#/acre)		0.3	1.7	3.7			0.5	1.8	3.8
Tolerance Interval	0-30%	30-50%	50 - 80%	80% +		0-30%	30-50%	50 - 80%	80% +
Snag Density (#/acre)	0-0.3	0.3 - 1.7	1.7-3.7	3.7+		0-0.5	0.5-1.8	1.8-3.8	3.8+

Often times, DecAID only had one study available to base its tolerance levels on. While applying findings from a single research site to another area is not always wholly applicable, DecAID provides the best available science to determine effects to a species at this time. Used as a comparison for effects across all alternatives, it can be a useful tool. Tolerance levels do not equate to population potential, nor imply viability, but they are assumed to indicate habitat at varying snag densities.

More information on DecAID can be found on the website at:
www.fs.fed.us/wildecology/decaid/decaid_background/decaid_home.htm

Deer and Elk Habitat

The Deschutes Forest Plan defines suitable deer hiding cover as one of the following:

- Six acres or larger capable of hiding 90 percent of a standing adult deer from view of a human at a distance of 200 feet, or
- Six acres or larger with an average height of six feet and which has not been thinned in 15 years, or
- Residual clumps of one half acre or larger stands within units with advanced regeneration (trees including small trees up to seven inches in diameter) and at least 12 greater than seven inch trees per acre remaining after harvest (LRMP, WL-54, p. 4-58). Residual clumps less than six acres in size were not modeled which likely under-represents the amount of hiding cover present in the subwatershed analysis.

Suitable elk hiding cover is similar**:**

- Being six acres or larger capable of hiding 90 percent of a standing adult elk from view of a human at a distance of 200 feet, or
- Six acres or larger with an average height of 10 feet and which has not been thinned in 20 years, or residual clumps of two acres, or
- Larger stands within units with advanced regeneration (trees including whips up to seven inches in diameter) and at least 12 greater than seven inch trees per acre remaining after harvest (LRMP, WL-47, p.4-57).

To be conservative, hiding cover for both deer and elk was modeled using Gradient Nearest Neighbor (GNN) with the criteria of hiding 90 percent of a standing adult elk from view of a human at a distance of 200 feet. This condition was modeled using trees with a density of at least 469 trees/hectare (190 trees/acre or a tree every 15 ft) with a diameter of 3-25 cm (1-10 in) and at least two meters (7 ft) tall across the West-Bend planning area. Similarly thermal cover for both deer and elk was modeled using the GNN. The criteria used to model thermal cover were an average stand height of 30feet and the stands must contain 40% crown cover.

An important finding from the Starkey Experimental Forest and Range studies is that road (or route) density is not the best predictor of habitat effectiveness for elk. Instead, a model based on distance bands proved to be a more spatially explicit and biologically meaningful tool for assessing effects from roads. Road densities do not provide a spatial depiction of how roads are distributed on the landscape (Rowland 2005). Consequently, a distance banding analysis was conducted on the 40,000 acre project area. Open motorized routes (roads and trails) were buffered at three scales (also referred to as distance bands) to display the amount of National Forest acreage within the buffers. The three distance bands applied included: a) acres and percent of the project area within 660 feet of open motorized routes, b) acres and percent of the project area greater than ½ mile from an open motorized route, and c) acres and percent of the project area greater than one mile from an open motorized route. Hillis et al. (1991) defined elk security habitat for forested stands greater than 250 acres in size and greater than ½ mile from an open route. Rowland et al. (2000) determined that the distance of 1,969 yards (1,800 meters) is equivalent to that at which elk response to open roads diminished markedly. Therefore, acreage greater

than one mile from an open motorized route is assumed to provide greater security habitat for elk than the ½ mile distance.

Survey and Manage

Survey and manage species are managed by the Deschutes National Forest Land and Resource Management Plan (LRMP) as amended by the Northwest Forest Plan (NWFP). Management of these species occurs within the range of the northern spotted owl under the Northwest Forest Plan. These species were addressed where they occur under another category (i.e. TES, MIS, BCC etc.), if they did not they were addressed individually and listed as NWFP.

Evaluation Criteria and Comparison Measures

Evaluation criteria are developed to illustrate the effects to wildlife and how those effects differ by alternative. In this analysis, commercial thinning and fuels treatments are the major impacts to habitat quality, quantity and species life needs. Using the same units of measure allows the major impacts to be easily understood and compared, providing the Decision Maker the necessary data to make an informed decision. Key Issues were identified during scoping that relate to wildlife and wildlife habitat as described in Chapter 1.6. Analysis in this section of the EIS will address the following key issues:

Variability in Thinning Approach on the Landscape

Deer Cover: Some stands within Deer Habitat (M7) provide cover but are underutilized due to large stand acreages. The interior of the stands do not provide forage, which is an essential component of cover. In order to have a more optimum cover/forage ratio, it is necessary to create openings in the canopy cover, increasing the potential utilization of the stand through an increase in forage and edge effect. Alternatives 3 and 4 will modify the prescriptions (on 1,124 acres Alt. 3 and 419 acres Alt. 4) to create small group openings (1.0 to 5.0 acres) for increased forage and to provide nearby hiding cover in the future. Small openings would be planted with ponderosa pine seedlings.

Measurement: Acres of thermal cover reduced within M7 to improve future forage and hiding cover.

Goshawk Habitat Management

Within the mid-elevation ponderosa pine and mixed conifer zone, two historic northern goshawk territories exist. There has not been an active nest in either site for at least five years and there is no requirement to manage the territories. Although these territories are not currently active, they do provide suitable nesting habitat for goshawk and are proposed for management to promote long-term nesting and post fledging habitat. The proposed action will thin across the historic territories to develop LOS ponderosa pine.

This was identified as a key issue because some members of the public are opposed to seeing any management in the goshawk habitat areas. An alternative was developed that takes a different approach to management in the historic goshawk areas by avoiding treatment in the 30-acre nest areas and modifying prescriptions, in a radiating fashion from the nest out. See goshawk analysis for specific details.

Measurement: Acres of goshawk habitat enhanced outside of 30-acre nest stands.

Ryan Ranch Key Elk Area Thermal Cover

The proposed action would thin, mow and/or burn 1,891 acres of the Ryan Ranch Key Elk Area (KEHA, 5,002 acres). All existing hiding cover will be retained; thermal cover will be reduced by approximately180 acres. Comments suggested that the Forest analyze an alternative that retained all thermal cover within the KEHA. Alternative 4 was developed to retain all thermal cover in the KEHA.

Measurement: Percent of project area with thermal cover in Key Elk Habitat prior to and following treatment.

Winter Range (MA-7) Thermal Cover

The LRMP General Theme and Objectives for MA-7 state "Ideally, cover and forage areas should be in close proximity for optimum use by big game, with cover making up 40 percent of the land area. Approximately three-quarters of cover areas should be thermal cover with the remainder being hiding areas. Some stand conditions may satisfy both kinds of cover."

Approximately 31% of the project area provides thermal cover. The thermal cover is in a transition area where deer migrate from south to north to the Tumalo Winter Range. Trees in the area are in need of thinning, but thinning treatments would reduce this available thermal cover to below the desired LRMP stated ideal levels which would necessitate a Forest Plan Amendment. Alternative 4 drops treatment in the thermal cover in MA-7.

Measurement: Percent of Deer Habitat Management Area (MA-7) with thermal cover prior to and following treatment.

Redundant Analysis

To provide a more efficient analysis and to avoid redundancy, species with similar habitats were combined or effects referred to and not repeated. Analyses are sufficient to disclose effects to the public and for the decision maker to make an informed decision.

3.6.3 Management Indicator Species and Other Species of Concern

The Deschutes National Forest Land and Resource Management Plan (LRMP) (USDA 1990a), 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. All but the following MIS have been covered in previous sections (TES section) and will be discussed below: northern goshawk, Cooper's hawk, sharp-shinned hawk, great gray owl, great blue heron, golden eagle, waterfowl, red-tail hawk, osprey, woodpeckers, bats, American marten, elk, and mule deer.

In addition to the above mentioned MIS species there have been a number of wildlife species deemed species in which analysis is required or "species of concern" either through the Northwest Forest Plan (e.g. bats; pg C-43) or through other directives (e.g., landbirds, see Birds of Conservation Concern section).

Table 89: Management Indicator Species Summary for the Deschutes National (covered in this section)

Species	Habitat	Habitat Present	Know Occurrence in Project Area
Northern Goshawk (*Accipiter gentiles*)	Mature and old-growth forests; especially high canopy closure and large trees	Yes	No
Coopers Hawk (*Accipiter cooperi*)	Similar to goshawk, can also use mature forests with high canopy closure/tree density	Yes	No
Sharp-shinned Hawk (*Accipiter striatus*)	Similar to goshawk in addition to young, dense, even-aged stands	Yes	No
Great Gray Owl (*Strix nebulosa*)	Mature and old growth forests associated with openings and meadows	Yes	No
Great Blue Heron (*Ardea herodias*)	Riparian edge habitats including lakes, streams, marshes and estuaries	Yes	No
Golden Eagle (*Aquila chrysaetos*)	Large open areas with cliffs and rock outcrops	No	No
Waterfowl*	Lakes, ponds, streams	Yes	Yes
Red-tailed Hawk (*Buteo jamaicensis*)	Large snags, open country interspersed with forests	Yes	No
Osprey (*Pandion haliaetus*)	Large snags associated with fish bearing water bodies	Yes	Yes
Neotropical Migrants*	Various habitats	Yes	Yes
Bats*	Forested areas, riparian	Yes	Yes
American Marten (*Martes americana*)	Mixed Conifer or High Elevation late successional forests with abundant down woody material	Yes	No
Elk (*Cervus elephas*)	Mixed habitats	Yes	Yes
Mule Deer (*Odocoileus hemionus*)	Mixed habitats	Yes	Yes
Snags and Down Wood Associated Species and Habitat* or Primary Cavity Excavators	Snags and down woody material	Yes	Yes

Northern Goshawk

Existing Condition

Source habitats for goshawk are old forest and unmanaged young forests in montane, lower montane, and riparian woodland communities. Important habitat attributes of goshawk prey species include snags, down logs, woody debris, large trees, openings, herbaceous and shrubby understories and an intermixture of various forest structural stages (Wisdom et al. 2000). During winter some goshawks

may travel short distances to lower elevations and more open habitats in all upland woodland types (Wisdom et al. 2000) (USFS 2012).

From Wisdom et al. 2000 – "Goshawks nest in various forest structural conditions …nest stands are generally characterized by large trees and the densest canopy cover available within the area (Reynolds et al. 1992) but are occasionally located in small-diameter trees (Hayward and Escano 1989, Squires and Ruggiero 1996)." Foraging occurs in various cover types and structural stages, and the juxtaposition of several habitats may enhance the quality of foraging habitat around nest sites (Hargis et al. 1994) (USFS 2012).

In general, goshawk nest areas are unique in structure, with large trees, dense canopies, and high canopy closure. Goshawk nesting habitat in eastern Washington and Oregon is generally composed of mature and older forests (McGrath et al. 2003). Nest stands are typically composed of a relatively high number of large trees, high canopy closure (>50%), multiple canopy layers, and a relatively high number of snags and downed wood (Finn 1994, McGrath et al. 2003) (USFS 2012).

The data from the BBS (Breeding Bird Survey) for the state of Oregon and the Great Basin Bird Conservation Region (BCR 9), due to the low detectability of this species using BBS methods, the relative abundance is low. The population trend for the BCR is "Possible to moderate population decrease". Partners in Flight (PIF) provides a population estimate database which provides estimates at a continental scale (including global or range-wide population estimates for North American species), population estimates for Bird Conservation Regions (or State portions), estimates for individual states and provinces, and estimates where BCRs overlap with states and provinces (Blancher et al. 2007). The Oregon portion of BCR 9 has only about 0.1% of the total global population and only 14% of the total BCR 9 population of northern goshawks. The detection rate is low (.0.01) for the BBC routes. However, the routes are generally along roads and simply record species observed. As noted earlier, goshawks are difficult to detect and prefer closed canopy forest where they are difficult to observe (USFS 2012).

The following is a potential list of threats due to habitat alteration (USFS 2012):

- Timber harvest is the principal threat to breeding goshawk populations (Squires and Reynolds 1997) due to their reliance on mature and old-growth timber, especially for nesting, although not exclusively (Marshall et al. 2006).
- Fire suppression may lead to increased susceptibility of stand-replacing fire and insect and disease outbreaks, which can result in the deterioration or loss of nesting habitat (Graham et al. 1999 as cited in NatureServe 2011, Wisdom et al. 2000).
- Loss of foraging habitat due to dense conifer understory as a result of fire suppression. Dense understories may obstruct flight corridors used by goshawks to hunt prey (Wisdom et al. 2000).
- Predation on goshawk by other raptors including Red-tailed hawk (*Buteo jamaicensis*), great horned owl (*Bubo virginianus*), and long-eared owl (*Asio otus*) which invade habitat following canopy reduction by logging (Crocker-Bedford 1990).
- Falconry - Goshawks can legally be taken for falconry in various states, including Oregon. Take by falconers is considered low; therefore it is thought to be a negligible threat.

In addition to habitat alteration, threats from disturbance due to logging activities conducted near nests during the incubation and nestling periods can cause nest failure due to abandonment (NatureServe 2011, Squires and Reynolds 1997). Also, high road densities may result in loss of snag and down wood habitat important to goshawk prey (Wisdom et al. 2000) (USFS 2012).

Surveys to protocol were completed for the northern goshawk within the West-Bend project area in 2010 -2011. No nest sites were identified as a result of the surveys. Five historic nest sites occur within

the project area and were active between 1998 and 2005 (NRIS Wildlife Database). These nest locations are considered to be one territory due to the close proximity of these nests. Every known active and historically used goshawk nest-site is to be protected from disturbance by retaining a 30 acre no treatment area around the nest site and mapping a 400 acre post fledging area associated with the nest core directed by the Deschutes Forest Plan as amended (USDA 1994). They are only considered active if activity has been documented at the nest site in the last 5 years (USDA 1994). There have been no active goshawk nest sites documented within the project area within the last five years.

Through the Forest wide assessment completed for MIS, goshawk reproductive habitat was mapped across the entire Deschutes National Forest. Approximately 9,803 acres of habitat exists within the project area. Cumulatively, approximately 37,383 acres habitat occurs within the watershed and approximately 446,557 acres of habitat occurs across the Deschutes National Forest. Table 90 summarizes these acreages.

Table 90: Northern Goshawk habitat within the West-Bend project area, watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
9,803 acres	37,838 acres	446,557 acres

For the detailed assessment on the Northern Goshawk for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Environmental Consequences

Alternative 1 – No Action – Existing Ecological Trend

Areas that currently provide suitable goshawk habitat would most likely have increased mortality due to tree stress. Continued high stand densities will reduce the longevity of residual large trees structure that occurs in these stands. In the long-term, available nest trees will be limited and the future development of larger nesting trees will be prolonged. In stands of second growth ponderosa pine, short-term affects from high stand densities reduces the resiliency of these stands against bark beetle attack. The long-term effects from beetle outbreaks include high densities of small snags within project area, and as a result lack the recruitment of large tree structure over time. Lack of large tree structure within the project area and watershed has been identified as limiting through the historic range of variability analysis (HRV) within the EIS.

Due to stand densities within the project area and increases in mortality overtime, the risk of large scale stand replacing fire across the West-Bend project area also increases over time, potentially impacting high density stands that provide goshawk habitat reproductive habitat.

Potential fire hazard for the existing condition/no action of the West Bend Planning area has been predicted by using a number of state of the art tools. Remote sensing satellite imagery from 2004 was updated using ArcFuels (Ager et al. 2011) to reflect activities accomplished since 2004. The data was then analyzed in the computer model FlamMap (v. 3.0) under specific weather conditions. FlamMap, a fire behavior mapping and analysis program that computes fire behavior characteristics (rates of spread, flame length, crown fire potential, etc.) over an entire landscape, was used to determine the existing stand condition's potential fire hazard. FlamMap is a state of the art tool used by many researchers and modelers (Finney 2006; Stratton 2004; Ager, Finney & McMahon 2006; Gercke & Stewart 2006; Opperman et al. 2006; Ager et al. 2006; Yohay et al. 2009; Krasnow et al. 2009; Arca et al. 2007; Stratton 2006; Knight & Coleman 1993). FlamMap output lends itself well to landscape comparisons (e.g. pre- and post-treatment effectiveness) and for identifying hazardous fuel and topographic combinations, thus aiding in prioritization and assessments (Stratton, 2004). Although the (modeling) approach has limitations, model outputs yield useful information for planning, assessing, and

prioritizing fuel treatments (Stratton 2004). The data inputs necessary for FlamMap include aspect, slope, elevation, fuel model, canopy height, canopy base height, crown bulk density, and crown class. Specific wind and fuel conditions used for running the model may be referenced in the fuels section of the EIS. Under the No Action Alternative approximately 9,317 acres or 36% of the project area is predicted to be at extreme hazard. An additional 1593 acres or 6% of the project area is predicted to be at moderate to high hazard. Fire effects analysis and best available science supports that moderate to high hazard potential would be damaging to valued stand characteristics; extreme hazard with high flame lengths and varying degrees of crown fire would be most damaging. High intensity crown fire has been a major cause of habitat reduction to the northern goshawk across the Deschutes National Forest over the last 10 years.

Overall, high stand densities will result in a decrease in tree vigor among all size classes. The most significant effect of high stand densities will be the gradual loss of the existing large-tree component/nesting habitat which is likely to be at a much higher rate than if stand densities were reduced to more healthy levels.

Action Alternatives

Direct and Indirect Impacts

Alternative 2, 3, and 4:

Thinning From Below (HTH) Ladder Fuels Reduction (LFR), Skid and Deck

These three treatment types all thin from below, but occur within different seral classes, plant associations and geographical locations within the project area. Treatments associated with HTH are commercial thinning from below and occur in ponderosa pine and mixed conifer stands containing mature or over-over mature overstories with advanced stages of regeneration in the understory. HTH treatments will thin from below removing trees 7 inches dbh and larger. Ladder Fuels Reduction Treatments typically occur within mixed conifer stands and are more commonly associated with the urban interface areas within the project. LFR treatments are a non-commercial thinning; removing trees 7 inches dbh and less in the understory of mature ponderosa pine, white-fir, and lodgepole pine. This treatment reduces the risk of fires moving from the forest floor to the overstory trees minimizing crown fire potential. Skid and Deck units occur in pure ponderosa pine plantation that were planted in the 1950s and 1960s these plantation are in advanced stages of regeneration and provide high canopy cover (>50%) Treatments will also thin from below, removing both commercial and non-commercial size trees. Due to these stands being an even aged plantation, trees to remove are all roughly the same size and are all on the right between commercial and non-commercial size trees (around 7”dbh).

Thinning in suitable goshawk habitat would occurs in both second growth ponderosa pine, multi-storied ponderosa pine and mixed conifer stands containing residual large trees. Thinning from below in both HTH and LFR treatments will favor the largest ponderosa pine in pure pine stands In mixed conifer stands, thinning will favor ponderosa pine and healthy white-fir. A target basal area of 60 square feet is the objective, but will vary across these stands. Different scenarios exist depending on the existing basal area, site productivity, and stand structure objectives as well as differing slightly by alternative. This treatment aids in maintaining large trees by reducing their susceptibility to fire and insects by removing competition for space and nutrients. Thinning decreases stand densities and allows for faster growth of young trees while reducing risk (removal of ladder fuels). However, canopy cover is reduced overall resulting in more open stands. Negative impacts may result from more open stands by removing dense patches which may impact prey species habitat if large areas are treated. Beneficial impacts should result from reducing risk to existing suitable habitat and facilitating the development of future habitat. These treatments also enhance foraging habitat if large trees remain containing interlocking crowns. Similarly, Skid and Deck treatments will open stands, reducing crown closure and potentially affecting foraging habitat. However, Skid and Deck stands are a very dense homogenous stand structure

and due to the high canopy closures in these stand, treatments will open stands up enhancing the development of herbaceous ground vegetation potentially providing better foraging habitat in the long-term from increased rodent populations associate with the increased grasses, forbs, shrubs in these stands.

Overstory Removal (HCR)

Due to the removal of ponderosa pine from theses stands through past management activities, stands are comprised primarily of lodgepole pine and white-fir. These tree species are not fire resistant, and due to mountain pine beetle outbreaks in the watershed, much of the lodgepole pine is dead, reducing canopy closures and contributing to fuel loading as well as decreasing the amount of suitable reproductive goshawk habitat. White-fir is also a short-lived species, and highly susceptible to insects and disease, and many of the white-fir in these stands are declining from mistletoe or other diseases. The stands are typically dominated in the overstory with lodgepole pine and have a wide range of age groups of white fir. To meet the desire for a diverse landscape pattern the dead and live overstory lodgepole pine will be removed except for seed trees and the white fir will be left in a clumping pattern, removing overstory mistletoe trees where understory development is desired and leaving clumps undisturbed to reduce disease potential. These stands will still be considered a regeneration harvest because of the variability of the final stocking. Treatments will decrease overstory canopy closure, diminishing the suitability of goshawk reproductive habitat in these areas. However, by clumping the residual green white-fir, and retaining all ponderosa pine and healthy lodgepole pine and white fir in the overstory, these areas will continue to provide potential foraging habitat. Residual overstory trees will provide perch sites for the goshawk while clumps of white-fir will provide perch sites for prey habitat. Goshawks will utilize the residual overstory trees as perch sites hunting their prey species (perching birds) residing in the small clumps of trees.

Mowing and Burning Only (MB)

Underburning will occur in stands with a more fire resistant overstory and fewer small (<9" dbh) trees than in small tree thinning units. Some thinning of small trees (up to 8" dbh) may be needed as a pre-treatment to fire. Mowing of brush may also occur where existing brush density and height would contribute to undesirable fire behavior. This treatment aids in maintaining the overstory by reducing the susceptibility to wildfire and will favor longer-lived, more fire resistant species like ponderosa pine. Beneficial impacts should result in more stable habitat over the long term. Negative impacts may result in the potential degradation of prey species habitat with the consumption/loss of some softer snags, down woody material, and brush. However, this will be minimal due to the lower intensity burn versus that of a wildfire. Table 91 summarizes the amount of goshawk reproductive habitat affected by the action alternative identified for the West-Bend project.

Table 91: Total acres of goshawk reproductive habitat associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	5,527.4	5,524.96	4,215.49
HCR	756.14	756.14	756.14
LFR	41.59	36.92	270.65
Skid & Deck	929.83	929.83	591.13
Mow and Burn	934.73	943.62	2323.58
Total Acres Affected	**8,190**	**8,191**	**8,157**

Affects to goshawk habitat are similar under Alternatives 2, 3 and 4. The outcome of the affects to habitat as a result of each treatment type is the same across all action alternatives, the only thing that changes by alternative is the total acres of habitat treated; however, within the areas identified as HTH under Alternatives 3 and 4 treatments were developed to address the key issue of goshawk habitat management. Due to the historic territories being inactive for over 5 years, alternative 2 proposed to thin through territories reducing stand densities to promote forest health and reduce the risk of stand replacing fire. Under Alternative 3and 4, treatments were developed around two of the most recently active historic territories, with the goal of promoting long-term sustainable habitat. Yountz et al. (2008) was utilized to design treatments which would maintain existing large tree structure while promoting the development of greater forest diversity for nesting and foraging. In addition, treatments would also need to meet the purpose and need of reducing insects, disease, and the risk of stand replacing wildfire. The Forest Plan standards and guides, within active territories, direct the delineation of a 400 acre PFA and a 30 acre nest core, where no treatment will occur. Treatments within the PFA must be designed to promote post fledging habitat. Yountz et al. recommends delineating a 420 acre PFA. Within the two historic territories, approximately 1,590 acre PFA was delineated and the entire stands associated with each historic nest site were excluded from treatment totaling approximately 69 acres.

Thinning target densities within the PFA, which surround the nest stands were designed in a radiating fashion, where thinning will retain a higher density of trees immediately adjacent to the nest stands. Stands further away from the nest stand will be thinned heavier leaving a lower average basal area. Therefore, thinning prescriptions in the PFA range from 80 square feet of basal area to 40 square feet of basal area. In addition, there are stands and small aggregate patches that will remain untreated for prey habitat. The objective is to create a mosaic of stand densities surrounding the nest stands to provide habitat for a variety of prey species, while promoting heterogeneity in second growth ponderosa pine stands and reducing insects and disease in mixed conifer stands. Prey habitat includes highly interspersed groups of mid-aged trees (140+ years) and old trees (230+ years) with interlocking crowns (for tree squirrels), small openings of 1.25 acres around tree groups (for ground squirrels, rabbits, birds) decadent reserve trees and snags (for woodpeckers, tree squirrels), logs (for ground squirrels, rabbits, woodpeckers) and woody debris (for grounds squirrels, rabbits, birds) (Yountz 2008).

Yountz et al. identifies 4 prescriptive objectives for PFA's in even-aged and two-aged stands that will be implemented; 1) Where some age class diversity is present, leave as many under-represented trees, in small groups as possible. Small groups of white-fir will be clumped where stands are predominantly ponderosa pine. 2) Create openings for age class recruitment on 15-20% of stands, by removing groups of trees from a predominant age class, specifically those containing diseases. Within mixed conifer stands, pockets of lodgepole pine containing insects and disease will be targeted for removal creating openings in these. 3) Thin trees to initiate the development of greater forest diversity and desired structural characteristics. To reduce the risk of stand replacing fire, and promote the development of late and old structure ponderosa pine which is greatly lacking in the project area, second growth ponderosa pine stands 40-80 years old will be thinned. Opening these stands up promotes the development of herbaceous plants diversifying the forest floor. 4) Create a matrix between tree groups if less than full stocking level is desired. Across the project area, within mid-elevation ponderosa pine and mixed conifer dry PAG's, 15% percent of the project area will remain untreated, and in higher elevation stands containing mixed conifer wet PAG, 20% of the project area will remain untreated. Residual untreated areas will be left as whole stand as well as aggregate patches. These areas will have a higher stocking rate and will provide some diversity of canopy cover across the landscape as these retention clumps could benefit some prey species as well as provide nesting opportunities. These untreated stands will create a matrix between the thinned stands associated with the PFA, stands receiving thinning from below to reduce fuel loading adjacent to the wildland urban interface, and stands scheduled for overstory canopy removal (HCR) due to high amount of insect and disease which are considered regeneration harvest.

Overall, approximately 8,190 acres of goshawk reproductive habitat are associated with treatments identified under Alternative 2, approximately 8,191acres under Alternative 3, and approximately 8,157 under Alternative 4.

Loss of the large tree component would be slowed on treated acres as trees respond to the increased growing space resulting from thinning from below.

Overall within the LOS stands, overstory structural diversity will remain, but understory complexity will be reduced through thinning, mowing, and burning. Although prey habitat will be reduced in the short-term residual habitat will remain providing foraging opportunities for the goshawk. Long-term benefits of treatments will be a reduction in stress to the overstory promoting longevity, but also to promote the development of future old growth in the stand that will provide long-term nesting habitat.

In the short-term, Alternative 4 affects fewer acres of habitat than Alternative 2. However, in the long-term, treatments do not promote the development of more fire resistant mixed conifer stands or promote the development of LOS ponderosa pine by creating structural heterogeneity. Alternative 4 was developed to be responsive to public comments of treatments to thermal cover for deer and elk, leaving large areas untreated. The longevity of existing habitat will diminish in the short-term, and as a result will not promote the fire resilient ponderosa pine within these stands which are a key component of goshawk habitat on eastside forests. Alternative 3 is the most proactive alternative for the management of long-term goshawk habitat across the project area and does the best job at maintaining existing habitat while developing long-term future habitat.

The FlamMap hazard assessment conducted for Alternative 2 shows a reduction in extreme hazard by 98% of the existing condition hazard to 233 acres. For all hazard classes shown to be damaging to valued stand characteristics- moderate, high and extreme hazard, hazard in these classes was reduced by 7,667 acres or by 70% of the existing condition hazard. The hazard assessment conducted for Alternative 3 shows a reduction in extreme hazard by 98% of the existing condition hazard to 234 acres. For all hazard classes shown to be damaging to valued stand characteristics- moderate, high and extreme hazard, hazard in these classes was reduced by 7,645 acres or by 70% of the existing condition hazard. Lastly, hazard assessment conducted for Alternative 4 shows a reduction in extreme hazard by 98% of the existing condition hazard to 234 acres. For all hazard classes shown to be damaging to valued stand characteristics- moderate, high and extreme hazard, hazard in these classes was reduced by 7,575 acres or by 69% of the existing condition hazard.

Cumulative Effects

The majority of nest sites on the Bend/Ft. Rock RD are located within both the mixed conifer and ponderosa pine PAGs. Due to the dominance of lodgepole pine, the mixed conifer PAG has experienced moderate to heavy mortality with the insect and disease outbreak over the last 10 to 15 years. The majority of the outbreak occurred in the pure lodgepole pine PAG in the high elevations, but the intensity of the outbreak was such that it spread into the mixed conifer stands at lower elevations. Although the majority of the outbreak has subsided, beetle activity continues to occur in small pockets of dense trees. Tree mortality from insects and disease and subsequent overstory canopy loss has reduced suitable nesting habitat for goshawks. In addition, much of the Bend/Ft. Rock RD ponderosa pine PAG occurs in dense second growth stands created from the clear cutting that occurred in the early 1930s. The residual natural regeneration created a legacy of overstocked ponderosa pine which had become suppressed and occurrences of disease and infestation outbreaks were surfacing through the late 1980s and early 1990s, also causing overstory canopy loss. By the mid 1990s many landscape scale thinning project shad been implemented to deal with these issues. The projects minimally retained existing nesting habitat while thinning stands to reduce disease and ongoing susceptibility to insect outbreaks

Within the watershed (zone of influence for cumulative effects) a variety of past thinning projects occurred, primarily in stands of low elevation second growth ponderosa pine. Goshawk surveys occurred within these areas and territories were identified and protected from thinning. Treatments were designed to reduce the risk of stand replacing fire and promote the development of contiguous stands of future old growth ponderosa pine, while reducing the stands susceptibility to insects and disease. The majority of thinning removed trees 8 inch dbh and less, but also commercially thinned trees up to 21 inches dbh. Mowing and prescribed fire continue to occur in these areas on roughly a five year rotation.

Table 27 was reviewed for potential projects contributing to cumulative effects to goshawk. The following ongoing vegetation management projects occur within suitable goshawk habitat within the watershed and contribute to cumulative effects. Measures were incorporated to retain suitable nesting habitat for each project area as well as enhance habitat conditions. Overall, treatments proposed will improve goshawk habitat conditions by promoting the development of large structure and reducing the risk of loss of existing habitat from other large-scale disturbances. These ongoing projects will treat approximately 11,703 acres.

Table 92: Ongoing and foreseeable vegetation projects that may contribute to cumulative effects.

Project	Status	Acres
Rocket Vegetation Management	Planning	6,387acres of commercial thinning, plus mowing and underburning.
Sparky timber sale and hazard tree removal.	Ongoing/ Planned	172 acres along project boundary and Cascade lakes highway. Commercial thinning, salvage, understory thinning, fuels treatments (pile, mow, burn).
Fry timber sale and fuels treatment	Ongoing/Planned	106 acres surrounded by project on north end. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest and understory treatments completed, Fuels treatments remaining.
Jet Timber Sale part of West Tumbull project	Ongoing/Planned	Within the watershed 584 acres in Skyliners road upper community. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest continuing Understory treatments and fuels treatments remaining.
East Tumbull HFRA Project (Net T.S., Set T.S., NT7)	Ongoing/Planned	2,534 acres within east 1/3 of West Bend Project. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest finished, understory treatments for fuels remaining.
Katalo East and West Projects	Ongoing/Planned	1,435 acres within project area center 1/3 of west bend project. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest finished, understory tree treatments finished, fuels treatments remaining-burning
Feline timber sale	Ongoing	143 acres within project area. Tee harvest and understory treatments finished. Fuels treatments remaining.
Skyliner CFLRA	Ongoing	35 acres of treatment within the wildlife urban interface of the Skyliner community.
Invasive Plant Control EIS	Planned	Within project area and across Forest. Herbicide and manual treatment of invasive plant populations

Ongoing and future recreation development is also occurring in the watershed. The majority is of development occurs in the forms of trail and trailhead development. These developments promote increased human use to areas containing suitable goshawk nesting and foraging habitat. Although no goshawk habitat will be removed with these projects, due to the ongoing and future thinning within the

watershed, the increase of human disturbance to the area could displace birds as a result. However, through ongoing vegetation management project road closure is being implemented to reduce road densities within the watershed, minimizing disturbance from motorized vehicles and recreation. The following Table 93 is a list of ongoing and future foreseeable recreation projects within the watershed, taken from Table 27, which may contribute to cumulative effects to MIS.

Table 93: Ongoing and foreseeable recreation-related projects.

Recreation		
Phil's Trailhead Enhancement	Planning	Providing paved parking area, toilets, and trailhead kiosks. Approximately 1.4 acres impacted.
Mountain Biking	Ongoing	Within and around West Bend project area. Wheeled and bipedal recreation of trails. Some cutting of trees for trails and safety.
Deschutes River area recreation	Ongoing	Day use areas at several locations.
Developed and Dispersed Camping	Ongoing	Dispersed camping throughout project area. No developed camp sites.
Meissner Snopark Expansion	Implementation 2013	Existing parking area to be expanded. Parking will be available for a total of 180 spaces. A Nordic event start/finish area would be approximately 2 acres and would not be returned to a forested condition.
Cascade Lakes welcome station and parking lot	Implementation 2013	Providing building with power and water, restrooms, interpretive trail and paved parking lot for access to site and trail systems.
Ryan Ranch	Analysis and public comment completed	Restoration of wetland, removal of dike, interpretive trails and boardwalk
Roads		
Road Closures	Planning	Roads were identified to be closed in Katalo East, Katalo West, and East Tumble projects.

Private lands are not managed for goshawk habitat. Therefore, it is assumed that any habitat provided by private timberland in the watershed is incidental and may not be long term.

Goshawk populations are not expected to decline across the watershed. Most of the territories have already become inactive due to the loss of nesting and fledgling habitat from ongoing insect and disease impacting the mixed conifer habitat types. However suitable habitat exists in the watershed to assist with attainment of population objective for the Deschutes National Forest. Habitat availability continues to occur for dispersing goshawks, but will be limited in the short-term with increased competition for what remains.

Of the 9,803 acres of reproductive habitat identified within the project area, Alternative 2 will treat approximately 8,190 acres of reproductive habitat, approximately 8,191 under Alternative 3, and approximately 8,157 under alternative 4. The project area has been surveyed to protocol and no treatments are associated with any active nest sites or territories.

Of the 37,838 acres of goshawk reproductive habitat within the watershed, cumulatively Alternative 2, 3 and 4 will treat approximately 21% of the total habitat.

On average the treatments are associated with 1% of the total goshawk reproductive habitat across the Deschutes National Forest.

Conclusions

The Oregon Natural Heritage Information Center maintains a list of the most current information available on the distribution and abundance of animals native to Oregon. For the state of Oregon, they

rank the northern goshawk population in Oregon S3, "Vulnerable", but nationally they are demonstrably wide-spread, abundant, and secure, G5.

The No Action Alternative may impact goshawks and their habitat due to the ongoing loss of large structure and the conversion of stands to non-sustainable and non-fire resistant species as well as stand replacing fire.

The Action Alternatives have the potential to impact goshawks and their habitat by reducing stand densities and canopy closures potentially affecting suitable nesting habitat and prey species habitat. However, through project design criteria, treatments have been designed to maintain residual habitat in treatment units as well as the retention of untreated stands throughout the project area providing habitat connectivity. Mitigation measure have also been incorporated in the event a new nest site is discovered prior to or during implementation.

No impacts will occur to known occupied habitat as a result of any action alternative. Although treatments will occur in suitable habitat it will not preclude use by the goshawk. These areas will still provide foraging opportunities, and residual untreated areas will still provide nesting opportunities within the project area.

Although treatments will thin stands that are currently suitable reproductive habitat, the West-Bend project will not contribute to a change in viability within the watershed or on the Deschutes National Forest for the goshawk.

Consistency

Implementation of the West-Bend project is consistent with the Standards and Guidelines for the Deschutes National Forest Land Resource Management Plan. Treatments will be beneficial to the long-term management of goshawk habitat. No new road systems or temporary road systems will be located within any known goshawk nest stands.

Cooper's and Sharp-shinned Hawks

Existing Condition

Cooper's Hawk

The Cooper's and sharp-shinned hawks are considered MIS species in the Deschutes LRMP. They often use dense cover in which to hunt and nest. In Oregon, Reynolds and Wight (1978) studied Cooper's hawk distribution, nest density, and productivity in 3 subregions: 1) the Coast Range and the west slope of the Cascade Range, a moist, densely forested region with a mild maritime climate referred to as western Oregon; 2) southwestern Oregon, which includes the Siskiyou Mountains, characterized by relatively warm, wet winters and hot, dry summers; and 3) eastern Oregon (including the east slope of the Cascade range), a high elevation and more dry region with affinities to the Rocky Mountain forests. The tree species composition in the Bly study area varied from pure stands of ponderosa pine at lower elevations, to mixed stands of ponderosa pine and white fir at mid-elevations, to mixed and pure stands of white fir and lodgepole pine at high elevations. Stands of all age classes in each timber type were represented, however the most common type was mature ponderosa pine overstory with mixed understory of ponderosa pine and white fir. As part of Reynolds and Wight's study from 1978, Reynolds et al. (1982) further studied Cooper's hawk habitat within the same geographic reference: Coast Range and eastern Oregon, including the west and east slopes of the Cascades, and the Wallowa, Blue, Ochoco, Bly, and Steen's mountains in eastern Oregon. Vegetational and physiographic characteristics of nest sites were obtained and the analysis concluded that this species nests in stands that resembled the even-aged, 2nd-growth stands in larger older trees (30-60 years old in the northwestern region and 50-70 years old in eastern Oregon), and have deep crowns. In northwestern Oregon, all nests except one (ponderosa pine) were in Douglas-fir stands, whereas in eastern Oregon ten nests were in ponderosa pine stands, five were in white fir stands, and three were in Douglas-fir stands.

Also, Cooper's hawk nests in both regions were on horizontal limbs against the trunk (a few were out on limbs or in crotches of double trunks) and were either immediately below the nest-tree crown or in the lower portion of the crown. Nests in eastern Oregon were commonly in deformed trees infected by dwarf mistletoe and that had heavy foliage, witches brooms, or double trunks. Nest height and nest-tree height were nearly the same in both regions.

Based on the literature reviews in the state of Oregon, there are many similarities in the vegetation on the DNF and nest-site selections of these characteristics are occurring. Differences are also apparent between study areas (i.e. The study area in eastern Oregon has more streams and creeks, and the topography is steeper versus some areas on the DNF; and southern Oregon has large expanses of oak where it is non-existent on the DNF), but similarities in forest composition occur. It is important to take this variability into account when making inferences about habitat use on the DNF from studies at other locations. (USFS 2012).

Only a few studies have investigated the foraging habitat of Cooper's hawks (Fischer 1986, Mannan and Boal 2000, Murphy et al. 1988). We know little of preferences for stands of differing densities, ages, tree sizes, or edge versus deep forests by Cooper's hawks (Reynolds 1989). However, they appear to use available forests opportunistically provided that the available types are not too dense for flight below or within the canopy (Reynolds 1989). (USFS 2012).

Nature Serve identified Cooper's hawk as secure at the global and national scale, and apparently secure in the state of Oregon. It was not identified on the Federal and State Sensitive species list, Birds of Conservation Concern list, Oregon Conservation Strategy, or the Partners in Flight lists. (USFS 2012).

The following is a potential list of threats due to habitat alteration for the Cooper' hawk (USFS 2012):

- Timber harvest - Treatments such as Commercial and non-commercial thinning, shelterwood and clearcut harvesting, where it reduce crown cover and dense forest. Impacts to habitat will be unique from site to site due to the varying structure of the forest.
- Recreation - Habitat loss from developed and dispersed recreation, as well as new transportation routes associated with new facilities.
- Livestock grazing-Annual removal of prey habitat from grazing.
- Mining - Habitat loss from removal of forest in developing the mine. Disturbance to adjacent habitat from operations.
- Prescribed fire - Prescribed burns simulate natural forms of disturbance that occur periodically across the landscape. These forms of disturbance are likely to be important in providing future nest sites for Cooper's hawks.
- Fire suppression - Results of fire suppression include an increase in tree density and an increased likelihood of crown fires. How increased tree density affects Cooper's hawks should depend on the degree that tree density increases. If tree density is too high, it could interfere with the ability of the Cooper's hawk to fly and hunt. However, increased tree density in some areas might improve the quality of the habitat for nesting. High-intensity crown fires are presumed to be the most deleterious consequence of fire suppression. Crown fires result in vast stand-replacing disturbances with significant habitat loss in ponderosa pine cover types, but especially in lodgepole pine cover types and in mixed conifer.
- Invasive plant establishment - Cheatgrass (Bromus spp.) could be a problem for Cooper's hawk and their prey species. This species invades areas after a disturbance and leads to the rapid accumulation of highly flammable fuel, shortening the fire-free interval. Fires occur more frequently, causing a decline in some perennial grass species, further favoring cheatgrass

expansion. The result is a loss in the heterogeneity of the landscape, potentially lowering prey diversity and availability.

- Fuelwood harvest - Fuelwood harvest could adversely affect habitat if snags are removed that are used as perch sites or prey species habitat or cause disturbance during the breeding season.
- Falconry - Cooper's hawks can legally be taken for falconry in various states, including Oregon. Take by falconers is considered low; therefore it is thought to be a negligible threat.

Sharp-shinned Hawks

As part of Reynolds and Wight's study from 1978, Reynolds et al. (1982) further studied sharp-shinned hawk habitat within the same geographic reference: Coast Range and eastern Oregon, including the west and east slopes of the Cascades, and the Wallowa, Blue, Ochoco, Bly, and Steen's mountains in eastern Oregon. All nest sites in eastern Oregon were in even-aged stands of white fir (7), Douglas-fir (1), ponderosa pine (1), or aspen (1). The vegetative structure was essentially the same as in the even-aged nest sites in northwestern Oregon, with the exception that tree density and diameter were less uniform in eastern Oregon. The analysis concluded that this species nested in stands of 3 different vegetative structures: most nests (81%) were in young (25-50 years), even-aged conifer stands with single-layered canopies; 2 nests (13%) were in old-growth (200+years) stands of conifers with multilayered canopies; and 1 nest was in a dense stand of stunted quaking aspen. Sharp-shinned hawk nests in both regions were placed in the denser portion of the lower canopy against the trunk or in a crotch of a double or split trunk. (USFS 2012)

Based on the literature reviews for the state of Oregon there are many similarities in the vegetation on the DNF, including the characteristics of nest-site selections. Differences are also apparent between study areas (i.e. the study area in eastern Oregon has more streams and creeks, and the topography is steeper versus some areas on the DNF; and southern Oregon has large expanses of oak where it is non-existent on the DNF), but similarities in forest composition occur. It is important to take this variability into account when making inferences about habitat use on the DNF from studies at other locations. (USFS 2012)

Few telemetry studies have been performed on sharp-shinned hawks, therefore little information is available on foraging habitat. From observations of prey species deliveries to nests, Reynolds and Meslow (1984) estimated that sharp-shinned hawks foraged primarily in the upper canopy zone. However, Clarke (1984) and Joy (1990) observed that sharp-shinned hawks did forage near the ground. Joy et al. (1994) reported that of 11 sharp-shinned hawk nest sites, mature aspen was the most common (8 of11) vegetation within a 2 km circle around the nest, mixed aspen-conifer was the most common "secondary" habitat (9 of 11), and conifer forest was the most "limited" habitat type. Platt (1973) monitored a male sharp-shinned hawk with radio-telemetry and observed that the male primarily hunted in a clonal-oak grassland community. The author suggested the males' attraction to this community was related to high food availability. (USFS 2012)

Nature Serve identified sharp-shinned hawk as secure at the global and national scale, and apparently secure in the state of Oregon. It was not identified on the Federal and State Sensitivespecies list, *Birds of Conservation Concern list,* Oregon Conservation Strategy, or the Partners in Flight lists. (USFS 2012).

Comparisons Of Sharp-Shinned Hawk, Cooper's Hawk, and Northern Goshawk Habitat

Several studies have compared nesting habitat use between coexisting Accipiters in North America (Fischer 1986, Kennedy 1988, Moore and Henny 1983, Reynolds et al. 1982, Reynolds 1983, Siders and Kennedy 1996, Trexel et al. 1999, Wiggers and Kritz 1991). Where these species coexist, a relationship occurs in which tree height and DBH of nest trees increases in proportion to Accipiter body size (Kennedy 1988, Reynolds et al. 1982, Siders and Kennedy 1996). For example, sharp-shinned hawk nest sites in Oregon were characterized as dense, 40 to 60-year-old even-aged conifer stands while

Cooper's hawk nest sites were 50 to 80year-old conifer stands with somewhat larger, more widely spaced trees, and goshawk nest sites were dense, mature conifer stands with varying densities of mature, overstory trees (Reynolds et al. 1982). However, high interspecific overlap occurs between the species in the use of nest site characteristics such as basal area, canopy cover, and tree density (Kennedy 1988, Moore and Henny 1983, Siders and Kennedy 1996). Siders and Kennedy (1996) observed large overlaps between Cooper's hawk and goshawk nest site characteristics while Moore and Henny (1983) reported large overlaps between Cooper's hawk and sharp-shinned hawk nest site characteristics. (USFS 2012)

Threats to the sharp-shinned hawk are similar to those addressed for the Coopers' hawk (USFS 2012).

Surveys were conducted during goshawk monitoring. No detections or nests were identified within the project area. One active Coopers' hawk nest site occurs within the project area. (NRIS Wildlife Database)

Through the Forest wide assessment completed for MIS, Cooper's and sharp-shinned hawk reproductive habitat was mapped across the entire Deschutes National Forest.

Approximately 9,246 acres of Cooper's hawk habitat exists within the project area. Approximately 32,849 acres of habitat occurs within the watershed and approximately 275,487 acres of habitat occurs across the Deschutes National Forest.

Approximately 10,838 acres of sharp-shinned hawk habitat exists within the project area. Approximately 42,351 acres of habitat occurs within the watershed and approximately 426,285 acres of habitat occurs across the Deschutes National Forest.

Table 94 and Table 95 summarize habitat acreages for both Cooper's and sharp-shinned hawks:

Table 94: Cooper's hawk habitat within the West-Bend project area, Watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
9,246 acres	32,849 acres	275,487 acres

Table 95: Sharp-shinned hawk habitat within the West-Bend project area, Watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
10,838 acres	42,351 acres	426,285 acres

For the detailed assessment on the Cooper's and sharp-shinned hawk for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Analysis Issue – Effects to Coopers' and sharp-shinned hawks

Measure: Acres of suitable reproductive habitat affected for Coopers' and sharp-shinned hawks.

Environmental Consequences

Alternative 1 – No Action – Existing Ecological Trend

Habitat conditions would remain the same for the short-term. Stand densities would continue to increase due to fire suppression. This would increase the amount of potential habitat over time. However, with increased stand densities comes increased risk of loss from disturbance events (insects, disease, or fire). These events would likely impact the densest stands the greatest due to the stand conditions which would result in reduced availability of suitable habitat in the project area.

Areas that currently provide suitable habitat would most likely have increased mortality levels due to tree stress in the long-term. Without the treatments prescribed to thin from below within multi-storied ponderosa pine and mixed conifer stands, stand densities will reduce the longevity of residual old growth and large tree structure that occurs in these stands. In high density stands of second growth ponderosa pine and plantations with advanced regeneration, due to overstocking and high amounts of mistletoe, in the short-term the mistletoe will reduce the resiliency of these stands against bark beetle attack. In the long-term, the second growth stands and plantations will likely contain bark beetle outbreaks and high densities of small snags will occur within the project area, and habitat would diminish.

Due to stand densities within the project area and increases in mortality overtime, the risk of large scale stand replacing fire across the West-Bend project area also increases over time, potentially impacting high density stands that provide sharp-shinned reproductive habitat.

Potential fire hazard for the existing condition/no action of the West Bend Planning area has been predicted by using a number of state of the art tools. Remote sensing satellite imagery from 2004 was updated using ArcFuels (Ager et al. 2011) to reflect activities accomplished since 2004. The data was then analyzed in the computer model FlamMap (v. 3.0) under specific weather conditions. FlamMap, a fire behavior mapping and analysis program that computes fire behavior characteristics (rates of spread, flame length, crown fire potential, etc.) over an entire landscape, was used to determine the existing stand condition's potential fire hazard. FlamMap is a state of the art tool used by many researchers and modelers (Finney 2006; Stratton 2004; Ager, Finney & McMahon 2006; Gercke & Stewart 2006; Opperman et al., 2006, Ager et al. 2006; Yohay et al. 2009; Krasnow et al. 2009; Arca et al. 2007; Stratton, 2006, Knight & Coleman, 1993). FlamMap output lends itself well to landscape comparisons (e.g. pre- and post-treatment effectiveness) and for identifying hazardous fuel and topographic combinations, thus aiding in prioritization and assessments (Stratton 2004). Although the (modeling) approach has limitations, model outputs yield useful information for planning, assessing, and prioritizing fuel treatments (Stratton 2004). The data inputs necessary for FlamMap include aspect, slope, elevation, fuel model, canopy height, canopy base height, crown bulk density, and crown class. Specific wind and fuel conditions used for running the model may be referenced in the fuels section of the EIS. Under the No Action Alternative approximately 9,317 acres or 36% of the project area is predicted to be at extreme hazard. An additional 1,593 acres or 6% of the project area is predicted to be at moderate to high hazard. Fire effects analysis and best available science supports that moderate to high hazard potential would be damaging to valued stand characteristics; extreme hazard with high flame lengths and varying degrees of crown fire would be most damaging.

Overall, high stand densities will result in a decrease in tree vigor among all size classes reducing canopy closure and nesting habitat for both the Cooper's and sharp-shinned hawks.

Effects Common to Alternatives 2 (Proposed Action), Alternative 3, and Alternative 4

Direct and Indirect Impacts

Thinning From Below (HTH), Harvest Improvement Cut (HIM) Ladder Fuels Reduction (LFR), Skid and Deck

Thinning in suitable habitat would occur in both second growth ponderosa pine and multi-storied mixed conifer stands. Thinning (from 7" dbh and up) from below will favor the largest ponderosa pine in pure pine stands. In mixed conifer stands thinning will favor ponderosa pine and healthy white-fir. An average basal area of 60 square feet is the target in these stands, except under Alternatives 3 and 4 where an average basal area of 80 square feet will remain within goshawk PFA stands. Different scenarios exist depending on the existing basal area, site productivity, and stand structure objectives depending on alternative. These treatments aid in maintaining the larges trees where they exist, reducing their susceptibility to fire and insects by removing competition for space and nutrients.

Thinning decreases stand densities and allows for faster growth of young trees while reducing risk (removal of ladder fuels). However, canopy cover is reduced overall resulting in more open stands which may directly impact the Coopers' and sharp-shinned hawk habitat by removing reproductive habitat. Beneficial impacts should result from thinning as canopies will be opened up and stand densities reduced to lessen the risk of a large-scale event (insects, disease, or fire).

Harvest Cut with Reserves (HCR)

Due to the removal of ponderosa pine from theses stands through past management activities, stand are comprised primarily of lodgepole pine and white-fir. These tree species are not fire resistant, and due to mountain pine beetle outbreaks in the watershed, much of the lodgepole pine is dead, reducing canopy closures and contributing to fuel loading as well as decreasing the amount of suitable reproductive habitat. White-fir is also a short-lived species, and highly susceptible to insects and disease, and many of the white-fir in these stands are declining from mistletoe or other diseases. The stands are typically dominated in the overstory with lodgepole pine and have a wide range of age groups of white fir. To meet the desire for a diverse landscape pattern, the dead and live overstory lodgepole pine will be removed except for seed trees and the white fir will be left in a clumping pattern removing overstory mistletoe trees where understory development is desired and leaving clumps undisturbed to reduce disease potential. These stands will be considered a regeneration harvest because of the variability of the final stocking. Treatments will decrease overstory canopy closure, diminishing the suitability of reproductive habitat in these areas. However, by clumping the residual green white fir, and retaining all ponderosa pine and healthy lodgepole pine and white fir in the overstory, these areas will continue to provide potential foraging habitat. Residual overstory trees will provide perch sites while clumps of white-fir will provide perch sites for prey habitat. Reserves of untreated habitat will be retained within these units at a level of 15% of the over treated stand to maintain habitat connectivity.

Mowing and Burning Only (MB)

Underburning will occur in stands with a more fire resistant overstory and fewer small (<9" dbh) trees than in small tree thinning units. Some thinning of small trees (up to 8" dbh) may be needed as a pre-treatment to fire. Mowing (mastication) of brush may also occur where existing brush density and height would contribute to undesirable fire behavior. These treatments will reduce both fuels associated with thinning and overall fuel loadings to acceptable levels. Fuel treatments will reduce fire risk and will reduce competition to established trees, further increasing the stands resiliency to wildfire. Mowing and burning will both be utilized as a primary stand treatment as well as a secondary follow up treatment to thinning where it is needed. Fuels treatments will also reduce the understory complexity which may result in a change or reduction in potential prey species. However, adjacent untreated areas may be able to provide the structural complexity for prey species that will provide potential foraging opportunities.

Table 96 summarizes the amount of Coopers' hawk reproductive habitat affected by the action alternative identified for the West-Bend project.

Table 96: Total acres of Coopers' hawk reproductive habitat associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	5460.91	5458.46	4149.67
HCR	638.94	638.94	638.94
LFR	39.81	35.14	268.88
Skid & Deck	897.14	897.14	558.88
Burn	925.83	936.28	2721.45

Total Acres Affected	**7,963**	**7,966**	**8,338**

Table 97 summarizes the amount of sharp-shinned hawk reproductive habitat affected by the action alternative identified for the West-Bend project.

Table 97: Total acres of sharp-shinned hawk reproductive habitat associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	6,057.81	6,054.26	4,653.17
HCR	1042.59	1042.59	1042.59
HIM	61.6	61.6	61.6
LFR	44.7	40.03	275.55
Skid & Deck	952.52	952.52	613.37
Burn	986.99	992.77	2,276.66
Total Acres Affected	**9,146**	**9,144**	**8,923**

Affects to Cooper's and sharp-shinned hawk habitat are similar under Alternative 2, 3 and 4. The outcome of the affects to habitat as a result of each treatment type is the same across all action alternatives, the only thing that changes by alternative is the total acres of habitat treated. Alternative 3 was developed to address the key issues of variability of thinning approach on the landscape, final removal treatment to lodgepole pine seed tree units, and goshawk habitat management. Similarly Alternative 4 carried through issues from Alternative 3, but Alternative 4 addresses the issue of the reduction of deer and elk thermal cover within the project area. Under Alternative 4 thinning of stands containing thermal cover were dropped, although fuels treatments remained in some stands capable of being maintained with fuels treatments only. As a result, there is a net decrease in the total acres of sharp-shinned hawk reproductive habitat that is treated in both Alternatives 3 and 4. Under alternative 4, Cooper's hawk habitat treatments increase due to the prescription change from thinning to maintenance with prescribed fire. Therefore affects to reproductive habitat by alternative is similar, since the same prescriptions will be implemented under each alternative. Total acres of reproductive habitat treated will change by alternative.

The project area and habitat varies greatly from east to west due to the increase in elevation, the rain gradient associated with the change in elevation, and the site potential associated with the inherent soil quality within this east to west pattern. To capture the importance of habitat variation across the project area, the project area was broken up into four ecotones moving from east to west. A habitat retention strategy was defined where in the low elevation ponderosa pine ecotone (approximately 16,146 acres), approximately 10% of this zone would be left in un-treated stands and aggregate patches, in the mid-elevation ponderosa pine mixed conifer dry ecotone (approximately 3,966 acres) approximatley15% of this landscape would be left in untreated stand and aggregate patches, within the high elevation mixed conifer wet stands (approximately 3,027 acres), approximately 20% of this landscape would left in untreated stands and aggregate patches, and lastly the lodgepole pine community (approximately 2,027 acres), where in regeneration harvest units 15% of each harvest unit will remain untreated. These untreated areas were identified to retain habitat connectivity between thinned stands associated with project treatments.

Overall, approximately 7,963 acres of Coopers' hawk reproductive habitat are associated with treatments identified under Alternative 2, approximately 7,965 acres under Alternative 3, and approximately 8,338 acres under Alternative 4.

Overall, approximately 9,148 acres of sharp-shinned reproductive habitat are associated with treatments identified under Alternative 2, approximately 9,145 acres under Alternative 3, and approximately 8,924 acres under Alternative 4.

All treatments described above will aid in the development of a more disturbance-resilient landscape.

The Cooper's and sharp-shinned hawks are smaller accipiter' and therefore can utilize younger stands that offer seclusion and structure for nest support than the much larger goshawk which needs larger trees for nest support and overhead canopy to make the larger bird more discreet. Potential nesting habitat would most likely develop within proposed units within 20-40 years. In the short-term, the designated cover clumps and untreated stands would provide dispersal, foraging, and potential nesting habitat.

Foraging habitat would not necessarily decrease in acreage, but would decrease in quality from mechanical shrub treatment or prescribed fire. For Cooper's and sharp-shinned hawks, the reduction of shrubs from mowing activities can impact their prey species of ground dwelling small mammals and shrub/ground nesting passerines. These ground species depend on the shrubs for nesting, and cover for hiding from predators. This activity would reduce the amount of available habitat for some Cooper's and sharp-shinned hawk prey species, potentially reducing areas utilized by them for foraging as well as minimizing the availability of prey within suitable nesting areas.

In the short-term, Alternative 4 affects the fewest number of acres of habitat for sharp-shinned hawk and Alternative 2 affects the fewest number of acres of habitat for the Cooper's Hawk. Alternative 3 provides a complexity of treatment types to develop more fire resistant mixed conifer and ponderosa pine stands while retaining both nesting and foraging habitat.

The FlamMap hazard assessment conducted for Alternative 2 shows a reduction in extreme hazard by 98% of the existing condition hazard to 233 acres. For all hazard classes shown to be damaging to valued stand characteristics- moderate, high and extreme hazard, hazard in these classes was reduced by 7,667 acres or by 70% of the existing condition hazard. The hazard assessment conducted for Alternative 3 shows a reduction in extreme hazard by 98% of the existing condition hazard to 234 acres. For all hazard classes shown to be damaging to valued stand characteristics- moderate, high and extreme hazard, hazard in these classes was reduced by 7,645 acres or by 70% of the existing condition hazard. Lastly, hazard assessment conducted for Alternative 4 shows a reduction in extreme hazard by 98% of the existing condition hazard to 234 acres. For all hazard classes shown to be damaging to valued stand characteristics- moderate, high and extreme hazard, hazard in these classes was reduced by 7,575 acres or by 69% of the existing condition hazard. Over the long-term, these treatments will aid in retaining multi-storied mixed conifer stands with complex structure and residual second growth ponderosa pine stands that provide habitat for Cooper's and sharp-shinned hawks to stand replacing fire or insects and disease. This has consistently occurred across the Forest over the last 10 to 15 years.

Cumulative Effects

Territories on the Bend/Ft. Rock RD have been wide spread, located within the mixed conifer PAGs containing multi-storied highly complex stands as well as 60 to 80 year old second growth ponderosa pine with high canopy closure. Due to the dominance of lodgepole pine, the mixed conifer PAG has experienced moderate to heavy mortality with the insect and disease outbreak over the last 10 to 15 years. The majority of the outbreak occurred in the pure lodgepole pine PAG in the high elevations, but the intensity of the outbreak was such that it spread into the mixed conifer stands at lower elevations. Although the majority of the outbreak has subsided, beetle activity continues to occur in small pockets of dense trees. Tree mortality from insects and disease and subsequent overstory canopy loss has had the greatest influence on Cooper's and sharp-shinned hawk habitat due to the reduction of canopy cover. In

addition, much of the Bend/Ft. Rock RD ponderosa pine PAG occurs in dense second growth stands created from the clear cutting that occurred in the early 1930s. The residual natural regeneration created a legacy of overstocked ponderosa pine which has provided highly suitable Cooper's and sharp-shinned hawk habitat, but had become suppressed and occurrences of disease and infestation out breaks were surfacing through the late 1980s and early 1990s, also causing overstory canopy loss. By the mid-1990s many landscape scale thinning projects had been implemented to deal with these issues. The projects minimally retained existing nesting habitat while thinning stands to reduce disease and ongoing susceptibility to insect outbreaks.

Within the watershed (zone of influence for cumulative effects) a variety of past thinning projects occurred in the watershed, primarily in stands of low elevation second growth ponderosa pine which is primary habitat for Cooper's and sharp-shinned hawk. Treatments were designed to reduce the risk of stand replacing fire and promote the development of contiguous stands of future old growth ponderosa pine, while reducing the stands susceptibility to insects and disease. The majority of thinning removed trees 8 inch dbh and less, but also commercially thinned trees up to 21 inches dbh. Mowing and prescribed fire continue to occur in these areas on roughly a five year rotation.

Ongoing and futures foreseeable vegetation management projects occur or will occur within suitable habitat within the watershed and contribute to cumulative effects (see Table 92). Measures were incorporated to retain suitable nesting habitat for each project area as well as enhance habitat conditions. Overall, treatments proposed will improve habitat conditions by promoting the development of more fire and disease resistant open stand containing large tree structure and reducing the risk of loss of existing habitat from other large-scale disturbances. These ongoing projects will treat approximately 11,703 acres.

Ongoing and future recreation development is also occurring in the watershed (see Table 93). The majority is of development occurs in the forms of trail and trailhead development. These developments promote increased human use to areas containing suitable nesting and foraging habitat. No habitat will be removed with these projects, but due to the ongoing and future thinning within the watershed, the increase of human disturbance to the area could displace birds as a result. However, through ongoing vegetation management project road closures are being implemented to reduce road densities within the watershed, minimizing disturbance from motorized vehicles and motorized recreation.

Private lands are not managed for Coopers' and sharp-shined hawk habitat. Therefore, it is assumed that any habitat provided by private timberland in the Watershed is incidental and may not be long term.

Of the 9,246 acres of Cooper's hawk reproductive habitat identified within the project area Alternative 2 will treat approximately 7,963 acres of reproductive habitat, approximately 7,966 under Alternative 3, and approximately 8,338 under alternative 4. There is one active nest site within the project area. To maintain the nest core and stand characteristics associated with the nest, the entire 59 acres stand was removed from treatment.

Of the 10,383 acres of sharp-shinned hawk reproductive habitat identified within the project area Alternative 2 will treat approximately 9,146 acres of reproductive habitat, approximately 9,144 under Alternative 3, and approximately 8,923 under alternative 4. There are no known nest sites associated with any of the proposed alternatives.

Of the 32,849 acres of Coopers' hawk reproductive habitat within the Watershed, cumulatively Alternative 2 and 3 will treat approximately 24% and Alternative 4 will treat approximately 25% of the total habitat.

Of the 42,351 acres of sharp-shinned hawk reproductive habitat within the Watershed, cumulatively Alternative 2, 3 and 4 will treat approximately 21% of the total habitat.

Cumulatively, on average the treatments are associated with 3% of the total Cooper's reproductive habitat and on average the treatments are associated with 2% of the total sharp-shinned hawk reproductive habitat across the Deschutes National Forest.

Conclusions

Sharp-shinned and Cooper's hawks are both ranked S4, "Apparently Secure" in the state of Oregon (NatureServe 2009).

The No Action Alternative could affect Coopers' and sharp-shinned hawk and their habitat due to the ongoing loss of multi-storied dense stand and the conversion of stands to non-sustainable and non-fire resistant species as well as stand replacing fire in the short-term.

The Action Alternatives have the potential to affect Coopers' and sharp-shinned hawk and their habitat by reducing stand densities and canopy closures potentially affecting suitable nesting habitat and prey species habitat. However, through project design criteria, treatments have been designed to maintain residual habitat in treatment units as well as the retention of untreated stands throughout the project providing habitat connectivity. Mitigation measure have also been incorporated in the event a new nest site is discovered prior to or during implementation.

No loss of habitat or disturbance will occur to known occupied territories as a result of any action alternative. Although treatments will occur in suitable habitat it will not preclude use by the Coopers' and sharp-shinned hawk. These areas will still provide foraging opportunities, and residual untreated areas will still provide nesting opportunities within the project area.

Although treatments will thin stands that are currently suitable reproductive habitat, the West-Bend project will not contribute to a change in viability within the Watershed or on the Deschutes National Forest for the Coopers' and sharp-shinned hawk. Sufficient habitat exists to maintain the viability of this species in the watershed and across the Forest.

Implementation of the West-Bend project would be consistent with the Standards and Guidelines for the Deschutes National Forest Land Resource Management Plan.

Great Gray Owl

Existing Condition

This species was identified in the NWFP (USDA 1994a) as a protection buffer species requiring surveys due to an apparent range expansion resulting from opening up dense-canopied stands with shelterwood type harvest activities. A Regional survey protocol was developed in 1995 (USDA 1995) and was updated in January of 2004 (Version 3.0) (USDA/USDI 2004a). An amendment to the NWFP occurred in 2001 which moved the great gray owl from a protection buffer species to a Category C species. This category contained uncommon species for which pre-disturbance surveys are practical. The great gray owl is considered a Management Indicator Species in the Deschutes LRMP.

For great gray owl habitat the availability of nest sites and suitable foraging habitat are considered the most important factors (Collins 1980; Nero 1980; Mikkola 1983). Since foraging and nesting habitat can be quite different, proximity of these key components may be important as well. Other components include prey abundance (vole and/or gopher), meadow vegetation (height and cover), meadow moisture, forest canopy cover, and snag presence (Bull Henjum 1990, Whitfield and Gaffney 1997). For central Oregon, Bryan and Forsman (1987) found key habitat for great gray owls was a meadow system associated with coniferous forests. (USFS 2012)

Great gray owls use mature coniferous forests within proximity 0.1 to 0.2 miles (161-321m) of an open, typically a wet meadow (Marshall et al. 2003; Riper et al. 2006; Hayward and Verner 1994; Duncan 1997). In central Oregon, great gray owls also occupy old lodgepole pine or ponderosa/lodgepole pine mix forests in proximity to openings (Marshal et al. 2003). A study in the Cascades found the openings

great gray owl use range in size, anywhere from 15-250 acres (6-101 ha) (Bryan and Forsman 1987). Where mature stands (for nesting and roosting) exist near open grassy areas (for foraging), tree species and forest composition seem of little importance to these birds (Hayward and Verner 1994) (USFS 2012).

Mixed conifer/lodgepole pine/mountain hemlock communities associated with meadows are considered the preferred habitat for this species. Recent studies in the Blue Mountains (Bull and Henjum 1990, Bull et al. 1988) have shown that owls will inhabit openings created by timber harvest activities, especially those that mimic natural gaps. (USFS 2012)

Male great gray owls in northeast Oregon were observed foraging in stands with 11-59 percent canopy closure (Bull et al. 1998; Bull and Hejum 1990). The dominate understory of the forage stands is grass (Winter 1988; Duncan and Hayward 1994). While foraging, they will use perches, both live trees and snags, 10-16 ft (3-5 m) off the ground in open forests and meadows (Winter 1988; Duncan Hayward 1994; Marshall et al. 2003). Large meadows without perches are rarely used; the birds seem to prefer the forest edges or adjacent small meadows when no perches are available. In Oregon, male great gray owls use perches with an average height of 18 ft (5.5 m) (Winter 1988; Bull Henjum 1990) and an average dbh of 11 in (27 cm) (Winter 1988). The average distance they will fly from perch to prey was 34 ft (10.5 m) Bull and Hejum's (1990) and Winter's (1988) study. (USFS 2012)

Foraging habitat throughout the great gray owl's range is relatively open, grassy habitat including bogs, natural meadows, open forests and selective/regeneration harvest areas (Nero 1980, Winter 1986, Goggans and Platt 1992, Duncan 1997). The size of the openings does not seem to matter as much as the availability of prey (D. Quintana-Coyer, Per. Obs. 2003, Platt and Goggans, 1992). They prefer open areas with few trees where there are advantage points to hunt from perches (Johnsgard 1988). In south-central and northeastern Oregon, Bryan and Forsman (1987) and Bull and Henjum (1990) reported great gray owls foraging in and showing statistical selection for open forests, with grass or grass/forb ground cover. (USFS 2012)

Globally, the great gray owl is secure and there is no evident population decline in the vast majority of the range, however actual population data is lacking for many areas (Nero 1979, NatureServe 2011, Kirk et al. 1995 in NatureServe 2011). For Oregon, great gray owl populations are vulnerable. Threats listed by NatureServe (2011) include loss of habitat through overgrazing of meadows and logging of mature forests. (USFS 2012)

The definition used to map nesting habitat was all forest types with tree diameters equal to or greater than15 inches in all seral stages with an open or dense canopy cover, and forests within 0.35 mi from an opening. Openings have to be 10 acres and greater, with fire or man-made openings equal to or less than 5 years of age. Modeling resulted in 197,929 (80,099 ha) of potential great gray owl nesting habitat. Areas within the West-Bend project identified as suitable reproductive habitat are primarily associated with upper and middle Tumalo Creek, as well as the portion surrounding the Deschutes River associated with Ryan Ranch Meadow. Although no nest sites occur with the project area, historic great gray owl observations have occurred within the vicinity of Ryan Ranch Meadow.

Surveys were conducted in areas containing suitable habitat through past vegetation management projects. No known nest sites occur within the West-Bend project area. Approximately 2,217 acres of great gray owl habitat exists within the project area. Approximately 15,992 acres of habitat occurs within the watershed and approximately 197,929 acres of habitat occurs across the Deschutes National Forest.

The following Table 98 summarizes habitat acreages for the great gray owl.

Table 98: Great gray owl habitat within the West-Bend project area, Watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
2,217 acres	15,992 acres	197,929 acres

For the detailed assessment on the great gray owl for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Environmental Consequences

Alternative 1 – No Action

In the absence of catastrophic occurrences, habitat trends would increase with canopy layers, canopy cover, down woody material, and snags. However, in many mixed conifer and ponderosa pine stands, large ponderosa pine are being replaced by white fir and lodgepole pine which are more susceptible to insects, disease, and are less fire tolerant (short-lived species). Loss of future large structure may render large areas unsuitable for great grays by decreasing potential nesting structure. Where high stand densities exist, there is an increased risk of fire. Increased fire intensities could destroy critical habitat elements like snags. This would prolong the development of suitable great gray habitat in the West-Bend project area.

Effects Common to Alternatives 2 (Proposed Action), Alternative 3, and Alternative 4

Direct and Indirect Impacts

Thinning From Below (HTH), Non-Commercial Thinning (PCT)

Thinning from below in suitable great gray owl habitat would occur primarily in second growth ponderosa pine. In the vicinity of Ryan Ranch Meadow, some lodgepole pine encroachment exists. Thinning would focus on the removal of overstory and understory lodgepole pine, reducing ladder fuels to the residual ponderosa pine in the area. Thinning (from 9" dbh and up) from below will favor the largest ponderosa pine in pure pine stands, although treatments are primarily focused on ponderosa pine stands and some mixed conifer thinning will also occur. In mixed conifer stands thinning will favor the largest ponderosa pine and healthy white-fir. A target basal area of 60 square feet is the objective, but will vary across these stands. Different scenarios exist depending on the existing basal area, site productivity, and stand structure objectives as well as differing slightly by alternative. This treatment aids in maintaining large trees by reducing their susceptibility to fire and insects by removing competition for space and nutrients. However, canopy cover would be reduced resulting in more open stands. Negative impacts may result from more open stands by removing dense patches which may impact prey species habitat if large areas are treated. Beneficial impacts should result from reducing risk to existing suitable habitat and facilitating the development of future habitat. These treatments also enhance foraging habitat if large trees remain containing interlocking crowns.

Non-commercial thinning has been identified adjacent to the Riparian Habitat Conservation Areas and Riparian Reserves along the meadow associated with Deschutes River and Tumalo Creek. The objectives of these treatments are to reduce conifer encroachment and allow for more hardwood development in these areas. Treatments will be beneficial to the great gray owl by restoring the perimeter of the meadow to its historic range promoting more open conditions enhancing great gray owl foraging.

Prescribed Burning (Burn)

Prescribed burning will occur as a follow up treatment within thinned stands as well as the primary treatment to ponderosa pine stands previously thinned under past vegetation management projects. Treatments will reduce herbaceous plant material opening up the forest floor providing better foraging opportunities for the great gray owl. In addition, burning adjacent to Ryan Ranch Meadow will occur, reducing lodgepole pine encroachment and herbaceous plants. This treatment will also maintain and enhance the long-term foraging habitat within this area for the great gray owl.

Table 99: Thinning, and burning within Great Gray Owl Reproductive Habitat

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	1084.17	1084.17	803.07
PCT Mechanical	138.77	138.77	138.77
Burn	377.4	377.4	649.39
Total Acres Affected	**1,600**	**1,600**	**1,591**

Approximately 1,600 acres of great gray owl reproductive habitat is identified to be treated within the project area. . Although commercial thinning will reduce canopy cover, in the long-term, treatments will be beneficial to great gray owl habitat. Treatments will promote the development of LOS ponderosa pine, providing future nesting and roosting habitat.

Non-commercial thinning and prescribed burning will promote foraging habitat for the great gray owl in the short-term. In the long-term, where treatments are associated with meadow habitat, reclamation of the historic meadow perimeter will occur. However, loss of snags and down woody material primarily by underburning may impact habitat, although impacts should be minor in scope across the project area. Small tree thinning may allow for increased growth of remaining trees resulting in suitable habitat at a faster rate. It will also reduce the risk of a large scale fire event occurring protecting existing suitable habitat.

Cumulative Effects

Nest sites on the Bend/Ft. Rock RD are associated with the ponderosa pine PAGs and primarily occur adjacent to meadow habitat along the Deschutes River corridor. Typically, the nest stands contain residual old growth ponderosa pine. The habitat within the watershed and the project area is associated with 60 to 80 year second growth ponderosa pine, which is natural regeneration from clear cut harvesting that occurred in the 1930s. Due to fire suppression these stands became densely stocked and have encroached upon the meadow habitat as well as contributed to ladder fuels and competition for resource to the residual old growth pine that occur in the watershed. By the mid-1990s thinning projects occurred within the watershed to deal with these issues. The projects minimally retained existing nesting habitat while thinning stands to reduce disease and ongoing susceptibility to insect outbreaks. The majority of thinning removed trees 8 inch dbh and less, but also commercially thinned trees up to 21 inches dbh. Mowing and prescribed fire continue to occur in these areas on roughly a five year rotation.

Within the watershed (zone of influence for cumulative effects) ongoing and future foreseeable vegetation management projects occur within suitable great gray habitat and contribute to cumulative effects (Table 100). Measures were incorporated to retain suitable nesting habitat for each project area as well as enhance habitat conditions. Overall, treatments proposed will improve great gray owl habitat conditions by promoting the development of large structure and reducing the risk of loss of existing habitat from other large-scale disturbances. These ongoing projects will treat approximately 2,534 acres.

Table 100: Ongoing and Future Foreseeable Vegetation Projects Contributing to Cumulative Effects

Project	Status	Acres
East Tumbull HFRA Project (Net T.S., Set T.S., NT7)	Ongoing/Planned	2,534 acres within east 1/3 of West Bend Project. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest finished, understory treatments for fuels remaining.
Invasive Plant Control EIS	Planned	Within project area and across Forest. Herbicide and manual treatment of invasive plant populations

Ongoing and future recreation development is also occurring in the watershed (Table 101). The majority of development occurs in the forms of trail and trailhead development. These developments promote increased human use to areas containing suitable goshawk nesting and foraging habitat. Although no great gray owl habitat will be removed with these projects, due to the ongoing and future thinning within the watershed, the increase of human disturbance to the area could displace birds as a result. The Ryan Ranch project will restore meadow habitat, but will also increase recreation opportunity, which decreases the utility of certain parts of the meadow for wildlife. The majority of the use of the meadow by the great gray owl is at night, but they also forage early to mid-morning, so there is still the potential of human disturbance. Through ongoing vegetation management projects road closure are being implemented to reduce road densities within the watershed, minimizing disturbance from motorized vehicles and recreation. The following is a list of ongoing and future foreseeable recreation projects within the watershed:

Table 101: Ongoing and Future Foreseeable Projects Contributing to Cumulative Effects

Project	Timing	Description
Mountain Biking	Ongoing	Within and around West Bend project area. Wheeled and bipedal recreation of trails. Some cutting of trees for trails and safety.
Deschutes River area recreation	Ongoing	Day use areas at several locations.
Developed and Dispersed Camping	Ongoing	Dispersed camping throughout project area. No developed camp sites.
Cascade Lakes welcome station and parking lot	Implementation 2013	Providing building with power and water, restrooms, interpretive trail and paved parking lot for access to site and trail systems.
Ryan Ranch	Analysis and public comment completed	Restoration of wetland, removal of dike, interpretive trails and boardwalk
Roads		
Road Closures	Planning	Roads were identified to be closed in Katalo East, Katalo West, and East Tumble projects.

Of the 2,217 acres of great gray owl reproductive habitat identified within the project area, Alternatives 2 and 3 will treat approximately 1,600 acres of reproductive habitat, and approximately 1,591 under alternative 4. There are no known nest sites associated with any of the proposed alternatives.

Alternative 2, 3 and 4 will treat approximately 10% of the total 15,992 acres of great gray owl reproductive habitat within the watershed

Cumulatively, the treatments associated with the west bend project area in addition to those cumulative actions associated with the watershed will effect <1% of the total great gray owl reproductive habitat across the Deschutes National Forest.

Conclusions

For Oregon, great gray owl populations are vulnerable. Threats listed by NatureServe (2011) include loss of habitat through overgrazing of meadows and logging of mature forests. (USFS 2012)

The No Action Alternative could affect habitat by continued meadow encroachment by conifers and the loss of residual nesting habitat due to over stocked stands. .

The Action Alternatives have the potential to affect great gray owl and their habitat by reducing stand densities and canopy closures potentially affecting suitable nesting habitat, however the treatments will not reduce individual large trees or snags that could provide potential nesting habitat. In addition, due to understory thinning and prescribed fire, treatments will enhance foraging opportunities as well as prey species habitat. Mitigation measures have also been incorporated in the event a new nest site is discovered prior to or during implementation.

No impacts will occur to known occupied territories as a result of any action alternative. Although treatments will occur in suitable habitat it will not preclude use by the great gray owl. These areas will still provide foraging opportunities, and residual untreated areas will still provide nesting opportunities within the project area.

Although treatments will thin stands that are currently suitable reproductive habitat, the West-Bend project will not contribute to a negative change in viability or on the Deschutes National Forest for the great gray owl.

Implementation of the West-Bend project is consistent with the Standards and Guidelines for the Deschutes National Forest Land Resource Management Plan.

Great Blue Heron

Existing Condition

The great blue heron is widespread and remarkably adaptable. During the breeding season, herons forage in wetlands, water bodies and water courses of all shapes and sizes, but can also be found occasionally in upland areas as well. Butler et al. (2000) identifies the following as key foraging habitats: shallow coastal marine waters, coastal mangrove swamps, sea beaches, prairie, pasture and cultivated fields, aquacultural ponds, and residential and commercial sites where handouts or fish scraps can be found. In coastal Yucatan, species prefers freshwater systems (Ramo and Busto 1993), but in the Pacific Northwest it prefers seacoasts (Butler 1997). Several studies have observed a preference for areas of open water and estuarine wetlands (Butler 1997; Loegering and Anthony 1999; Cister and Galli 2002; Kelly et al. 2005), but one study in Mississippi found herons avoided open water areas (Custer et al. 2004). This variability in the literature attests to their adaptability in and the difficulty in generalizing about their habitat use.

Great blue herons will nest in trees, bushes, on the ground and on artificial structures, usually near water. It prefers to nest in vegetation on islands or in swamps, probably to avoid ground predators. In Oregon, nest locations were determined primarily by proximity and availability of food, however nest-site fidelity is weak (Marshall et al. 2003). (USFS 2012)

Suitable breeding habitat for the great blue heron is present on all ranger districts of the Deschutes National Forest. The Deschutes LRMP identifies heron rookeries as the limiting factor for this species.

As stated earlier, herons can build nests on a variety of substrates, but known rookeries on the Deschutes National Forest occur in trees. The Oregon Conservation Strategy identifies rookeries as the species concentration area, with the important habitat features being large trees near foraging areas (open grassy and wetland habitats) and low levels of human disturbance during the nesting season. The body of scientific literature supports this strategy, notably the sensitivity to disturbance. (USFS 2012)

Recent records (1981-2011) for great blue heron rookeries on the Deschutes National Forest suggest that there are up to 9 to 10 known heron rookeries on or adjacent to the Forest. The data suggests that there were at least 1-3 rookeries active in this 30 year timeframe. (USFS 2012)

Habitat is very marginal within the project area; the majority of habitat is associated with the Deschutes River corridor. From review of the wildlife database; no know heron rookeries exist in the project area. There are no historic heron observations within the project area. (NRIS Wildlife Datatbase)

Based on the various conservation ranking systems, great blue heron populations in general are not threatened; but there is concern in protecting nesting colonies or rookeries. Specifically in Oregon, the Willamette Valley was the only noted area where nesting colonies were at risk (Oregon Conservation Strategy, February 2006). (USFS 2012)

The following is a potential list of threats for the great blue heron (USFS 2012):

- Nest predation from large raptor
- Human disturbance
- Pesticides use in agriculture

All lakes, ponds, wet meadows, streams, and rivers were buffered by ½ mile to develop a preliminary habitat layer. Wildfire areas and areas with recent (5 yrs) activities were excluded. Wetlands and lakes include both the wetland or water body and the associated buffer. Habitat will be over-estimated for this analysis because the buffers may not include habitat with tree sizes necessary for nesting.

No surveys were conducted for the great blue heron, and no known rookeries exist within the project area. Approximately 286 acres of great blue heron habitat exists within the project area. Approximately 8,743 acres occurs of habitat occurs within the Watershed and approximately 211,200 acres of habitat occurs across the Deschutes National Forest.

Table 102: Great blue heron habitat within the West-Bend project area, Watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
286 acres	8,743 acres	211,200 acres

For the detailed assessment on the Great Blue Heron for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Environmental Consequences

Alternative 1 – No Action – Existing Ecological Trend

There are no known nests, colonies, or rookeries within the project area. In the absence of disturbance events, habitat trends would continue with increased stand densities, canopy cover, down woody debris and snags. However, with increased stand densities comes increased risk of loss from disturbance events. In addition, the riparian habitat also exhibits increased conifer densities, which would increase over the short-term limiting available foraging habitat. Trees growing in heavily stocked stands may also lead to smaller limb structure, which would limit available nesting habitat.

Effects Common to Alternative 2(Proposed Action) Alternative 3, and Alternantive 4

Direct and Indirect Impacts

Thinning from below (HTH), Skid and Deck

Habitat is very marginal within the project area. The riparian zones associated with both perennial and intermittent streams have very narrow riparian zones and do not provide contiguous habitat except where the project is boundary is adjacent to Ryan Ranch meadow.

No treatment will occur within 50 feet of riparian zones of streams or wetlands. The high elevation ponds and wetlands within the project area have no associated treatments. Thinning from below will occur in black bark ponderosa pine stands and 40 year old plantations that occur adjacent to the Deschutes River and Tumalo Creek corridor. Treatments proposed are intended reduce stand densities to increase the growing space for dominant trees in the stand. A follow up treatment of shrub mowing and prescribed fire will occur in thinned stands. Collectively, all associated treatments will reduce the risk of stand replacing fire and outbreaks of insects and disease while accelerating the development of contiguous stands of LOS ponderosa pine.

Table 103 summarizes the amount of great blue heron habitat associated with treatments under each action alternative for the West-Bend project.

Table 103: Total acres of heron reproductive habitat associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	166.8	172.36	158.79
Skid & Deck	85.62	85.62	85.62
Total Acres Affected	**252**	**258**	**244**

Overall, approximately 252 acres of great blue heron habitat are associated with treatments identified under Alternative 2, approximately 258 under Alternative 3, and approximately 244 under Alternative 4.

Overall, in the short-term treatments will reduce the loss to existing large tree structure that could provide potential rookery sites, in the long-term treatments will accelerate the development of large tree structure to provide potential future opportunities for rookery sites.

Cumulative Effects

Trends are indicating increased recreation levels within our national forests. Much of this use is concentrated around waterbodies/waterways. Within the watershed (zone of influence),increased recreation use along waterways may deter use by herons for nesting. However, road closures and closure of dispersed campsites within riparian reserves will aid in reducing disturbance potential for nesting great blue herons.

Within the watershed ,fire suppression has resulted in degradation of some meadows across the district due to conifer encroachment and the accumulation of deep thatch layers. This further reduces foraging habitat for this species. However, meadow enhancement is being implemented in Ryan Ranch meadow which borders the project. Although meadow enhancement could benefit the great blue heron, the Ryan Ranch meadow also proposes to developed recreation such as a board walk and trail system increasing disturbance to portions of the meadow.

Within the 8,743 acres of blue heron reproductive habitat within the Watershed, cumulatively Alternative 2, 3, and 4 will treat on average approximately 251 acres within the watershed or 3% of the total habitat.

Cumulatively, the treatments are associated with 1% of the total blue heron reproductive habitat across the Deschutes National Forest.

Overall, implementation of the action alternatives will promote the development of large structure, riparian health, hardwood diversity and meadow enhancement which will increase habitat development for great blue herons.

Conclusions

The No Action alternative may have affects to great blue herons and their habitat by perpetuating the loss of large tree structure.

The Action Alternatives may have beneficial affects to great blue herons and their habitat by reducing fire risk, accelerating growth of residual stands, increasing diversity, and enhancing meadow habitat.

Although treatments will thin stands that are currently suitable reproductive habitat, the West-Bend project will not contribute to a change in viability on the Deschutes National Forest for the blue heron. The West-Bend project proposes thinning from below and therefore will not remove suitable habitat. There is no incremental reduction of habitat associated with the West-Bend project and therefore will maintain the viability of this species in the watershed and across the Forest. The West-Bend project will promote the development of long-term habitat by developing large tree structure, meeting habitat objectives of Forest Plan.

Implementation of the West-Bend project would be consistent with the Standards and Guidelines for the Deschutes National Forest Land Resource Management Plan.

Golden Eagle

Existing Condition

Golden eagles generally inhabit open country, in prairies, arctic and alpine tundra, open wooded country, and barren areas, especially in hilly or mountainous regions (NatureServe 2011). Additionally, they utilize juniper and open ponderosa pine forests. It forages in a variety of habitat types and successional stages, preferring areas with an open shrub component that provides food and cover for prey (Marshall et al. 2006). Rugged terrain with ridges, cliffs and rock crop, and dwarf or low-shrub vegetation has been noted to be common in golden eagle territories (McIntyre et al. 2006). (USFS 2012)

Nests on rock ledge of a cliff or in a large tree (e.g., oak or eucalytus in California, white pine in eastern North America). Pair may have several alternate nests; may use same nest in consecutive years or shift to alternate nest used in different years (NatureServe 2011). In Oregon, suitable nesting and foraging habitat can be found in mountains, canyons, and rolling hills. Of 506 occupied nests in 1982, 35% were in mature trees and 65% on ledges along rims and cliffs (Isaacs and Opp 1991). Nests are typically large live ponderosa pine with sturdy open branching and a trunk dbh > 30 in (75 cm). Nests persist for many years and are often rebuilt in same location if destroyed. It occasionally builds nests on electric transmission towers (Marshall et al. 2006). (USFS 2012)

Throughout most of the Great Basin, black-tailed jackrabbits are the main prey item and numerous studies have correlated eagle production with jackrabbit abundance (Olendorff 1976, Kochert 1980, Thompson et al. 1982; In Marshall 2006). In central Oregon, where jackrabbit populations have been depressed since the mid-1980s, a study of diet and prey selection conducted 1999-2000 showed a great variety of prey species. Remains of the following prey items were found in the nests or observed delivered to the young: mountain cottontail, California and Belding's ground squirrels, marmots, woodrats, other small mammals, Kokanee salmon, and a variety of birds including pheasants, waterfowl, and rock doves. Golden eagles will occasionally kill newborn deer and pronghorn fawns, and lambs of mountain and domestic sheep (Palmer 1988; In Marshall et al. 2006). They will eat fresh carrion and are skilled pirating prey from other raptors (Marshall et al. 2006). (USFS 2012)

For the detailed assessment on the Golden Eagle for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Conclusion

No habitat occurs within the West-Bend project area for the golden eagle and therefore there are no impacts identified to this species as a result of the West-Bend project. For the detailed assessment on the golden eagle for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Waterfowl

Existing Condition

Open lakes, ponds, streams, rivers, and wet/dry meadows provide foraging habitat for most waterfowl species. Some species utilize large snags for nesting, while others utilize open grassy areas near the water's edge. Most waterfowl diets consist primarily of vegetation although some animal matter (caddisflies, crustaceans, and mollusks) may be consumed (Csuti et. al 1997 pp. 66, 84-87, 89, 96, 99-102).

Twenty-seven game species of waterfowl, including ducks, coots, geese, and swans are found within the Forest. The larger lakes and reservoirs provide summer nesting or migrational stop-over habitat, with Crane Prairie Reservoir, Wickiup Reservoir, and Davis Lake being especially productive. The estimated summer population for the Forest is estimated to number about 2,600 pairs. Relatively few waterfowl remain to overwinter, as most water bodies ice over. Waterfowl that do remain are often prey species for wintering bald eagles (Deschutes National Forest EIS, pages 3-18 to 3-19). (USFS 2012)

Although some habitat improvements, primarily nesting structures, have been accomplished, substantial opportunities remain at such locations as Wickiup Reservoir and Big Marsh (Deschutes National Forest EIS, page 3-19). (USFS 2012)

Waterfowl production will be increased where possible with appropriate habitat enhancement, and continued maintenance of waterfowl nesting boxes and platforms (WL-39 Forest Plan, page 4-55). (USFS 2012)

Additionally, although the goals and standards in the Forest Plan under Riparian Areas/Wetlands, Streamside Management Units, and Flood Plains on pages 4-61 thru 4-63 do not specifically address waterfowl, they would provide guidance and protection of waterfowl habitats. (USFS 2012)

The amount of potential or suitable waterfowl habitat at the Forest-wide scale is difficult to determine. Different species of waterfowl require specific and/or diverse habitats and can be highly influenced by annual weather. The habitat analysis of the smaller lakes and hundreds of miles of streams would be complex given the diversity of their locations, physical characteristics, elevations and forested matrix situations. Those lakes in wilderness and roadless areas at higher elevations for example would most likely provide the best potential nesting habitats for species such as goldeneyes. This is further compounded by the diversity of habitats utilized by the individual species and the variability (i.e. foraging) for each from the spring nesting season to the fall migration. (USFS 2012)

For the detailed assessment on waterfowl for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Approximately 502 acres of waterfowl habitat exists within the project area. Approximately 4,796 acres of habitat occurs within the watershed and approximately 71,205 acres of habitat occurs across the Deschutes National Forest.

Table 104 summarizes the amount of waterfowl habitat associated with treatments under each action alternative for the West-Bend project.

Table 104: Waterfowl habitat within the West-Bend project area, Watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
502 acres	4,796 acres	71,205 acres

Environmental Consequences

Alternative 1 – No Action – Existing Ecological Trend

There are no known nest sites, within the project area. In the absence of disturbance events, habitat trends would continue with increased stand densities, canopy cover, down woody debris and snags. However, with increased stand densities comes increased risk of loss from disturbance events. In addition, the riparian habitat also exhibits increased conifer densities, which would increase over the short-term limiting available foraging habitat. Conifer encroachment would also out compete riparian vegetation by shading out vegetation also reducing potential nesting and loafing habitat over time further degrading habitat.

Effects Common to Alternatives 2(Proposed Action), Altnerative 3, and Altnerative 4

Direct and Indirect Impacts

Thinning from below (HTH) Ladder Fuels Reduction (LFR)

Waterfowl habitat is associated with the portions of the project area that occurs along the Deschutes River and Tumalo Creek. Within these areas, two treatments are proposed to thin stands from below retaining the healthiest trees in the stand. Although stands will be thinned a fully stocked stands will exist post treatment. These stands also exist within portions of the urban interface and therefore ladder fuels reduction is proposed within these areas to reduce the risk of crown fire adjacent to homes and private property. No treatment will occur within 50 feet of riparian zone, and therefore should not impact valuable nesting habitat. Prescribe fire and mechanical shrub treatments are proposed within thinned stand as a follow up treatment. Fuels treatment could potentially create snags in the short-term to provide to those waterfowl that utilize dead wood habitat for nesting. Treatments will be beneficial to habitat by reducing conifer encroachment and the risk of stand replacing fire to riparian habitat. Treatment will promote the development of riparian plants by reducing the shading adjacent to the riparian zone.

Table 105: Acres of potentially suitable waterfowl reproductive habitat associated with each alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	72.28	72.28	63.38
LFR	40.25	40.25	40.25
Total Acres Affected	**113**	**113**	**104**

As a result of riparian buffers implemented for the project area, no streamside habitat will be impacted from any proposed actions. Treatment will reduce conifer competition with the riparian zone allowing for the expansion of riparian plant in to the upland, enhancing long-term reproductive habitat in these areas.

Cumulative Effects

Within the Watershed (zone of influence) aloss of snag habitat in and adjacent to recreation areas is a concern due to the limited amount of nesting structures available along potentially suitable habitat for waterfowl who use dead wood habitat for nesting. However, high use recreation areas may not be preferred nest sites due to the increased disturbance levels. Snag habitat in between campgrounds or parking areas is important to retain due to the loss of this habitat component elsewhere.

In addition, within the watershed, fire suppression has resulted in degradation of some meadows across the district due to conifer encroachment. This further reduces foraging habitat for this species by decreasing the amount of open standing water in meadow habitat. Ongoing meadow enhancement is currently being planned within Ryan Ranch meadow to reduce conifer encroachment. A board walk and trail are also being planned and may preclude use of portions of the meadow due to the increase in disturbance by humans.

Approximately, 113 acres of habitat associated with Alternative 2 and 3, as well as the 104 acres of habitat associated with Alternative 4 will not be reduced. Treatment will promote the development of riparian species adjacent to the streams and meadow associated with the West-Bend project cumulatively benefiting waterfowl habitat in the Watershed.

Within the 4,796 acres of waterfowl reproductive habitat within the watershed, on average Alternative 2, 3, and 4 will treat approximately 110 acres of habitat or 2% of the total habitat within the watershed.

Cumulatively, the treatments are associated with <1% of the total waterfowl reproductive habitat across the Deschutes National Forest.

Overall, implementation of the action alternatives will promote the development of a more fire resilient ponderosa pine stand, increasing riparian health, hardwood diversity, and meadow enhancement which will increase habitat development for the waterfowl.

Conclusions

The No Action alternative will not affect waterfowl or their habitat.

There will be no incremental loss to waterfowl habitat from the West-Bend project and therefore will not contribute to a change in viability within the Watershed or on the Deschutes National Forest. Sufficient habitat exists to maintain the viability of this species in the watershed and across the Forest by providing sufficient habitat to meet the Forest Plan objectives.

Implementation of the West-Bend project would be consistent with the Standards and Guidelines for the Deschutes National Forest Land Resource Management Plan. There will be no streamside habitat altered or removed except where snags pose a hazard to high use recreation areas.

Red-tailed Hawk

Existing Condition

The red-tailed hawk is an abundant species occupying a variety of open to semi-open habitat types and can tolerate ranging elevations, alpine to sea level. However, they generally avoid tundra and dense, unbroken forests (DeGraaf and Rappole 1995, Timossi and Barrett 1995). Preferred habitats are open to semi-open coniferous, deciduous and mixed forests, forest edges, grasslands, parklands, rangelands, river bottomlands, and agricultural fields with scattered trees (Gilligan et al.1993, Johnsgard 1990, Timossi and Barrett 1995, DeGraaf and Rappole 1995, Marshall et al. 2003, NatureServe 2011). Forest clearings, alpine meadows, estuaries, marshes, agricultural lands, clear cuts, sagebrush plains, and high elevation environments are also used, though less commonly (Gilligan et al.1993, Timossi and Barrett 1995, Marshall et al. 2003, NatureServe 2011). (USFS 2012)

Limiting factors in preferred habitat selection are availability of suitable perches and hunting grounds open enough to locate and catch ground prey (NaturerServe 2011, Fitch et al. 1946, Janes 1984, Janes 1994). Perches can be any object that provides an unobstructed view of a red-tailed hawk territory. These objects are usually high and can be natural, e.g. tree, snag, cliff, rock, or man-made, e.g. utility pole, tower, fence (Janes 1984, Janes 1994, Fitch et al 1946, NatureServe 2011). In the Fitch et al. (1946) study, perches were an essential aspect in red-tailed hawk territory. The perches were used for foraging, roosting, resting, mating, and defending territory. The Janes (1984) study found pairs that establish territories with more perches tend to rear more young. (USFS 2012)

Nesting occurs in large mature trees, usually at a forest edge or near an opening in canopy (Fitch et al. 1946, Moorman et al. 1996, Timossi and Barrett 1995, DeGraaf and Rappole 1995). Nests are usually placed higher in trees verses other raptors, and are generally in the largest, tallest tree available or smaller deformed trees where branch structure supports this higher placement (DeGraaf et al. 1991, Timossi and Barrett 1995, DeGraaf and Rappole 1995, La Sorte et al. 2004). Red-tailed hawks seem to prefer nesting trees with open crowns. The placement of a nest is usually next to the trunk of a tree in a crotch or fork from 30 to 90 feet (9-27 m) above the ground (DeGraaf et al. 1991, Verner and Boss 1980, Timossi and Barrett 1995). Nests are often reused from year to year provided the nest is not occupied by earlier nesting raptors and is in suitable condition (Fitch et al. 1946, DeGraaf and Rappole 1995, Tesky 1994). In treeless areas, nests are built on artificial nest structures, the crossbars of utility poles, and towers (Timossi and Barrett 1995 DeGraaf and Rappole 1995, Marshall et al. 2003, NatureServe 2011). Occasionally, red-tailed hawks will use and add material to an existing raven, crow, gray squirrel, or large accipiter nest. La Sorte et al. (2004) found steep slopes are an important factor for a nest site. The steep slope allows for easy entry to the nest from above the canopy layer, allowing for unobstructed views of surrounding area and protection from the slope. Red-tailed hawks will use the same nest for multiple years, particularly if the nest is in suitable location and suitable condition (Fitch et al. 1946, Young 1989 in Tesky 1994). (USFS 2012)

For the detailed assessment on red-tailed hawk for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Past harvest activities had produced habitat conditions favorable for red-tailed hawks by clear-cutting stands adjacent to mature and late-seral stands. This provided open areas for foraging adjacent to potential roosting and nesting habitat. Due to the age of the clear cuts, many have grown in with trees and shrubs diminishing foraging availability of the red-tailed hawk.

The red-tailed hawk is not on any federal, state, or other conservation lists . Globally, the population is increasing and has no significant threats (NatureServe 2011). Nationally, the population is increasing or stable in most areas (NatuerServe 2011). In Oregon, the red-tailed hawks are secure; the population is not decreasing (NatureServe 2011). (USFS 2012)

Through the Forest wide assessment completed for MIS, red-tailed hawk reproductive habitat was mapped across the entire Deschutes National Forest. Approximately 9,296 acres of habitat exists within the project area. Approximately 16,480 acres habitat occurs within the Watershed and approximately 192,492 acres of habitat occurs across the Deschutes National Forest. Table 106 summarizes these acreages:

Table 106: Red-tailed hawk reproductive habitat within the West-Bend project area, Watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
9,296 acres	16,480 acres	192,492 acres

Environmental Consequences

Alternative 1 – No Action

With the no action alternative, suitable nest trees that occur within dense stands would most likely have increased mortality due to tree stress. Without treatments in the second growth stands, stand densities will prolong future development of larger nesting trees. These high density stands will remain susceptible to bark beetle activity and the susceptibility will increase over time. High stand densities will result in the overall decrease in tree vigor among all size classes. The most significant effect of high stand densities will be the gradual loss of the existing large-tree component/nesting habitat that is likely to be much faster than if the stand densities had been reduced to more healthy level.

Effects Common to Alternatives 2(Proposed Action), Alternative 3, and Alternative 4

Direct and Indirect Impacts

Thinning From Below (HTH), Skid and Deck), Prescribe Burning Only, Ladder Fuels Reduction (LFR) Harvest Improvement Cut)

These treatment would not impact or remove any nesting habitat (i.e. trees >21" dbh). The proposed actions associated with the project would increase foraging areas for red-tailed hawks by removing trees (under 21" dbh) and potentially increasing access to prey at ground level over the associated acres. Thinning from below will help to decrease the stress on the larger overstory trees, thus retaining potential nest sites for the long-term (>20 years). Treatments to early and mid-seral stands would promote and accelerate the development of LOS. During thinning operations it is expected that individual snags would be lost through the felling of snags that pose a hazard to workers and or equipment.

The reduction of shrubs from mowing and burning as a follow up to thinning and units identified as prescribed burning only, activities can impact prey species of ground dwelling small mammals (ground squirrels, cottontails, voles, and pocket gophers). These ground species depend on the shrubs for cover for hiding from predators and the forbs for food. This activity would reduce the amount of available habitat for red-tailed hawk prey species, potentially reducing areas utilized by them for foraging as well as minimizing the availability of prey within nesting areas. Impact from mowing and burning are short in duration (<10 years) and will provide a high diversity of prey habitat (grasses, forb and shrubs) in the long-term.

In addition, during prescribed fire treatments incidental snags could be lost from fire reducing large snags that also provide nesting opportunities, but trees may be converted to snags from these operation. Mortality of snags in ponderosa pine habitat during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags < 15 cm dbh. Several studies showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988, Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for snags, presumably because the trees that did not burn during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988, Bagne et al. 2008).

Harvest Cut with Reserves (HCR)

Due to the removal of ponderosa pine from these stands through past management activities, stands are comprised primarily of lodgepole pine and white-fir. These tree species are not fire resistant, and due to mountain pine beetle outbreaks in the watershed, much of the lodgepole pine is dead, reducing canopy closures and contributing to fuel loading as well as decreasing the amount of suitable reproductive red-

tailed hawk habitat. White-fir is also a short-lived species, and highly susceptible to insects and disease, and many of the white-fir in these stands are declining from mistletoe or other diseases. The stands are typically dominated in the overstory with lodgepole pine and have a wide range of age groups of white fir as well as some mountain hemlock. In these stands, to meet the desire for a diverse landscape pattern and to break up fuel continuity on the landscape, the dead and live overstory lodgepole pine will be removed (except seed trees) and the white fir will be left in a clumping pattern removing trees containing mistletoe from the overstory. These stands will still be considered a regeneration harvest because of the variability of the final stocking. Similar to the standard thinning from below, this treatment will not target healthy trees greater than 21 inches in diameter. However, this treatment has been designed to promote the development of ponderosa pine in stands where it previously existed in a greater abundance, creating more fire resistant mixed conifer stands. The overstory and understory will be removed and ponderosa pine will be planted where it occurs in the overstory providing a more fire resistant species in the future. The potential to remove large white-fir greater than 21 inches in diameter exists which could reduce nesting habitat for the red-tailed hawk. Although, some large white-fir will be retained in the group openings, where large trees greater than 21 inches occur that are very close to becoming snags, these trees will be retained to provide future snag habitat.

Table 107: Total acres of red-tailed reproductive habitat associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	6078.27	6096.51	4693.87
HCR	96.52	96.52	96.52
HIM	63.16	63.16	63.16
LFR	13.12	4.67	242.19
Skid & Deck	1318.13	1318.13	944.96
Burn	1039.5	1048.81	2525.96
Total Acres Affected	**8609**	**8628**	**8567**

Impacts to habitat will be minimal, but treatments will promote the development of LOS stands promoting large tree production and red-tailed hawk habitat in the long-term. Affects to red-tailed hawk habitat are similar under Alternative 2, 3 and 4. The outcome of the affects to habitat as a result of each treatment type is also consistent across all action alternatives. Alternative 4 was developed to address the key issue of treatment to mule deer and elk thermal cover. Treatments were dropped in multiple stands containing thermal cover, and therefore to reduce the threat of stand replacing fire and impact to WUI, more thorough LFR treatments were proposed under Alternative 4 in the WUI. These changes are reflected in Table 107.

The project area and habitat varies greatly from east to west due to the increase in elevation, the rain gradient associated with the change in elevation, and the site potential associated with the inherent soil quality within this east to west pattern. To capture the importance of habitat variation across the project area, the project area was broken up into four ecotones moving from east to west. A habitat retention strategy was defined where in the low elevation ponderosa pine ecotone (approximately 16,146 acres), approximately 10% of this zone would be left in un-treated stands and aggregate patches, in the mid-elevation ponderosa pine mixed conifer dry ecotone (approximately 3,966 acres) approximatley15% of this landscape would be left in untreated stand and aggregate patches, within the high elevation mixed conifer wet stands (approximately 3,027 acres), approximately 20% of this landscape would left in untreated stands and aggregate patches, and lastly the lodgepole pine community (approximately 2,027 acres), where regeneration harvest 15% of each harvest unit will remain untreated. These untreated

areas were identified to retain habitat connectivity between thinned stands associated with project treatments. These areas will continue to provide foraging and nesting habitat for the red-tailed hawk through all action alternatives.

Cumulative Effects

Territories on the Bend/Ft. Rock RD have been wide spread, nest sites are typically located in large ponderosa pine associated with a clear cut or shelter wood type harvest within both the mixed conifer and ponderosa pine PAGs. Much of the Bend/Ft. Rock RD ponderosa pine PAG occurs in dense second growth stands created from the clear cutting that occurred in the early 1930's. The residual natural regeneration created a legacy of overstocked mature ponderosa pine which has created unsuitable nesting conditions for the red-tailed hawk due to lack of openings for foraging. Incidental nesting and foraging opportunities became available over time, trees had become suppressed and occurrences of disease and infestation out breaks were surfacing through the late 1980's and early 1990's, also causing overstory canopy loss. By the mid 1990's many landscape scale thinning projects had been implemented to deal with these issues. Thinning opened the stands to provide better pray habitat and better access to prey species for the red-tailed hawk.

Within the watershed (zone of influence)a variety of past thinning projects have occurred in the, primarily in stands of low elevation second growth ponderosa pine. Treatments were designed to reduce the risk of stand replacing fire and promote the development of contiguous stands of future old growth ponderosa pine, while reducing the stands increasing susceptibility to insects and disease. The majority of thinning removed trees 8 inch dbh and less, but also commercially thinned trees up to 21 inches dbh. Mowing and prescribed fire continue to occur in these areas on roughly a five year rotation.

The following ongoing vegetation management projects occur within suitable red-tailed hawk habitat within the watershed and contribute to cumulative effects. Measures were incorporated to retain suitable nesting habitat for each project area as well as enhance habitat conditions. Overall, treatments proposed will improve habitat conditions by opening stands promoting habitat for prey species while accelerating the development late and old structure ponderosa pine stands. These ongoing projects will treat approximately 11,189 acres.

Table 108: Ongoing and Future Foreseeable Projects Contributing to Cumulative Effects

Project	Status	Acres
Rocket Vegetation Management	Planning	6,387acres of commercial thinning, plus mowing and underburning.
Fry timber sale and fuels treatment	Ongoing/Planned	106 acres surrounded by project on north end. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest and understory treatments completed, Fuels treatments remaining.
Jet Timber Sale part of West Tumbull project	Ongoing/Planned	Within the watershed 584 acres in Skyliners road upper community. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest continuing Understory treatments and fuels treatments remaining.
East Tumbull HFRA Project (Net T.S., Set T.S., NT7)	Ongoing/Planned	2,534 acres within east 1/3 of West Bend Project. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest finished, understory treatments for fuels remaining.

Katalo East and West Projects	Ongoing/Planned	1,435 acres within project area center 1/3 of west bend project. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest finished, understory tree treatments finished, fuels treatments remaining-burning
Feline timber sale	Ongoing	143 acres within project area. Tee harvest and understory treatments finished. Fuels treatments remaining.
Invasive Plant Control EIS	Planned	Within project area and across Forest. Herbicide and manual treatment of invasive plant populations
Other: activities on adjacent private land; e.g. Skyliner Forest (sale, development?)		

The invasive plant control prescribed for the watershed will not affect habitat for the red-tailed hawk and therefore is not seen as a cumulative effect.

Ongoing and future recreation development is also occurring in the watershed. The majority is of development occurs in the forms of trail and trailhead development. These developments promote increased human use to areas containing suitable nesting and foraging habitat. No habitat will be removed with these projects, due to the ongoing and future thinning within the watershed, the increase of human disturbance to the area could displace birds as a result. However, through ongoing vegetation management project road closures are being implemented to reduce road densities within the watershed, minimizing disturbance from motorized vehicles and motorized recreation. The following is a list of ongoing and future foreseeable recreation projects within the watershed:

Table 109: Ongoing and Future Foreseeable Recreation Projects Contributing to Cumulative Effects

Phil's Trailhead Enhancement	Planning	Providing paved parking area, toilets, and trailhead kiosks. Approximately 1.4 acres impacted.
Mountain Biking	Ongoing	Within and around West Bend project area. Wheeled and bipedal recreation of trails. Some cutting of trees for trails and safety.
Deschutes River area recreation	Ongoing	Day use areas at several locations.
Developed and Dispersed Camping	Ongoing	Dispersed camping throughout project area. No developed camp sites.
Meissner Snopark Expansion	Implementation 2013	Existing parking area to be expanded. Parking will be available for a total of 180 spaces. A Nordic event start/finish area would be approximately 2 acres and would not be returned to a forested condition.
Cascade Lakes welcome station and parking lot	Implementation 2013	Providing building with power and water, restrooms, interpretive trail and paved parking lot for access to site and trail systems.
Ryan Ranch	Analysis and public comment completed	Restoration of wetland, removal of dike, interpretive trails and boardwalk
Roads		

Road Closures	Planning	Roads were identified to be closed in Katalo East, Katalo West, and East Tumble projects. Roads are identified for closure in Rocket project.

Private lands are not managed for red-tailed hawk habitat. Therefore, it is assumed that any habitat provided by private timberland in the Watershed is incidental and may not be long term.

Overall, approximately 8,609 acres of red-tailed hawk habitat are associated with treatments identified under Alternative 2, approximately 8,628 acres under Alternative 3, and approximately 8,567 under Alternative 4.

Of the 16,480 acres of red-tailed hawk reproductive habitat within the Watershed, Alternative 2, 3 and 4 will treat approximately 50% of the total habitat.

This project will not remove or cause any incremental affectto the red-tailed hawk or its habitat within the Watershed. Treatments are designed to accelerate the development of contiguous stand of large ponderosa pine providing future habitat or will thin understories and removes individual trees containing insects and disease to maintain the longevity of large tree structure.

Cumulatively, red-tailed hawk populations are expected to remain stable across the district due to their generalist behavior. There may be increased competition for remaining nest sites among this species and other large raptor species. Also distribution of red-tailed hawks across the Forest may become patchier due to the fires, focusing on low-severity burn areas near open habitat.

Cumulatively, the treatments are associated with an average of approximately 8,601 acres of red-tailed hawk reproductive habitat or 4% of the total red-tailed reproductive habitat across the Deschutes National Forest.

Conclusions

In Oregon, the red-tailed hawks are secure; the population is not decreasing (NatureServe 2011).

The No Action Alternative could affect red-tailed hawk and their habitat due to the ongoing loss large ponderosa pine from insects and disease.

The Action Alternatives do not target large tree component for removal unless they contain disease that is jeopardizing other large trees or will preclude the development of future late and old structure habitat. Through project design criteria, treatments have been designed to maintain residual habitat in treatment units as well as the retention of untreated stands throughout the project providing habitat connectivity. Mitigation measure have also been incorporated in the event a new nest site is discovered prior to or during implementation.

No impacts will occur to known occupied territories as a result of any action alternative. Although treatments will occur in suitable habitat it will not remove any primary reproductive habitat elements and will not preclude use by the red-tailed hawk. These areas will still provide foraging and nesting opportunities. In addition, residual untreated areas will still provide nesting opportunities within the project area.
Although treatments will thin stands that are currently suitable reproductive habitat, the West-Bend project does not propose to remove large snags or large ponderosa pine trees that could potentially be used for nest sites, treatments will promote open understories aiding in foraging, and therefore will not contribute to a change in viability within the Watershed or on the Deschutes National Forest for the red-tailed hawk.

Implementation of the West-Bend project would be consistent with the Standards and Guidelines for the Deschutes National Forest Land Resource Management Plan. Minimal amounts of red-tailed hawk

habitat will be altered, and as a result treatments will promote the long-term habitat viability for this species.

Osprey

Existing Condition

The osprey is specialized for catching fish and nesting occurs primarily along rivers, lakes, reservoirs, and seacoasts. They have relatively long wings for their body mass and require very open nest sites which they access both for landing and an unobstructed view from the nest (Poole 1989, Van Daele and Van Daele 1982, Richardson and Miller 1997). They build large bulky stick nests, which are often reused in subsequent years. (USFS 2012)

Preferred nest sites are usually snags or dead topped trees near or surrounded by water, presumably to deter mammalian predation (Ewins 1997). However, cliffs and rock pinnacles and even bare ground on predator-free islands are also used. They also nest on a wide variety of artificial structures including utility poles, wharf pilings, windmills, microwave towers, chimneys, cell towers, off-shore duck blinds, buoys, and channel markers (Marshall et al. 2003, NatureServe 2011). (USFS 2012)

Osprey nest trees and snags over water may be considerably shorter than those on land whereas they tend to choose trees taller than the surrounding canopy in forested areas (Vana-Miller 1987). The tree species used for nesting does not appear to be important (Vana-Miller 1987). Rather, preferred structural components include large-diameter dead or live trees (broken top) that provide a flattened basket at least 12 inches (0.3 meters) at diameter breast height (dbh) with at least 1 strong branch close to the nest to support perching and fledglings (Lind 1976). The nest is usually at or a few feet below the top of the snag/tree. (USFS 2012)

Some ospreys maintain one or more alternate or "frustration nests" in addition to their main nest, either nearby or up to 1.24 miles (2 km) away (Vana-Miller 1987, Anderson 1985). These nests likely provide an alternate location for nest-building if the main nest tree fails or if the nest is occupied, such as by Canada geese. (USFS 2012)

For the detailed assessment on the osprey for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

The NatureServe status for osprey is secure at the global level (G5), secure for breeding (N5B) apparently secure for non-breeding (N4B) at the national level, and secure (S5) at the Oregon state level. Although pesticide-related problems still exist in some areas, it is considered secure at the global level due its large range, increasing population trend in many areas where it was formerly depleted by effects of pesticides, and benefits from active management. The global status was last reviewed on November 22, 1996.

The following is a potential list of threats due to habitat alteration for the osprey (USFS 2012):

- Human disturbance causing nest abandonment.
- Lack of nest sites from timber management, shoreline development, hazardous tree removal, and fuelwood gathering.
- Road development and associated human disturbance; road systems to develop utility corridors and associated tree removal.
- Fire and fuels management causing the removal of large snags that provide alternate nest sites; inundation of nest sites with smoke during nesting season causing nest abandonment.
- Reservoir water level management during drought situations limiting foraging abilities.

Potential habitat was mapped by buffering fish bearing lakes and streams by 1 mile, and within that 1 mile buffer reproductive habitat was mapped where 4 snags or green trees per acre greater than or equal

to 21 inches in diameter. The Deschutes River and Tumalo Creek Corridor provides the main source of foraging habitat for the Osprey. Although Tumalo Creek contain fish, it is narrow and turbulent and very few large pools exist, providing limited foraging opportunities for the Osprey. Osprey nest sites occur along the Deschutes River adjacent to the project area. There are no known nest sites that occur in the project area. Osprey nests are located on the opposite side of the river than the project area, which is most likely due to lack of developed roads and trail along that side of the river.

No surveys have been completed for osprey, a review of the NRIS wildlife database confirmed not historic nest sites are located within the project area.

Through the Forest wide assessment completed for MIS, osprey reproductive habitat was mapped across the entire Deschutes National Forest. Approximately 8,024 acres of habitat exists within the project area. Cumulatively, approximately 36,995 acres habitat occurs within the Watershed and approximately 496,233 acres of habitat occurs across the Deschutes National Forest. Table 110 summarizes these acreages:

Table 110: Osprey habitat within the West-Bend project area, Watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
8,024 acres	36,955 acres	496,233 acres

Environmental Consequences

Alternative 1 – No Action

Current potential nest trees (snags) are often located within densely stocked stands and are more susceptible to wildfire, due to increased fuel loadings from fire suppression. Under the no action alternative potential nesting habitat will continue to be at an increased risk to wildfire. In addition, there are currently a limited number of large trees available for potential nest sites located within potential osprey habitat. Replacement large trees are also a concern; many future potential nest trees are within overstocked stands, which will increase the amount of time the trees will take to get to the desired size and height.

Effects Common to Alternative2 (Proposed Action), Alternative 3, and Alternative 4

Direct and Indirect Impacts

Thinning From Below (HTH), Harvest Cut with Reserves (HCR), Harvest Improvement Cut (HIM) Non-commercial Plantation Thinning (PCT), Ladder Fuels Reduction, Burning Only

All of these treatments would maintain the largest and healthiest overstory trees in the stands. Treatments within the project area will break up the fuel continuity and reduce the risk of a landscape scale fire event, which should reduce the risk to individual large snags and trees. The largest and healthiest green trees (future large snags) will not be removed.

The HCR units are in mixed conifer stands with dead and dying lodgepole and white-fir, which have created areas of high fuel loading in the higher elevations of the project area. Although HCR areas are within the higher elevation, they still exist within the habitat buffer areas of fish bearing streams. HCR treatments will retain the largest trees and snags in the stand which could potentially provide nesting opportunities. However, the majority of the trees removed under this treatment are smaller diameter, primarily less than 21 inches in diameter. There are occurrences of ponderosa pine in the overstory, which provide the best and longest lasting nest trees and all healthy ponderosa pine will be retained. Since this is an over story removal prescription, where ponderosa pine exists in the overstory, it will be

planted in the understory to promote a more fire resilient mixed conifer stand in the future. It will also ensure that it will continue to provide viable osprey habitat in the future.

Within HTH units associated with the ponderosa pine PAG, currently there are a limited numbers of large trees available for potential nest and roost sites located near Tumalo Creek and the Deschutes River in the project areas due to the fact the majority of the ponderosa pine is 60 to 80 year old second growth. Future large snags are a concern; many are in overstocked stands, which will increase the time it takes the trees to reach the desired size and height. Thinning overstocked stands will reduce competition which should increase growth rates to the remaining trees. Similarly, the LFR stands and HIM units will also thin from below leaving the largest trees in the stands and favoring ponderosa pine in the overstory. These treatments are specifically designed to remove fuel loading in the urban interface, but also promote the development of LOS stands that are more resilient to natural disturbances (fire, insects and disease). In a study conducted by Cochran and Barret (1999), they were able to show that 30 years after thinning there were large differences in average tree sizes among different group stocking levels. They were also able to show that growth rates of the 20 largest diameter trees per acre were reduced by competition from smaller trees. Similarly, treatments are expected to accelerated the development contiguous LOS stands through thinning, providing a variety of nesting options for Osprey in the long-term.

Within the areas that have identified for prescribed burning, there is also potential of changing large snags into down wood. Burning prescriptions and pre-ignition fuels reduction should reduce the chance of losing large snags. However, it is assumed that a small percentage of large snags will be affected by prescribed burning. Mortality of snags in ponderosa pine habitat during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags < 15 cm dbh. Several studies showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988; Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for snags, presumably because the trees that did not burn during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988; Bagne et al. 2008).

Generally, large snags would be avoided during treatments, but due to OSHA regulations snags posing a hazard may be removed.

Table 111: Total acres of osprey reproductive habitat associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	3292.11	3310.13	2539.97
HCR	116.09	116.09	116.09
HIM	78.06	78.06	78.06
PCT	192.82	200.38	200.38
PCT Mechanical	227.95	227.95	227.95
LFR	76.95	65.83	96.07
Skid & Deck	845.32	845.32	713.67
Burn	1307.24	1307.24	2062.49
Total Acres Affected	**6137**	**6151**	**6035**

The above list of treatments are all associated with the osprey buffer area that surround fish bearing streams within the project area. All treatments reduce the potential risk of stand replacing fire. The majority of thinning that is associated with osprey habitat is thinning from below treatments in second growth (40 to 80 year old) ponderosa pine stands, and fully stocked stands will be maintained post thinning. These treatments will retain the largest trees in the stand which will potentially provide future nesting habitat.

Non-commercial thinning will only treat small diameter plantation, residual large trees that occur in these stands will be retained. Non-commercial thinning will promote the development of future large tree structure promoting the development of long-term osprey habitat.

The potential removal of snags greater than 21inches in diameter could occur where the pose hazard to operations.

Cumulative Effects

Territories on the Bend/Ft. Rock RD have been wide spread, located primarily along the Deschutes River corridor and around the large lakes and reservoirs. Many developed recreation areas such as trails, campgrounds, day use areas occur in these areas. Danger trees are routinely removed from recreation facilities (campgrounds, summer home tracts, etc.) and major travel routes. Continued loss of large snag habitat in and adjacent to recreation facilities and major travel routes due to safety reasons limits available nesting sites along suitable water bodies across the district. Large snag habitat outside designated recreation areas are important to retain since most, if not all, large snag habitat will eventually be lost in the recreation sites over time.

Within the watershed (zone of influence) much of the areas surrounding the Deschutes River are second growth ponderosa pine that are a result of the clear cutting that occurred in the 1930s A variety of past thinning projects occurred in the watershed in the 1980's through the mid-1990s in these areas. Treatments were designed to reduce the risk of stand replacing fire and promote the development of contiguous stands of future old growth ponderosa pine, while reducing the stands increasing susceptibility to insects and disease. The majority of thinning removed trees 8 inch dbh and less, but also commercially thinned trees up to 21 inches dbh. Mowing and prescribed fire continue to occur in these areas on roughly a five year rotation.

The following ongoing vegetation management projects occur within suitable osprey habitat within the watershed and contribute to cumulative effects. Measures were incorporated to retain suitable nesting habitat for each project area as well as enhance habitat conditions. Overall, treatments proposed will improve habitat conditions by promoting the development of more fire and disease resistant open stands containing large tree structure and reducing the risk of loss of existing habitat from other large-scale disturbances. These ongoing projects will treat approximately 11,083 acres.

Table 112: Ongoing and Future Foreseeable Projects Contributing to Cumulative Effects

Reasonably Foreseeable Vegetation Management Projects with potential Impact to Lewis woodpecker habitat.		
Project	**Status**	**Acres**
Rocket Vegetation Management	Planning	6,387acres of commercial thinning, plus mowing and underburning.
Jet Timber Sale part of West Tumbull project	Ongoing/Planned	Within the watershed 584 acres in Skyliners road upper community. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest continuing Understory treatments and fuels treatments remaining.
East Tumbull HFRA	Ongoing/Planned	2,534 acres within east 1/3 of West Bend Project.

Project (Net T.S., Set T.S., NT7)		Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest finished, understory treatments for fuels remaining.
Katalo East and West Projects	Ongoing/Planned	1,435 acres within project area center 1/3 of west bend project. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest finished, understory tree treatments finished, fuels treatments remaining-burning
Feline timber sale	Ongoing	143 acres within project area. Tee harvest and understory treatments finished. Fuels treatments remaining.
Invasive Plant Control EIS	Planned	Within project area and across Forest. Herbicide and manual treatment of invasive plant populations

The invasive plant control prescribed for the watershed will not affect habitat for the osprey and therefore is not seen as a cumulative effect.

Ongoing and future recreation development is also occurring in the watershed which contributes to cumulative effects. The majority is of development occurs in the forms of trails and trailhead development. These developments promote increased human use to areas containing suitable osprey nesting habitat. Although no nesting habitat will be removed with these projects, due to the ongoing hazard tree removal associated with these developed recreation sites, there is the potential to continue to lose suitable nest trees overtime. The following is a list of ongoing and future foreseeable recreation projects within the watershed.

Table 113: Ongoing and Future Foreseeable Recreation Projects Contributing to Cumulative Effects

Recreation		
Mountain Biking	Ongoing	Within and around West Bend project area. Wheeled and bipedal recreation of trails. Some cutting of trees for trails and safety.
Deschutes River area recreation	Ongoing	Day use areas at several locations.
Developed and Dispersed Camping	Ongoing	Dispersed camping throughout project area. No developed camp sites.
Cascade Lakes welcome station and parking lot	Implementation 2013	Providing building with power and water, restrooms, interpretive trail and paved parking lot for access to site and trail systems.
Ryan Ranch	Analysis and public comment completed	Restoration of wetland, removal of dike, interpretive trails and boardwalk
Roads		
Road Closures	Planning	Roads were identified to be closed in Katalo East, Katalo West, East Tumbel and Rocket projects.

Ongoing meadow enhancement is currently being planned within Ryan Ranch meadow to reduce conifer encroachment over approximately 30 acres. This meadow is associated with the Deschutes River corridor; a board walk and trail are also being planned and may preclude use of portions of the river corridor due to the increased human disturbance. The project will remove trees up to 21 inches dbh encroaching on the meadow.

None of the ongoing and reasonably foreseeable vegetation management projects within the Watershed propose to remove large tree structure or large snags within the project adjacent to fish bearing lakes or streams.

Private lands are not managed for osprey habitat. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long term.

Of the 8,024 acres of reproductive habitat identified within the project area Alternative 2 will treat approximately 6,137 acres of reproductive habitat, approximately 6,151 under Alternative 3, and approximately 6,035 under alternative 4. There are no known nest sites or active territories associated with any action alternative. All alternatives promote the development of future large tree structure as well as retain the largest and healthiest trees in the stand. All alternatives will maintain existing reproductive habitat as well as promote the long-term development of future reproductive habitat.

Of the 36,955 acres of osprey reproductive habitat within the Watershed, cumulatively Alternative 2, 3, and 4 will not remove large trees or snags that provide osprey habitat. Treatments are associated with approximately 6,107 acre average of each alternative which is approximately 1% of the total habitat in the watershed. There is no net loss in habitat to the watershed as a result of the project. On The treatments identified under each alternative are associated with <1% of the total osprey reproductive habitat across the Deschutes National Forest. There is no net loss in osprey habitat to the Forest as a result of the project.

Conclusions

The No Action alternative may impact osprey habitat by perpetuating the loss of large structure.

Although, there are large areas of treatment associated with habitat in all alternative the potential to remove large tree habitat is very limited in this project. The project promotes fuels reduction and forest health in the short-term and in the long-term promotes the longevity of large tree structure and a fire resistant landscape. Over all alternatives 2-4 will have the potential to incrementally impact habitat, where large ponderosa pine and white-fir greater than >21" dbh have the potential to be removed. Removal is minimal and incidental and will impact very little habitat and therefore will not contribute to a change in viability on the Deschutes National Forest for the osprey. Implementation of the West-Bend project would be consistent with the Standards and Guidelines for the Deschutes National Forest Land Resource Management Plan for areas outside Osprey Management Areas. There will be very little habitat altered or removed in the short-term and in the long-term will promote habitat within the project area.

Bats

Existing Condition

Most bat species are associated with foraging within forested areas while a few other species are closely associated with foraging in and adjacent to riparian areas. Several surveys have been conducted on forest to determine what species and habitats bats are using (Perlmeter 1996 and 1997, Perkins 1998, district files). The Townsends big-eared bat, pallid bat, spotted bat, and Fringed Myotis are all Region 6 Sensitive species. These species have all been addressed in the Biological Evaluation for TES wildlife.

American Marten

Existing Condition

Martens are closely associated with forested habitats that have complex physical structure near the ground (Buskirk and Powell 1994, Bull et al. 2005, Slauson et al. 2004 and 2007). Open areas, such as regeneration logging units, recent severely burned areas, and natural openings are avoided, especially during the winter. Martens cross and re-cross their own tracks to investigate micro habitat features, such as stumps, logs, and brush piles that might contain food. They often use fallen logs as runways

(Clark et al. 1987). Forested riparian habitats are used disproportionately higher than they are available, which indicates their importance as travel corridors (Bull and Heater 2005, Buskirk et al. 1989). (USFS 2012)

Much of their time during winter is spent resting or hunting beneath the snow in subnivean spaces created by physical structure close to the ground. This complex structure is more characteristic of older forest structural stages than younger forests. These conditions are also more characteristic of moist and cold forest types where fire return intervals are greater, allowing time for dead wood to be recruited and accumulate. Large logs may be particularly important as winter resting structures (Bennett 1984). (USFS 2012)

Martens are extremely susceptible to predation and are reluctant to venture into openings (Buskirk and Powell 1994). Martens seem to be sensitive to patch size, and usually avoid open habitats dominated by grasses, forbs, and saplings, especially in winter. These areas do not provide the structure necessary for a network of travel ways under the snow, nor do they offer access to this subnivean zone. A lack of overstory cover offers little protection from predators. These open habitats also have more severe microclimatic conditions than areas with forest canopy cover (Buskirk and Powell 1994). (USFS 2012)

Older aged forests often provide overstory cover from avian predators and the means to escape avian and mammalian predators (Bull and Heater 2001). Because marten avoid openings and prefer larger forest patches (Chapin et al.1998 and Hargis et al.1999), habitat fragmentation may lead to isolation of local populations too small for long term viability (Gibilisco 1994). (USFS 2012)

Marten use a variety of structures for resting and denning sites. Resting and denning sites offer protection from predation and thermal stress; thus, availability of quality denning sites likely increases the rates of survival and fecundity in marten (Raphael and Jones 1997). A variety of structures are used for dens, with trees, logs, and rocks accounting for 70 percent of the reported den structures. In virtually all cases of dens in trees, snags, or logs, dens were found in large structures characteristic of late-successional forests. In the Blue Mountains, marten selected for specific habitat as determined by comparing used sites with available and unoccupied sites ($p<0.01$) (Bull et al. 2005). Stands used by martens had higher densities of large snagsgreater than 20 inches dbh and trees greater than 10 inches dbh. They selected unharvested, closed canopy (50-75%), old-structure stands in subalpine fir and spruce forests. Northern aspects in upper slopes and drainages were selected for. In the Cascades, marten selected sites with higher canopy closure during snow periods than during snow-free periods (Raphael and Jones 1997). In Oregon, canopy closure at rest sites in lodgepole pine dominated stands averaged 36% in snow periods and 27% in snow-free periods. (USFS 2012)

Raphael and Jones (1997) found that down wood and slash piles were important resting and denning structures in the eastern Cascades of central Oregon. Forests in their study area were dominated by lodgepole pine. (USFS 2012)

For the detailed assessment on the marten for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

The current conservation status of the American marten as listed by NatureServe, as secure nationally and globally, but the Oregon Department of Fish and Wildlife Sensitive Species List status is Vulnerable which signifies that the species is facing one or more threats to their populations and/or habitats. Vulnerable species are not currently imperiled in a specific geographic area or the state, but could become so with continued or increased threats to populations and/or habitats.

Historically the primary threat to marten range-wide was loss of source habitat through conversion to early seral stages by logging or wildfire. The Land and Resource Management Plan (LRMP) for the Deschutes National Forest went into effect in 1990 and the LRMP recognized the current mountain pine beetle epidemic was killing thousands of acres of lodgepole pine forest and removing habitat for marten. In the early 2000s uncharacteristic wildfires contributed to additional loss of habitat on the forest.

Thousands of acres of dead and dying trees created conditions suitable for stand replacement wildfires that increased in acreage to 46,660 acres during the 1990s decade and mushroomed to 190,000 acres during the 2000-2010 decade. While not all of this acreage was suitable marten denning habitat, much of the fire acreage in both decades was in mixed conifer and mountain hemlock plant associations that provided marten resting, foraging, and denning habitat. The majority of the acreage occurred on the north end of the Deschutes National Forest, Sisters Ranger District. Most of the fire acreage was defined as stand replacement that removed the overstory as well consuming much of the coarse woody debris on the ground and standing snags. This combination removed marten foraging, resting, and denning suitability on tens of thousands of acres and has likely had the greatest impact on marten on the Deschutes National Forest over the last 20 years the DLRMP has been in place. (USFS 2012)

The West-Bend project contains very little marten habitat due to the fact that there is only minor amounts of mixed conifer wet and lodgepole pine PAGs in the project area.

Through the Forest wide assessment completed for MIS, American marten reproductive habitat was mapped across the entire Deschutes National Forest. Approximately 630 acres of habitat exists within the project area. Approximately 15,439 acres of habitat occurs within the Watershed and approximately 435,607 acres of habitat occurs across the Deschutes National Forest. Table 114 summarizes these acreages:

Table 114: American marten habitat within the West-Bend project area, Watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
630 acres	15,439 acres	435,607 acres

Denning habitat was modeled in Wildhab using all plant association groups (PAGs) except juniper and ponderosa pine without the presence of lodgepole pine. Only dense stands were considered denning habitat except in the lodgepole pine and dry cold white fir PAGs where open and dense were deemed suitable for denning. Those PAGs where lodgepole pine is an early seral species were also considered suitable denning habitat. Minimum dbh was defined as equal to or greater than 5 inches (Class 3) for lodgepole pine and equal to or greater than 15 inches (class 5) for the other PAGs.

Environmental Consequences

Alternative 1 – No Action – Existing Ecological Trend

The project area contains minimal habitat for marten which occur in the high elevation mixed conifer, mountain hemlock, and residual green lodgepole pine stands. This habitat is contained in the western end of the project area and occurs above 5400 feet. Marten probably avoid the ponderosa pine and mixed conifer dry PAGs due to the more open nature of the stands and their tendency to avoid openings (Ruggerio et al. 1994). These stands also lack complex horizontal structure typically found in more mesic forest conditions and along riparian reserves. However, they may use the area for dispersal in a north to south continuum along the slopes of the Cascades. Some individual blocks of habitat occur in mixed conifer dry stands and although it is marginal habitat, the habitat was identified based upon the overstory canopy cover the stands provide.

Within the Tumalo watershed within the lodgepole pine community, a mountain pine beetle out break occurred killing 90% of the lodgepole pine stands from 2001 to 2008, with beetle mortality continuing to date. Very little canopy cover occurs in these stands making marten susceptible to predation, rendering these stands unsuitable habitat. Overtime, as dead trees are recruited as down logs, these concentrations of down logs accumulate and subnivean foraging and resting opportunities will be provided for the marten. Within mixed conifer stands, areas that currently provide suitable marten habitat would most likely have increased mortality due to tree stress from competition. Without the

treatments prescribed to thin from below within multi-storied mixed conifer stands, stand densities will reduce the longevity of residual old growth and large tree structure that occurs in these stands. In the short-term, available denning habitat will be limited and in the long-term the future development late and old structure characteristics would be prolonged as well as stands containing sufficient canopy cover to provide protection from predation.

Potential fire hazard for the existing condition/no action of the West Bend Planning area has been predicted by using a number of state of the art tools. Remote sensing satellite imagery from 2004 was updated using ArcFuels (Ager et al., 2011) to reflect activities accomplished since 2004. The data was then analyzed in the computer model FlamMap (v. 3.0) under specific weather conditions. FlamMap, a fire behavior mapping and analysis program that computes fire behavior characteristics (rates of spread, flame length, crown fire potential, etc.) over an entire landscape, was used to determine the existing stand condition's potential fire hazard. FlamMap is a state of the art tool used by many researchers and modelers (Finney, 2006, Stratton, 2004, Ager, Finney & McMahon, 2006, Gercke & Stewart, 2006, Opperman et al., 2006, Ager et al., 2006, Yohay et al, 2009, Krasnow et al., 2009, Arca et al., 2007, Stratton, 2006, Knight & Coleman, 1993). FlamMap output lends itself well to landscape comparisons (e.g. pre- and post-treatment effectiveness) and for identifying hazardous fuel and topographic combinations, thus aiding in prioritization and assessments (Stratton, 2004). Although the (modeling) approach has limitations, model outputs yield useful information for planning, assessing, and prioritizing fuel treatments (Stratton, 2004). The data inputs necessary for FlamMap include aspect, slope, elevation, fuel model, canopy height, canopy base height, crown bulk density, and crown class. Specific wind and fuel conditions used for running the model may be referenced in the fuels section of the EIS.

Under the No Action Alternative approximately 9,317 acres or 36% of the project area is predicted to be at extreme hazard. An additional 1,593 acres or 6% of the project area is predicted to be at moderate to high hazard. Fire effects analysis and best available science supports that moderate to high hazard potential would be damaging to valued stand characteristics; extreme hazard with high flame lengths and varying degrees of crown fire would be most damaging. Across the Deschutes National Forest, landscape scale fires have created a decline of marten habitat over the last 10 years. These fires have consumed large areas of mixed conifer stands due to fuel concentration and stand densities associated with these PAG's. The West-Bend project area contains a large area of fuel concentration in Tumalo Creek Watershed due to the vast mortality in the lodgepole pine, as the fire burns down hill stand densities and ladder fuels within both the mixed conifer and ponderosa pine stands, have the potential to create similar large scale stand replacing fires that have occurred on the Forest. A stand replacing fire event would remove most of the structure, which would prolong the development of marten habitat for several decades.

Overall, high stand densities will result in a decrease in tree vigor among all size classes. The most significant effect of high stand densities will be the gradual loss of the existing historic large-tree component/denning habitat which is likely to be at a much higher rate than if stand densities were reduced to more healthy levels.

Action Alternatives 2, 3, and 4

Direct and Indirect Impacts

Thinning From Below (HTH)

Thinning in suitable marten habitat would occur in mixed conifer stands containing residual old growth trees. Thinning from below (from 7" dbh and up) will favor ponderosa pine and healthy white-fir. Target basal area between 40 to 60square feet is the target for each stand but will vary from 40 to 140 on dominant over story tree species in each stand. Where stand are dominated by white fire basal areas will be higher, as residual over story white-fire will be left in clumps. Different scenarios exist

depending on alternative and the existing basal area, site productivity, and stand structure objectives. This treatment aids in maintaining large trees by reducing their susceptibility to fire and insects by removing competition for space and nutrients. Thinning decreases stand densities and allows for faster growth of young trees while reducing risk (removal of ladder fuels). However, canopy cover is reduced overall resulting in more open stands. Negative impacts may result from more open stands, reducing the canopy cover and potentially making the marten more susceptible to predation. Beneficial impacts should result from reducing risk to existing suitable habitat and facilitating the development of future habitat. This treatment will not remove any snags or down wood unless the snag poses a hazard during operations. Snag cavities utilized by marten are often white-fir snags excavated by pileated woodpeckers. Treatments will maintain the largest and healthiest white-fir to provide future snags and down wood.

Harvest Cut with Reserves (HCR)

Due to the removal of ponderosa pine from these mixed conifer stands through past management activities, stand are comprised primarily of white-fir and lodgepole pine. These tree species are not fire resistant, and due to mountain pine beetle outbreaks in the project area, much of the lodgepole pine is dead, reducing canopy closures and contributing to fuel loading as well as decreasing the amount of suitable reproductive marten habitat. White-fir is also a short-lived species, and highly susceptible to insects and disease, and many of the white-fir in these stands are declining from mistletoe. The project proposes to remove the overstory and promote ponderosa pine within these stands where it previously existed, creating a more fire resilient mixed conifer stand in the long-term. To maintain habitat for the marten healthy white-fir will be retained in clumps. High densities of small dead trees (<7" dbh) that contribute to to fuel loadings may be removed, but the large snags meeting habitat requirement >10inches dbh will be retained to provide short-term habitat for rest site opportunities. Negative impacts may result from more open stands by removing dense patches, creating areas where marten are more susceptible to predation. Long-term beneficial impacts should result from treatments by reducing risk to existing suitable habitat and facilitating the development of more fire resistant future habitat by promoting the development of ponderosa pine in these stands. Where interlocking crowns remain in the overstory, marten use will continue due to the security and overstory structure that the stands will continue to provide.

Table 115 summarizes the amount of marten reproductive habitat associated with each action alternative identified for the West-Bend project.

Table 115: Total acres of marten reproductive habitat associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	145.89	150.34	142.33
HCR	219.06	219.06	219.06
Total Acres Affected	**365**	**369**	**361**

Affects to marten habitat are similar under Alternatives 2, 3 and 4. The outcomes of the affects to habitat as a result of each treatment type are also consistent across all action alternatives. The project area and habitat varies greatly from east to west due to the increase in elevation, the rain gradient associated with the change in elevation, and the site potential associated with the inherent soil quality within this east to west patter. To capture the importance of habitat variation across the project area, the project area was broken up into four ecotones moving from east to west. A habitat retention strategy was defined where in the low elevation ponderosa pine ecotone (approximately 16,146 acres), approximately 10% of this zone would be left in un-treated stands and aggregate patches, in the mid-

elevation ponderosa pine mixed conifer dry ecotone (approximately 3,966 acres) approximatley15% of this landscape would be left in untreated stand and aggregate patches, within the high elevation mixed conifer wet stands (approximately 3,027 acres), approximately 20% of this landscape would left in untreated stands and aggregate patches, and lastly the lodgepole pine community (approximately 2,027 acres), 15% of each harvest unit will remain untreated in regen harvest units. These untreated areas were identified to retain habitat connectivity between thinned stands associated with project treatments.

Overall, approximately 365 acres of marten reproductive habitat are associated with treatments identified under Alternative 2, approximately 369 acres under Alternative 3, and approximately 361 under Alternative 4. Loss of the large tree component should be slowed on treated acres as trees respond to the increased growing space from the removal of tree densities and disease from the stands.

Overstory structural diversity will be reduced in HCR units but will remain in HTH units and understory complexities will be reduced through follow up fuels treatments to deal with slash generated from thinning activities. Fuels treatments associated with harvest treatments may have impacts to martens and their prey species. Although prey habitat will be reduced in the short-term, some residual habitat will remain providing foraging opportunities for the marten. Long-term benefits of treatments will be a reduction of stress to the overstory promoting the longevity of the residual large tree structure, but also promoting the development of future old growth in stands that will be thinned from below, providing long-term habitat. Although in a meta-analysis by Fontaine and Kennedy 2012, the analysis showed that surrogate fuels treatments (thinning and prescribed fire) in fire prone forests, increased vertebrate biodiversity.

Affected habitat varies little between each alternative and these differences are insignificant.

The project area and habitat varies greatly from east to west due to the increase in elevation, the rain gradient associated with the change in elevation, and the site potential associated with the inherent soil quality within this east to west pattern. To capture the importance of habitat variation across the project area, the project area was broken up into four ecotones moving from east to west. A habitat retention strategy was defined where in the low elevation ponderosa pine ecotone (approximately 16,146 acres), approximately 10% of this zone would be left in un-treated stands and aggregate patches, in the mid-elevation ponderosa pine mixed conifer dry ecotone (approximately 3,966 acres) approximatley15% of this landscape would be left in untreated stand and aggregate patches, within the high elevation mixed conifer wet stands (approximately 3,027 acres), approximately 20% of this landscape would left in untreated stands and aggregate patches, and lastly the lodgepole pine community (approximately 2,027 acres), 15% of each harvest unit will remain untreated in regeneration harvest units. These untreated areas were identified to retain habitat connectivity between thinned stands associated with project treatments.

The FlamMap hazard assessment conducted for Alternative 2 shows a reduction in extreme hazard by 98% of the existing condition hazard to 233 acres. For all hazard classes shown to be damaging to valued stand characteristics- moderate, high and extreme hazard, hazard in these classes was reduced by 7,667 acres or by 70% of the existing condition hazard. The hazard assessment conducted for Alternative 3 shows a reduction in extreme hazard by 98% of the existing condition hazard to 234 acres. For all hazard classes shown to be damaging to valued stand characteristics- moderate, high and extreme hazard, hazard in these classes was reduced by 7,645 acres or by 70% of the existing condition hazard. Lastly, hazard assessment conducted for Alternative 4 shows a reduction in extreme hazard by 98% of the existing condition hazard to 234 acres. For all hazard classes shown to be damaging to valued stand characteristics- moderate, high and extreme hazard, hazard in these classes was reduced by 7,575 acres or by 69% of the existing condition hazard.

See snag and down wood analyses to review the projects effect to dead wood habitat as it relates to the marten.

Cumulative Effects

Potentially suitable habitat outside the wilderness is located within the mixed conifer and lodgepole PAGs. Currently, the lodgepole pine PAG and the lodgepole pine within mixed conifer stands are experiencing mountain pine beetle infestation. Throughout the Three Sisters Wilderness and associated areas, the lodgepole pine PAGs have experienced mass mortality over the last 10 years. This has led to unsuitable habitat conditions for the marten as stands lose their canopy cover further reducing potential habitat on the district. Past clear cuts have occurred in these plant associations within the watershed to deal with disease and infestation, which has fragmented marten habitat.

Within the watershed (zone of influence), ongoing vegetation management projects occur within suitable habitat that contribute to cumulative effects. Measures were incorporated to retain suitable reproductive habitat for each project area. Overall, treatments proposed will improve habitat conditions by promoting the development of more fire and disease resistant open stand containing large tree structure and reducing the risk of loss of existing habitat from other large-scale disturbances. These ongoing projects will treat approximately 207 acres.

The following are a list of ongoing or reasonably foreseeable projects occur in suitable marten habitat and contribute to cumulative effect in the watershed.

Table 116: Ongoing and Future Foreseeable Projects Contributing to Cumulative Effects

Reasonably Foreseeable Vegetation Management Projects with potential Impact to Lewis woodpecker habitat.		
Project	**Status**	**Acres**
Sparky timber sale and hazard tree removal.	Ongoing/ Planned	172 acres along project boundary and Cascade lakes highway. Commercial thinning, salvage, understory thinning, fuels treatments (pile, mow, burn).
Skyliner CFLRA	Ongoing	35 acres of treatment within the wildlife urban interface of the Skyliner community.
Invasive Plant Control EIS	Planned	Within project area and across Forest. Herbicide and manual treatment of invasive plant populations

Private lands are not managed for marten habitat. Therefore, it is assumed that any habitat provided by private timberland in the watershed is incidental and may not be long term.

Because of the large amount of potential habitat that has experienced mortality from beetle outbreaks populations are expected to decline in the watershed. Actions to reduce fragmentation, human disturbance, and the loss of dead and downed wood will create more fire-resilient habitat that will closer mimic historic habitat that will benefit marten populations in the long-term within the West-Bend project.

Of the 630 acres of reproductive habitat identified within the project area Alternative 2 will treat approximately 365 acres of reproductive habitat, approximately 369 under Alternative 3, and approximately 361 under alternative 4.

Of the 15,439 acres of marten reproductive habitat within the watershed, cumulatively Alternative 2, 3, and 4 will treat on average approximately 365 acres or 2% of the total habitat.

Treatments identified within each alternative under the West-Bend project have the potential to remove <1% of the total marten reproductive habitat across the Deschutes National Forest.

Conclusions

The Oregon Natural Heritage Information Center maintains a list of the most current information available on the distribution and abundance of animals native to Oregon. For the state of Oregon, the Oregon Natural Heritage program lists martens as S3/4, "Vulnerable" to "Apparently Secure".

The No Action Alternative could affect marten and their habitat due to the ongoing loss of large structure and the conversion of stands to non-sustainable and non-fire resistant species as well as stand replacing fire.

The Action Alternatives have the potential to affect marten and their habitat by reducing stand densities and canopy closures potentially affecting suitable denning and resting habitat. However, through project design criteria, treatments have been designed to maintain residual habitat in treatment units as well as the retention of untreated stands throughout the project providing habitat connectivity.

Although treatments will occur in suitable habitat it will not preclude use by marten. Residual structure and untreated areas within treatment units will provide habitat on a stand level basis. These areas will still provide potential areas of reproductive habitat as well as foraging opportunities.

The West-Bend project will not contribute to a change in viability within the Watershed or on the Deschutes National Forest for the marten. Implementation of the West-Bend project would be consistent with the Standards and Guidelines for the Deschutes National Forest Land Resource Management Plan. Treatments will be beneficial to the long-term management of marten habitat.

Big Game

Existing Condition

Deer

The most important deer habitats in Eastern Oregon are summer habitat, including areas needed for reproductive activities and winter habitat. Preferred summer habitat provides adequate forage to replace body reserves lost during winter and to maintain normal body functions. Summer habitat also includes areas specifically used for reproductive purposes. These areas must have an adequate amount of succulent vegetation, offering highly nutritional forage. In addition, areas used for reproduction should provide isolation from other deer, security from predators and minimal competition from other ungulates. Summer habitat areas are common throughout Eastern Oregon, and can be found in areas varying from lowland agricultural lands to high elevation mountain areas. Winter habitat is found predominately in lower elevation areas of Eastern Oregon. These areas usually have minimal amounts of snow cover and provide a combination of geographic location, topography, and vegetation that provides structural protection and forage. Due to the low nutritive values of available forage during the winter, deer are forced to rely on their body reserves acquired during the summer for winter survival. (ODFW 2002). (USFS 2012)

Deer annually migrate between winter and summer habitats. Migration strategies have evolved to allow animals to respond to spatial and temporal availability of food and cover, thus maintain their energetic balance (Garrott et al. 1987, Nicholson et al. 1997). Mule deer populations exhibit different strategies in response to seasonal variation of resources. Mule deer populations may be entirely residential (Eberhardt et al. 1984, Bowyer 1986), entirely migratory (Gruell and Papez 1963, Zalunardo 1965, Garott et al. 1987), or contain both migratory and residential deer (Brown 1992, Nicholson et al. 1997, Mathews and Coggins 1998). Residential deer may shift areas of activity within their home ranges seasonally and may share winter range areas with migratory deer (Brown 1992). Migratory deer make movements from high-elevation summer ranges to low-elevation winter ranges. During migration, deer tend to follow broad corridors, influenced by topographic features, which become less distinct as the distance from winter range increases (Thomas and Irby 1990). In addition, transition ranges may be important for weight gain during migration in some years (Thomas and Irby 1990). Winter range, corridors, and transition areas may be important to mule deer survival in severe winters, thus need to be

evaluated for potential impact by development and other land use activities (Thomas and Irby 1990). (USFS 2012)

The West-Bend project area is within both mule deer winter and summer range. Deer summer range was identified within the Deschutes Land and Resource Management Plan under Management Indicator Species to provide management direction in forested stands at higher elevations which mule deer occupy from late spring to late fall. High quality forage is essential in summer range, providing nutrients for antler growth, milk production for lactating does, providing energy for breeding season in late fall and maintaining reserves to assist with winter survival. This type of high quality forage is provided by the development of nutrient rich early seral forbs and shrubs. High quality forage is produced by prescribed and wildfires, and tree thinning which open stands enhancing shrub and forb production by reducing shading.

Two primary S&Gs which are associated with summer range includes hiding cover and open road densities. Hiding cover is a habitat attribute which provides escapement from predation as well as avoidance from harassment potential by hunters and other recreation use. Road densities are used to mitigate habitat impacts from vegetation management, and where hiding cover S&G's cannot be met, road densities are used to further eliminate disturbance from an area. The guidelines for hiding cover states, "Hiding area must be present over 30% of National Forest Land in each implementation unit, resulting in 70% of each implementation unit existing as a hiding area or within 600 feet of a hiding area. Black bark stands will not be used to measure conformance". A separate set of guidelines are used to address "Black Bark Pine Management" which are second growth pine stands 60-80 years old. These stands provide very poor quality hiding cover due to the lack of horizontal structure and a single age class of trees. (USFS 2012) Approximately 12,429 acres of deer summer range occurs within the West-Bend project area.

The Deschutes LRMP established Management Area 7 (MA-7) to manage vegetation to provide optimum habitat conditions on deer winter and transition ranges, considering the optimum productivity of the land. In addition, MA 7 would also provide opportunities for some domestic livestock forage, wood products, visual quality, and recreation opportunities. This management area contains approximately 209,684 acres of which approximately 95,400 were identified as not suitable for timber production, which provide unforested habitat and therefore may not likely contribute to thermal cover objectives. Approximately 113,500 acres of the MA 7 were identified as appropriate for timber production providing forested habitat, which could contribute to both thermal and hiding cover objectives. MA -7 was identified to maintain optimum winter habitat for deer when they are conserving energy and in need of highly nutritious forage. Specific constituent elements consist of forage availability due to snow depth, hiding cover to avoid disturbance, and thermal cover to escape snow depth and cold temperature. Similar to summer range, winter range contains 3 primary standards and guides which include hiding and thermal cover, and open road densities. The guidelines for cover state "cover should make up 40% of the land area, approximately three quarters existing as thermal cover and the remainder as hiding cover." Similar to summer, road densities are used to mitigate habitat impacts from vegetation management, and where hiding cover S&Gs cannot be met, road densities are used to further eliminate disturbance from an area. (USFS 2012) Approximately 8,407 acres of winter range (LRMP MA-7) lies within the West-Bend project area.

The project is within the Upper Deschutes Wildlife Management Unit (WMU) designated by ODFW. The population objective for mule deer within this WMU is 2,200 wintering deer. Although there has been a precipitous drop in population from 1990 to 2011, buck to doe ratios continue to meet Management Objectives (M.O.) and therefore allowable harvest has not changed from 2,200 available tags. However, due to the decline in the population and low fawn recruitment, very minimal antlerless harvest occurs. (USFS 2012)

For the detailed assessment on the mule deer for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012). The conservation status based on the Nature Serve ranking indicate the mule deer is secure at globally, nationally, and state wide (USFS 2012).

The following is a potential list of threats to mule deer habitat identified within their range in the intermountain west as well as the Deschutes National Forest (USFS 2012):

- Vegetative species composition has been modified - Invasive plants replacing native shrubs.
- Vegetative structure has been modified - In the absence of fire, the expansion of juniper woodlands reducing diversity of understory grasses, forbs, and shrubs.
- Nutritional quality has decreased – as plants mature and are not regenerated through a disturbance, the nutritional quality also diminishes.
- Usable habitat has been lost and fragmented due to human encroachment and associated activities – due to urbanization, towns are expanded and developments are built within historic winter range areas. Gas and oil expansion also affects migration and habitat loss. On a local level, due to the size of the Central Oregon Community, motor vehicle collisions and traffic volume have created barriers to mule deer migration and removed segments of the population.
- Poaching- removal of individuals from the population due to poaching is the largest loss of deer above all in Central Oregon.

Table 117 addresses Standards and Guides outside of Deer Management Area 7 (Mule Deer Summer Range) specific to the management of viable summer range habitat:

Table 117: Summer Range Standards and Guides

Hiding Cover: 30% Suitable hiding cover must meet one of the following criteria.	***Open Road Densities within the Watershed.**	**Black Bark: 10% of treated stand will be in clumps to provide visual screening throughout and meet the following criteria**
Six acre or larger Stand Capable of hiding 90%of a standing adult deer at 200 feet.	≤ 2.5 mi. per sq. mile	A minimum of ½ acre in size which have not been thinned or harvest for at least 20 years. Small clumps will be suitable in dense stand but larger (4 or 5 acre) clumps may be needed in more open stands.
Six acres or larger stand with an average height of 6 feet and has not been thinned in 15 years		Clumps will be dispersed throughout the unit sot that visual screening is provided by the clumps in a combination with topographic features.
Residual clumps of ½ acre or larger stands within units with advanced regeneration and at least 12 trees greater than 7" dbh per acre remaining after harvest. Clumps should be located away from roads.		

*The watershed is being used as the implementation unit to calculate average road density and hiding cover objectives (LRMP WL-53).

Table 118 addresses Standards and Guides for Management Area 7 (Mule Deer Winter Range) specific to the management of viable winter range habitat.

Table 118: General Theme and Objectives / MA - 7 Standards and Guidelines

*Thermal Cover General Theme and Objectives	**Hiding Cover General Theme and Objectives	OHV Seasonal Closure M7-1	Open Road Densities M7-22	Annual Fuels Treatment M7-26
30%percent of the Winter Range	10% of the Winter Range	December 1 –March 31	1.0-2.5 mile/sq. mile	2.0 – 2.5 % of MA-7

*Where site productivity is capable of producing forested stands that provide thermal cover.
** Where site productivity is capable of producing forested stand or shrubs that provide hiding cover

Through the Forest wide assessment completed for MIS, mule deer hiding cover and road densities within the summer range was mapped across the entire Deschutes National Forest. Approximately 4,579 acres of hiding cover exists within the project area. Approximately 37,395 acres of hiding cover occurs within the Watershed and approximately 716,957 acres of hiding occurs across the Deschutes National Forest.

In addition, the Forest wide assessment completed for MIS, mule deer hiding and thermal cover as well as road densities was mapped for MA-7 across the Deschutes National Forest. In addition, to directly correlate MA-7 habitat objective to the specific herd unit areas in which the winter population census occurs, MA-7 was divide into subunits. By separating MA-7 into these specific subunits, an analysis of Forest practices can more accurately be completed to display actions directly affecting habitat objectives associated with a specific deer herd. Lastly, the scope and scale of the subunits will provide a basis to develop strategies for managing cover quality, diversity of seral classes of winter forage, and road densities. Cumulatively, approximately 605 acres of hiding cover exists within the portion of the West-Bend project associated with MA-7, 3,148 acres in the Tumalo Winter Ranger Sub-Unit, and 25, 924 acres across the entire MA-7 on the Deschutes National Forests. In addition, there is approximately 1,545 acres of thermal cover within the West-Bend portion of MA-7, 2,091 acres within the Tumalo Winter Range Sub-Unit, and 24,705 acres across the entire MA-7 on the Deschutes National Forest. Table 119, Table 120, and Table 121 summarize these acreages for MA-7.

Table 119: Mule deer summer range hiding cover within the West-Bend project area, the watershed, and across the Deschutes National Forest.

Acres of hiding cover in the West-Bend Project Area	Acres of hiding cover in the Watershed	Acres of hiding cover on the Deschutes National Forest
4,579 acres	37,395 acres	716,957 acres

Table 120: Mule deer winter range hiding cover within the West-Bend project area, the winter range sub-unit, and across the entire MA-7 on the Deschutes National Forest

Acres of hiding cover in the West-Bend Project Area	Acres of hiding cover in the Tumalo Winter Range Sub-Unit	Acres of hiding cover across entire MA-7 on the Deschutes National Forest
605 acres	3,148 acres	25,924 acres

Table 121: Mule deer winter range thermal cover within the West-Bend project area, the winter range sub-unit, and across the entire MA-7 on the Deschutes National Forest

Acres of thermal cover in the West-Bend Project Area	Acres of thermal cover in the Tumalo Winter Range Sub-Unit	Acres of thermal cover across the entire MA-7 across the Deschutes National Forest
1,545 acres	2,091 acres	24,705 acres

The West-Bend project lies within two 10th field watersheds, North Unit Diversion Dam-Deschutes River and Tumalo Creek. Within the summer range associated with the two watersheds, on average open road densities exist at a level of 2.66 miles per square miles. Within the two 10th field watersheds, approximately 111,379 acres is identified as summer range. Approximately, 33% of the watershed exists as hiding cover.

Road densities exist at the level of 2.78 miles per square mile within the Tumalo Winter Range Sub-Unit.

Approximately 13% of the Tumalo Winter Range Sub-Unit exists as hiding cover and approximately 8% of the Winter Range Sub-Unit exists as Thermal Cover.

The following is a summary describing mule deer habitat relative to Forest Plan Standards and Guides for mule deer: Because of previous road closure decisions, existing condition open road densities are approaching the objectives within the Deschutes LRMP of 2.5 miles per square mile for summer range and approaching the higher end of the objective 1.0 – 2.5 mile per square mile within Management Area 7.

Hiding cover exceeds Forest Plan standard for summer range, where hiding cover exists over 33% of summer range within the watershed.

Hiding cover exceeds Forest Plan standard for the Tumalo Winter Range Sub-Unit, where hiding cover exists over 13% of the winter range sub-unit. However, thermal cover does not meet Forest Plan Standards, where thermal cover exists over 8% of the winter range sub-unit.

Elk

The Deschutes NF has one primary allocation for the management of elk habitat on forest. Eleven Key Elk Habitat Areas (KEHAs) occur across the forest to provide optimum habitat conditions for both summering and wintering elk herds. Management direction within the Deschutes LRMP is specific only to KEHAs. The northern portion of the Ryan Ranch KEHA occurs within the West-Bend project area (Figure 42). Approximately 5,002 acres of the Ryan Ranch KEHA are associated with the West-Bend project.

Vegetation management direction within the key areas focuses on providing vegetation characteristics which provide both thermal and hiding cover. Thermal cover are those stands with enough canopy cover and stand density to help prevent elk from radiational heat loss at night when ambient temperatures are apt to be less than body temperatures (Thomas 1979). In addition, thermal cover stands limit snow accumulation as well as providing tree trunks and low ground vegetation to reduce air speed and chill factor (Thomas 1979). Hiding areas and travel corridors are provided in each key area to allow elk the security to move throughout each key area. To assist in limiting disturbance to elk within each key areas, objective for road densities have been identified in the Deschutes LRMP to compliment hiding cover management (USFS 2012).

Although the DNF contains hunt-able populations of elk, it is not considered a Forest that has the capacity of producing large populations of elk such as those National Forests in northeast Oregon associated with the Blue Mountain Plateau (personal communication Corey Heath and Steven George

ODFW 2011). The DNF contains a variety of habitat types; from high elevation alpine ecosystems to dry juniper/shrub habitat at the lowest elevations, with the predominant habitat type across the DNF being ponderosa pine. Although elk use the these habitat types across various Forests within the State of Oregon, the DNF tends to produces an understory dominated by shrubs consisting of bitterbrush, snowbrush (ceanothus), and or Manzanita. Bitterbrush occurs within the lower elevation more xeric ponderosa pine stands or lodgepole pine stands with well-drained soil types. Snowbrush and Manzanita are associated with higher elevation ponderosa pine and mixed conifer stands. Over the last 20 years timber harvest on the Forest has changed from clear cutting/regeneration harvests to thinning from below with objectives of reducing stand densities, minimize the risk of stand replacing wild fire, and outbreaks of insects and disease. Generally, timber harvests opens stands up, reduces shading and produces shrub fields of snow brush, Manzanita, and at lower elevation bitter brush. These shrubs are not preferred forage by elk and many of these areas are avoided. Subsequent, prescribed fire with frequent reentry can reduce shrub densities and promote forage such as Idaho fescue, elk and Ross's sedge. Reentry with fire is key to reduce shrub competition with grasses, sedges, and forbs. Grasses and forb production on the Forest typically occurs along streams and stringer meadows and as a result the majority of elk and KEHAs are associated with these areas. (USFS 2012)

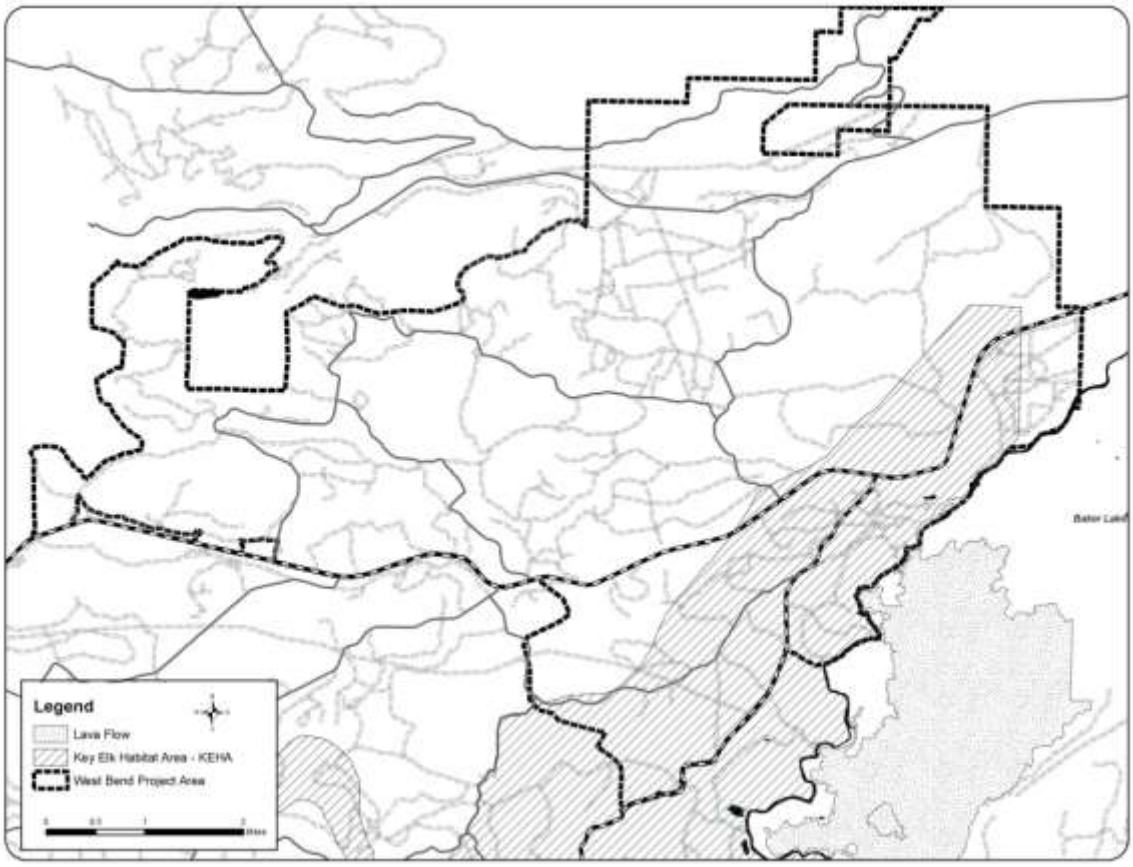


Figure 46: Ryan Ranch Key Elk Habitat Area Relative to the West Bend Project

Elk herds are small and very transient, moving long distances between suitable habitat across the DNF. As mentioned before riparian habitats are an important summer habitat and as a result the KEHAs are generally associated with large riparian expanses. During early summer while cows are calving, these areas are extremely important for calf survival, providing cover and high quality forage for lactating

cows. Summer Range on the Bend/Ft. Rock includes the upper Deschutes River and Fall River Corridor and associated stringer meadow. As calves become more mobile in mid to late summer, these small herds begin to move out of the drainages to higher elevations to find cooler and well shaded areas. Typically these higher elevations are where breeding takes place beginning in late summer or early fall. Elk travel large distance throughout these high elevation areas utilizing the cascades and the various buttes West of Highway 97. Fewer elk occur east of highway 97 and move greater distances between cover, from Walker Mountain on the southern end of the Forest, moving north using various buttes along the eastern fringe as well Newberry Crater. Elk will continue to use these high elevation areas throughout the fall and into winter until snow accumulations force them to lower elevation habitats. Due to the size and hardiness of elk they are not as susceptible to snow accumulation as mule deer and can sometimes over winter without making drastic elevation changes (USFS 2012).

Roads, and also off-road recreational activities such as ATV use and mountain biking, have significant direct and indirect effects on herd productivity (Rowland and others 2005). Hunting, in fact, is the main source of mortality for adult elk (Wisdom and Cook 2000) outside national parks (Hal Salwasser, personal communication) and in the absence of predator populations (Bruce Johnson, personal communication). Elk are more vulnerable to hunters in roaded areas than in unroaded areas (Rowland and others 2005). Roads also break large tracts of habitat into smaller chunks, reduce vegetative cover used by elk for security and act as a vector for exotic plant species. All these things degrade habitat quality for elk. (OFRI 2007 in USFS 2012)

Elk exhibit higher stress levels and increased movement rates near roads. In addition, off-road recreation, which is increasing rapidly on public lands, also has a pronounced effect on elk behavior, causing them to flee to avoid ATVs, mountain bikes, equestrians and the like (Wisdom and others 2005). Elk can spend a substantial amount of energy avoiding pervasive human disturbances. This energy cost may not be adequately accounted for in conventional assessments of elks' nutritional condition (Johnson and others 2005). (OFRI 2007 in USFS 2012)

Four ODFW Wildlife Management Units (WMUs); Metolius, Upper Deschutes, Paulina, and Fort Rock are associated with the DNF. The Metolius and Upper Deschutes WMU's and a small portion of the Ft. Rock WMU west of highway 97(West Ft. Rock) are within the General Cascade Elk rifle season. Controlled hunts for the Deschutes National Forest include; controlled rifle season for the Paulina WMU and portions of the Ft. Rock WMU east of highway 97 (East Ft. Rock) and a controlled muzzleloader hunt associated with all WMU's on Deschutes National Forest. Archery hunting on the Forest is on a general season basis. Due to the small number of elk on the Forest and the great distances these small herds travel, hunter success is extremely low (USFS 2012).

The population estimates for each of the WMUs are consistent with the trend data for all of Eastern Oregon (Personal Communication Corey Heath and Steven George ODFW 2011). Trend data is not collected for these WMUs, populations are estimated annually based on management objectives (MOs) for bull to cow ratios, and there is no MOs for calf to adult ratios. Calf data is collected and used to assist with population projection (Personal Communication Corey Heath and Steven George ODFW 2011). Annually ODFW monitors hunter success and bull ratios to help define the general trends of these populations, watching for precipitous declines. The West-Bend project area is within the Upper Deschutes WMU, although the population is below MO for the Upper Deschutes WMU, trend data for elk is stable to increasing. The overall MO for elk populations in the High Cascade WMU's is currently stable to slightly increasing. (USFS 2012)

Standard and Guides were identified to maintain optimum habitat for elk during both winter and summer seasons for KEHAs. Specific constituent elements consist of forage availability due to snow depth, hiding cover to avoid disturbance, and thermal cover to escape snow depth /cold temperature and thermal cover to escape the heat and high temperatures of summer. High quality forage is essential in the summer, providing nutrients for antler growth, milk production for lactating cows, providing energy

for breeding season in late summer and maintaining reserves to assist with winter survival. This type of high quality forage is provided by the development of nutrient rich earl seral grasses and forbs. Forage is produced from thinning and prescribed fire which opens stands, reducing shading and shrub competition, enhancing grass and forb production. (USFS 2012)

Two primary S&Gs which are associated with the KEHAs include hiding cover and open road densities. Hiding cover is a habitat attribute which provides escapement from predation as well as avoidance from harassment potential by hunters and other recreation use. Road densities are used mitigate habitat impacts from vegetation management, where hiding cover S&Gs cannot be met, road densities are used to further eliminate disturbance from an area. The guidelines for hiding cover states, "Hiding area must be present over 30% of National Forest Land in each key area. Lakes and 50 to 80 year old ponderosa pine stands (black bark) should not be used in evaluating conformance." A separate set of guidelines are used to address "Black Bark Pine Management." These stands provide very poor quality hiding cover due to the lack of horizontal structure and a single age class of trees.

For the detailed assessment on the elk for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012). The conservation status based on the Nature Serve ranking indicate elk is secure globally, nationally, and state wide (USFS 2012).

The following is a potential list of threats to elk habitat identified within their range on the Deschutes National Forest (USFS 2012):

- Due to lack of natural fire, much of the habitat associated with the KEHA's, or various riparian areas/stringer meadows have missed several fire cycles and as a result conifer encroachment has reduced riparian plant diversity due to shading and competition for resources.
- Much of the habitat areas especially associated with the upper Deschutes River corridor have received an increase in human disturbance from recreation over the last 15 to 20 years.
- Motorized and non-motorize recreation trail densities have increased as well as the amount of motorized use on open roads. With the amount of thinning for Forest Health that occurs within and adjacent to KEHAs, disturbance from non-motorize and motorize recreation, habitat effectiveness diminishes within summer and winter habitat.

Table 122 addresses standard and guidelines (S&Gs) specific to maintaining viable habitat within KEHAs.

Table 122: Key Elk Habitat Area Vegetation and Road Management Standards and Guidelines

Cover Standards and Guidelines in each KEHA	Cover Standard and Guidelines for Black Bark in each KEHA	Open Road Densities in each KEHA
Hiding Cover: Must be present over at least 30% of NFS lands in each KEHA and meet one of the following conditions listed below.	Black Bark: At least 30% of the KEHA will be in clumps that will provide visual screening throughout the area and meet the following conditions below.	Road densities should not exceed 0.5 – 1.5 miles per sq. mi. within each KEHA. Where public use is heavy the low end of the range should be the objective, and for light public use the high end should be the objective.
Six acre or larger Stand Capable of hiding 90% of a standing adult deer at 200 feet.	A minimum of 6 acre in size which has not been thinned or harvested for at least 20 years. Smaller stands may be used if bark beetle epidemic is a concern.	Density will be applied as an average over the KEHA and will be used as a threshold for further evaluation. The procedure described in the Transportation S&G's will be used implementing this guideline if existing or proposed densities exceed threshold target. Final judgment on open road densities will be based on the further evaluation rather than the

Cover Standards and Guidelines in each KEHA	Cover Standard and Guidelines for Black Bark in each KEHA	Open Road Densities in each KEHA
		density guideline.
Six acres or larger stand with an average height of 10 feet and has not been thinned in 20 years.	Canopy cover at the highest percentage that will maintain healthy stand conditions with a low risk of catastrophic damage due to insects and disease. Minimum canopy cover must be 40% to qualify as thermal cover.	
Residual clumps of 2 acre or larger stands within units with advanced regeneration and at least 12 greater than 7 dbh per acre remaining after harvest. Clumps should be located away from roads.	Minimum stand height of 40 feet	
Thermal Cover: Must be present over at least 20% of KEHA, excluding lakes and black bark pine. Minimum of 10 acre stand with average height of 40 feet. Minimum of 40% canopy cover. Stands may provide both hiding areas and thermal cover.	Dispersed throughout the key area.	

Through the Forest wide assessment completed for MIS, elk thermal cover, hiding cover, and road densities within each KEHA was mapped for the Deschutes National Forest. Approximately, 30 acres of hiding cover and 791 acres of thermal cover exists within the portion of the project area associated with the Ryan Ranch KEHA. Cumulatively, approximately 3,437 acres of hiding cover and 4,478 acres of thermal cover occurs within the Ryan Ranch KEHA. Table 123 and Table 124 summarize these acreages.

Table 123: Elk hiding cover within the West-Bend project area of the Ryan Ranch KEHA, and across the entire Ryan Ranch KEHA

Acres of hiding cover in the West-Bend project area associated with the KEHA	Acres of hiding cover across the entire Ryan Ranch KEHA
30 acres	3,437 acres

Table 124: Elk thermal cover within the West-Bend project area of the Ryan Ranch KEHA, and across the entire Ryan Ranch KEHA

Acres of thermal cover in the West-Bend project area associated with the KEHA	Acres of thermal cover across the entire KEHA
791 acres	4,478 acres

Approximately 16% of the Ryan Ranch KEHA exists as hiding cover and approximately 21% exists as thermal cover. Cover does not meet Forest Plan Standards for hiding cover, but exceeds the Standard for thermal cover. Road densities exist at the level of 2.7 miles per square mile within the Ryan Ranch KEHA. Open road densities do not meet the objectives within the Deschutes LRMP of 0.5 – 1.5 mile per square mile within the Ryan Ranch KEHA.

Mule Deer and Elk Hiding Cover with MA-7 and Ryan Ranch KEHA

During the initiation of the West-Bend project the Oregon Department of Fish and Wildlife was consulted on the management of mule deer and elk habitat. Due to the close proximity of the project area to the City of Bend and the increasing developed and dispersed recreation in the project area. Forage quality and security cover are the most important habitat components for ungulate populations in the area, due to the high amount of disturbance animal receive from recreation use. Hiding cover is limited and below Forest Plan S&Gs throughout the Tumalo Winter Range Sub-Unit and the Ryan Ranch KEHA, therefore no treatment would occur within deer or elk hiding cover in these areas. In addition, within low elevation ponderosa pine stand, associated with mule deer winter range and the Ryan Ranch KEHA 10% of the entire area will be left excluded from thinning. Although some untreated areas will not qualify as hiding cover, these stands will assist with screening animals providing some security as they move between areas containing hiding cover.

Environmental Consequences

Alternative 1 – No Action

Sumer range habitat is the most important in that it provides the basis of building fat reserves for mule deer and elk keeping animals healthy and alive through the winter months.

Without treatment it is expected hiding cover and thermal cover would increase in the short-term with increasing stand densities. In the long-term, as stands mature and stand densities increase so does the risk of insects, disease, and wildfire which has been identified as a major factor contributing to the loss of hiding cover and thermal cover across the Forest. Over the last 10 years, more than 100,000 acres of stand replacing fire has occurred on the Deschutes National Forest, severely impacting cover in the short-term. Disturbance species, such as ceanothus, provide an increased forage opportunity. This forage is only beneficial to deer for approximately 10-15 years when nutrient levels diminish and the forage is no longer beneficial. Shrubs begin to dominate burned stands and provide cover, but in many areas with broken terrain, shrubs are not robust enough to provide viable cover. In the long-term, viable forage in these burned areas can be drastically reduced if fire is not utilized to promote a continuous cycle of regenerating shrubs, and cover is reduced until regenerating stands develop enough to once again provide cover.

Within elk key areas, without treatment and prescribed burning riparian shrub diversity and grass and forb production will continue to decrease. In the event of a fire, key areas would become dominated by shrubs (primarily manzanita ceanothus) and would not provide sufficient foraging opportunities or shade during summer months. From local observation of fire killed stands on the Forest, elk will avoid shrub dominated areas that lack green trees.

Mule Deer Summer Range Hiding Cover

Action Alternatives 2, 3, and 4

Direct and Indirect Impacts

Thinning From Below (HTH), Overstory Removal (HOR), Harvest Cut with Reserves (HCR), Harvest Improvement Cut (HIM)

Highly suitable hiding cover is provide by stand that contain a dense understory of small trees. Within HOR, HCR, and HIM unit these treatment all focus on removing over story trees, the majority of these trees removed are small commercial sized trees between 8 and 15 inches dbh. The boles of these trees provide little cover, but a secondary treatment of non-commercial thinning will occur in these stands removing dense understory trees less than 8 inches dbh. The understory provides the majority of the cover in these stands, through follow up treatments of burning and mowing there will likely be no cover remaining in these stands post treatment. Within HTH stands, these stands are identified to thin from

below maintaining a fully stocked stands in the overstory with fewer understory replacement trees. Although this treatment will likely reduce hiding cover the boles of the over story and residual understory will continue to provide some screening for deer. Stand densities will exist at a level that will break up the site distance to provide screening as deer move to areas contain higher quality hiding cover.

Underburning and or mowing is associated with all treatment types, these fuels treatments may impact both forage quality and quantity as well as hiding cover in the short-term. Mowing and burning in high shrub areas will reduce summer forage opportunities. However, in the mowing/underburning of shrubs will result in shrub cycling reducing the amount of late seral shrubs that have low nutrient level, stimulating the grown and development of new early seral vegetation rich in nutrients, aiding the mule deer in fat storage for winter months. The project area contains predominantly late seral ceanothus in the higher elevation with inclusion of mid seral manzanita and bitterbrush at the lower elevations. Mowing/underburning will set back large areas to early seral shrubs of bitterbrush and ceanothus stimulating the growth of herbaceous plant material increasing summer foraging opportunities for the next 10 years. This treatment may also reduce down logs across the project area, which also provide cover opportunities for bedding at night and security for fawn while does are away foraging.

Mule Deer Thermal Cover MA-7

Alternative 2

HTH, Mow/Burn

Thermal cover stands provide high amounts of overstory canopy cover greater than or equal to 40%. Bitterbrush is the primary forage for deer in winter months and is not shade tolerant, typically thermal cover stands lack bitterbrush due to shading from their high canopy closure. To provide quality forage within MA-7 approximately 1,124 acres of thermal cover was proposed for thinning to create better diversity of forbs and shrubs for winter and early spring forage. The site potential of thermal cover stands is high as a result of the inherent soil quality in this area; however, these stands at 40% canopy cover are not sustainable. These high sites have the capabilities of producing high shrub densities which could also provide cover for mule deer in the short-term.

The entire 1,124 acres of thermal cover associated with thinning, also have follow up treatments of mowing and/or burning. In addition, 421 acres of thermal cover identified in MA-7 within the West-Bend project, will only receive fuels treatments of mowing and /or burning.

Thinning and fuels treatments were designed to promote the development and diversity of forb and shrub production. Fuels treatment with the low elevation pine stands are designed to be implemented on a 5 year rotation to allow plants to recovering, providing a rotation of highly palatable stand of early seral shrubs and forbs.

Alternative 3

As a result of consultation with the Oregon Department of Fish and Wildlife under Alternative 3, 1,124 acres of thermal cover treatments were identified for thinning with a follow up treatment of mowing and/or burning, similar to Alternative 2 with 421 acres identified for mowing and/or burning. However, within the 1,124 acres of thermal cover identified for thinning, 419 acres of thermal cover areas were selected for thinning with small group opening. These small group opening would be less than or equal to 5 acres in size. Treatment areas were selected as far away from open road and trails, with the goal of developing highly suitable future hiding cover within the next 10 year. The goal of the openings is to recruit high density stand of regeneration ponderosa pine, to provide security due to the high amount of dispersed and developed recreation in the MA-7.

Alternative 4

Under Alternative 4, there will not be any thinning associated with thermal cover except within units identified for small group opening totaling 419 acres. Quality hiding cover is still badly needed in the project areas, therefore group openings will continue to be implemented. Mowing/and or burning will continue to occur within 1,545 acres of thermal cover, to continue to provide higher quality forage within the project area.

Elk Thermal Cover within Ryan Ranch KEHA

Alternatives 2 and 3

Under Action Alternative 2 and 3 approximately 292 acres of thermal cover will be thinned and followed up with fuel treatments of mowing and/or burning. Objective of treatment are to open canopies to provide better forage opportunities for elk throughout the KEHA. A thermal cover analysis was completed across the Ryan Ranch KEHA; acres identified for thinning will reduce thermal cover but will maintain thermal cover at Forest Plan S&Gs.

Alternative 4

No thermal cover will be removed under this alternative.

Table 125 summarizes the amount of deer hiding cover associated with each action alternative identified for the West-Bend project.

Table 125: Total acres of mule deer summer range hiding cover associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	602	602	602
HOR	208	208	208
HCR	1,117	1,117	1,117
HIM	91	91	91
Total Acres Affected	2,018	2,018	2,018

Table 126: Total acres of mule deer thermal cover associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	1,124	1,124	419
Mow/Burn	421	421	421
Total Acres Affected	1,545	1,545	840

Table 127: Total acres of elk thermal cover associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	292	292	0
Total Acres Affected	292	292	0

Mule Deer Summer Range

Affects to deer hiding cover for deer and elk are similar under Alternative 2, 3, and 4.The outcome of the affects to cover as a result of each treatment type are also consistent across all action alternatives.

Treatments will reduce hiding cover across the project area, reducing cover over approximately 2,018 acres. Acres and treatment type are reflected in Table 125.

Mule Deer Winter Range

Affects to thermal cover across deer winter range change by alternative and were developed from key issues associated from external collaboration and scoping. Alternative 2 was developed for the proposed action and focuses on providing high quality foraging habitat, by reducing overstory densities, creating a more contiguous forage base across the winter range. Under Alternative 3, ODFW promoted the development of future high quality hiding cover, due to the lack of cover in the winter range and the high amounts of disturbance that occurs. Alternative 4 was developed in response to public comment, and no thermal cover would be thinned. Fuels treatment and small group openings would occur to continue to develop hiding cover. Acres and treatment type are reflected in Table 126.

Ryan Ranch Key Elk Area

Under Alternative 2 and 3 thermal cover would be thinned and receive a follow up treatment of mowing and/or burning. Treatments will reduce thermal cover, but similar to the objective in MA-7, the goal is to promote the development of a contiguous high quality forage base, that is shaded out by high canopy closure. As result of public comment no treatment will occur in thermal cover stand under Alternative 4. Acres and treatment type are reflected in Table 127.

Overall, under all alternatives for both MA-7 and the Ryan Ranch KEHA, no hiding cover will be removed under any action alternative. Within mule deer summer range approximately 2,018 acres of hiding cover will be reduced. Within MA-7, thermal cover will be reduced over 1,124 acres through thinning and will be reduce to 419 acres under Alternative 4. Under Alternative 2 and 3, within the Ryan Ranch KEHA thermal cover will be reduce on 292 acres, and will remain untreated under Alternative 4.

Lastly, no roads are proposed for closing or obliteration under the any action alternative. However, 30 miles of roads were identified to be closed under past management project and many of them remain open or were closed and reopened through unauthorized travel. To minimize disturbance to ungulate population from motorized recreation, a review of identified close roads will be completed and if they remain open or have been re-opened through unauthorized use road will be decommissioned through this project.

Within low elevation pines stand associated with MA-7 and the Ryan Ranch KEHA. This areas is west of NWFP lands, 10% of the entire area will be retained in untreated stands or aggregate patches.

Within mule deer summer range, in areas associated with dry mixed conifer habitat and high elevation ponderosa pine 15% of the entire PAGs will be left in untreated stand as well as aggregate patches. In the mixed conifer wet PAG, 20% of this habitat type will be left in untreated stands and aggregate patches. In the lodgepole pine PAG, in areas identified for treatment 15% of each treatment unit will be retained in untreated patches.

Cumulative Effects

Much of the Bend/Ft. Rock RD ponderosa pine PAGs including the West-Bend project area, associated with MA-7 and into higher summer range, occurs in second growth stands created from the clear cutting that occurred in the early 1930s. Deer are highly responsive to early seral forage from clear cut logging and wildfires that create highly palatable early seral forage condition. As a result of the clear cutting deer populations increased to an all-time high in the mid-1960s. As a result of natural regeneration, dense stands of second growth ponderosa pine developed over this large land base, shading out and reducing foraging opportunities. As a result, of the densification of stands and the increase in human population from the 1960s until today, mule deer habitat and habitat effectiveness has greatly diminished. In the mid-1970s within summer range areas, shelterwood harvest prescriptions retained 8 to 20 live overstory trees per acre removing the majority of overstory in these stands within the

watershed. Shelterwood harvest occurred across much of the forest during this time period, creating a new source of forage and deer populations peaked again in the early to mid-80s but not to the level of the 1960s. By the mid-1990s, many landscape scale thinning projects had been implemented to deal with the dense stand of second growth "black bark" ponderosa pine and beetle outbreaks that were killing trees. By this time the population of people as well as developed and dispersed recreation in central Oregon had greatly increased. Although thinning within these areas greatly increase forage, it also reduced hiding cover which exposed deer to high levels of disturbance. Due to more people living in central Oregon, it also increased traffic volumes on highway, directly increasing mortality from vehicle collusions bisecting migration routes. In addition, due to the increase in people in the communities mortality also grew exponentially from poaching. Today poaching continues to be the highest cause of mortality to deer populations in central Oregon (USFS 2012). Lastly, due to land development many historic winter ranges no longer and deer occupy less suitable winter range areas.

Within the watershed (zone of influence) a variety of past thinning projects have occurred, primarily in stands of low elevation second growth ponderosa pine. Treatments were designed to reduce the risk of stand replacing fire and promote the development of contiguous stands of future old growth ponderosa pine, while reducing the stands increasing susceptibility to insects and disease. The majority of thinning removed trees 8 inch dbh and less, but also commercially thinned trees up to 21 inches dbh. Mowing and prescribed fire continue to occur in these areas on roughly a five year rotation.

Ongoing vegetation management projects occur within suitable big game habitat within the watershed and contribute to cumulative effects (see Table 92). These projects occur within suitable habitat and likely will remove cover within the watershed. Measures were incorporated to retain cover across each project area. Overall, treatments proposed will improve habitat conditions by promoting the development of more fire and disease resistant open stand containing large tree structure promoting a contiguous forage base and retaining residual cover to avoid disturbance. These ongoing projects will treat approximately 11,703 acres.

Ongoing and future recreation development is also occurring in the watershed and is primarily occurring within the MA-7 and the Ryan Ranch KEHA. The majority is of development occurs in the forms of trails and trailhead development. These developments promote increased human use to areas containing suitable foraging habitat, but hiding cover may be limiting. Habitat effectiveness in the watershed decreases greatly within increased human use. Some habitat will be removed with these projects but will be minor, but due to the ongoing and future thinning within the watershed to improve habitat, the increase of human disturbance could render habitat enhancement efforts ineffective by displacing animals. However, through ongoing vegetation management project road closures are being implemented to reduce road densities within the watershed, minimizing disturbance from motorized vehicles and motorized recreation. Table 93 lists ongoing and future foreseeable recreation projects within the watershed.

Private lands are not managed for big-game habitat. Therefore, it is assumed that any habitat provided by private timberland in the Watershed is incidental and may not be long-term.

Mule Deer Summer Range

Of the 4,579 acres of hiding cover identified within the project area Alternative 2, 3, and 4 will treat approximately 2,018 acres of hiding cover reducing hiding cover in the watershed. Approximately, 31% of the watershed will exist as hiding cover post treatment exceeding Forest Plan Standards and guide of 30%.

Management Area-7

Thermal and hiding cover is below Forest Plan S&Gs for MA-7. No treatments are proposed in hiding cover except prescribed fire and/or shrub mowing. There is the possibility that prescribed fire could remove some cover areas, but the objectives are to retain viable cover through the implementation of

prescribed fire. Treatments propose to remove thermal cover under all alternatives. Under Alternative 2 and 3 approximately 1,124 acres will directly reduce habitat and 419 acres will directly reduce habitat under alternative 4. Mowing and burning is not expected to reduce thermal cover. Since the project proposes to further reduce thermal cover, a Forest Plan Amendment will be completed for the project.

Ryan Ranch KEHA

Only 30 acres of hiding cover exists within the portion of the project area associated with the Ryan Ranch KEHA. None of the action alternatives propose to thin hiding cover. Prescribed fire and/or mowing will occur in stands associated with hiding cover, but the objective are to retain hiding cover where it exists. Approximately 292 acres of thermal cover will be treated under Alternative 2 and 3, cumulatively thermal cover will be retained at a level of 20% across the Ryan Ranch KEHA meeting Forest Plan S&Gs.

Road Densities

The current road densities are in excess of Forest Plan S&Gs for MA-7, the Ryan Ranch KEHA, and deer summer range. The project does not propose to close roads, however the project will decommission user created roads and trails, and enhance ineffective existing road closure to ensure habitat effectiveness of proposed treatments. Approximately 44 miles of road closures and decommissioning proposed with all alternatives of the Rocket project area (which shares the North Unit Diversion Dam – Deschutes River Watershed with West Bend) will reduce road density within the largest watershed of the project area to about 2.2 miles per square mile, which is within the Forest Plan guideline of 2.5 miles per square mile. These road closures are expected to take place following complete Rocket project activities, which will begin implementation about one year from now.

Conclusions

The West-Bend project is within the Upper Deschutes herd management unit identified by the Oregon Department of Fish and Wildlife. Although the overall population of mule deer has dropped far below management objective, the buck to doe ratio annually meets ODFW objective of 15 bucks per 100 does. Limiting factors for mule deer population as identified within MIS Assessment for Mule Deer is providing quality forage and cover. Summer range habitat is critical for mule deer, where large areas of early seral browse in areas of limited disturbance is extremely important to build fat reserves needed to get deer through the rut and the directly following winter months. In addition the elk population is steady to increasing with the Upper Deschutes herd management unit. (USFS 2012)

The No Action Alternative could affect mule deer and elk and their habitat due lack of early seral forage within the project area and in the Watershed. In the event of a wild fire, areas of early seral forage could be created, but due to road densities all security cover would be lost and deer would be more vulnerable to disturbance and predation.

The Action Alternatives have the potential to benefit mule deer and elk winter and summer habitat. Through prescribed fire treatments, thinning with group openings, and thinning from below with prescribed fire as a follow up treatment, treatments will open stands creating earl seral vegetation providing new areas of summer forage. Hiding cover is maintained through project design, maximizing forage production and providing screening cover for animals to disperse through the project area. Lastly, enhancing existing road closures and decommissioning user created roads and trails will further reduce disturbance, increasing the habitat effectiveness of newly created foraging areas. In the long-term Alternative 3 is the most proactive alterative in developing big-game habitat. Treatments are designed to provide long-term foraging opportunities, while retaining existing hiding cover and developing future hiding cover throughout summer and winter habitat.

Treatments associated with the West-Bend project will not contribute to a change in viability within the watershed or on the Deschutes National Forest for the deer and elk. Sufficient habitat exists to maintain

the viability of this species in the watershed and across the Forest and continue to provide habitat to meet the Forest Plan objectives by retaining thermal and hiding cover and maximizing forage opportunities. In addition, treatment will promote the future development of hiding cover maintaining viable habitat within the project area.

A Forest Plan Amendment is necessary to address the further reduction of thermal cover below Forest Plan S&Gs within MA-7 under Alternatives 2, 3, and 4. The amendment is discussed in section 3.18.2.

Birds of Conservation Concern

In January 2001, President Clinton issued an executive order on migratory birds directing federal agencies to avoid or minimize the negative impact of their actions on migratory birds, and to take active steps to protect birds and their habitats. Federal agencies were required within two years to develop a Memorandum of Understanding (MOU) with the U.S. Fish and Wildlife Service to conserve migratory birds including taking steps to restore and enhance planning processes whenever possible. To meet this goal in part the U.S. Fish and Wildlife Service developed the Birds of Conservation Concern released in December 2002 (USFWS 2002) and an update to the original list was released in 2008 (USFWS 2008a).

Birds of Conservation Concern are 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. Birds of Conservation Concern encompasses three distinct geographical scales – North American Bird Conservation Initiative (NABCI) Bird Conservation Regions (BCRs), USFWS Regions, and the National scale which represents species that have the highest conservation priorities in the United States, including the island "territories" in the Pacific and Caribbean.

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, landbirds, shorebirds, waterbirds, 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 conserve avian diversity in North America and includes preventing or removing the need for additional ESA bird listings by implementing proactive management and conservations actions (USFWS 2008a). The 2008 lists were derived from three major bird conservation plans: the Partners in Flight North American Landbird Conservation Plan, the United States Shorebird Conservation Plan, and the North American Waterbird Conservation Plan. Conservation concerns stem from population declines, naturally or human-caused small ranges or population sizes, threats to habitat, or other factors.

Bird Conservation Regions (BCRs) were developed based on similar geographic parameters and are the basic units within which all bird conservation efforts should be planned and evaluated (USFWS 2008a). One BCR encompass the West-Bend project area – BCR 9, Great Basin. See Table 128 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 West-Bend project area.

Table 128: BCR 9 (Great Basin) BCC 2008 list

Bird Species	Preferred Habitat	Habitat within the West-Bend Project Area (Y or N)
Greater Sage Grouse (Columbia Basin DPS)	Sagebrush dominated Rangelands	No
Eared Grebe (non-breeding)	Open water intermixed with emergent vegetation	No
Bald Eagle	Lakeside with large trees	Yes
Ferruginous Hawk	Elevated Nest Sites in Open Country	No
Golden Eagle	Elevated Nest Sites in Open Country	No
Peregrine Falcon	Cliffs	No
Yellow Rail	Dense Marsh Habitat	No
Snowy Plover	Dry Sandy Beaches	No
Long-billed Curlew	Meadow/Marsh	No
Marbled Godwit	Marsh/Wet Meadows	No
Yellow-billed Cuckoo	Dense riparian/cottonwoods	No
Flammulated Owl	Ponderosa pine forests	Yes
Black Swift	Cliffs associated with waterfalls	No
Calliope Hummingbird	Open mountain meadows, open forests, meadow edges, and riparian areas	No
Lewis's Woodpecker	Ponderosa pine forests	Yes
Williamson's Sapsucker	Ponderosa pine forests	Yes
White-headed Woodpecker	Ponderosa pine forests	Yes
Loggerhead Shrike	Open country with scattered trees or shrubs	No
Pinyon Jay	Juniper, juniper-ponderosa pine transition, and ponderosa pine edges	No
Sage Thrasher	Sagebrush	No
Virginia's Warbler	Scrubby vegetation within arid montane woodlands	No
Green-tailed Towhee	Open ponderosa pine with dense brush	No
Brewer's Sparrow	Sagebrush clearings in coniferous forests/bitterbrush	No
Black-chinned Sparrow	Ceanothus and oak covered hillsides	No
Sage Sparrow	Unfragmented patches of sagebrush	No
Tricolored Blackbird	Cattails or Tules	No
Black Rosy Finch	Rock outcroppings and snowfields	No

Landbird Strategic Plan

The Forest Service has prepared a Landbird Strategic Plan (USDA 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 publications 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), A Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington was published in March 2000 (Altman and Holmes 2000), and A Conservation Strategy for Landbirds in the Northern Rocky Mountains of Eastern Oregon and Washington was published in May 2000 (Altman 2000). These documents outline 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. These documents provide recommendations for habitat management. The East-Slope Cascades Strategy covers the Deschutes National Forest and the forest is contained within the Central Oregon sub-province. See Table 129 for specific habitat types highlighted in these documents, the habitat features needing conservation focus and the focal bird species for each.

Table 129: Priority habitat features and associated focal species for the East-Slope Cascade Strategy

Habitat	Habitat Feature	Focal Species for Central Oregon	Habitat within the Project Area (Y or N)
Ponderosa Pine	Large patches of old forest with large snags	White-headed woodpecker	Yes
	Large trees	Pygmy nuthatch	Yes
	Open understory with regenerating pines	Chipping sparrow	Yes
	Patches of burned old forest	Lewis' woodpecker	Yes
Mixed Conifer (Late-Successional)	Large trees	Brown creeper	Yes
	Large snags	Williamson's sapsucker	Yes
	Interspersion grassy openings and dense thickets	Flammulated owl	Yes
	Multi-layered/dense canopy	Hermit thrush	Yes
	Edges and openings created by wildfire	Olive-sided flycatcher	Yes
Lodgepole Pine	Old growth	Black-backed woodpecker	Yes
Whitebark Pine	Old growth	Clark's nutcracker	No
Meadows	Wet/dry	Sandhill Crane	No
Aspen	Large trees with regeneration	Red-naped sapsucker	Yes
Subalpine fir	Patchy presence	Blue Grouse	Yes

Cavity Nesters (Woodpeckers) on the Deschutes National Forest

In addition, the Deschutes LRMP identifies all Cavity Nesting Birds that occur on the Forest as a Management Indicator Species. There are 11 species of cavity nesters that occur on the Deschutes National Forest. Table 130 contains the list of bird species.

Table 130: Cavity Nesters (Woodpeckers)

Habitat	Species	Habitat Occurs in the West-Bend Project Area (Y or N)
Lodgepole pine - old growth	Black-backed woodpecker	Yes
Deciduous/mixed deciduous and conifer or riparian - Aspen or riparian cottonwood	Downy woodpecker	Yes
Ponderosa pine/mixed conifer - open stand open canopies	Hairy woodpecker	Yes
Ponderosa pine - burned forest	Lewis' woodpecker	Yes
Various conifer forest habitats - open stands large tree structure, forest edges	Northern flicker	Yes
Mixed conifer-Late seral Grand fir/white-fir type, multi-layered canopy	Pileated woodpecker	Yes
Ponderosa pine - large trees	Pygmy nuthatch	Yes
Various conifer forest -mature and old growth forest only.	Red-breasted nuthatch	Yes
Aspen with ponderosa pine - Riparian aspen or cottonwood	Red-breasted sapsucker	No
Aspen - large trees with regeneration	Red-naped sapsucker	Yes
Sub-alpine and alpine forests- old forests of lodgepole pine, grand-fir/white-fir, Engelmann spruce/subalpine fir, whitebark pine, and mountain hemlock. Also post fire habitats	Three-toed woodpecker	Yes
Ponderosa pine - large trees	White-breasted nuthatch	Yes
Ponderosa pine - old growth forest with large snags	White-headed woodpecker	Yes
Mixed Conifer - large trees	Williamson sapsucker	Yes

Following effects analysis address potential impacts to Bird of Conservation Concern, Land Bird Focal Species and MIS woodpecker. The bald eagle, white-headed and Lewis' woodpeckers were addressed in Biological Evaluation for TES species and therefore will not be addressed in this effects analysis.

Ponderosa Pine – Large Trees and Snags – Pygmy Nuthatch, Red-breasted nuthatch, white-breasted nuthatch Chipping Sparrow

Existing Condition

The pygmy nuthatch is a resident of ponderosa pine forests east of the Cascades but outside the breeding season, is found just outside the ponderosa pine zone. The red-breasted nuthatch is most abundant in old-growth and mature conifer forests during the breeding season in the Cascade Range but can be found in younger stands at variable densities. The red-breasted nuthatch forages on tree trunks and main branches (Marshall et al. 2003). The white-breasted nuthatch is found in two main habitat types in Oregon – oak and ponderosa pine (Marshall et al. 2003). East of the Cascade crest, they are sympatric with both the red-breasted and pygmy nuthatches (Marshall et al. 2003). They use cavities excavated by woodpeckers or those formed by decay in both live and dead trees for nesting and roosting, but nest primarily in live trees (Marshall et al. 2003). All species are closely associated with mature or old growth ponderosa pine forests but may be found in mixed conifer forests dominated by ponderosa pine. Pygmy and white-breasted nuthatches excavate their own cavity.. Nuthatches forage on the outer branches in the upper canopy on needle clusters, cones, and emerging shoots with some limited foraging on bark. (Marshall et al. 2003). Risks to these species include loss of mature ponderosa pine forests, fire suppression resulting in overstocked stands and reduced snag recruitment, salvage logging, and chemical use (Marshall et al. 2003) (USFS 2012).

The chipping sparrow is an uncommon to common summer resident preferring open habitats with a shrub or grass component. Chipping sparrows prefer open coniferous forests or stands of trees interspersed with grassy openings or low foliage (Marshall et al. 2003 pp. 538-540). In central Oregon, good numbers of chipping sparrows can be found in juniper, ponderosa pine, and lodgepole pine communities but are not present in sagebrush (Marshall et al. 2003 pp. 540-542). This sparrow breeds in scattered locations in the Cascades and throughout higher elevations of eastern Oregon. The diet of this sparrow is not well known. A study conducted for central Oregon (Eastman 1960 in Marshall et al. 2003) shows a preference for weed seeds. Declines in populations have been noted from Breeding Bird Survey (BBS) results (1966-2000) for the chipping sparrow showing a 3.9% decrease per year. Some reasons for this decline includes habitat changes due to fire suppression resulting in closed canopy habitat, cowbird parasitism, and competition with house sparrows and house finches.

The conservation status based on the Nature Serve ranking indicate the pygmy nuthatch is secure at globally, nationally, and state wide (USFS 2012). The conservation status based on the Nature Serve ranking indicate the red-breasted nuthatch is secure at globally, nationally, and state wide (USFS 2012). The conservation status based on the Nature Serve ranking indicate the white-breasted nuthatch is secure at globally, nationally, and state wide (USFS 2012).

The conservation status based on the Nature Serve ranking indicate the chipping sparrow is ranked as Least Concern globally, nationally, and state wide. For the detailed assessment on the pygmy, red-breasted, and white-breasted nuthatch, for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Habitat for these species occurs throughout the Deschutes National Forest. Approximately 7,937 acres of habitat exists within the project area. Approximately 19,452 acres of habitat occurs within the watershed and approximately 243,364 acres of habitat occurs across the Deschutes National Forest.

Table 131 summarizes these acreages.

Table 131: Habitat for these species within the West-Bend project area, the watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
7,937 acres	19,452 acres	243,364 acres

Environmental Consequences

Alternative 1 – No Action – Existing Ecological Trend

The ecological trend is that snag habitat would continue to be provided in the short and long-term. Previously treated stands would continue to grow providing future late-structural habitat. Untreated dense stands would continue to see increased snag recruitment through tree mortality from natural disturbances such wildfire, wind events, insect and disease pathogens, and lightning. High tree density in some of the ponderosa pine and mixed conifer stands would not only retard the development of large diameter (>21") ponderosa pine and white-fir trees and future snags but also may hasten the development of smaller diameter snags and CWM as a result of mortality from bark beetles, disease, or fire. Large snags and downed logs would continue to be limited for the nuthatches. The increased fire risk that would also occur would put these limited habitat features at risk. If a high intensity wildfire did burn through the planning area, habitat for many of these species would be lost. Most species of MIS woodpeckers take advantage of snags and insect infestation following fire at varying degrees (Saab and Dudley 1998).

Habitat for species that are more dependent on closed canopies and dense understories (i.e. red-breasted nuthatch) will continue to increase over time. At higher elevations white-fir will continue to out compete ponderosa pine resulting in increased stand densities and loss of late successional conditions over time. This will eventually result in fewer large snags and down woody material on the landscape and fewer nesting sites. Loss of ponderosa pine results in fewer foraging opportunities for species like the pygmy nuthatch that need large diameter trees. Increased stand densities and brush densities increases the risk of loss which could further reduce the availability of habitat in the area for most late successional species. Increased stand densities is a major factor in the decline of chipping sparrow habitat, which can be directly tied to fire suppression over the last 100 years. Stand densification as a result of no action would continue to be a factor in habitat loss.

Action Alternatives 2, 3, and 4

Direct and Indirect Impacts

Thinning From Below (HTH), Skid and Deck, Harvest Cut with Reserves (HCR), Harvest Overstory Removal (HOR) Non-commercial thinning (PCT), Prescribed Burn Only (Burn)

The nuthatches and chipping sparrow are all dependent on large ponderosa pine trees and snags. Each species utilizes ponderosa pine habitat in a unique way, for example chipping sparrow is dependent on large trees and snags, but uses regenerating understories for foraging. Nuthatches forage in the upper canopy on the outer braches within needle clusters. All species utilize a variety of uneven-aged stands at some point during the breeding season. Habitat associated with each treatment type varies greatly for these species, but all stand types provide habitat. Within HTH stands, these stands consist of contiguous second growth (60 to 80 year old) ponderosa pine. Trees in these stands are not typically old growth, but are large and many are approaching 20 inches in diameter with some new regeneration in the understory providing foraging habitat for all species. Similarly, Skid and Deck treatment are associated with 40 to 50 year old plantations . These are dense homogenous stands with an average tree diameter

of 7 to 10 inches dbh and trees are approximately 30 to 40 feet tall. There is an occasional tree in the 20 inch dbh range but they are rare in these areas. These stands primarily provide habitat for the pygmy and whit-breasted nuthatch. The HCR units are at higher elevations and consist of ponderosa pine with an understory of white-fire and lodgepole pine. Habitat exists for all species but specifically red-breasted nuthatch and chipping sparrow that also utilize mixed conifer forests. HOR treatments provide very little habitat, these are primarily lodgepole pine stands and are associated with the fewest acres. The HOR stands provide habitat for the chipping sparrow with containing individual large lodgepole pine in the overstory with regenerating understories. Non-commercial thinning and prescribed fire will occur throughout these habitats and although no large structure will be removed in the short-term these treatments could impact foraging habitat due to removal of regeneration trees, grasses, and shrubs.

Disturbance to habitat may occur during treatments which may result in altering their foraging locations or behavior. All species are dependent on large tree habitat and ponderosa pine 21 inches and greater will not be targeted for removal in any treatment type. In addition large snags are not targeted for removal, but there is a possibility for incidental loss of snags during treatments.

Generally, snags would be avoided during treatments except for HCR units, where these units are designed to treat overstory mixed conifer that have high densities of dead and dying trees. The majority of the overstory in these stands is made up of lodgepole pine and white-fir. Overstory trees identified to remove are on average 14 inches in diameter. The largest and healthiest trees will be retained in these stands. Units identified for HOR will also remove overstory lodgepole pine, in seed tree units, where individual trees were left following the last harvest as seed trees. These are not fully stocked overstory stands and individual lodgepole pine to be removed are an average of 16” dbh. Under Alternative 3 where these trees contain mistletoe, trees will be girdle and retained as snags. Although some of the bigger white-fir and lodgepole pine provide habitat in these stands, the habitat if very marginal and predominantly is used for foraging. These treatments will not greatly impact nesting habitat, but could altering foraging patterns in these areas due to density reductions for the nuthatches but promote foraging habitat for chipping sparrow in the long-term.

Overall, thinning from below or plantation thinning (HTH, Skid and Deck, PCT) within second growth ponderosa pine stands will treat the majority of suitable habitat for pygmy, and white breasted nuthatch within the project area. Thinned areas will open up stands which should benefit species such as chipping sparrow and red-breasted nuthatch. Treatments will accelerate the development of future LOS ponderosa pine stands as well as recruiting tree development in the understory providing addition foraging areas for chipping sparrow. Thinning will also open up site distances around suitable nest trees, which should help these species with predator avoidance around nest sites. In addition the thinning will reduce ladder fuels associated with large trees. Ladder fuel reduction will decrease risk of losing the remaining large trees. In addition, removal of the understory in overstocked stands will decrease the competition for nutrients and water, which should also lower the susceptibility to insects and disease. An important benefit to thinning is the reduction in beetle caused mortality (Cochran and Barret 1999a).

Currently there are a limited number of large snags and trees available as well as replacement large trees within ponderosa pine stands. Many of the future large trees are within overstocked stands, which will increase the amount of time the trees will take to get to the desired size and height. Thinning overstocked stands will reduce competition which should increase growth rates to the remaining trees. Cochran and Barret (1999a) were able to show that 30 years after thinning there were large differences in average tree sizes among different group stocking levels. They also showed that growth rates of the 20 largest diameter trees per acre were reduced by competition from smaller trees. Increasing growth rates will benefit these species by creating more contiguous stands of available suitable habitat in the long-term.

Burning treatments will reduce both activity fuels and overall fuel loadings to acceptable levels. Reduction of fuels will reduce fire risk and will reduce competition to established trees, further increasing the stands resiliency to wildfire. Fuels treatments will also reduce the understory complexity, which could lower small mammal densities. A reduction in small mammal populations could reduce predation pressures to cavity nesters. There is the potential to lose snags during burning operations that provide nesting habitat, but there is also the potential to recruit new snags during this process.

Mortality of snags in ponderosa pine habitat during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags < 15 cm dbh. Several studies showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988; Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for snags, presumably because the trees that did not burn during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988; Bagne et al. 2008).

Table 132 summarizes the amount of habitat associated with treatments under each action alternative for the West-Bend project.

Table 132: Total acres of habitat associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	3749.13	3751.36	3283.88
HCR	96.96	96.96	96.96
HOR	155.45	84.51	84.51
PCT	43.37	43.37	50.71
Skid & Deck	890.91	890.91	743.69
Burn	2079.39	2079.39	2594.24
Total Acres Affected	**7,015**	**6,947**	**6,854**

Affects to species habitat are similar under Alternatives 2, 3 and 4. The outcomes of the affects to habitat as a result of each treatment type are also consistent across all action alternatives. Under Alternatives 3 and 4, HOR stand were dropped from issues brought up in scoping and remaining HOR units will create snags out of overstory trees containing mistletoe rather than full removal. Alternative 4 also drops commercial thinning in ponderosa pine, to ensure that a landscape scale approach to fuels management remains within the project area; however there is an increase in burn units and PCT under Alternative 4.

The project area and habitat varies greatly from east to west due to the increase in elevation, the rain gradient associated with the change in elevation, and the site potential associated with the inherent soil quality within this east to west pattern. To capture the importance of habitat variation across the project area, the project area was broken up into four ecotones moving from east to west. A habitat retention strategy was defined where in the low elevation ponderosa pine ecotone (approximately 16,146 acres), approximately 10% of this zone would be left in un-treated stands and aggregate patches, in the mid-elevation ponderosa pine mixed conifer dry ecotone (approximately 3,966 acres) approximatley15% of this landscape would be left in untreated stand and aggregate patches, within the high elevation mixed conifer wet stands (approximately 3,027 acres), approximately 20% of this landscape would left in untreated stands and aggregate patches, and lastly the lodgepole pine community (approximately 2,027 acres), where 15% of each harvest unit will remain untreated within regeneration harvest units. These

untreated areas were identified to retain habitat connectivity between thinned stands associated with project treatments.

Overall approximately 7,015 acres of habitat will be treated under Alternative 2, approximately 6,947 acres under Alternative 3, and approximately 6,854 under Alternative 4. Risk of loss of the large tree component will be reduced on treated acres as trees respond to the increased growing space resulting from thinning from below.

Within ponderosa pine and mixed conifer stands dominated by ponderosa pine overstory structural diversity will remain, but understory complexity will be reduced through follow up treatments to deal with slash generated for activities such as mowing, and burning. Fuels treatments associated with harvest treatments could potentially be beneficial as treatments reduce understory complexity, promoting a more herbaceous understory increasing an insect prey base. Although foraging habitat will be reduced in the short-term, for species such as the chipping sparrow through the removal of regenerating pines in the understory, some residual habitat will remain providing foraging opportunities. Long-term benefits of treatments will be a reduction of stress to overstory promoting the longevity of large tree structure and the limited residual old growth, but also promoting the development of future old growth in the stand that will provide long-term habitat.

Similarly, in skid and deck and PCT units within ponderosa pine containing advanced regeneration, treatment will reduce some foraging habitat but will not remove any residual large trees. These stands are very homogenous and overstocked; treatments will promote stand heterogeneity through variable density thinning. Treatment will accelerate the development of large tree structure promoting the development of future nesting and foraging habitat for all these species, but could remove some foraging habitat for the chipping sparrow and white-breasted nuthatch the use younger stand for foraging habitat in the short-term.

In the short-term, Alternative 4 affects fewer acres of habitat than Alternative 2. However, in the long-term treatments associated with Alternative 3 are the most proactive in promoting the development of more fire resistant stands. The longevity of existing habitat will diminish in the short-term, and as a result will not promote open grown fire resilient ponderosa pine stands as well as more fire resilient stands of ponderosa pine dominated mixed conifer. See DecAid Snag and Log Analysis for the projects effect to dead wood habitat and distribution.

Cumulative Effects

Past harvest activities have led to the loss of large tree habitat within the watershed, which has resulted in a decline in foraging and nesting habitat for these species. However, more recent vegetation management projects are more focused on restoration of large, open ponderosa pine stands by focusing on thinning reducing stand densities and mowing and burning, reducing brush levels. These types of activities will enhance habitat conditions for those species dependent on open ponderosa pine stands or mixed conifer stands dominated by ponderosa pine. Within the watershed (zone of influence) ongoing and future vegetation management projects occur within suitable habitat which contributes to cumulative effects. Measures were incorporated to retain suitable nesting habitat for land birds in these project areas as well as enhance habitat conditions. Overall, treatments proposed will improve habitat conditions by promoting the development of large structure and reducing the risk of loss of existing habitat from other large-scale disturbances. These projects all primarily thin stand from below enhancing large tree habitat. These ongoing projects will treat approximately 11,703 acres in the watershed (see Table 92).

Private lands are not managed for habitat. Therefore, it is assumed that any habitat provided by private timberland in the watershed is incidental and may not be long term.

Of the 7,937 acres of reproductive habitat identified within the project area, Alternative 2 treatments are associated with approximately 7,015 acres of reproductive habitat, approximately 6,947 under

Alternative 3, and approximately 6,854 under alternative 4 which contribute to cumulative effects within the watershed.

Of the 19,452 acres of reproductive habitat within the Watershed, cumulatively Alternative 2 and 3 are associated with approximately 36% and Alternative 4 is associated with 35% of the total habitat. On average the treatments will thin, mow and burn approximately 6,848 acres or less than 2% of the total habitat across the Deschutes National Forest.

Conclusions

Nature serves lists these species as secure Globally, Nationally, and State wide.

The No Action Alternative could affect habitat due to the ongoing loss of large structure and the conversion of stands to non-sustainable from insects, disease, and but predominantly stand replacing fire.

Treatments associated with the ponderosa pine PAG propose thinning from below, promoting the development of contiguous stands of late and old structure habitat that these species need for nesting and foraging. In mixed conifer habitat with ponderosa pine, the project will also manage stands by thinning from below, but will favor the ponderosa pine to develop a more fire resistant stands containing large ponderosa pine as the dominant species. However, through project design criteria, treatments have been designed to maintain untreated stands throughout the project providing small tree diversity that could also provide foraging opportunities. In mixed conifer dominated by lodgepole pine, the overstory will be thinned retaining the largest residual healthy trees in these stands to continue to provide nesting and foraging habitat.

Overall, implementation of the action alternatives as well as other projects across the district should result in improved habitat conditions for those species dependent on large ponderosa pine habitat which could lead, to increased populations. Cumulatively there will be a decrease in dense understory habitat; these changes will result in more sustainable habitat conditions across the landscape and move habitat conditions closer to historical conditions. Fire suppression has created denser conditions than historically occurred which resulted in an increase in dense habitat species and a decline in open pine habitat species. Some snag habitat will be lost, however measures are in place to minimize effects.

Although treatments will thin stands that are currently suitable reproductive habitat, the West-Bend project will not contribute to a change in viability within the Watershed or on the Deschutes National Forest for these species.

Implementation of the West-Bend project would be consistent with the Standards and Guidelines for the Deschutes National Forest Land Resource Management Plan.

Implementation of the West-Bend project would also be consistent with the biological objectives outlined in the Conservation Strategy for the East-slope Cascades Mountains and treatments will be beneficial to the management of long-term habitat.

Landbird Conservation Strategy Consistency

Biological objectives are based on actions that occur within habitat. Consistency will address biological objectives for above listed woodpeckers and landbirds.

Landbird Conservation Strategy Consistency

Species	Biological Objectives	Consistent Yes, No, or NA	Rationale
In Ponderosa Pine Stands and Mixed Conifer Dominated by Ponderosa Pine: **Pygmy Nuthatch**	PYGMY NUTHATCH		
	Provide a mean of 10 trees/acre >21"dbh and at least 2 trees >31"dbh	Yes	Treatment will not target large ponderosa pine except where diseased trees are hindering the development of future Late and Old Structure stands. In such a case sufficient large trees will be left to me this objective.
	Provide a mean of 1.4 snags/acre >8"dbh with 50% >25"dbh in a moderate to advanced state of decay	Yes	Due to the amount of mortality within the watershed sufficient snags will exist to meet this requirement as well as those retained in the project area.
Chipping Sparrow **Other species to benefit from objectives: White-breasted Nuthatch, Red-breasted nuthatch**	CHIPPING SPARROW		
	Interspersion of herbaceous ground cover w/shrub and regen pine patches	Yes	Within the low elevation ponderosa pine PAG and mid elevation ponderosa pine and mixed conifer dry PAG 10-15% of the project area associated with each PAG will be left in untreated patches as well as entire stands containing habitat
	20-60% cover in shrubs (including small trees) and >20% of shrub layer in regen saplings conifers, mean canopy cover 10-30%	Yes	Within the low elevation ponderosa pine PAG and mid elevation ponderosa pine and mixed conifer dry PAG 10-15% of the project area associated with each PAG will be left in untreated patches as well as entire stands containing habitat
	Ensure a mix of understory conditions such that 10 to 30% of the landscape meets site level conditions as describe above	Yes	>30% of the project area will be retained as untreated habitat and will meet site level conditions as described

Mixed Conifer, Edges and Openings Created by Wildfire – Olive-sided Flycatcher and Hairy Woodpecker

Existing Condition

The olive-sided flycatcher is a summer resident that breeds in low densities throughout coniferous forests of Oregon. The hairy woodpecker is a resident in forests throughout Oregon except for juniper.

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). Similar to the flycatcher, the hairy woodpecker is found primarily in mixed conifer and ponderosa pine forests adjacent to deciduous stands but is most common in burns or areas infested with mountain pine beetles (Marshall et al. 2003). There is some preference for older stands for the hairy woodpecker and where old trees are absent, they prefer thinned stands. Nesting success for the flycatcher was highest within forest burns where snags and scattered tall, live trees remain (Marshall et al. 2003 and Wisdom et al. 2000 p. 215). Common features of nesting habitat include tall prominent trees and snags used as foraging and singing perches. The flycatcher 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 pp. 374-375). The hairy woodpecker nests in dead trees with light to moderate decay and their diet consists of beetles, ants, spiders, and other insects (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 for the olive-sided flycatcher. Factors potentially contributing to population declines on breeding grounds include habitat loss through logging, 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 fires, the juxtaposition of early and late seral habitats becomes less favorable. However, the Columbia Basin (Southern Cascades) shows increases of >60% for the olive-sided flycatcher compared to other areas. BBS data (1966-2000) for Oregon show no significant decline for the hairy woodpecker (0.5% decline per year).

The conservation status based on the Nature Serve ranking indicate the hairy woodpecker is secure globally, nationally, and state wide. (USFS 2012)

The conservation status based on the Nature Serve ranking indicates the olive-side flycatcher is near threatened, through the International Union for Conservation of Nature (IUCN) Red List of threatened species.

For the detailed assessment on the hairy woodpecker for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Habitat for the olive-sided flycatcher and hairy woodpecker occurs throughout the Deschutes National Forest. Through the Forest wide assessment completed for MIS, hairy woodpecker reproductive habitat was mapped across the entire Deschutes National Forest and will be used as a surrogate for the olive-sided. Approximately 17,682 acres of habitat exists within the project area. Approximately 51,985 acres habitat occurs within the Watershed and approximately 507,920 acres of habitat occurs across the Deschutes National Forest. Table 133 summarizes these acreages:

Table 133: Habitat for both species within the West-Bend project area, Watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
17,682 acres	51,985 acres	507,920 acres

Environmental Consequences

Alternative 1 – No Action

Overtime, stocking density in suitable habitat would continue to increase, thus losing habitat components needed by the olive-sided flycatcher and hairy woodpecker. Existing dense stands would

continue to fall apart due to tree mortality, creating openings which may provide future habitat. This alternative would leave the stands in a dense condition, making them susceptible to fire, which could benefit this species by providing early post-fire habitat it needs. However, there is a risk that green trees would not be left due to the intensity of the fire and would only provide habitat for this species in the short-term until trees fell.

Action Alternatives 2, 3, and 4

Direct and Indirect Impacts

Thinning From Below (HTH), Skid and Deck, Harvest Improvement Cut (HIM), Ladder Fuels Reduction (LFR), Prescribed Burning (Burn) Harvest Overstory Removal (HOR) and Harvest Cut with Reserves (HCR)

Thinning from below (HTH), skid and deck, Ladder Fuel Reduction and Harvest Improvement Cut (HIM) will occur throughout the project area. Treatments will consist of primarily removing material primarily <8"dbh and in some cases up to 12" dbh material in advanced regeneration plantations and naturally regenerated stands. In commercial thinning from below (HTH), treatments will focus on maintaining the overstory trees in pure ponderosa pine and mixed conifer dry stands providing overstory large tree structure. The HIM treatments and LFR treatment will primarily occur in the urban interface adjacent to private property. These stands are dominated by small trees and will focus on reducing stand densities adjacent to private property, primarily removing second growth lodgepole pine favoring white-fir and ponderosa pine. This treatment will result in the accelerated growth of residual trees while reducing the fire hazard. Long-term beneficial impacts of small tree thinning will be the reduction of habitat fragmentation by promoting the development of LOS habitat which include large snags at an accelerated rate. Short-term beneficial impacts will be seen in the reduction of risk to existing suitable habitat. This treatment will beneficial to the hairy woodpecker by creating large snags over the long-term to be utilized as nesting and foraging habitat.

Within HOR and HCR treatments overstory trees will be removed. The HCR units occur within mixed conifer stands containing high mortality levels from insect and disease. Treatments will remove fuel loading in these units, retaining the healthiest largest trees in the stands, and favoring ponderosa pine where it exists. The average diameter of trees removed is approximately 14 inches and in general the trees in these stands are small. The HOR stands are past lodgepole pine seed tree cuts and were identified to remove individual residual lodgepole pine from the overstory in Alternative 2 and under Alternative 3 and 4, only trees containing mistletoe will be girdled and left as snags to provide nesting habitat for these species as the trees die. The dead trees will provide some limited snag habitat within these stands as understory trees continue to develop. Due to the fact that that this will be a low density of snags within this area, the change from Alt. 3 is not measureable, but will provide some limited habitat to cavity nesters. Overall approximately 700 acres are associated with these treatments, residual reproductive habitat will remain but the quality of habitat will be reduced.

The objective of prescribed fire is to reduce fuel loading by using prescribed fire to create a continuous mosaic of burned and unburned habitat. Treatments may unintentionally burn existing snags, however new snags could also be recruited through this process. Mortality of snags in ponderosa pine habitat during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags < 15 cm dbh. Several studies showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988; Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for snags, presumably because the trees that did not burn during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988; Bagne et al. 2008).

Table 134 summarizes the amount of habitat associated with treatments under each action alternative for the West-Bend project.

Table 134: Total acres of habitat associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	9865.66	9819.18	7767.81
HCR	459.02	459.02	459.02
HIM	94.07	94.07	94.07
HOR	262.43	153.67	153.67
LFR	27.8	42.7	314.69
Skid & Deck	1984.87	1984.87	1508.28
Burn	3021.68	3021.46	4926.05
Total Acres Affected	**15,716**	**15,575**	**15,225**

Overall, approximately 15,716 acres of habitat are associated with treatments identified under Alternative 2, approximately 15,575 acres under Alternative 3, and approximately 15,225 acres under Alternative 4. Alternative 3 is the most proactive, on the landscape this alternative does the best job at breaking up fuel continuity and maintaining large tree habitat adjacent to forest edges.

Overall, implementation of the action alternatives will maintain existing habitat conditions for olive-sided flycatcher and hairy woodpecker by maintaining and enhancing the development of large trees structure across the project area. Treatments reduce the risk of losing existing habitat to stand replacing fire. Through thinning, small opening will be created and providing some edge habitat while retaining a full stocked overstory for perch trees. Treatments will not preclude use of the project area by this species and will increase as contiguous stand of LOS habitat develops across the project area. These changes will result in more sustainable habitat conditions across the landscape and move habitat conditions closer to historical conditions. Fire suppression has created denser conditions than historically occurred which resulted in an increase in dense habitat species and a decline in open pine habitat species. Some snag habitat will be lost, however, due to project design effects are minimized.

The project area and habitat varies greatly from east to west due to the increase in elevation, the rain gradient associated with the change in elevation, and the site potential associated with the inherent soil quality within this east to west pattern. To capture the importance of habitat variation across the project area, the project area was broken up into four ecotones moving from east to west. A habitat retention strategy was defined; where in the low elevation ponderosa pine ecotone (approximately 16,146 acres), approximately 10% of this zone would be left in un-treated stands and aggregate patches, in the mid-elevation ponderosa pine mixed conifer dry ecotone (approximately 3,966 acres) approximatley15% of this landscape would be left in untreated stand and aggregate patches, within the high elevation mixed conifer wet stands (approximately 3,027 acres), approximately 20% of this landscape would left in untreated stands and aggregate patches, and lastly the lodgepole pine community (approximately 2,027 acres), where regeneration harvest 15% of each harvest unit will remain untreated. These untreated areas were identified to retain habitat connectivity between thinned stands associated with project treatments.

See DecAID Snag and Log Analysis for the projects effect to dead wood habitat and distribution.

Cumulative Effects

Past harvest activities have led to the loss of large tree habitat within the watershed, which has resulted in a decline in foraging and nesting habitat for these species. However, more recent vegetation

management projects are more focused on restoration of large tree habitat within mixed conifer stands. These treatments thin stands from below reducing stand densities to promote the development of large tree structure and incorporate mowing and burning, to reduce the risk of stand replacing fire. These types of activities will enhance habitat conditions for olive-sided flycatcher and hairy woodpecker which are dependent on large tree structure and snags for foraging and nesting, with small areas containing edges and prescribed fire producing insect populations that these two species can forage on.

Within the watershed (zone of influence) future foreseeable and ongoing vegetation management projects occur within suitable habitat which contributes to cumulative effects. Overall, treatments proposed will improve habitat conditions by promoting the development of large structure and reducing the risk of loss of existing habitat from other large-scale disturbances. These ongoing projects will treat approximately 11,703 acres (see Table 92).

There are very limited vegetation management activities that occur within the mixed conifer PAG in the Watershed. Overall, treatments will improve habitat conditions by promoting the development of large structure and reducing the risk of loss of old growth stands from other large-scale disturbances. These projects are implementing thinning from below primarily in second growth stands as well as prescribed natural fire. Treatments will open stands maintaining snags and large tree structure, as well as promoting development of future late and old structure Treatment will enhance foraging opportunities by opening canopies providing foraging opportunities in the overstory for the flycatcher. The hairy woodpecker will benefit from treatment in the short-term by individual trees recruited as snags during burning operations and in the long-term by promoting the development of large trees structure and snags over time. Although treatments are occurring in the ponderosa pine PAG, the potential for the olive-sided flycatcher and hairy wood pecker to use these treatment areas is high due to the type of treatments occurring.

Private lands are not managed for habitat. Therefore, it is assumed that any habitat provided by private timberland in the Watershed is incidental and may not be long term.

Of the 17682 acres of reproductive habitat identified within the project area Alternative 2 treatments will thin approximately 15,716 acres of reproductive habitat, approximately 15,575 acres under Alternative 3, and approximately 15,225 under alternative 4.

Of the 51,985 acres of reproductive habitat within the watershed, cumulatively Alternative 2, 3, and 4 are will thin, mow, and burn on average approximately 15,505 acres which equates to approximately 30% of the total habitat. On average the treatments are associated with 3% of the total habitat across the Deschutes National Forest.

Conclusions

Nature serves lists the hairy woodpecker as secure globally, nationally, and state wide and the olive-sided flycatcher as near threatened globally. The No Action Alternative could affect habitat due to the ongoing loss of large structure and the conversion of stands to non-sustainable from insects, disease, and but predominantly stand replacing fire.

Treatments associated with the mixed conifer PAG propose thinning from below, promoting the development of contiguous stands of late and old structure habitat that these species need for nesting and foraging. In mixed conifer habitat dominated by ponderosa pine, the project will also manage stands by thinning from below, but will favor the ponderosa pine to develop a more fire resistant stand containing large ponderosa pine as the dominant species. In addition overstory treatment in mid-seral mixed conifer stands and individual lodgepole pine removal will reduce habitat, but will also promote the develop of large tree structure in the long-term, but more importantly will break up fuel continuity and reduce the risk of stand replacing fire to highly suitable habitat. However, through project design criteria, treatments have been designed to maintain untreated stands throughout the project providing small tree diversity that could also provide foraging opportunities.

Overall, implementation of the action alternatives as well as other projects across the district should result in improved habitat conditions for those species dependent on open ponderosa pine habitat which could lead, over time, to increased populations. Cumulatively there will be a decrease in dense understory habitat; these changes will result in more sustainable habitat conditions across the landscape and move habitat conditions closer to historical conditions. Fire suppression has created denser conditions than historically occurred which resulted in an increase in dense habitat species and a decline in open pine habitat species. Some snag habitat will be lost, however measures are in place to minimize effects.

Although treatments will thin stands that are currently suitable reproductive habitat, the West-Bend project will not contribute to a change in viability within the Watershed or on the Deschutes National Forest for the olive-sided flycatcher and hairy woodpecker.

Implementation of the West-Bend project would be consistent with the Standards and Guidelines for the Deschutes National Forest Land Resource Management Plan. Implementation of the West-Bend project would also be consistent with the biological objectives outlined in the Conservation Strategy for the East-slope Cascades Mountains and treatments will be beneficial to the management of long-term habitat.

Landbird Strategy

Biological objectives for olive-sided flycatcher habitat in mixed conifer/ponderosa pine stands with edges and openings created by wildfire will be assessed.

Table 135: Landbird Strategy – Biological objectives for olive-sided flycatcher habitat

Species	Objective	Do Not Meet, Meets, Not Applicable	Rationale
Olive-sided Flycatcher **Other species to benefit from objectives:** **Hairy Woodpecker**	Where ecologically appropriate in mixed conifer through natural events or management maintain: >2% of landscape as post-fire habitat	Not applicable	This is not a post fire salvage project.
	Where ecologically appropriate in mixed conifer through natural events or management maintain: >40% of the post fire landscape as unsalvaged.	Not applicable	The project is not a fire salvage project.
	Where salvage is occurring in post fire old ponderosa pine forest maintain or provide: in burns >100 acres, salvage <50% of standing dead and down	Not applicable	The project is not a fire salvage project.
	Where salvage is occurring in post fire old ponderosa pine forest maintain or provide: retain all trees/snags >20”dbh and >50% of those 12-20”dbh	Not applicable	The project is not a fire salvage project.
	Where salvage is occurring in post fire old ponderosa pine forest maintain or provide: retain all trees/snags >20”dbh and >50% of those 12-20”dbh	Not applicable	The project is not a fire salvage project.

	Where salvage is occurring in post fire old ponderosa pine forest maintain or provide: patches with a mix of live and dead trees/snags to provide potential nesting trees in context of potential foraging and perch trees	Not applicable	The project is not a fire salvage project.

Mixed Conifer, Large Trees and Snags –Pileated Woodpecker, Brown Creeper, Hermit Thrush, Flammulated Owl, and Williamson's Sapsucker

Existing Condition

The brown creeper is the only North American bird that relies on both the trunk and bark of trees for nesting and foraging. The pileated woodpecker is limited altitudinally by habitat availability as the higher and lower elevations lack enough large trees for nesting, roosting and foraging. The brown creeper is found predominantly in coniferous forests but can be located in hardwood stands as well. Pileated woodpeckers occur primarily in dense mixed conifer forests in late seral stages and are rarely found in pure ponderosa pine stands. Brown creepers nest under loose, sloughing bark of large diameter snags with little to moderate decay. The mean diameter of nest trees range from 16" dbh to 42" dbh. In northeastern Oregon, creeper abundance was positively associated with the height of the canopy and density of trees. (Marshall et al. 2003 pp.453-456). Adams and Morrison (1993) found similar results with creepers being highly correlated with mature-aged stands with moderate overall stand density. Pileated woodpeckers need large diameter snags or live trees with decay for nesting and roosting sites, large diameter logs for foraging on ants and other arthropods, and dense canopy to provide cover. Creepers seem to be fairly common but forest management practices, especially the loss of large diameter snags and live trees, may cause a threat to this species. BBS data (1966-1991) for the pileated woodpecker shows no significant change. Risks include activities that eliminate or reduce the number of snags, logs, and cover. In addition, conversion of fir stands to pure ponderosa pine reduces suitable habitat. (Marshall et al. 2003).

The hermit thrush is an uncommon to common summer resident preferring mid to high elevation mature and old growth forests at mid to high elevations. The hermit thrush breeds in mature forests of all types especially those with a shaded understory of brush and small trees ranging from aspen groves to juniper woodlands to moderately open coniferous forests. Higher densities of hermit thrushes have been reported in old-growth riparian stands relative to other mature and young riparian stands. The hermit thrush nests on the ground or use small trees in the understory. They are ground foragers of insects; however fruits and berries may also be consumed especially during migration and in winter. Populations seem to be stable at this time. Microsites selected for foraging tend to have little to no vegetation or litter. Threats to the hermit thrush include the loss of mature forests and controlled burning of forest understories, especially spring burning. Hermit thrush responses have been known to decrease after fires (Sallabanks 1995). (Marshall et al. 2003 pp. 483-485 and 487-489).

Williamson's sapsuckers are highly adaptable and are able to withstand considerable disturbance. Populations seem to be fairly stable however, snag removal remains the primary threat for this species (Marshall et al. 2003). Flammulated owl habitat also includes dense patches of saplings or shrubs used for roosting. All species nest in snags or live trees with decay. Williamson's sapsuckers are weak excavators and select for the soft and decayed wood for nest sites regardless of tree species (Marshall et al. 2003). The flammulated owl forages exclusively at night primarily for nocturnal arthropods (USDA 1994b). Little is known on the population status of the flammulated owl and no data are available for the pygmy nuthatch to indicate significant population declines (Marshall et al. 2003).The flammulated owl is unique in the Pacific Northwest. It preys almost exclusively on insects and is a neotropical

migrant. Williamson's sapsuckers are summer residents east of the crest and are most often found in ponderosa pine during the breeding season (Marshall et al. 2003). The flammulated owl and Williamson's sapsucker breed on the eastern slope of the Cascades and are found in mature to old growth forests with limited understories at mid to high elevations (Marshall et al. 2003).

The project area contains very limited mixed conifer habitat containing the large trees structure needed by these species. Therefore there is limited effect to habitat as a result of proposed treatments.

The conservation status based on the Nature Serve ranking indicate the pileated woodpecker is secure globally, nationally, and state wide (USFS 2012). The conservation status based on Nature Serve ranking indicates the brown creeper, flammulated owl, and hermit thrush are "least concern" for these species.

The conservation status based on the Nature Serve ranking indicate the Williamson's sapsucker is secure at globally, nationally, and state wide (USFS 2012). For the detailed assessment on the pileated woodpecker for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Through the Forest wide assessment completed for MIS, pileated woodpecker reproductive habitat was mapped across the entire Deschutes National Forest and will be used as a surrogate for the brown creeper, hermit thrush, and chipping sparrow. Approximately 184 acres of habitat exists within the project area. Cumulatively, approximately 8,328 acres habitat occurs within the Watershed and approximately 180,077 acres of habitat occurs across the Deschutes National Forest. Table 136 summarizes these acreages:

Table 136: Habitat within the West-Bend project area, Watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
184 acres	8,328 acres	180,077 acres

Environmental Consequences

Alternative 1 – No Action – Existing Ecological Trend

There are no known direct impacts associated with the no action alternative. Increased stand densities perpetuates the problem of losing large structure over time, which these species require for suitable nesting and foraging habitat. In dense stands, increased competition for nutrients will prolong the development of large trees. Nest site availability will be limited increasing competition for existing sites leading to greater predation risks. Increased stand densities may increase the risk of loss from fire. These structures would be consumed more rapidly with increased fire intensities and may lead to large areas of the landscape being unsuitable if such an event were to occur.

The Williamson's sapsucker would see a decrease over-time as stands begin to deteriorate; this species is a weak excavator and feeds on sap wells of smaller diameter trees but utilizes large snags for nesting. Dense stands of large and small diameter green trees would deteriorate in the short-term. Due to stand densities very few large trees would develop over the long-term and large snags for nesting would be limited in the project area.

Action Alternatives 2, 3, and 4

Direct and Indirect Impacts

Thinning From Below (HTH), Harvest Cut with Reserves (HCR) Harvest Overstory Removal (HOR), Non-commercial Thinning (PCT), Ladder Fuels Reduction (LFR), Skid and Deck, and Prescribe Burn (Burn)

There are no known direct impacts to any of the above listed species as a result of any action alternatives. However, indirect impacts exist from the removal of green trees 21 inches and greater associated with thinning from below in mixed conifer/ponderosa pine (HTH). Large trees identified for removal in these treatment types will primarily be white-fir that are competing with large diameter ponderosa pine for nutrients or are creating ladder fuels to overstory ponderosa pine. In addition HCR units will also reduce habitat by removing overstory white-fir to break up fuel continuity in mixed mortality mixed conifer stands, the average diameter for removal is 14 inches dbh in these stands Dead white-fir or green white-fir with decadence and decay are the preferred foraging species for the pileated woodpecker and provide nesting, roosting, and foraging habitat for the other previously mentioned species. Although treatments will favor ponderosa pine, residual white-fir will remain as clumps and individual trees in areas they are not competing with overstory ponderosa pine. In addition large snags are not targeted for removal, but there is a possibility for incidental loss of snags during treatments. Generally, snags would be avoided during treatments, but incidental removal would occur, as OSHA regulations require removal of snags that pose hazard to operations.

Non-commercial thinning in plantations with advance regeneration, ladder fuels reduction, and lodgepole pine HOR treatments will not reduce reproductive habitat due to the small size of trees they will remove in the mixed conifer and ponderosa pine stands. However, treatment could reduce foraging habitat in these stand. Minimal effects are anticipated due to the limited amount of habitat associated with the project.

Prescribed burning is also proposed. These treatments will reduce both activity fuels and overall fuel loadings to acceptable levels. Fuel treatments will reduce fire risk and will reduce competition to established trees, increasing the stands resiliency to wildfire. The objective is to create a mosaic of burned and unburned areas, creating a discontinuous distribution of fuel throughout the project areas. Due to the removal of shrubs from prescribed burning this treatment has the potential to reduce reproductive habitat for the hermit thrush. However, fuels treatments could also enhance flammulated owl foraging habitat by promoting grass/forb/shrub complexities which will increase insect production.

In untreated habitat, there will continue to be an increased risk from disturbance, although breaking up the fuel continuity across the landscape will reduce the risk of a large scale disturbance event. In addition some of the areas identified for no treatment occur within higher site potential areas (i.e. riparian habitat conservation areas or riparian reserves), sites capable of producing large trees with greater canopy closure. These areas have the potential to provide habitat.

Table 137 summarizes the amount of habitat associated with treatments under each action alternative for the West-Bend project.

Table 137: Total acres of habitat associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	4.67	4.67	4.67
HCR	28.24	28.24	28.24
HOR	18.9	2	2

Treatment	Alternative 2	Alternative 3	Alternative 4
PCT Mechanical	1.11	1.11	1.11
PCT	2.89	19.79	19.57
LFR	0.44	0.44	0.44
Skid & Deck	16.68	16.68	16.68
Burn	8.9	8.9	8.9
Total Acres Affected	82	82	82

Overall, approximately 82 acres of habitat are associated with treatments identified under Alternative 2, 3 and 4.

In areas identified for thinning, canopies will be opened up and stand densities reduced to lessen the risk of a large-scale event (insects, disease, or fire). Thinning will directly reduce canopy cover, but it will also reduce the fire risk to individual stands by breaking up the fuel continuity across the landscape, reducing the risk of larger scale disturbance events. Overall treatment are minimal in scope and scale and impact will be insignificant.

Overall, the treatments described above will aid in the development a more resilient landscape to disturbance.

See DecAID Snag and Log Analysis for the projects effect to dead wood habitat and distribution.

Cumulative Effects

The largest impact to mixed conifer habitat and associated species has been from the series of large scale wildfires that have occurred across the forest since 2002. Pileated woodpeckers prefer nesting and foraging in white-fir due to the fibrous nature of the tree when it dies and it is readily occupied by carpenter ants, preferred forage of the pileated. In addition areas containing high mortality in white-fir stands from root disease and mistletoe also occurred across the mixed conifer zone and provided an abundance of foraging habitat for the pileated woodpecker. These high mortality areas fueled the series of large fires but remain as dead or dying stands on the Bend-Ft. Rock, where little fire has occurred. Ongoing habitat deterioration in the mixed conifer zone across the district has greatly reduced pileated habitat, brown creeper, and hermit thrush habitat through loss of large trees.

Within the watershed (zone of influence) a few ongoing vegetation management projects occur within suitable habitat that contribute to cumulative effects (Table 138). Overall, treatments proposed will improve habitat conditions by promoting the development of more fire and disease resistant open stand containing large tree structure and reducing the risk of loss of existing habitat from other large-scale disturbances. These ongoing projects will treat approximately 207 acres.

Table 138: Ongoing and Future Foreseeable Vegetation Management Projects Contributing to Cumulative Effects

Project	Status	Acres
Sparky timber sale and hazard tree removal.	Ongoing/ Planned	172 acres along project boundary and Cascade lakes highway. Commercial thinning, salvage, understory thinning, fuels treatments (pile, mow, burn).
Skyliner CFLRA	Ongoing	35 acres of treatment within the wildlife urban interface of the Skyliner community.
Invasive Plant Control EIS	Planned	Within project area and across Forest. Herbicide and manual treatment of invasive plant populations

Private lands are not managed for habitat. Therefore, it is assumed that any habitat provided by private timberland in the Watershed is incidental and may not be long term.

Of the 184 acres of reproductive habitat identified within the project area Alternative 2, 3, and 4 treatments are associated with approximately 82 acres of habitat.

Of the 8,328 acres of reproductive habitat within the watershed, cumulatively Alternative 2, 3, and 4 will thin approximately 82 acres. With the ongoing and reasonably foreseeable projects within the watershed total acres affected habitat amount to approximately 1% of the total habitat.

The treatments are associated with far less than <1% of the total habitat across the Deschutes National Forest.

Conclusions

Nature serves lists these species as secure Globally, Nationally, and State wide and at "least concern".

The No Action Alternative could affect habitat due to the ongoing loss of large structure and the conversion of stands to non-sustainable habitat from insects, disease, and stand replacing fire.

Treatments associated with the mixed conifer PAG propose thinning from below, promoting the development of contiguous stands of late and old structure habitat that these species need for nesting and foraging. In mixed conifer habitat dominated by ponderosa pine, the project will also manage stands by thinning from below, but will favor the ponderosa pine to develop a more fire resistant stand containing large ponderosa pine as the dominant species. Treatment will maintain large white-fir in the overstory, except where it is the dominant species and then ponderosa pine will be promoted. Through project design criteria, treatments have been designed to maintain untreated stands throughout the project providing small tree diversity that could also provide foraging opportunities for species like the hermit thrush.

Overall, implementation of the action alternatives as well as other projects across the district should result in improved habitat conditions for these species dependent on mixed conifer habitat. Cumulatively there will be a decrease in dense understory habitat; reducing foraging opportunities, especially for both the hermit thrush and pileated woodpecker, since the focus will be thinning dense stands of unhealthy white-fir and lodgepole pine. However, treatments will maintain healthy white-fir in the overstory promoting a more fire resilient mixed conifer stand and minimizing the risk of losing more landscape to wildfire, creating unsuitable habitat to the pileated woodpecker, brown creeper, and hermit thrush. Large untreated blocks of habitat have been retained through the project area prove habitat connectivity as well as retention of habitat within each treatment unit. The project will promote long-term habitat for these species by reducing the risk of stand replacing fire, and promoting the development of large tree structure in mixed conifer stands.

Although treatments will thin stands that are currently suitable reproductive habitat, the West-Bend project will not contribute to a change in viability within the Watershed or on the Deschutes National Forest for the pileated woodpecker, brown creeper, hermit thrush, Williamson's sapsucker, and flammulated owl

Implementation of the Travel Management Rule is also consistent with the biological objectives outlined in the Conservation Strategy for the East-slope Cascades Mountains and Conservation Strategy for the Northern Rocky Mountains.

Landbird Strategy

Biological objectives for brown creeper and hermit thrush in mixed conifer late succession, multi-layered, dense canopy, and vertical cover will be assessed.

Table 139: Landbird Strategy – Biological objectives for brown creeper and hermit thrush

Species	Objective	Do Not Meet, Meets, Not Applicable	Rationale
	BROWN CREEPER		
Brown Creeper **Hermit Thrush**	Where ecologically appropriate initiate actions in mixed conifer forests to maintain or provide: blocks of late-successional habitat >75 acres	Meets	The project will be a thin from below. Therefore, the larger trees will remain on the landscape post activity.
Flammulated Owl	Where ecologically appropriate initiate actions in mixed conifer forests to maintain or provide: >4 trees/acre >18"dbh with at least 2 trees >24"dbh	Meets	The project will be a thin from below. Therefore, the larger trees will remain on the landscape post activity.
Willimason's Sapsucker	HERMIT THRUSH		
Other species to benefit from objectives: **Pileated Woodpecker**	Where ecologically appropriate initiate actions in mixed conifer to maintain or provide: patches of forest with multi-layered structure and a dense understory shrub layer	Meets	Patches of mixed conifer will remain untreated. In areas that are proposed for treatment the goal is to move stands towards historical condition.
	FLAMMULATED OWL		
	>10 snags/100 acres, >12in. dbh and >6ft. tall	Yes	No ponderosa pine snags will be targeted for removal in ponderosa pine thinning and Mixed conifer dry thinning
	>20 trees/8 acres, >21 in. dbh to function as recruitment snags	Yes	This project proposes to thin stand from below favoring ponderosa pine >20 in. dbh for retention where it occurs. The exception is ~200 acres of mixed conifer where overstory treatments focus on trees with an average diameter of 14 inches dbh. No large trees exist in these stands.
	WILLIAMSON'S SAPSUCKER		
	1 snag /acre, >18 in. dbh in ponderosa pine	Yes	Within ponderosa pine treatment, the focus will be thinning of green trees, no ponderosa pine snags are targeted for removal

Species	Objective	Do Not Meet, Meets, Not Applicable	Rationale
	Mean canopy cover 25-75%	Yes	The project will thin stand from below, residual canopy closures will exist on the low end of the range, except within the ~ 200 acres of overstory removal units

Coniferous Forests – Edges – Northern Flicker

Existing Condition

The northern flicker is a common resident throughout Oregon and is encountered in almost any terrestrial habitat. It is generally most abundant in open forests and forest edges adjacent to open country while they tend to avoid dense forest (Marshall et al. 2003). There is some evidence the flicker prefers older mature forests. Reinkensmeyer (2000 in Marshall et al. 2003) noted the preference for old growth versus mid-successional western juniper in central Oregon. Most nests in forested areas are found in older, open forests, along older forest edges, and in large diameter remnant snags (Marshall et al. 2003). They also tend to nest in trees with moderate to heavy decay. The flicker diet consists of ants, beetles, crickets, other insects, fruits, and seeds and they prefer to forage on the ground (Marshall et al. 2003). BBS data (1966-2000) for Oregon show a non-significant decrease of 0.6% per year decline. The flicker requires open space and may gain foraging habitat from human caused changes but the presence of decayed wood is still required. (USFS 2012)

The conservation status based on the Nature Serve ranking indicate the Northern flicker is secure globally, nationally, and state wide level (USFS 2012).

For the detailed assessment on the Northern flicker for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Approximately 8,828 acres of reproductive habitat exists within the project area. Cumulatively, approximately 19,456 acres of habitat occurs within the Watershed and approximately 219,576 acres of habitat occurs across the Deschutes National Forest. Table 140 summarizes these acreages.

Table 140: Northern flicker habitat within the West-Bend project area, Watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
8,828	19,456 acres	219,576 acres

Environmental Consequences

Alternative 1 – No Action

Increased stand densities perpetuates the problem of losing large structure over time from competition and disturbance events, which this species requires for suitable nesting and foraging habitat. It also limits available nest sites, resulting in more competition for existing sites between species. Increased

stand densities may increase the risk of loss from fire. This species requires snags for nesting and generally utilizes larger snags associated with older mature forests. In the event of fire existing snags are lost and replaced with hard snags. Currently there are a limited number of large trees available for potential use. Replacement large trees are a concern. Many of the future habitat trees are within overstocked stands, which will increase the amount of time the trees will take to get to the desired size. In the short-term as over-stocked stands die and openings are created, flicker use could increase, but due to the lack of large trees, the longevity and utility of the small snags that will occur in these stands are limited. Individual large trees which provide potential habitat are surrounded by dense patches of smaller trees with some shrubs in the understory. Competition for nutrients and water makes these trees more susceptible to insects and disease. In addition, large trees within densely stocked stands are more susceptible to wildfire, due to increased fuel loadings and ladder fuels from 100 years of fire suppression. Large trees will continue to be at an increased risk to insect, disease, and wildfire.

Action Alternatives 2, 3, and 4

Direct and Indirect Impacts

Thinning From Below (HTH) Harvest Cut with Reserves (HCR) Harvest Overstory Removal (HOR) Non-commercial thinning (PCT) Skid and Deck, Prescribed Burn (Burn)

The northern flicker is a generalist in that it utilizes a variety of habitat types effectively and resides at varying elevations. It nests in mature late structure stands, and forages in open areas that provide insects, seeds, and fruiting plants. Flickers primarily forage on the ground, but will also excavate for forage. Although they are an excavator they typically excavate for nesting. Past regeneration harvest that created large openings provided areas more conducive to be utilized by the flicker and; however these regeneration harvests are about 40 years old and understory stand densities have grown up and do not provide these open habitat type any longer. The thinning and fuels treatments planned under the action alternatives within both mixed conifer and ponderosa pine are designed to reduce the risk of high intensity wildfires in the short-term. In addition treatments will retain residual late and old structure stand characteristics that exist throughout the project area and promote the development of late and old structured (LOS) habitat throughout the project area in the long-term. Treatments will thin the 40 year old plantations opening these areas up for use by the flicker in the short-term, and promote the development of large tree structure in theses plantations in the long-term which will also recruit large snags to be used as nesting habitat. The action alternative will also remove dead and dying trees in mid-seral mixed conifer stands to break of fuel continuity across the project area. Treatment will maintain the largest and healthiest tree in the overstory, continuing to provide large structure to be recruited as nesting habitat also enhancing habitat by reducing stand densities to provide better foraging opportunities and access to the forest floor.

With the exception of the occasional felling of snags that may pose a hazard to human safety during thinning operations associated with mature ponderosa pine stands, thinning operations would have no direct effects to snags or coarse woody material habitats. Commercial harvest would directly affect green tree replacements by reducing the number of trees in treatment units. However the units would retain more than sufficient green tree replacements to exceed levels for snag recruitment in the long-term. Thinning would open up areas, and the indirect effects of treatments include healthier stands, but could reduce some foraging opportunities in the short-term. In addition through prescribed burning, there is the potential to recruit overstory snags and down wood in the short-term that could enhance nesting and foraging habitat in mature ponderosa pine stand.

The objective of prescribed fire is to reduce fuel loading by using prescribed fire to create a continuous mosaic of burned and unburned habitat. Treatments may unintentionally burn existing snags, however new snags could also be recruited through this process. Mortality of snags in ponderosa pine habitat during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found

that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags < 15 cm dbh. Several studies showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988, Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for snags, presumably because the trees that did not burn during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988; Bagne et al. 2008). Table 141 summarizes the amount of habitat associated with treatments under each action alternative for the West-Bend project.

Table 141: Total acres of flicker habitat associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	4339.15	4337.37	3569.88
HCR	47.59	47.59	47.59
HOR	111.86	68.9	68.94
PCT	45.15	45.37	45.37
Skid & Deck	1038.14	1038.14	896.03
Burn	2304.9	2309.57	3015
Total Acres Affected	7,887	7,847	7,704

Overall, approximately 7,887 acres of habitat are associated with treatments identified under Alternative 2, approximately 7,847 acres under Alternative 3, and approximately 7,704 under Alternative 4. Alternative 3 is the most proactive approach to long-term habitat management to these species. Alternative 4 will treat the least amount of habitat of all the alternatives.

Proposed treatments would reduce the risk of high intensity wildfire by thinning the understory, reducing the ladder fuels that make the area susceptible to a stand replacing fire. Treatments would accelerate stand development providing long-term habitat for the flicker which is prefers a variety of habitat types but focus on mature stands. Although the recruitment of dead wood habitats would be slow, silvicultural treatments would provide beneficial indirect effects by promoting faster growth of green tree replacements, ultimately providing larger diameter snags and down wood over the next 30+ years. As the stands age, additional snags and logs would develop, providing a higher diversity of habitat and structure. As a result, stands would contain more abundant nesting habitat. In the short-term, commercial thinning from below and thinning of plantation with advance regeneration will reduce the dense understory in the ponderosa pine and mixed conifer stands, which could promote ground foraging for the flicker.

See DecAID Snag and Log Analysis for the projects effect to dead wood habitat and distribution.

Cumulative Effects

The wildfires that have occurred across the forest since 2002 have created large openings and a flush of insects to provide a short-term foraging opportunity for the flicker. In addition, large areas of mountain pine beetle outbreaks have occurred throughout the high elevation lodgepole pine also creating large openings and foraging opportunities for the flicker. Nesting and foraging associated with these landscape scale disturbance events occurs in short-term pulses, it has been noted that insect pulses as well as snag decline begins within the first 10 years following the fire therefore utility of these areas by the flicker has begun to diminish. A variety of past fuels reduction projects occurred in the low elevation ponderosa pine within the watershed and focused on thinning second growth black-bark ponderosa pine stands from below and applied prescribed fire and mowing to reduce shrub densities. Treatment were designed to reduce the risk of stand replacing fire and promote the development of

contiguous stands of future late and old structure ponderosa pine promoting large tree structure. The majority of thinning removed trees 8 inches dbh and less although trees up to 21 inches were also removed. Treatments were designed to promote habitat for ponderosa pine obligates and improve winter habitat for mule deer as well as other generalist such as the flicker. Prescribed fire continues to be used to manage these stands on roughly a five year rotation. Through continued prescribed burning, these treatments have produced open pine stands recruiting an occasional snag to be used as nesting habitat. In addition, prescribed fires have created a mosaic of early seral bitterbrush and bunch grasses which produce seeds and insect for maintaining long-term foraging opportunities for the flicker.

Within the watershed ongoing vegetation management projects occur within suitable habitat that contributes to cumulative effects. Measures were incorporated to retain suitable habitat for each project area as well as enhance habitat conditions. Overall, treatments proposed will improve habitat conditions by promoting the development of more fire and disease resistant open stand containing large tree structure and reducing the risk of loss of existing habitat from other large-scale disturbances. These ongoing projects will treat approximately 11,189 acres (Table 196).

Table 142: Ongoing and Future Foreseeable Projects Contributing to Cumulative Effects

Project	Status	Acres
Rocket Vegetation Management	Planning	6,387acres of commercial thinning, plus mowing and underburning.
Fry timber sale and fuels treatment	Ongoing/Planned	106 acres surrounded by project on north end. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest and understory treatments completed, Fuels treatments remaining.
Jet Timber Sale part of West Tumbull project	Ongoing/Planned	Within the watershed 584 acres in Skyliners road upper community. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest continuing Understory treatments and fuels treatments remaining.
East Tumbull HFRA Project (Net T.S., Set T.S., NT7)	Ongoing/Planned	2,534 acres within east 1/3 of West Bend Project. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest finished, understory treatments for fuels remaining.
Katalo East and West Projects	Ongoing/Planned	1,435 acres within project area center 1/3 of west bend project. Commercial thinning, understory thinning, fuels treatments (pile, mow, burn). Tree harvest finished, understory tree treatments finished, fuels treatments remaining-burning
Feline timber sale	Ongoing	143 acres within project area. Tee harvest and understory treatments finished. Fuels treatments remaining.
Invasive Plant Control EIS	Planned	Within project area and across Forest. Herbicide and manual treatment of invasive plant populations

Private lands are not managed for flicker habitat. Therefore, it is assumed that any habitat provided by private timberland in the Watershed is incidental and may not be long term.

Of the 8,828 acres of Northern flicker reproductive habitat identified within the project area Alternative 2 is will thin, mow, and or burn approximately7,887 acres of reproductive habitat, approximately 7,847 acres under Alternative 3, and 7,704 acres under Alternative 4. There are no known nest sites associated with any of the proposed alternatives.

Of the 19,456 acres of reproductive habitat within the Watershed, Alternative 2, 3, and 4 combined with the ongoing and reasonably foreseeable projects will treat approximately 40% of the total habitat.

Cumulatively, these treatments will thin .mow, and/or burn 4% of the total habitat across the Deschutes National Forest.

Conclusions

Nature serves lists these species as secure globally, nationally, and state wide.

The No Action Alternative could affect habitat due to the ongoing loss of large structure and the conversion of stands to non-sustainable habitat from insects, disease, and stand replacing fire.

Treatments under the action alternatives will be beneficial to the northern flicker by retaining the largest trees and snags within areas of identified habitat. Portions of the project area will remain in untreated stand and aggregates of untreated patches. These untreated areas could continue provide nesting habitat as well. Overall treatments will promote habitat for the flicker in the long-term by providing large trees and snags throughout the project area, as well as openings that provide foraging opportunities, creation more contiguous stands of suitable habitat.

Although treatments will thin stands that are currently suitable reproductive habitat, the West-Bend project will not contribute to a change in viability within the Watershed or on the Deschutes National Forest for the Northern flicker. Implementation of the West-Bend project would be consistent with the Standards and Guidelines for the Deschutes National Forest Land Resource Management Plan.

Lodgepole Pine Habitats/Recent Post-fire Habitats – Black-backed and Three-toed Woodpeckers

Existing Condition

The black-backed woodpecker is a unique species. Altman (2000) identified it as a focal species for old-growth lodgepole pine. However, it is also highly associated with post-fire environments. Therefore, it will be discussed as it relates to both green lodgepole pine forests and post-fire environments regardless of plant association. The three-toed woodpecker has been identified as a "bark beetle specialist" found in high elevation forests near the Cascade crest (Marshall et al. 2003). These two species are sympatric having overlapping ranges however, Goggans et al. (1989) found the three-toed woodpecker to occupy areas between 4500-5600' elevation while black-backed woodpeckers occupied lower elevations. Where three-toed woodpeckers overlap with black-backed woodpeckers, three-toed woodpeckers forage higher on the trunks of trees than black-backed woodpeckers and on the limbs (Marshall et al. 2003). (USFS 2012)

Lodgepole Pine Habitat

Wisdom et al. (2000) describes source habitats for black-backed woodpeckers as a year round resident that occurs in various forest types. Across its range it is most abundant in recently burned forests, but in Oregon, bark-beetle killed forests are frequently occupied. Marshall et al. (2003 pp. 368-370) reports for the black-backed woodpecker the "center of abundance" in Oregon is the "lodgepole pine forest east of the Cascade crest between Bend and Klamath Falls". Endemic levels of mountain pine beetles, common in lodgepole pine (10"+ dbh and 170 tpa), provide a constant food source for both species. In a study conducted on the Deschutes National Forest, Goggans et al. (1989) suggested management for black-backed and three-toed woodpeckers is tied to the maintenance of decay and disease. They found these two species of woodpeckers used stands with a mean diameter of 8"dbh for nesting with a mean nest tree diameter of 11"dbh suggesting selection for single-storied mature/overmature stands. All nests in the study were in lodgepole pine stands and 93% of foraging took place in lodgepole pine forests.

Goggans found mountain pine beetles had infested 81% of the trees used for foraging. Recent dead trees were used most often (68%) for foraging. (USFS 2012)

Post-fire Habitat

Black-backed woodpeckers are highly associated with stand replacement fire while three-toed woodpeckers have been linked. Saab, Dudley and Thompson (2004) found black-backed woodpeckers rapidly colonize stand replacement burns within 1-2 years post-fire but are rare within 5 years which may be due to a decrease in prey of larval bark and wood boring beetles. NatureServe (2005) reports three-toed woodpecker populations increase 3-5 years post-fire. Several studies found that black-backed and three-toed woodpeckers are found primarily in unlogged sites or clumps of high density trees/snags for both nesting and foraging (Saab and Dudley 1998, Hejl and McFadzen 2000, Haggard and Gaines 2001, and Saab et al. 2002). These stands may provide greater foraging opportunities since these species feed primarily on bark and wood boring beetles (Saab et al. 2002, and Saab, Dudley and Thompson 2004). In addition, black-backed woodpeckers select for small diameter snags (12.7" $\pm$ 1.1"dbh) for nesting and nest in hard snags with little decay (Saab and Dudley 1998 and Saab et al. 2002). They also select nest sites with the highest densities of snags >9"dbh (Saab and Dudley 1998). (USFS 2012)

Wood boring insects that come in with fire differ from mountain bark-beetle outbreaks. Marshall et al. (2003) warns that burned forests and bark-beetle outbreaks should not be considered equivalent habitats. Wisdom contrasted nesting success for black-backed woodpeckers of 68.5 percent in bark beetle infested forests in Oregon with 100 percent success in burned forests of western Idaho and northwestern Wyoming. Squirrel predation accounted for nest losses in Oregon. In Idaho, post- fire recolonization of large burn areas by squirrels did not take place during the first 3 years after the fire. It should be noted however that black-backed and three-toed woodpecker population increases in fire areas last for 5 years (Saab and Dudley 1998), whereas large infestations of mountain bark-beetle in the lodgepole pine forests on the Deschutes National Forest last 10 years. In small-scale infestations of mountain bark-beetles in lodgepole pine or mixed conifer forests occur on a never ending cycle. Snag densities in this habitat type vary widely. (USFS 2012)

The conservation status based on the Nature Serve ranking indicate the black-backed and three-toed woodpeckers are secure at globally, nationally, and vulnerable at the state level. (USFS 2012)

For the detailed assessment on the black-backed and three-toed woodpeckers for the Deschutes National Forest, see the Forest-wide Species Assessment (USFS 2012).

Black-backed Woodpecker

Through the Forest wide assessment completed for MIS, black-backed woodpecker reproductive habitat was mapped across the entire Deschutes National Forest. Approximately 7,067 acres of habitat exists within the project area. Approximately 20,273 acres habitat occurs within the Watershed and approximately 446,152 acres of habitat occurs across the Deschutes National Forest. Table 143 summarizes these acreages:

Three-toed Woodpecker

Through the Forest wide assessment completed for MIS, three-toed woodpecker reproductive habitat was mapped across the entire Deschutes National Forest. Approximately 2,799 acres of habitat exists within the project area. Approximately 13,804 acres of habitat occurs within the Watershed and approximately 367,650 acres of habitat occurs across the Deschutes National Forest. Table 144 summarizes these acreages:

Table 143: Black Backed habitat within the West-Bend project area, Watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
7,067 acres	20,273 acres	446,152 acres

Table 144: Three-toed habitat within the West-Bend project area, Watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
2,799 acres	13,804 acres	367,650 acres

Environmental Consequences

Alternative 1 – No Action – Existing Ecological Trend

In the absence of disturbance events, habitat trends would continue with increased stand densities, canopy cover, down woody debris and snags within the mixed conifer plant association group (PAG). However, there would be a shift in species composition with a decrease in longer-lived species (ponderosa pine). Loss of large structure would also continue with increased stand densities due to species like white fir being able to out-compete ponderosa pine. There will be a continued loss of structure in and adjacent to high use areas (campgrounds, private inholdings, etc.). Within the lodgepole pine plant association group, a mountain pine beetle outbreak has occurred in and adjacent to the project area. Beetle activity has subsided and therefore foraging habitat is dropping off, however these areas would continue to provide an abundance of potential nesting opportunities at a landscape scale. Use of the lodgepole pine community will decrease by these species as beetle activity diminishes. This process is a natural cycle for the lodgepole pine community.

The project will continue to become increasingly susceptible to a large scale stand replacing fire, insects, and disease. In both ponderosa pine and mixed conifer PAG's, with this type of disturbance event, there is the potential for snag/log creation. Fire created snags typically only provides foraging habitat as insects occupy habitat directly after the fire, and decreases over the next 10 year as observed in the roughly 100,000 acres of stand replacing fire that occurs on the Sisters Ranger District. In addition, fire killed trees typically only last as snags for approximately 9-10 years before they start to fall from decay and wind shear leaving area void of snags which has also been observed within 10+ year old fires on the Sisters Ranger District. In addition, areas currently regenerating from mountain pine beetle mortality in the lodgepole pine PAG would be further set back from a stand replacing fire, prolonging the development in areas that historically provide consistent rotations of habitat. In areas of the ponderosa pine and mixed conifer PAGs, foraging and nesting opportunities would be created in the short-term.

Action Alternatives 2, 3, and 4

Direct and Indirect Impacts

Thinning From Below (HTH), Skid and Deck, Non-commercial Plantation Thinning (PCT), Harvest Overstory Removal (HOR), Harvest Cut with Reserves (HCR) Prescribed Burning (Burn)

The thinning and fuels treatments planned under the action alternatives are designed to reduce stand density, minimize the risk of high intensity wildfires and ongoing insect outbreaks and disease in the project area.

The action alternatives do not propose commercial harvest or salvage of any snags or coarse woody material within any ponderosa pine. Treatments associated with thinning from below, skid and deck and non-commercial thinning are primarily associated with overstocked ponderosa pine stands that provide habitat for these species, due to the dense nature of the stands. With the exception of the occasional felling of snags that pose a hazard to human safety during timber sale operations, commercial harvest treatments would have no direct effects to snags or coarse woody material habitats within ponderosa pine habitats.

Harvest cut with reserves will remove dead and dying trees from the overstory in mixed conifer stands, targeting lodgepole pine and white-fir. The average diameter for removal would be 14 inches dbh and the largest healthy trees in the stands would be retained as green tree replacements, overall treatment will greatly reduce the overstory dead and live trees. However the units would retain sufficient green tree replacements to provide future snag densities for habitat types (See DecAID Analysis). Thinning would open up areas, reducing the quality of the habitat for black-backed and three-toed woodpecker. Indirect effects of treatments include healthier stands that could reduce the foraging potential in the short term.

Within the lodgepole pine plant associations Alternative 2, 3, and 4 propose an overstory removal cut (HOR) which will remove residual individual lodgepole pine in partial seed tree cuts. The overstory is sparse due to the type of past harvest and residual large green trees would be removed which could provide future nest trees in stands where snags will be limited. These residual individual overstory trees also contains mistletoe and instead of removal, mistletoe trees will girdled and left to provide snag habitat for the woodpeckers.

Table 145 summarizes the amount of black-backed reproductive habitat affected by the action alternative identified for the West-Bend project.

Table 145: Total acres of black-backed woodpecker habitat associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	4435.44	4443.67	3566.32
HOR	24.91	22.02	22.02
HCR	244.86	244.86	244.86
PCT	37.36	37.36	35.14
PCT Mech	20.01	20.01	20.01
Skid & Deck	833.76	833.76	746.58
Burn	461.47	470.37	1209.38
Total Acres Affected	**6,058**	**6,072**	**5,844**

Table 146 summarizes the amount of three-toed reproductive habitat affected by the action alternative identified for the West-Bend project.

Table 146: Total acres of three-toed woodpecker reproductive habitat associated with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HTH	1605.02	1605.02	1193.37
HCR	207.5	207.49	207.49
PCT Mechanical	20.02	20.02	20.02
Skid & Deck	203.94	203.94	203.27
Burn	207.05	207.05	581.12
Total Acres Affected	**2,244**	**2,243**	**2,205**

Overall, approximately 6,058 acres of black-backed woodpecker habitat are affected by treatments identified under Alternative 2, approximately 6,072 acres under Alternative 3, and approximately 5,844 under Alternative 4. Alternative 3 is the most proactive approach to long-term habitat management to these species. Alternative 4 will treat the least amount of habitat of all the alternatives in the short-term retaining more nesting habitat for this species.

Approximately 2,224 acres of three-toed woodpecker habitat are affected by treatments identified under Alternative 2, approximately 2,243 acres under Alternative 3, and approximately 2,205 acres under Alternative 4. Similarly, alternative 3 is the most proactive approach to long-term habitat management to this species. Alternative 4 will treat the least amount of habitat of all the alternatives in the short-term retaining more nesting habitat for this species.

Proposed treatments would reduce the risk of high intensity wildfire by thinning the understory, reducing the ladder fuels that make the area susceptible to a stand replacing fire. Although the recruitment of dead wood habitats would be slow, silvicultural treatments would provide beneficial indirect effects by promoting faster growth of green tree replacements, ultimately providing larger diameter snags and down wood over the next 30+ years. As the stands age, additional snags and logs would develop, providing a higher diversity of habitat and structure. In the short-term thinning from below and prescribed fire will reduce the dense understory in the ponderosa pine and mixed conifer removing potential foraging habitat. Reducing understory densities will not preclude foraging, but will limit the abundance of foraging habitat, thus changing foraging behavior to focus on residual areas of denser habitat.

As a result of treatment, the black-backed and three-toed woodpeckers may see a decrease in habitat as their need for larger areas of beetle outbreaks or burned forest would be less likely within the project area in the short-term due to stand density reduction for the proposed treatments. The indirect effects of this alternative are healthier stands of larger trees. Because black-backed woodpeckers utilize trees with heart-rot for nesting and actively seek mountain pine beetle infested trees for foraging, the green tree density reduction planned would also reduce current and future nesting opportunities where thinning would occur.

The project area and habitat varies greatly from east to west due to the increase in elevation, the rain gradient associated with the change in elevation, and the site potential associated with the inherent soil quality within this east to west pattern. To capture the importance of habitat variation across the project area, the project area was broken up into four ecotones moving from east to west. A habitat retention strategy was defined where in the low elevation ponderosa pine ecotone (approximately 16,146 acres), approximately 10% of this zone would be left in un-treated stands and aggregate patches, in the mid-elevation ponderosa pine mixed conifer dry ecotone (approximately 3,966 acres) approximatley15% of this landscape would be left in untreated stand and aggregate patches, within the high elevation mixed

conifer wet stands (approximately 3,027 acres), approximately 20% of this landscape would left in untreated stands and aggregate patches, and lastly the lodgepole pine community (approximately 2,027 acres), where regeneration harvest occurs 15% of each harvest unit will remain untreated. These untreated areas were identified to retain habitat connectivity between thinned stands associated with project treatments. Untreated areas that remain will continue to contain insect out breaks and recruit snags and nesting habitat in the short-term to provide both nesting and foraging habitat for these species.

See DecAID Snag and Log Analysis for the projects effect to dead wood habitat and distribution.

Cumulative Effects

Approximately 6,500 acres have burned in the watersheds from 1979-1990, with 940 of these acres occurring in the project area. These events created pulses of higher snag and down wood densities than would normally occur with natural succession. However, these high density snag areas are short-lived with most snags falling down within 25 years.

Black-backed and three-toed woodpeckers are two species that are known for their exploitation of deadwood habitat. They use forest stands where beetle outbreaks are occurring, or where stand replacing fire has just occurred and insects subsequently move in. These insect pulses typically drive short-term population densities until the insect outbreak subsides in the first 5 years. Secondarily, with the high density of dead trees from fire and the increased decay rate due to beetles boring into the trees, the burned forests provide a good source of nesting habitat within the fires first 10 years before snags begin to fall.

Currently mountain pine beetles are infecting stands throughout the watershed and causing mortality throughout the West Bend planning area. This impact is occurring in lodgepole pine, mixed conifer, ponderosa pine and mixed lodgepole and ponderosa pine stands. Aerial detection surveys from 2001 through 2010 identified cumulatively 10,200 acres of bark beetle impacts. Field visits to the West Bend project area found 42% of the area dominated by ponderosa pine had bark beetle mortality and 73% of the lodgepole pine dominated stands. With the combination of dense stands and lodgepole pine, the susceptibility to mountain pine beetle attack and mortality continues. These two factors identify a large part of the planning area with risk to mortality from bark beetles. Where large old ponderosa pine occur in and adjacent to the project area some mortality due to increased densities and the susceptibility to western pine beetles has occurred recently. However, historical outbreaks have occurred in the watershed and past regeneration harvest were implemented in lodgepole pine stand to deal with these outbreaks. Many lodgepole pine stands exist in the watershed as young regenerating stands which do not currently provide habitat.

Within the watershed, ongoing and future vegetation management projects occur within suitable habitat contributing to cumulative effects. These treatments are planned to reduce stand densities in primarily second growth black-bark ponderosa pine stands. Although some mixed conifer will be thinned as well. Objective are to promote the development of large structure and reducing the risk of loss of existing habitat from other large-scale disturbances such as ongoing beetle outbreaks and followed by landscape scale fire. Overall, treatments proposed will reduce suitable habitat, but provide areas of untreated habitat except where they are associated with the urban interface. These ongoing projects will treat approximately 11,703 acres (see Table 92.

From the both stand replacing fire and insects out breaks, reproductive habitat is not limited in the short-term for the black-backed and three-toed woodpecker (See DecAID Analysis for snag levels).

Of the 7,067 acres of black-backed woodpecker reproductive habitat identified within the project area. Alternative 2 could affect approximately 6,058 acres of reproductive habitat, approximately 6,072 acres under Alternative 3, and 5,844 under Alternative 4.

Of the 20,273 acres of reproductive habitat within the Watershed, Alternative 2, 3, and 4 are could affect approximately 29% of the total habitat.

On Treatments identified within the West-bend project area will thin, mow, and/or burn approximately 1% of the total habitat across the Deschutes National Forest.

Of the 2,799 acres of three-toed woodpecker reproductive habitat identified within the project area, Alternative 2 could affect approximately 2,244 acres of reproductive habitat, approximately 2,245 acres under Alternative 3, and 2,205 acres under Alternative 4.

Of the 13,804 acres of reproductive habitat within the watershed, Alternative 2, 3, and 4 could affect approximately 16% of the total habitat.

Treatments identified within the West-Bend project area will thin, mow, and/or burn far less than 1% of the total habitat across the Deschutes National Forest.

Conclusion

Nature serves lists these species as secure globally, nationally, and state-wide.

The No Action Alternative could reduce habitat due to the ongoing loss of large structure and the conversion of stands to non-sustainable habitat due to the amount of mortality occurring in overstocked ponderosa pine, mixed conifer and lodgepole pine stand from mountain pine beetle outbreaks occurring across the district. In addition, across the forest uncharacteristically large landscape scale fires are occurring across the Forest, having the greatest impact on the longevity of long-term sustainable habitat.

Treatments will be beneficial to the both species by reducing the risk of stand replacing fire. Due to the fires that have occurred across the Forest, although they provide a large amount of foraging and nesting in the short-term, they weren't characteristic of the events that historically occurred and there will be large voids of habitat due to the amount of time it will take to develop full stocked overstory stands. By thinning and reducing fuel concentrations it will allow for small events to occur that provide habitat and maintain populations across the landscape rather than large expanses of short-term habitat. Large areas of the project in the higher elevation mixed conifer stands will be left untreated, where beetles will continue to work and provide a forage base as well as nesting habitat. In addition, within all plant association entire stands will be left untreated to maintain existing habitat. These areas will also continue to serve as foraging and nesting habitat. Overall due to the amount of mountain pine beetle associated with the lodgepole pine, mixed conifer and ponderosa pine community in the watershed and on the Forest level, reproductive habitat is not in shortage for these species.

Although treatments will thin stands that are currently suitable reproductive habitat, the West-Bend project will not contribute to a change in viability within the Watershed or on the Deschutes National Forest for the black-backed and three-toed woodpecker.

Implementation of the West-Bend project would be consistent with the Standards and Guidelines for the Deschutes and Ochoco National Forest Land Resource Management Plans.

Landbird Strategy

Biological objectives for black-backed woodpecker in in old growth lodgepole pine will be assessed.

Table 147: Landbird Strategy – Biological objectives for black-backed woodpecker

Species	Objective	Do Not Meet, Meets, Not Applicable	Rationale
Black-backed Woodpecker **Other species to benefit from objectives:** **Three-toed Woodpecker**	Where ecologically, initiate actions in lodgepole pine forest to maintain or provide: >1000 acres of lodgepole pine forest dominated by and managed for late successional conditions	Meets	Untreated areas associated with the LPP community will exceed the recommended level.

Subalpine Fir – Blue Grouse

Existing Condition

The blue grouse is the largest grouse in Oregon and a short distant migrant throughout coniferous forests. It uses a wide variety of habitats in the spring and summer including forests, forest edges, shrublands, openings, and riparian habitats with dense cover. Nesting for the blue grouse occurs on the ground and habitat is highly variable with most successful nests associated with downed logs. The blue grouse feeds on insects, berries, and seeds of a variety of forbs and shrubs. (Marshall et al. 2003 pp.181-183). Wisdom et al. (2000 Vol. 2, p. 248) notes source habitats include a mix of early seral habitats, especially sites with high shrub densities and mature forested habitats. Trends for summering habitat for the blue grouse were found to be neutral overall for the Columbia Basin while the Southern Cascades shows increases of $\geq$20% (Wisdom et al. 2000 Vol. 1, pp 44-46).

Wintering habitat differs for the blue grouse. Wisdom et al. (2000 Vol. 2, p. 177) states that source habitat for blue grouse wintering habitat includes old forest structure containing Douglas-fir, ponderosa pine, western larch, and mixed conifer. Marshall et al. (2003) also includes true fir and subalpine fir habitats as well. Pelgren (1996) found that blue grouse selected for open park-like stands of mature Douglas-fir and ponderosa pine rather than dense forests. Winter diets consist primarily of conifer needles, stems, and buds (Pelgren 1996). Trends for wintering habitat show an overall decline for the Columbia Basin. The Southern Cascades shows the same trends with greater than 20% but less than 60% decline in winter habitat (Wisdom et al. 2000 Vol. 1, pp 44-46).

Habitat for the blue grouse occurs throughout the higher elevations on the Deschutes National Forest in the following plant associations – lodgepole pine, Douglas-fir, white fir, subalpine fir, Shasta red fir, western hemlock, silver fir, mountain hemlock, and whitebark pine in open stands where the stand ranges from the grass/forb/shrub stage to poles (tree size ranges from 1" dbh to 10"dbh). Within the West-Bend project area and watersheds the majority of habitat exists at the higher elevations above approximately 4000 feet in elevation. The majority of use is associated with ridge tops and buttes containing dense stands of mixed conifer, subalpine fir, lodgepole pine, and mountain hemlock. Other high use areas are in similar dense stands, associated with man-made edges, or natural created edges from beetle out breaks or stand replacing fire.

Approximately 545 acres of blue grouse reproductive habitat exists within the project area. Approximately 3,592 acres of habitat occurs within the Watershed and approximately 97,692 acres of habitat occurs across the Deschutes National Forest. Table 148 summarizes these acreages:

Table 148: Blue grouse reproductive habitat within the West-Bend project area, Watershed, and across the Deschutes National Forest

Acres of Habitat in the West-Bend Project Area	Acres of Habitat in the Watershed	Acres of Habitat Across the Deschutes National Forest
545	3,592	97,692

Environmental Consequences

Alternative 1 – No Action

Areas that currently provide suitable mixed conifer habitat would most likely have increased mortality due to tree stress from competition. Without the treatments prescribed to thin from below within multi-storied mixed conifer stands, and treatments proposed reduce over story stand densities in areas of mid-seral mixed conifer with high levels of mortality, stand densities and associated insects and disease will reduce the longevity of residual overstory and multi-storied structure that occurs in these stands. In the long-term, available nest areas would diminish due to lack of overstory structure. Due to stand densities within the project area and increases in mortality overtime, the risk of large scale stand replacing fire across the West-Bend project area also increases over time, potentially impacting high density stand that provide the most suitable habitat for nesting.

Habitat in the high montane mixed conifer (mountain hemlock, subalpine fir, lodgepole pine) zone occurs primarily in the higher elevation on the furthest west end of the project area. High montane mixed conifer is very limited in the project area. These areas contain high mortality from mountain pine beetle in the lodgepole pine, which is creating a natural edge adjacent to hemlock and subalpine fir stands which the blue grouse prefer. These areas contain high fuel loadings in the lodgepole pine and in the long-term will likely see some level of fire through lightning activity.

Overall, high stand densities will result in a decrease in tree vigor among all habitats. The most significant effect of high stand densities will be the gradual loss of the overstory canopy component and the security it provides nesting habitat which is likely to be at a much higher rate than if stand densities were reduced to more healthy levels.

Effects Common to Alternative 2 (Proposed Action), Alternatives 3, and Alternative 4

Direct and Indirect Impacts

Mixed Conifer Thinning From Below (HTH), Mixed Lodgepole Overstory Removal (HOR), and

Table 149 summarizes the acres of treatments in the project area that will treat potential blue grouse habitat.

Table 149: Acres of potential blue grouse habitat with each treatment type by alternative

Treatment	Alternative 2	Alternative 3	Alternative 4
HOR	252	183	183
HTH	21	21	21
HCR	19	19	19
Total Acres Affected	292	223	223

Thinning from below in mixed conifer stands and overstory removal of mixed conifer and lodgepole pine stands will reduce both overstory and understory complexities within these stands and may reduce

some seclusion by reducing canopy closure effecting blue grouse nesting habitat. However, creating openings will enhance habitat in the short-term for these species by creating edge habitat with adjacent early seral vegetation enhancing foraging opportunities.

Follow up fuels treatment associated with thinning could potentially reduce nesting habitat in the short-term. These treatments will reduce shrubs and down logs that grouse use for nesting. However, recruitment of dead wood is expected as a result of treatment. Shrub regeneration is expected to occur within a 1 to 5 year period within these areas providing nesting opportunities.

The project area and habitat varies greatly from east to west due to the increase in elevation, the rain gradient associated with the change in elevation, and the site potential associated with the inherent soil quality within this east to west pattern. To capture the importance of habitat variation across the project area, the project area was broken up into four ecotones moving from east to west. A habitat retention strategy was defined where in the low elevation ponderosa pine ecotone (approximately 16,146 acres), approximately 10% of this zone would be left in un-treated stands and aggregate patches, in the mid-elevation ponderosa pine mixed conifer dry ecotone (approximately 3,966 acres) approximatley15% of this landscape would be left in untreated stand and aggregate patches, within the high elevation mixed conifer wet stands (approximately 3,027 acres), approximately 20% of this landscape would left in untreated stands and aggregate patches, and lastly the lodgepole pine community (approximately 2,027 acres), where regeneration harvest occurs, 15% of each harvest unit will remain untreated. These untreated areas were identified to retain habitat connectivity between thinned stands associated with project treatments. Therefore, project level retention will occur, maintaining habitat throughout the project area.

Overall, approximately 299 acres of blue grouse habitat are identified to receive treatments under Alternative 2, and 223 acres are associated with Alternative 3, and 4.

Cumulative Effects

This species is dependent on high elevation mixed conifer stand, as well as pure stands of mountain hemlock and sub-alpine fir associated with natural opening such as high alpine meadow or early seral condition. In lower elevation openings can be man-made, where early seral conditions and edge are associated with mechanical treatments. Typically blue grouse can be found on ridge tops or bench containing those characteristics.

Within the watershed (zone of influent)the majority of the habitat is associated with man-made treatments and at higher elevations the early seral condition are from either large stand replacing fires or mountain pine beetle outbreaks. No ongoing or reasonably foreseeable treatments are proposed in blue grouse habitat within the watershed. The largest and most recent impact to blue grouse habitat has been the mountain pine beetle outbreak that has greatly reduced canopy cover since 2001.

Of the 545 acres of blue grouse reproductive habitat identified within the project area, Alternative 2, is will treat approximately 295 acres of reproductive habitat and Alternative 3 and 4 will treat approximately 223 acres.

Of the 3,592 acres of reproductive habitat within the Watershed, cumulatively Alternatives 2, 3, and 4 are will treat approximately 8% of the total habitat.

The West-bend project will treat far less than 1% of the total habitat across the Deschutes National Forest.

Conclusion

The No Action Alternative could affect habitat due to the ongoing loss of large structure and the conversion of stands to non-sustainable habitat due to the amount of mountain pine beetle mortality associated with habitat across the district.

Treatments will be beneficial by reducing stand densities opening up stands and providing a new foraging opportunities from the creation of early seral grasses and forbs created by treatments. Habitat will be maintained within the project area and treatment of non-suitable habitat from the overall proposed vegetation management across the project area could produce a more connected landscape of blue grouse habitat at the higher elevation of the project area.

Although treatments will thin stands that are currently suitable reproductive habitat, the West-Bend project will not contribute to a change in viability on the Deschutes National Forest for the blue grouse.

Implementation of the West-Bend project would be consistent with the Standards and Guidelines for the Deschutes Land Resource Management Plans.

Landbird Strategy

Biological objectives for blue grouse habitat in sub-alpine fir stands will be assessed.

Table 150: Landbird Strategy – Biological objectives for blue grouse habitat

Species	Objective	Do Not Meet, Meets, Not Applicable	Rationale
Blue Grouse	Where ecologically appropriate, initiate actions in sub-alpine forest to maintain or provide: • Patches of multi-layered structure • Coniferous tree cover 15-55% • Shrub cover 10-40% and mean height of 16 inches • Herbaceous cover 35-80% and mean height of 6-22 inches	Meets	A minimum of 20% of the high elevation mixed conifer will remain in untreated stands.

Aspen – Red-naped Sapsucker

Existing Condition

The red-naped sapsucker is a summer resident typically found in forested habitats, especially riparian areas with aspen and cottonwood. It can be found in ponderosa pine stands as well and occurs less frequently in mixed conifer forests. Most nests are found in large diameter aspen trees with a mean diameter of approximately 10". It also breeds in cottonwood trees and prefers more moderately decayed trees for nesting. It drills holes resulting in sap wells, which provides food for other birds, insects, and mammals. Diet includes sap, cambium, soft parts beneath bark, insects found under bark, and berries. (Marshall et al. 2003 pp. 356-358).

Threats known to this species include long-term degradation of aspen and other riparian forest habitats from fire suppression and the lack of hardwood regeneration (Marshall et al. 2003 p. 358). In the past 100 to 150 years, there has been a dramatic decline in aspen forests due to a change in fire intervals (Bartos and Shepperd 1999). The lack of fire has allowed late successional species (e.g. conifer species) to move into aspen stands and out-compete the aspen. Bartos and Shepperd (1999) stated that most aspen will eventually be replaced by other communities like conifers, sagebrush, and other tall shrubs without some type of disturbance. Most known aspen stands on the Bend/Ft. Rock Ranger District have experienced conifer encroachment and are in need of treatment.

There is one aspen stand that is approximately 20 acres in size in the project area. As result of the last 100 hundred years of fire suppression, both lodgepole pine and Engelmann spruce have encroached on this aspen stand. The stand is relatively healthy, but some expansion and maintaining the health of the aspen is desired.

Environmental Consequences

Alternative 1 – No Action

The no action alternative will continue to allow the advancement of conifer species into aspen stands and eventually replace the aspen with conifer communities without some type of disturbance.

Effects Common to Alternative 2 (Proposed Action), Alternatives 3, and Alternative 4

Direct and Indirect Impacts

There will be no known direct effects to red-naped sapsuckers. Under all Action Alternatives conifers within the approximately 20 acres of aspen will be cut and felled. Conifers felled will be cut and felled, hinging the tree at height of approximately 3 feet to remain attached to the stump. Tree left in place will provide armoring of new aspen succors against ungulate browse. By felling conifers, it will remove competition allowing aspen to regenerate creating opening for them to grow.

Aspen restoration is a small-scale treatment within the project area but will result in increased habitat diversity. Aspen restoration will result in small openings in the short-term. However openings will stimulate growth of herbaceous plants and induce suckering of aspen. Treatments will benefit aspen stands in the long-term and create suitable habitat for the red-naped sapsucker. No aspen will be removed under these alternatives, and opening will be created from conifer felling.

Cumulative Impacts

Red naped sapsucker habitat is tied to aspen habitat which is limited within the watershed (zone of influence). Approximately 30 acres of aspen is associated with the watershed and has been identified with the Deschutes River Aspen project. Treatments are similar to those identified within the West-Bend project. Although the project has not been implemented the Deschutes River Aspen project will also remove conifer encroachment within this aspen stands. Treatments will reduce competition between conifers and aspen and stimulate regeneration, but will not remove any aspen. This project will also enhance future nesting and foraging habitat for the red-naped sapsucker.

Conclusion

The No Action Alternative could affect habitat due to continued conifer encroachment completely out competing the remaining aspen for resources. Without treatment, aspen would succumb to the conifer and the remaining habitat would be gone, completely removing red-naped sapsucker habitat in this area.

Under all Action Alternatives, treatments will be beneficial to red-naped sapsucker by removing encroaching conifers, allowing aspen to succor and creating a contiguous aspen.

Due to the poor quality of red-naped sapsucker habitat, and the fact that the project will not remove any aspen with the proposed treatments, the West-Bend project will not contribute to a change in viability on the Deschutes National Forest for red-naped sapsucker habitat in the short-term. In the long-term it is expected that treatment will increase viability of the red-naped sapsucker by promoting the recruitment of aspen within this stand.

Implementation of the West-Bend project would be consistent with the Standards and Guidelines for the Deschutes Land Resource Management Plans.

Snags, Down Wood, and Green Tree Replacements (See Appendix F for the complete analysis)

Dead wood (standing or down) plays an important role in overall ecosystem health, soil productivity and habitat for numerous wildlife species which depend on snags and logs for all or parts of their life cycle (Laudenslayer 2002). In forested environments, approximately 93 wildlife species are associated with snags including 4 amphibians, 63 birds, and 26 mammal species (Rose et al. 2001). Uses of snags

include nesting, roosting, preening, foraging, perching, courtship, drumming, and hibernating. Snags come in all sizes and go through decay processes that change them from standing hard to soft wood, then on the ground to continue decaying into soil nutrients. Not every stage of a snag's decay process is utilized by the same species, but rather a whole array at various stages or conditions.

Snags are the main contributors to down wood which provide organic and inorganic nutrients in soil development, microhabitats for invertebrates, plants, amphibians, and other small vertebrates, and structure for riparian associated species in streams and ponds. Size, distribution, and orientation may be more important than tonnage or volume. Small logs provide escape cover or shelter for small species. However, in general, larger sized logs are used by more species than smaller logs (Bull et al. 1997). Logs that lie along a contour are used more than those lying across contours. Use by species differs in relation to size, decay class, and purpose of use, as well as many other factors.

Too much down material may impede travel by big game and present a fire hazard. However, increased levels also provide cover for small invertebrates and may protect seedlings from browse and scorching. Optimum levels of down woody material for providing acceptable risks of fire hazard and fire severity while providing desirable amounts for soil productivity, soil protection, and wildlife needs were calculated for warm dry forest types and cool subalpine forest types in Western Montana by Brown et al. (2003). For wildlife, these optimum levels include both standing and downed coarse woody debris. Levels representing the high end for pre-settlement conditions were found as follows: 5 to 10 tons per acre for warm, dry ponderosa pine and Douglas-fir types, 10 to 20 tons per acre for cool Douglas-fir types, and 8-24 tons per acre for cool lodgepole pine and lower subalpine fir types (Brown et al. 2003).

Down wood abundance on the Deschutes National Forest is highly variable due to a limited availability of water and nutrients. This, combined with overcrowded stand conditions due to previous fire suppression, has led to tree mortality above historical levels, especially within smaller size classes (Table 151). In particular, plant association groups (PAGs) that tend to be drier (i.e., ponderosa pine and mixed conifer dry) may recruit a higher level of down wood today than under historical conditions. Previous fire suppression in the project area has decreased the consumption rate of down wood while other human practices such as firewood gathering has removed down wood.

The PAGs that occur within the West Bend project area are ponderosa pine, mixed conifer, and lodgepole pine. Wildlife species highly associated with these PAGs include the following LRMP Management Indicator Species (MIS): American marten, white-headed woodpecker, Lewis' woodpecker, black-backed woodpecker, three-toed woodpecker, pileated woodpecker, Williamson's sapsucker, and northern flicker. In addition, the mountain bluebird, flammulated owl, and pygmy nuthatch are included in this analysis because they are focal landbird species (Altman 2000) and/or Birds of Conservation Concern (BCC, USDI FWS 2008).

Table 151: Species with snags and/or down wood as a primary habitat feature

Species	LRMP Status*	Behavior	Habitat	Habitat Feature/ Conservation Focus
American marten	MIS	Secondary cavity denning and resting	Ponderosa Pine	Snags and down wood
White-headed woodpecker	MIS, BCC	Primary Cavity Excavator	Ponderosa Pine	Large trees
Lewis' Woodpecker	MIS, Focal Landbird, BCC	Primary Cavity Excavator	Ponderosa Pine	Patches of burned old forest
Black-backed woodpecker	MIS, Focal Landbird	Primary Cavity Excavator	Lodgepole Pine	Old growth

Three-toed woodpecker	MIS	Primary Cavity Excavator	High Elevation Lodgepole Pine	Snags and Burned areas
Pileated woodpecker	MIS	Primary Cavity Excavator	Mixed Conifer	Large snags/down wood
Williamson's sapsucker	MIS	Primary Cavity Excavator	Mixed Conifer	Large snags
Northern Flicker	MIS	Primary Cavity Excavator	Mixed, Mosaic	Snags and Down Wood
Mountain bluebird	BCC	Secondary Cavity nester	Mixed, Mosaic	Burned Areas
Flammulated Owl	Focal Landbird, BCC	Secondary Cavity Nester	Old Growth Ponderosa Pine	Large snags
Pygmy nuthatch	Focal Landbird	Primary Cavity Excavator	Ponderosa Pine	Large trees

Standards and guidelines in the Deschutes NF LRMP which apply to species associated with snags and down wood include WL-37 and WL-38:

WL-37: In coniferous forest, sufficient snags will be maintained to provide 40 percent of potential population levels of cavity nesting species within even-aged harvest units of the General Forest, visual areas (retention, partial retention, and middle ground), and Deer Management Area allocations. In uneven-aged harvest units, within the management areas noted above, live replacement trees will be left during any harvest to assure 60 percent of cavity nesting potential through the rotation, except where natural deficits occur in diameter classes. In both even and uneven-aged management, groupings of green replacements will be the preferred implementation technique. Compliance will be based on the harvest unit area rather than an individual acre evaluation. In all other management areas, at least 60 percent of cavity nesting species potential population needs will be provided.

WL-38: Specific guidance will be provided by the Deschutes National Forest Wildlife Tree Implementation Plan.

Eastside Screens

The Decision Notice for the Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales (known as the *Eastside Screens*) addresses the need for project design to include the principles of landscape ecology and conservation biology (USDA FS 1994a and 1995). Screen 3, the Wildlife Screen, represents direction and parameters based on general scientific principles and concepts. The purpose of the Wildlife Screen is to maintain options in the short-term for the conservation of wildlife species associated with late and old structural stages in eastern Oregon and Washington. This direction generally equates to approximately 2.25 snags per acre for the ponderosa pine and mixed conifer and 1.80 snags per acre in lodgepole pine. Specifically the direction for snags and down woody material are: 1) maintaining snags and green tree replacements (GTRs) of ≥15" dbh at 100% maximum potential population (MPP) for all vegetation types except lodgepole pine; 2) for lodgepole pine, maintain snags and green tree replacements of >10"dbh at 100% MPP; and 3) down logs ranging between 3 and 20 pieces per acre depending upon vegetative series (Table 152). The down log criteria are not intended to preclude the use of prescribed fire as an activity fuels modification treatment. Fire prescription parameters will ensure that consumption will not exceed 3 inches total (1/1/2 inches per side) of diameter reduction in the featured large log sizes below.

Table 152: LRMP Down Wood Requirements

Sale Activities				
Tree Species	**Pieces per acre**	**Diameter Small End**	**Piece Length**	**Total Lineal Length**
Ponderosa pine	3-6	12 inches	>6 feet	20-40 feet
Mixed conifer	15-20	12 inches	>6 feet	100-140 feet
Lodgepole pine	15-20	8 inches	>8 feet	120-160 feet
Prescribed Fire Parameter				
Consumption will not exceed 3 inches total (1/1/2 inches per side) of diameter reduction in the featured large log sizes above.				

The estimated number of trees per acre (tpa) required to meet best available science for Green Tree Replacements (GTRs) is as follows.

Table 153: Estimated number of trees per acre required to meet best available science for Green Tree Replacements

	Habitat Type		
	Ponderosa Pine	**Mixed Conifer**	**Lodgepole Pine**
100% MPP based on best available science	4 snags/acre	4 snags/acre	6 snags/acre
GTRs @ 13-19" residual stand*	8 tpa	8 tpa	6 tpa

*This concurs with the 10-19" average dbh for the small/medium structure stage defined in DecAID.

Wildlife Tree and Log Implementation Strategy

The Deschutes National Forest Wildlife Tree and Log Implementation Strategy (WLTL) provides guidance and options for meeting the snag, green tree replacement (GTR), and down log objectives across the forest, regardless of management direction (USFS 1994b). This strategy focuses on the treatment unit as the area of accountability for meeting WLTL objectives. It states that "Snags, GTRs, and down logs will not be provided on every acre in the forested ecosystem. A mosaic distribution of WLTL resources across the landscape maintaining viable populations and ecological functions is the desired condition." Current literature and research at the time, as well as incorporating the NWFP and Eastside Screen requirements were used to develop the number of hard snags (recently dead standing snag) needed by each species to support various percentages of their population. These were developed for each vegetative series and for areas west and east of the Northwest Forest Plan line.

Biological Potential

Habitat requirements, including snag and down woody material levels, were described in the LRMP and amended Eastside Screens for a variety of wildlife species using information known at the time in Thomas (1979) and Brown (1985). However, more recent empirical studies indicate that snag numbers and sizes selected by some wildlife species are far higher than those calculated by the maximum potential population technique (Bull et al. 1997, Rose et al. 2001).

This suggests that the LRMP direction of managing for 100 percent population levels (WL-37 S&G) of primary excavators may not represent the most current knowledge of managing for cavity nesters and that these snag levels, under certain conditions, may not be adequate for some species, particularly for

secondary cavity nesters. In addition, the current direction provides recommendations for green stands only when studies show that cavity-nesting birds require higher snag densities in post-fire conditions versus green stands for nesting and productivity (Bull et al. 1997, Rose et al. 2001). This is likely because cavity-nesting birds require more snags for foraging, cover, and protection from predators in post-fire environments.

Northwest Forest Plan (NWFP)

The NWFP provides S&Gs for snags and logs by land allocation (USDI and USDA 1994). There is no management within congressionally reserved lands; therefore, there are no S&Gs for snags and down wood. Harvest is limited in riparian reserves and late-successional reserves (LSRs) and treatments must meet the attainment of the Aquatic Conservation Strategy Objectives and follow guidance in LSR Assessments. Standards and guidelines for the matrix allocation also apply to the Administratively Withdrawn allocation.

Matrix S&Gs include the retention of green tree replacements and snags both in patches and singly. For treatments such as clear-cuts with reserves and shelterwood harvests, 15% of the area associated with each cutting unit is to be retained. However, this S&G does not apply to intermediate harvests (i.e. thinning). At a minimum, snags are to be retained in the harvest units at levels sufficient to support species of cavity nesting birds at 40% potential population levels.

DecAID advisory tool

The DecAID Advisor (Mellen-McLean et al. 2009) is used as the best available science for the West Bend snag analysis. DecAID is a web-based advisory tool that helps managers evaluate effects of forest conditions and existing or proposed management activities on organisms that use snags and down wood. It is a summary, synthesis, and integration of published scientific literature, research data, wildlife databases, forest inventory databases, and expert judgment and experience. DecAID is used to estimate sizes and densities of dead wood that provide habitat for many species and ecological processes. It presents information on the range of "natural conditions" (as represented by unharvested plots within the plots sampled), "current conditions" (all plots sampled, including both unharvested and harvested plots), and wildlife use.

Historical Range of Variability

The terms Historical Range of Variability (HRV), Natural Conditions, and Historical Conditions in DecAID are sometimes used interchangeably to indicate conditions which occurred on the landscape prior to the influence of humans (particularly Europeans). Because it is difficult to determine the actual snag and down wood levels prior to the influence of humans, the term Reference Condition is used in DecAID when referring to the use of vegetation inventory data from DecAID based on data from unharvested plots. When using the "natural condition" of snag and down wood distribution represented by the summary of forest inventory data from unharvested inventory data in DecAID, caution should be used due to years of fire exclusion. The vegetation data can help determine the "natural range of variability" for dead wood, which can be used as a proxy for HRV. It is assumed that adequate habitat will be provided because species which survived those levels of habitat in the past are present today. The more that current conditions deviate from HRV, the less likely it is that adequate habitat occurs on the landscape to sustain those species. Although existing snag and down wood levels and composition in DecAID may not accurately reflect pre-European "natural" or historical conditions, they are still within reason when comparing them to other recent research.

Comparison of DecAID with other research

Harrod et al. (1998) estimated snag densities in ponderosa pine dominated dry forests for snag densities (> 6" dbh) at 6 to 14 snags per acre (4.5-7.0 tons per acre) in pre-European settlement landscapes. These estimates were derived by calculating the basal area of snags from pre-1930 growth rates, holding

forest stand structure relatively constant (i.e., as a new live tree is recruited another one becomes a mortality) and applying published snag fall rates (Bull et al. 1980, Keen 1929, Raphael and Morrison 1987, and Schmid et al. 1985). It was assumed that historical frequent, low intensity fires did not accelerate snag fall rates.

Agee (2002) estimated lower snag densities (2 snags per acre) than Harrod et al. (1998) for the ponderosa pine/Douglas-fir forest series by estimating the number of trees in 0.25 acre clumps of 16 age classes and assuming that the oldest patch was killed by insects every 25 years. He assumed fire helped to decompose snag patches and after 5 fires at 10 year intervals, snags would be completely consumed. Agee (2002) compared his estimates to Harrod et al. (1998) but assumed an average snag diameter of 30" dbh when calculating biomass, whereas Harrod et al. (1998) estimated densities for size classes as small as 6" dbh. Results from regional studies in Eastern Washington and Oregon (across all land ownerships) by Ohmann and Waddell (2002) suggest there are currently 2.025 total snags per acre greater than 10"dbh, of which 0.405 snags are greater than 20"dbh.

Snag densities reported by Harrod et al. (1998), Agee (2002), and Ohmann and Waddell (2002) are within the range (50% tolerance level) of those reported in DecAID (Mellen-McLean et al. 2009) for Ponderosa pine/Douglas-fir and Eastside Mixed Conifer habitat types for small and medium trees.

How DecAID was Reviewed for the West Bend Project

Analysis areas should be sufficiently large to encompass the range of variation in wildlife habitat types and structural conditions that occur in the area (Mellen-McLean et al. 2009). In general, at least 20 square miles (12,800 acres) in each habitat type is suggested as a minimum size for an analysis. The North Unit Diversion Dam-Deschutes River and Tumalo Creek watersheds (HUC 10) were used for an appropriate comparison to the vegetation inventory data in DecAID for the West Bend project area.

The PAGs in the West Bend project area were compared to habitat types in DecAID. The DecAID habitat types are: (1) ponderosa pine/Douglas-fir (PP/DF) which best represents the ponderosa pine dry (PPD) and ponderosa pine wet (PPW) PAGs; (2) eastside mixed conifer (EMC) which best represents the mixed conifer wet (MCW) and MCD mixed conifer dry (MCD) PAGs; and (3) lodgepole pine (LP) (Table 154).

To review the entire DecAID analyses completed for the project and snag and log levels by alternative and by each species. See Appendix F.

Table 154: Plant Association Groups, corresponding Habitat Types in DecAID, and acres in the West Bend project area

Plant Association Group in West Bend Project Area	DecAID Habitat Type	Number of Acres in the West Bend project area
Ponderosa pine (wet and dry)	Ponderosa Pine/Douglas Fir	19,808
Mixed conifer (wet and dry)	Eastside Mixed Conifer	4,088
Lodgepole Pine (wet and dry)	Lodgepole Pine	1,391

An HRV analysis of existing snag density and down wood across the Deschutes National Forest and at the 5th field watershed (HUC 10) level used information from DecAID and the Ochoco and Deschutes Viable Ecosystems Management Guide (*Viable*, USDA FS 1994c). The Viable model was developed to classify vegetation on a landscape basis and compares existing vegetation with site potential. Viable stratifies the environment along a gradient of size, structure, species composition, and relative tree density. The various classifications are then linked to wildlife habitat requirements. The 2004 Deschutes National Forest satellite imagery layer was used to develop the Viable map. Data is mapped on a 25 meter pixel grid and assigned a value relating to size, structure, tree species, and tree density for

the animal species. The resulting layer was then updated by removing stand replacement and mixed mortality fires and forest management activities within the last five years.

The percentage of the landscape in each snag category was then weighted to match the HRV ranges from the Viable analysis. The snags per acre categories were summarized to get a historical range of snag densities that would be expected to occur in the West Bend analysis area.

Wildlife Data Tolerance Level

In DecAID, a tolerance level as it relates to wildlife data is defined as follows: "Tolerance Levels are estimates of the percent of all individuals in the population that are within some specified range of values" (Mellen-McLean et al. 2009). DecAID is not a viability model and tolerance levels should not be interpreted as population viability "thresholds." DecAID tolerance levels may be interpreted as three levels of "assurance": low (30% tolerance level), moderate (50% tolerance level), and high (80% tolerance level)" (Mellen-McLean et al. 2009). The higher the tolerance level, the higher the "assurance" that snag habitat is being provided. For example, using data from the wildlife species curves for white-headed woodpeckers in small and medium sized trees in the ponderosa pine/ Douglas-fir habitat type, the snag density (≥10"dbh) for white-headed woodpeckers is as follows:

Table 155: Wildlife Data Tolerance Level

Tolerance Level	Snags per acre	Explanation
30% tolerance level	0.3 snags/acre	Areas with < 0.3 snags/acre would be expected to be used for nesting by only 30% of the individuals within the population of white headed woodpeckers, and conversely 70% of the population would be expected to nest in areas with > 0.3 snags/acre.
50% tolerance level	1.7 snags/acre	Half the individuals within the population would be expected to nest in areas with <1.7 snags/acre and the other half would be expected to nest in areas with >1.7 snags/acre.
80% tolerance level	3.7 snags/acre	80% of the individuals within the population of white headed woodpeckers would be expected to nest in areas with <3.7 snags/acre and conversely 20% of the population would be expected to nest in areas with >3.7 snags/acre.

Direct and Indirect Impacts to Snags, Down Wood, and Green Tree Replacements

Alternative 1 (No Action)

There are no known direct impacts to snags, down wood, or green tree replacements (GTRs) under Alternative 1 (No Action). Currently there are a limited number of large snags on the landscape. Current fuel continuity due to increased fuel loadings from 100 years of fire suppression has put the landscape at risk of large fires. These large stand replacement events create snags; however, this pulse of snags is short lived (less than 25 years) and there is a long lag until snags are available on the landscape. In addition there are limited large trees to provide future large snag habitat. Competition will continue to increase in these overstocked stands and smaller snags are expected to increase across the landscape over time.

Snags are expected to increase over time as insects and disease in overly dense stands continue to cause additional tree mortality at natural levels consistent with increasing levels of inter-tree competition. Down wood levels would be expected to increase as snags continue to fall in the future in the absence of fire. Although a steady recruitment of new snags and logs are expected, they would generally be less than 20" dbh size classes, the preferred size class by many species of wildlife. Green tree replacements would also remain at existing levels across the landscape and all trees would continue to be available for use as green tree replacements.

Wildfires may create additional snags and logs beneficial to some woodpecker species. However, there is also risk of a high-intensity stand replacement fire which may reduce current habitat conditions for a larger number of species. In addition, these pulses of post-fire habitat are usually short-lived. Approximately 40% of the planning area has either a high or extreme fire hazard rating under 97th percentile weather and fuel conditions (Wall 2012 pers. comm.). Extreme fire hazard equates to high flame lengths and varying degrees of crown fire. Given assumptions made from best available science, extreme and even moderate and high fire hazard would be damaging to valued stand characteristics.

Small diameter down wood will continue to be created as competition for nutrients and water makes trees more susceptible to insects and disease. There are also limited large trees ≥ 21" dbh available for future large down wood recruitment. Increased stand densities perpetuates the problem of losing large structure over time, which these species require large trees for suitable nesting and foraging habitat. In dense stands increased competition for nutrients will require a longer period of time for the smaller trees to become large trees and utilized by these species. It also allows for fewer available nest sites, which could result in more competition for existing sites between species and lead to greater predation risks. Increased stand densities may increase the risk of loss from fire. These species require snags for nesting and utilize softer snags (moderate decay). These structures would be consumed more rapidly with increased fire intensities and may lead to large areas of the landscape being unsuitable if such an event were to occur.

Effects Common to Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

Large snags are not proposed for removal as part of the treatments under any of the action alternatives. Minor incidental loss of snags may occur during treatments due to OSHA requirements for removal of danger trees during operations; however these are incidental and would occur randomly throughout the project area, not affecting snag patches. Snags ≥ 10 inches dbh that are determined to be safety hazards will be felled and left as down wood. Alternatives 3 and 4 will cut dead and down lodgepole pine in the HCR and HSV treatments.

Under Alternatives 2, 3, and 4, green trees ≥21" dbh (future large snags) will not be removed east of the owl line. Under Alternatives 3 and 4, west of the owl line, white fir over 24" dbh line will be retained. The number and size of GTRs would also be decreased from proposed silvicultural prescriptions but levels retained in all treatments will provide adequate numbers of green tree replacements to provide future snags and down logs. Prescribed burning may affect GTRs by killing some residual trees, or parts of trees, in the unit.

All three alternatives propose understory treatments including non-commercial thinning, whip falling, and/or ladder fuel reduction units across all habitat types (ponderosa pine, mixed conifer, and lodgepole pine). These activities would not have impacts to snags, logs, and GTRs in the short-term, but may have some beneficial impacts to these habitat components in the long-term by creating stand conditions that would accelerate and develop larger tree structure and future snags and logs, than if these small trees were not thinned.

In areas identified for thinning, canopies will be opened up and stand densities reduced to lessen the risk of a large-scale event (insects, disease, or fire). Thinning will directly reduce canopy cover, but it will also reduce the fire risk to individual stands by breaking up the fuel continuity across the landscape reducing the risk of larger scale disturbance events. Retention of untreated clumps will occur in the mid-elevation mixed conifer amounting to about 5-10% of treated stands. These denser patches will have higher stocking rate and will provide some diversity of canopy cover across the landscape. Thinning is expected to reduce down wood recruitment in the short-term; however in the long-term it is anticipated that there will be more large trees that can be recruited into down wood.

In addition, removal of understory in overstocked stands will decrease the competition for nutrients and water, which is anticipated to lower the susceptibility of the trees to insects and disease (Cochran and

Barret 1999). Currently there are a limited number of large snags and trees available as well as replacement large trees. Many of the future large trees and snags are within overstocked stands, which will increase the amount of time the trees will take to get to the desired size and height. Thinning overstocked stands will reduce competition which should increase growth rates to the remaining trees. Sufficient recruitment of future large down wood from currently smaller green trees is of concern. Many are in overstocked stands which will increase the time it takes the trees to reach larger size and height. Cochran and Barret (1999) showed that 30 years after thinning on the Deschutes National Forest there were large differences in average tree sizes among different group stocking levels. They also showed that the growth rates of the 20 largest diameter trees per acre were reduced by competition from smaller trees.

Fuels treatments in the project area will break up the fuel continuity and reduce the risk of a landscape scale fire event, which should reduce the risk to individual large snags and trees. Effects to snags from prescribed underburning is similar for all three alternatives with slightly fewer acres proposed for underburning under Alternative 4 (17,162 acres) than for Alternative 2 (17,402 acres) or Alternative 3 (17,391 acres). Mortality of trees in ponderosa pine habitat during prescribed fire treatments in Arizona and California ranged from 20% (Randall-Parker and Miller 2002), 45% (Horton and Mannan 1988), and 56% (Bagne et al. 2008). All three studies found that larger diameter ponderosa pine trees were least likely to die, at least in the short-term. Horton and Mannan (1988) found a 20-fold increase in abundance of snags < 15 cm dbh and showed evidence of woodpecker foraging use in southeastern Arizona. Several studies showed that the highest snag losses were in areas where a long period of fire exclusion had occurred (Bagne et al. 1988, Holden et al. 2006). Bagne et al. (2008) and Horton and Mannan (1988) found that re-entry burns had a much lower mortality rate for trees, presumably because the trees that did not burn during the first entry were more resilient. Loss of snags from prescribed fire was partially mitigated by the creation of new snags (Horton and Mannan 1988, Bagne et al. 2008).

Fuels treatments will reduce the understory complexity, which could lower small mammal densities. A reduction in small mammal populations could minimize predation pressures on white-headed woodpeckers, thereby benefitting this species.

Within the areas that have prescribed fire identified, there is also potential of changing large snags into down wood. Burning prescriptions and pre-ignition fuels reduction should reduce the chance of losing large snags. However, it is assumed that some large snags would be consumed during prescribed fire operations.

Down wood that is on the ground is at risk of being consumed by the proposed prescribed fire treatments. Randall-Parker and Miller (2002) found that 50% of the down logs were consumed in the Arizona prescribed fires. Horton and Manann (1988) found that the number and volume of ponderosa pine logs decreased by 42% and 56% respectively after prescribed fire (both fall and spring burns). Preferred avian foraging sites before burning (logs with sapwood) were proportionately less numerous after the prescribed fire (Hortona and Manann 1988).

As outlined in the Eastside Screens, the West Bend project will maintain 20 to 40 lineal feet of down wood in ponderosa pine and 100-140 lineal feet of down wood in mixed conifer per acre with no more than 3 inches of total consumption after fuels treatments including underburning. In areas that do not have prescribed fire as part of the treatments, all current down wood will remain.

By reducing both activity fuels and overall fuel loadings, underburning and mastication treatments for all three alternatives is anticipated to increase stand resiliency to wildfire and reduce competition with established trees in the long-term.

In untreated habitat there will continue to be an increased risk from disturbance, although breaking up the fuel continuity across the landscape will reduce the risk of a larger scale disturbance events. In addition, some of the areas identified for no treatment occur within higher site potential areas (i.e.

riparian habitat conservation areas), which allows them to produce large trees with greater canopy closure. These areas have the potential to provide habitat.

Overall, Alternative 4 would have the least impacts to snags, down wood, and GTRs due to fewer acres treated from overstory removal, understory treatments, mowing, prescribed burning, and biomass removal, thus more acres of habitat left in the no treatment and leave areas.

Cumulative Impacts — Snags and Down Wood — Alternatives 2, 3, and 4

The cumulative impact analysis area includes the North Unit Diversion Dam-Deschutes River and the Tumalo Creek Watersheds. Timber harvest, wildfire and fuels management, road maintenance, danger tree removal, and firewood cutting have contributed to the distribution and density of snags and down wood across the West Bend analysis area. Private lands are not managed for the above mentioned species. Therefore, it is assumed that any habitat provided by these parcels is incidental and may not be long-term.

Vegetation Management

Extensive harvest activities, primarily clearcutting, occurred in the project area during the 1920s and 1930s. Thinning and other harvest activities in the 1970-1990s these activities removed most or all overstory trees and likely retained minimal snag and down wood habitat.

Sales planned west of the spotted owl line after 1994 utilized the Northwest Forest Plan standards and guidelines and followed Late-Successional Reserve Assessment guidelines by plant association group. These guidelines ranged from 4 to 13 snags per acre depending on the plant association group, and 120 linear feet of down wood at least 16 inches in diameter and 16 feet long. Sales planned after 1995 east of the owl line utilized the Eastside Screens, which calls for 2.25 snags ≥ 20 inches dbh per acre and 20 to 40 lineal feet per acre in ponderosa pine and 100-140 lineal feet per acre in mixed conifer. It is assumed that harvest units occurring within this time frame retained 1 to 4 snags per acre. Both the NWFP standards and guidelines and the Eastside Screens are applicable to the West Bend project area.

Shelterwood harvest prescriptions (1975 to present) retained 8 to 20 live overstory trees providing for some future large snag and log habitat as the younger stand develops into a mature stand, but would have eliminated the understory and mid-story cover and feeding substrate.

Ongoing vegetation management projects in the watersheds (West Tumbull HFRA, Sparky timber sale and hazard tree removal, Fry timber sale, East Tumbull HFRA, Katalo East and West Projects) focus on reducing understory vegetation to reduce risk of loss from wildfire. However, smaller sized down woody material may be consumed depending on treatments proposed. Overall, these impacts are expected to be minor and future recruitment of down wood will be available in the remaining stand.

Future vegetation management projects include the Rocket Vegetation Management project in the North Unit Diversion Dam-Deschutes River watershed.

A mountain pine beetle outbreak occurred in the analysis area starting in the late 1980s and continued into the early 1990s. Tree mortality occurred throughout. This event produced a huge pulse of dead wood habitat at a large landscape level.

Fire and Fuels Reduction

Approximately 6,500 acres have burned in the watersheds from 1979-1990, with 940 of these acres occurring in the project area. These events created pulses of higher snag and down wood densities than would normally occur with natural succession. However, these high density snag areas are short-lived with most snags falling down within 25 years.

Fuels reduction projects include mowing, burning, and thinning stands from below. Burning varies but may include underburning, jackpot burning of concentrations, pile burning, or some combination of these activities. A reduction in down woody material is usually associated with these activities with

some incidental snag loss. Material impacted primarily includes smaller size classes (<15" dbh) and those in more advanced decayed stages (Decay Classes 3-5). These treatments, however, may reduce the risk of loss to existing large snags and logs by reducing ground and ladder fuels.

Insects and Disease

Mountain pine beetle affects lodgepole pine and ponderosa pine. Western pine beetle impacts mostly large old ponderosa pine and the fir engraver impacts the true firs including white fir and subalpine fir. The stands in the West Bend project area, for bark beetle susceptibility, are separated into three main species groups, lodgepole pine, mixed conifer wet and ponderosa pine dominated stands.

Lodgepole pine are resistant to mountain pine beetle attacks when the trees are less than eight or nine inches in diameter. The lodgepole pine stands in the West Bend project area which had trees larger than nine inches diameter have been heavily attacked by a mountain pine beetle outbreak for the last 10 years. This attack is decreasing but still killing susceptible trees.

Mixed conifer wet stands are highly variable within and between stands. White fir, lodgepole pine and ponderosa pine trees can be found in different stocking levels. In these stands high densities and lodgepole pine are the main reason for bark beetle mortality.

Ponderosa pine stands are susceptible where stocking levels are high or lodgepole pine greater than 9 inches in diameter is in proximity. The proximity of lodgepole pine allows emerging bark beetles to attack ponderosa pine even though they are a less desired host. Unlike in lodgepole pine the bark beetle does not cause more contagion of impacts. Mortality of ponderosa pine and lodgepole pine typically is throughout the diameter ranges in the stand and may even be emphasized in the larger tree size groups. White fir in these stands have so far escaped the effects of fir engraver. High densities leave white fir susceptible to outbreaks of fir engraver especially if a drought cycle occurs.

Ponderosa pine stands found in the ponderosa pine and mixed conifer dry plant association groups dominate more than three quarters of the West Bend project area. These stands are blackbark stands and most were established in the 1920s and 30s and some as late as the 1960s. Many stands are pure ponderosa pine but stands with higher productivity may have lodgepole pine or some white fir tree stocking. Unmanaged stands tend to be dense with poles and larger blackbark trees and typically have heavy fuels from beetle mortality. The fuels are mostly down dead lodgepole pine from previous beetle infestations; however ponderosa pine and white fir mortality is becoming more common due to tree stress caused by heavy stocking levels. Managed stands of ponderosa pine have been precommercially or commercially thinned and are now 60–130 square feet of basal area. These stands have responded to lower stocking levels with increased growth, crown volume and understory tree and brush establishment. However, many of these stands still contain lodgepole pine and are above the UMZ.

Currently mountain pine beetles are infecting stands and causing mortality throughout the West Bend planning area. This impact is occurring in lodgepole pine, mixed conifer, ponderosa pine and mixed lodgepole and ponderosa pine stands. Aerial detection surveys from 2001 through 2010 identified cumulatively 10,200 acres of bark beetle impact. Field visits to the West Bend project area identified 42% of the area dominated by ponderosa pine had bark beetle mortality and 73% of the lodgepole pine dominated stands. With the combination of dense stands and lodgepole pine, the susceptibility to mountain pine beetle attack and mortality continues. These two factors identify a large part of the planning area with risk to mortality from bark beetles. Where large old ponderosa pine occur in and adjacent to the project area some mortality due to increased densities and the susceptibility to western pine beetles has occurred recently.

Danger Tree and Firewood Removal

Danger tree activities include the routine removal of snags along roads, high use recreation areas, and facilities. This activity occurs approximately 160 feet (one site potential tree height) on either side of

roads and from high use areas. Snag habitat remains in these areas however as they pose a danger to the public or facilities they are removed, therefore these areas are not managed for this habitat component. Snag levels continue to decline around these facilities. Danger tree removal has increased due to an increase in recreational trails, facilities, and parking areas.

Ongoing firewood removal projects include removal of dead lodgepole within 150 feet of roads in the project area (Roadkill) and Bearwallow Firewood project in the Tumalo Creek watershed adjacent to the north boundary of the West Bend project area.

Summary

This project would cumulatively affect the quantity of down wood and GTRs. However, it would enhance ponderosa pine and mixed conifer habitat within the watershed in the long-term by providing larger trees, which subsequently would become larger snags and down wood in the future.

Overall, down wood levels in both the North Unit Diversion Dam – Deschutes River and Tumalo Creek watershed are within the forest-wide historic range of variability, with the exception of Lodgepole pine in the Tumalo Creek watershed, which has slightly more acres with no down wood than the forest-wide HRV.

Alternatives 2, 3, and 4, would add to in combination with the proposed project, are expected to result in negative cumulative effects to down wood, and GTR habitat in the watersheds due to treatment activities. These effects would be considered small given the watershed is currently providing above HRV levels in the lower density snag patches and generally above HRV levels across all categories for down wood.

Conclusion – Snags and Down Wood – Alternatives 2, 3, and 4

Alternatives 3 and 4 do not propose falling of green white fir ≥24" dbh. East of the owl line Alternatives 2, 3, and 4 do not propose falling green trees > 21" dbh. Sufficient levels of green tree replacements will be retained to provide future recruitment of snags and down wood.

Prescribed fire activities are anticipated to result in the removal of some down wood on approximately 17,000 acres for all three alternatives.

Alternatives 2, 3, and 4 may impact snags and down wood but will not contribute to an overall downward trend of species' viability at the Forest level for the American Marten, white-headed woodpecker, Lewis' woodpecker, pileated woodpecker, Williamson's sapsucker, black-backed woodpecker, three-toed woodpecker, hairy woodpecker, or northern flicker. None of the action alternatives will lead to a trend toward Federal listing for the American marten, white-headed woodpecker or Lewis' woodpecker. The biological objectives for the white-headed woodpecker, black-backed woodpecker, Lewis's woodpecker, mountain bluebird, flammulated owl, and pygmy nuthatch under the Conservation Strategy for Landbirds of the East-Slope of the Cascades Mountains in Oregon and Washington will be met.

The West Bend project is consistent with the following Deschutes LRMP standards and guidelines WL-37 and WL-38, and amended Northwest Forest Plan and Eastside Screens:

Table 156: West Bend Consistency with Deschutes LRMP standards and guidelines WL-37 and WL-38, and amended Northwest Forest Plan and Eastside Screens

Standard and Guideline	Do Not Meet, Meets, Not Applicable	Rationale
WL-37 – As amended by the Eastside Screens, snags will be maintained to provide 100 percent of potential population levels of cavity nesting species. In addition live replacement trees will be left during any harvest to assure 100 percent of population potential through the rotations.	Meets	In addition the project is thinning from below and sufficient retention trees will be provided for future snags. There is a 15% retention for each of the final removal and regeneration type harvests.
WL-38 – Specific guidance will be provided by the Deschutes National Forest Wildlife Tree Implementation Plan.	Meets	The project is thinning from below and sufficient retention trees will be provided for future snags.
WL-38 – As amended by the Eastside Screens, 20 to 40 lineal feet per acre in ponderosa pine and 100-140 lineal feet per acre in mixed conifer will be retained	Meets	The project is thinning from below and sufficient retention trees will be provided for future snags.
Eastside Screen – Fire prescription parameters will ensure that that consumption will not exceed 3 inches total (1 ½ inches per side) of diameter reduction in the 20 to 40 lineal feet per acre of ponderosa pine and the 100-140 lineal feet per acre of mixed conifer.	Meets	Mitigation measures have been placed to ensure the required lineal feet of down wood remains post prescribed fire.

Survey and Manage Species

The West Bend Project applies the Survey and Manage species list in the 2001 ROD (Table 1-1, Standards and Guidelines, pages 41-51) and thus meets the provisions of the 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines.*

The following are Survey and Manage Wildlife Species identified in the 2001 ROD:

- Crater Lake Tight Coil (addressed under Regional Sensitive Species)
- Evening Field Slug (addressed under Regional Sensitive Species)
- Great Gray Owl (addressed under Management Indicator Species)

The 2001 amendment put into place a review process that would allow for the adding or dropping of species, based on new information as well as. A complete description of the categories can be found in the 2001 amendment Standards and Guidelines (S&G) pages 6 through 14. In April of 2004 the Crater Lake tightcoil was added to the Region 6 sensitive species list and in December of 2011 the evening slug was added. Both species have been previously discussed. Survey and manage animal species for the Deschutes National Forest includes the great gray owl, evening field slug and the Crater Lake tightcoil snail; these species are previously addressed under R6 Sensitive and MIS sections.

3.7 Botany – Threatened, Endangered, and Sensitive Plant Species

3.7.1 Summary of Key Findings

Green-tinged paintbrush *(Castilleja chlorotica):* Implementation of the action alternatives may impact individuals of the green-tinged paintbrush, but will not cause a trend toward Federal listing; at the same time, project activities are more likely to have a beneficial impact upon this species.

Newberry's Gentian *(Gentiana newberryi var. newberryi):* Implementation of the action alternatives will likely have a beneficial impact upon the Newberry's Gentian.

3.7.2 Introduction & Regulatory Framework

A biological evaluation (BE) was prepared to document consideration of Threatened, Endangered, and Sensitive (TES) plants related to the West Bend project. It was prepared in compliance with the Forest Service Manual (FSM) 2672.4 and the Endangered Species Act of 1973 (Subpart B; 402.12, section 7 consultation). The complete BE is on file at the Bend/Ft. Rock Ranger District.

Effects of this activity are evaluated for those TES plant species on the current Regional Forester's Sensitive Species List (FSM 2670.44, January 2008) that are documented or suspected to occur on the Deschutes National Forest.

3.7.3 Field Reconnaissance

There are no known threatened or endangered plant species, nor their habitat, within the project area. There are two Sensitive species in the project area. They are Newberry's gentian (*Gentiana newberryi var. newberryi*) and the green-tinged paintbrush (*Castilleja chlorotica*).

In 2010, about 1,030 of the highest probability acres were re-surveyed for the green-tinged paintbrush. The initial surveys of this area were in the early and mid- 1990s by Forest Service botanists or botanical contractors. Most of the known populations were relocated, while one new population was added.

The Newberry's gentian, located in 2006, totals about 7,000 plants and is located in one area, broken only slightly into three proximate locations. Because of the limited habitat available for the Newberry's gentian (which was surveyed in 2006), no further survey was done for that species.

3.7.4 Affected Environment

The area is dominated by these plant associations: ponderosa pine/bitterbrush/Idaho fescue; ponderosa/bitterbrush-snowbrush/needlegrass; ponderosa/bitterbrush-snowbrush/sedge; ponderosa/bitterbrush-snowbrush/fescue; ponderosa/bitterbrush-manzanita/fescue; ponderosa/bitterbrush/needlegrass; ponderosa/bitterbrush-manzanita/sedge; lodgepole pine/bitterbrush/fescue; lodgepole/sedge-lupine-penstemon; and mixed conifer/snowbrush-manzanita/sedge-penstemon.

Soils in the project area are generally characterized by sandy, pumiceous volcanic ash and pumice lapilli over buried soils on glacial till, as well as sandy volcanic ash on buried soils formed from glacial outwash. The elevation lies roughly between 4,000'-6,000'. The average annual precipitation measures about 15 - 30".

Green Tinged Paintbrush (CACH15) is endemic to Central Oregon only. The project area contains the northernmost known populations. There are also population centers about 10 miles southwest of the project area (3,000 plants), on Pine Mountain (about 30 miles southeast of Bend), on West Butte (BLM, north of Pine Mountain), and on Winter Rim on the Fremont National Forest, which has the largest concentrations. Overall, there are approximately 30,000 total plants on the Deschutes National Forest

and approximately 500,000 plants located on the Fremont National Forest. There are an unknown number of plants located on Bureau of Land Management lands.

While West Bend population is small compared to the overall global population, these populations lie at the edge of the global distribution, they may become important for their potential genetic contribution to the species (Lesica 1995). Within the project area boundaries, there are roughly 400 plants total, mostly located within two population centers (scattered over 23 locations), with another separate site. The plants located within the project area constitute about 12 percent of the local population (3,400 plants); slightly more than one percent of the DNF population, and less than one percent of the global population.

Many acres within West Bend are covered by manzanita and ceanothus. Manzanita, at least, is allelopathic, meaning it emits a chemical that inhibits other species from germinating near it. Neither of these species appear to tolerate the presence of other plants, including CACH15; therefore, the presence of these shrubs affects the distribution of CACH15 in West Bend and reduces available sites for it to colonize.

Figure 47: Newberry's gentian

About 50% of the overall project area has received TES plant species surveys in areas with the highest probability of finding TES plants. Some of these previous surveys occurred in the 1990s (Katalo, Kiwi), when the green-tinged paintbrush was first discovered within the current project area, and others have occurred since 2005 (East Tumbull, Fry, Meissner Sno-park trails expansion).

Figure 48: Green-tinged paintbrush

The type and scale of Forest Service management actions previously occurring in the West Bend project area consist of numerous harvest-related projects (thinnings and other harvesting in the 1970s, 80s, 90s); and ongoing and planned thinnings and fuels reduction treatments in and adjacent to the project (West Tumbull, Sparky, Fry, Jet, East Tumbull HFRA, Katalo East and West, Feline). There have been many recreation-associated projects as well: development of a mountain bike trail system, development of winter trail systems, improvements at Phil's trailhead, Meissner Sno-park expansion, and the Cascade Lakes Welcome Station and parking lot.

Figure 49: Habitat typical of dense green-tinged paintbrush populations near Pine Mountain; this is not typical in the West Bend project landscape.

According to the Forest's GIS data, there have been only three smaller wildfires in the project area in the past century. Historically, wildfire occurred more often than is now occurring, especially in the ponderosa plant associations. The present low incidence of fire has contributed to the current size, structure, and species composition of the tree overstory and understory helping to explain why CACH15 has established here. Because the tree canopies have grown broader, there is likely now a negative impact occurring because this species prefers more open canopy conditions. This is based upon the author's 21 years of observations of CACH15 on the Bend/Ft. Rock Ranger District: the West Bend project contains about 400 plants, while in the more open canopy conditions to the east, on and near Pine Mountain, about 30,000 plants exist. Farther south, on the Fremont National Forest, there are about 500,000 plants in primarily sagebrush plant associations. Based on these facts, it appears that CACH15 prefers more sunny conditions (as well as other considerations, such as a rocky shallow soil profile).

3.7.5 Environmental Consequences

Green Tinged Paintbrush (*Castilleja chlorotica)*

Alternative 1 (No Action)

Direct and Indirect Effects: By not removing trees that may eventually shade populations of CACH15 to the point where they would be extirpated from an area, there is the possibility that there will be a negative indirect effect without such actions.

The effects of no implementation of proposed activities may have both a positive and a negative effect upon CACH15. Years of fire exclusion/prevention in the project area have allowed shrubs to grow and proliferate, a situation which *Castilleja chlorotica* prefers; it is found in mid- to late-seral stage shrubs in this portion of its range and therefore would benefit from fire exclusion. Should a high intensity wildfire get started in these older shrubs, it would most likely kill CACH15 that is present; this has been observed both on Forest

Figure 50: Shaded habitat for Newberry's gentian in West Bend.

Service administered land and Bureau of Land Management lands (Ron Halvorsen, pers. comm.) where prescribed fire has burned through CACH15 populations. In the absence of fuel-reduction treatments such as mowing and prescribed fire, a wildfire could burn through CACH15 populations and habitat. This would likely eliminate CACH15 plants that may exist there.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: This alternative was not designed with treatments that would open up the canopy next to CACH15 populations. Although mitigations would buffer CACH15 from the treatment areas, avoiding direct impacts to plants, the heavy thinning adjacent to populations would not occur, and therefore the CACH15 would be left less likely to improve their numbers and vigor.

Alternatives 3 and 4

Direct and Indirect Effects: In alternatives 3 and 4, the units that are designed to enhance CACH15 habitat and populations are: 34, 37, 121, 122, 125, 129, 164, 165, 184, and 192. There are likely to be few direct effects by implementation of this alternative because these alternatives were developed to enhance the CACH15 populations within West Bend. There is the possibility that individual plants were overlooked during survey or colonized an area between survey and project implementation and could be inadvertently lost. (CACH has been observed to "wink out" from some areas and colonize new ones in the space of about five years). These losses, if any, would represent a minor fraction of the local and overall populations and would not move the species toward Federal listing status.

There could be positive indirect effects by implementation of the thinning treatments in these alternatives. Implementation of thinning could reduce shading of sites, which is helpful to this species. This is not to say that thinning will encourage CACH habitat on every acre within every unit. But, where those conditions exist that support CACH, removing or reducing the amount of shade will help. Also, any incidental material that can be picked up from inside CACH sites will help reduce shading and improve plant vigor.

Newberry's Gentian (*Gentiana newberryi var. newberryi*)

Alternative 1 (No Action)

Although less is known about the effects of management actions on Newberry's gentian, it is likely that, over time, the species can be expected to decline in numbers and vigor by not reducing the adjacent tree canopy. This conclusion is based upon the habitat attributes of known sites on the Deschutes National Forest.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: The adjacent treatment prescription is for heavy thinning. The treatments are likely to have a beneficial effect by providing an increase light and water availability for the plants. No treatments in any action alternative are designed specifically to benefit this species.

Alternatives 3 and 4

Direct and Indirect Effects: The Newberry's gentian populations are concentrated in a stringer meadow and, although they are placed within the context of a near-clearcut proposed for all action alternatives, are not in danger of being harmed during implementation. The populations are identified as an "Area to Protect" in the timber sale contract and will be protected through a mitigation measure that will keep postsale and fuels work out of them.

Although less is known about the effects of management actions on Newberry's gentian, it is likely that, over time, the species can be expected to increase or at least maintain its numbers and vigor by reducing the adjacent tree canopy. This conclusion is based upon the habitat characteristics of known sites on the Deschutes National Forest; these other populations are found in open conditions with no tree canopy.

Additionally, removal of adjacent trees may increase water availability to the meadow, and thus to the gentian population, because of the reduced demand for it (Pajutee, pers. comm., 2012); this situation would gradually diminish as the adjacent stand grows back.

Cumulative Effects

The scale of analysis for this section is the project boundary, chosen because it offers a landscape of reasonable size in which to determine effects. The past, present, and reasonably foreseeable projects in the West Bend area include development of the road system; industrial timber operations in the 1920s-1930s; smaller wildfires in the 1970s-1990s**;** tree thinning in the 1970s-1990s; the current and ongoing timber removal and fuels reduction projects of Sparky, Fry, Jet, Net, Set, Wet, Katalo East, Katalo West, and Feline; development of a mountain bike trail system and its attendant use; development of a winter trail system and its attendant use; firewood collection; heavy recreation use along the Deschutes River; developed and dispersed camping; the expansion of Meissner Sno-Park; construction of the Cascade Lakes welcome station and parking lot; restoration of Ryan Ranch Meadow and attendant altered recreation use and hydrologic regime; ongoing road reconstruction and maintenance; and the implementation of the Invasive Plant EIS and its attendant herbicide application.

Cumulative Effects with Alternative 2 (Proposed Action)

Past thinnings in areas without manzanita or ceanothus have likely improved the chances of CACH colonizing there; and although in this alternative there are no specific treatments designed to enhance either the green-tinged paintbrush or the gentian, overall the thinning treatments proposed in this alternative adjacent to these populations can be expected to improve the numbers and vigor of these two species, although in the case of the paintbrush, less so than in alternatives 3 and 4.

Because there are no TES plant sites in areas where the Deschutes-Ochoco Invasive Plant Treatment EIS herbicide treatments are planned, there are no expected effects from that action and therefore no anticipated cumulative effects. The Forest-wide invasive plant EIS incorporates an early detection/rapid response strategy that could quickly address new invasive plant populations, thereby reducing the chance they would reach the size of those currently found in portions of the West Bend project area.

Cumulative Effects with Alternative 3 and Alternative 4

Potential CACH habitat in the West Bend project and general vicinity has been affected by previous activities. The effects have more likely been negative than positive because activities occurred without knowledge that the plants were present, general distribution, or habitat requirements. Thus the positive effects (which would include opening of the canopy) likely happened by accident rather than design prior to 1991. During the past 20 years forest management has been designed to help ensure this species' maintenance. In conjunction with the past forest harvest and thinning activities, reducing the amount of shading over paintbrush can be expected to improve both the vigor and population.

Although less is known about the effects of management actions on Newberry's gentian, it is likely that, over time, the species can be expected to increase or at least maintain its numbers and vigor by reducing the adjacent tree canopy. This conclusion is based upon the habitat characteristics of known sites on the Deschutes National Forest; these other populations are found in open conditions with no tree canopy. Additionally, removal of adjacent trees may increase water availability to the meadow, and thus to the gentian population, because of the reduced demand for it (Pajutee, pers. comm., 2012); this situation would gradually diminish as the adjacent stand grows back.

Because there are no TES plant sites in areas where the Deschutes-Ochoco Invasive Plant Treatment EIS herbicide treatments are planned, there are no expected effects from that action and therefore no anticipated cumulative effects. The Forest-wide invasive plant EIS incorporates an early detection/rapid response strategy that could quickly address new invasive plant populations, thereby reducing the chance they would reach the size of those currently found in portions of the West Bend project area.

3.7.6 Deschutes National Forest Land and Resource Management Plan (LRMP) Consistency

The West Bend project, as regards TES plant species, is consistent with the Deschutes LRMP (1990). Records were checked for previously known TES plant populations (TE-1); suitable habitat was located (TE-2); and a field reconnaissance was performed to try to locate populations within the project area, and at the proper time of year when TES plant species in question would be found (TE-3). The remaining standards and guidelines for TES plant species do not apply to the West Bend project.

3.8 Botany – Survey and Manage Plant Species

3.8.1 Summary of Key Findings

- There are no known Survey and Manage sites located within the project.
- There is no old-growth habitat present within the area of disturbance, which would trigger survey for some species

3.8.2 Introduction

This report documents the survey findings, project effects, and project recommendations regarding the Northwest Forest Plan (NWFP) "Survey and Manage" plant species as they relate to the West Bend Project. Changes have been made since the draft EIS was published. First, the statement in the DEIS that survey was completed for the species *Cladonia norvegica* was in error and has been removed. There is no habitat for that species in the area of disturbance. Second, treatment unit 379 has been dropped from treatment because it was determined to be in a stand that could provide old growth habitat for fungi species that require survey.

The West Bend Projct applies the Survey and Manage species list in the 2001 ROD (Table 1-1, Standards and Guidelines, pages 41-51) and thus meets the provisions of the 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines* (2001 ROD).

Refer to the Project Record, Botany Survey and Manage Report to see the following appendices: Appendix A for the Survey and Manage categories into which species are grouped; Appendix B for a list and brief habitat description of the potential Deschutes National Forest species for which pre-disturbance surveys are required and for which any known sites are required to be managed; Appendix C for Definitions of "Equivalent Effort Surveys in Old Growth" and "Habitat Disturbing".

One way the NWFP requires the Forest Service to address late-successional forest ecosystem function is through consideration of "Survey and Manage" species associated with this ecosystem. These are selected species of fungi, lichens, bryophytes, vascular plants, and invertebrate animals whose viability are of concern within this broad ecosystem type.

The November 2000 FEIS identifies six categories into which species are grouped. In order to fall into one of these categories, the species must meet three basic criteria:

- The species must occur within the Northwest Forest Plan area, or occur close to the NFP area and have potentially suitable habitat within the NFP area.
- The species must be closely associated with late-successional or old-growth forest.
- The reserve system and other Standards and Guidelines of the NFP do not appear to provide for a reasonable assurance of species persistence.

All six categories contain a requirement to conduct "strategic surveys", which is something separate from project-level surveys and is not required to be addressed in this document.

Specific habitat information on Survey and Manage species is becoming better understood as species-specific surveys are conducted and data is compiled and compared. However, many habitat descriptions are based on relatively few records and will continue to be scrutinized and refined as new sites are discovered. The following discussion is an effort to assess and apply existing information as it relates to the West Bend project.

3.8.3 Affected Environment

The area is dominated by these plant associations: ponderosa pine/bitterbrush/Idaho fescue, ponderosa/bitterbrush-snowbrush/needlegrass, ponderosa/bitterbrush-snowbrush/sedge, ponderosa/bitterbrush-snowbrush/fescue, ponderosa/bitterbrush-manzanita/fescue, ponderosa/bitterbrush/needlegrass, ponderosa/bitterbrush-manzanita/sedge, lodgepole pine/bitterbrush/fescue, lodgepole/sedge-lupine-penstemon, and mixed conifer/snowbrush-manzanita/sedge-penstemon. The project supports soils that are generally characterized by sandy, pumiceous volcanic ash and pumice lapilli over buried soils on glacial till, as well as sandy volcanic ash on buried soils formed from glacial outwash. The elevation lies roughly between 4,000'-6,000'. The average annual precipitation measures about 15 - 30".

Vascular Plants

There is no habitat present within the project area for *Cypripedium montanum;* this species would require pre-disturbance surveys if habitat is present. Additionally, there are no known sites present within the project area for this species that would require management of those sites.

Bryophytes

Of the bryophytes requiring pre-disturbance survey if habitat is present, there is no habitat present within the project area for *Schistostega pennata.* Neither are there any known sites for this species within the project, which would require management if present.

There are no sites present for *Rhizomnium nudum* or *Tritomaria exsectiformis.* These species would require protection if sites were present. For *Tritomaria exsectiformis*, equivalent effort surveys would be required if there were potential habitat within old growth that would be disturbed, of which there is none (see discussion under the Fungi section for the Deschutes NF's old growth definition). Additionally there are no "high priority" sites present for *Buxbaumia viridis*, which would require management.

Surveys for Category B bryophytes are not warranted in the West Bend project because there is no old growth habitat present within proposed habitat-disturbing areas (see discussion under fungi formore information).

In 2001, surveys for 2001 ROD S&M species (including the bryophytes discussed inthis section) were conducted on specific trail re-routes in the Swampy Lakes area; no S&M species were located.

Lichens

There are no known sites for Calicium abietinum, *Chaenotheca chrysocephala, Chaenotheca ferruginea, Chaenotheca subroscida, Chaenothecopsis pusilla, Cladonia norvegica, Dermatocarpon luridum, Leptogium teretiusculum, and Tholurna dissimilis*, which would require management if present. Additionally, there are no "high priority" sites present for *Bryoria tortuosa*, which would require management.

Surveys for Category B lichens are not warranted in the West Bend project, because there is no old growth habitat present within proposed habitat-disturbing areas (see discussion under Fungi for more information).

In 2001, surveys for 2001 ROD S&M species (including the lichens discussed in this section) were conducted on specific trail re-routes in the Swampy Lakes area in 2001; no S&M species were located.

Fungi

Category B fungi are now required to have "equivalent effort" surveys conducted if the project proposes to enter old-growth habitat (see Appendix C of the Survey/Manage Report) and if the activity is deemed habitat-disturbing (see Appendix C of the Survey/Manage Report).

Surveys for Category B fungi are not warranted in the West Bend project, because there is no old growth habitat present within proposed habitat-disturbing areas. This determination was made using the 1993 Region 6 Interim Old Growth definitions referenced in Appendix C, and using the lidar dataset in the GIS library of the Deschutes National Forest, as well as a patch size criterion of at least five acres. There were a number of small polygons that showed up on the layer as Old Growth which is based on large tree structure, but upon further evaluation, they were all deemed to be incorrect, with the exception of one unit adjacent to the private land in Section 16. That unit has been removed from the project.

Additionally, there are no known sites present within the project area for fungi species that would require management of those sites (see listed fungi within Category B and D species in Appendix B).

3.8.4 Environmental Consequences

Effects Common to Alternatives 1 (No Action), Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

Direct, Indirect, and Cumulative Effects: There are no expected direct, indirect, or cumulative effects to Survey and Manage species in the proposed project because there are no known S&M sites present, and there is no old-growth habitat present within disturbance areas, which would trigger a survey for certain species.

3.9 Botany – Invasive Plants / Noxious Weeds

3.9.1 Introduction and Regulatory Framework

Forest Service Manual (FSM) direction requires that Noxious Weed Risk Assessments 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 2081.03).

Aggressive non-native plants, or noxious weeds, can invade and displace native plant communities causing long-lasting management problems. Noxious weeds can displace native vegetation, increase fire hazards, reduce the quality of recreational experiences, poison livestock, and replace wildlife forage. By simplifying complex plant communities, weeds reduce biological diversity and threaten rare habitats. Potential and known weeds for the Deschutes National Forest are listed in the Project Record, Invasive Plant Risk Assessment, Appendix A.

In addition to noxious weeds, which are designated by the State, there is a group of non-native plants that are also aggressive though are not officially termed "noxious". These species are also considered in this assessment.

3.9.2 Affected Environment

The area is dominated by these plant associations: ponderosa pine/bitterbrush/Idaho fescue, ponderosa/bitterbrush-snowbrush/needlegrass, ponderosa/bitterbrush-snowbrush/sedge, ponderosa/bitterbrush-snowbrush/fescue, ponderosa/bitterbrush-manzanita/fescue, ponderosa/bitterbrush/needlegrass, ponderosa/bitterbrush-manzanita/sedge, lodgepole pine/bitterbrush/fescue, lodgepole/sedge-lupine-penstemon, and mixed conifer/snowbrush-manzanita/sedge-penstemon. The project supports soils that are generally characterized by sandy, pumiceous volcanic ash and pumice lapilli over buried soils on glacial till, as well as sandy volcanic ash on buried soils formed from glacial outwash. The elevation lies roughly between 4,000'-6,000'. The average annual precipitation measures from approximately 15" to approximately 30".

There are many weed sites in the project area. Known sites are listed in Table 157. An invasive plant field reconnaissance of the project area was conducted in the summer of 2010. In addition to the previously-known weed sites, ten new ones were located.

Listed below are the known weed sites within the West Bend project, arranged by species and the associated Forest Service site numbers.

Table 157: Species of Invasive Plants present in the West Bend project

Species	Forest Service Site Numbers
Spotted knapweed	6110103, 6110113, 6110118 - 6110120, 6110161, 6110162, 6110174, 6110175, 6110184, 6110185, 6110322, 6110381, 6110385, 6110433, 6110444, 6110494, 6110548, 6110554 - 6110556, 6110559, 6110560, 6110571, 6110700, 6110706, 6110714, 6110757, 6110761, 6110763, 6110773, 6110775, 6110776, 6110778, 6110781, 6110783
Dalmatian toadflax	6110103, 6110118, 6110119, 6110161, 6110174, 6110175, 6110218, 6110389, 6110494, 6110496, 6110566, 6110589, 6110613, 6110700, 6110710, 6110773, 6110779
Canada thistle	6110113, 6110270, 6110271, 6110576
Russian thistle	6110175, 6110773, 6110783
Medusahead	6110621, 6110764

3.9.3 Weed Risk Ranking

The following factors were considered in determining the level of risk for the introduction or spread of noxious weeds.

Vectors (if contained in project proposal) ranked in order of weed introduction risk:

1. Heavy equipment (implied ground disturbance)
2. Importing soil/cinders
3. Off-Highway Vehicles
4. Grazing (long-term disturbance)
5. Pack animals (short-term disturbance)
6. Plant restoration
7. Recreationists (hikers, mountain bikers)
8. Forest Service project vehicles

The project proposal and exisitence of vectors was reviewed to determine if the risk if high, moderate, or low. Following are the definitions:

Figure 51: Definitions of plant vector risk

Risk	Vector
High	Known weeds in / adjacent to project area; AND
	Any of vectors #1-8 in project area; AND
	Project operation in/adjacent to weed populations.
Moderate	Any of vectors #1-5 present in project area.
Low	Any of vectors #6-8 in porject area; OR
	Known weeds in/adjacent to project area iwthout vector presence.

Discussion of Ranking

A risk ranking of HIGH is appropriate for this project because heavy equipment will be brought into the area (which brings a risk of importing weed seeds or parts with it) and because there are many known weed sites present within the project. There is also the chance that fill material will be brought into the project, which also presents weed introduction concern. Mitigations will reduce, but not eliminate, these concerns (see list of project design and mitigations in Chapter 2).

3.9.4 Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: The current weed treatment program would continue with hand pulling of weeds within most weed sites within the project area. In some cases weeds would be treated with herbicide. Either treatment method would prevent the weeds from setting seed, but would not affect the seed in the soil. Despite these efforts, some weeds would not receive treatment and manage to set seed and contribute to the seedbank. Also, because the West Bend project area is a popular destination for recreationists, new weed sites can be expected to be established. As an example, recreational vehicle visits to Phil's Trailhead in the West Bend project area averaged 247 vehicles per day during an 11-day period in June of 2011 (USFS 2012). And because maintenance level 1 roads and user-created roads would not be closed, these roads would continue to exist as areas where new weed introductions could occur.

Cumulative Effects: The effects regarding continued input of new weed seed into the project via recreational vehicles would be similar to those described under Direct and Indirect Effects for the No Action alternative. However, the Deschutes and Ochoco National Forests' Invasive Plant Treatment Environmental Impact Statement (EIS) was approved for use in 2012. This means that instead of having primarily hand-pulling as the main treatment option for the area's many weed sites, there is an herbicide option available via that EIS. This means that it will be likely that the weed sites in the project area will be reduced more quickly and have less chance of maturing to the seed development and seed dispersal stages. In addition to existing weed sites, new sites that are found could potentially be treated with herbicide via the "early detection/rapid response" (EDRR) feature within that EIS. The ultimate result is that the area's weed problem can be addressed in a much more effective and efficient manner.

Effects Common to Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

Direct and Indirect Effects: The largest concern over implementation of the stand and fuels treatments is that weed parts or seeds may be brought into the project on the equipment used to implement the project, or that project equipment may spread known populations via their tires. This includes water tenders that would bring in water for dust abatement. The mitigations requiring clean equipment in the project area and to inspect water intake sources for dust abatement (and treat weeds found) are helpful in preventing this; despite this, the risk is not reduced to zero. This is because of the weed seeds already in the soil seedbank, and also because of weeds that may be missed during treatment.

Maintaining closures on maintenance level 1 roads and closing user-created roads will reduce the areas where motor vehicles can travel and thus reduce the areas where infestations could occur.

From a weed standpoint, the Alternative 1 provides the most protection from invasive plants being introduced to the project area, because machinery and associated vehicles would not be driving over the area, creating inviting spots for invasives to germinate and thrive. However, because of the large number of recreational vehicles using the area, new populations can be expected to appear.

Alternatives 2-4 contain the most risk of weed establishment, although the mitigations will reduce, but not eliminate, that risk. There is no discernable difference between the three action alternatives in terms of weed risk.

Cumulative Effects: The scale for this analysis is the project boundary, so chosen because it offers a landscape of reasonable size in which to determine effects.

Although there have been many opportunities for invasive plant introductions in the past, the issue had not reached the tipping point until the past fifteen years or so, when invasive plant populations in Bend in particular have increased exponentially. Because Bend is the nearest large community from which harvest-related vehicles and other recreational vehicles would come from or through, this has resulted in a higher probability of weed introductions into the current project area than had previously been the case. The combination of the vehicles involved in West Bend project operations (despite mitigations being carefully followed) and those recreational vehicles already visiting the project area every day ensures that this area will remain a trouble spot for invasive plants.

Consistency with the Deschutes National Forest Land and Resource Management Plan (1990)

There are no Standards and Guidelines included in the 1990 Deschutes National Forest Land and Resource Management Plan addressing the weed issue.

The West Bend project meets the Forest Service Manual direction stating that for any project with a moderate to high risk of weed invasion, control measures must be in place. West Bend has a high risk, and control measures are in place that address that concern (Refer to FEIS, Resource Protection Measures, Table 18, and Prevention Strategy, pages 6-8 in the Invasive Plant Risk Assessment, Project Record).

3.10 Transportation System

3.10.1 Forest Service (FS) Highway Safety Act (HSA) System and Other Agency Roads

For access to the West Bend project road system, one must travel over portions of County and State Highways (Table 158). Forest Service HSA routes leading to Snoparks, Day-Use Areas within this project area are included in the below table. Deschutes County Forest highway 4601 (Skyliner Rd) and State Highway 382 (Cascade Lakes Hwy, FS 46) are primary routes from Bend to this area.

For individual road recommendations, maintenance and other road work refer to West Bend Road Recommendations table located in the Project Record.

Table 158: State and County Highways and Forest Service Highway Safety Act (HSA) Roads

Road	Jurisdiction [1]	Maintenance Level	From	Mile	To [2]	Mile	Miles
OR 382/FS 46	S	5	Forest Boundary	6.90	FS road 4600211	19.03	12.13
Skyliner Rd.	C	5	Forest Boundary	2.76	FS road 4601380	7.17	4.41
41	FS	3	Mile Post 4.71	6.62	Highway 46	11.33	4.71
4100700	FS	3	41	0.00	Aspen Camp DU	1.00	1.00
4100750	FS	3	4100700	0.00	Big Eddy DU	0.47	0.47
4100800	FS	3	41	0.00	Lava Island DU	0.80	0.80
4100870	FS	3	4120700	0.00	Lava Island DU	0.18	0.18
4600100	FS	3	Highway 46	0.00	Meadow Camp DU	1.33	1.33
4600225	FS	4	Highway 46	0.00	Swampy Lake TH	0.30	0.30
Total Miles							**25.33**

1. Jurisdiction: S = State; C = County; FS = Forest Service
2. DU = Day use; TH = Trail head

HSA roads within this planning area that are deficient in surfacing are listed below in Table 159. The roads listed are used extensively by recreation; recent harvest and thinning activities in this area have also contributed to the depletion of surface rock material. To support the project these roads should be resurfaced prior to project implementation (Table 159). In addition, general maintenance will also need to be performed on these routes during use.

Table 159: Highway Safety Act Identified Road Work Needed

Road	Maintenance Level	From Mile	To Mile	Total Miles	Work Needed
4600225	3	0.00	0.30	0.30	Chip Seal
4100700	3	0.00	1.00	1.00	Surface compacted depth 4", ¾" minus dense Grade Aggregate
4100750	3	0.00	0.47	0.47	
4100800	3	0.00	0.80	0.80	
4100870	3	0.00	0.18	0.18	
4600100	3	0.00	1.33	1.33	
Total Miles				**4.08**	

FS Collector Non-HSA System Roads

The Collector road system (Table 160) in this planning area has a very broad spectrum of surface types; these include native material surfaces, cinder, and crushed aggregate surfacing. Contributing factors impacting the FS road system are the lack of maintenance due to budgetary downward trends, workforce reduction and the impact of increased recreational use that has accumulated over the decade. Deferred maintenance needs are described in Chapter 2. Aggregate or cinder surfacing on these roads is diminished or worn-out, resulting in un-maintainable roads. Since these roads do not receive the same maintenance attention as the HSA roads, the need and degree of general maintenance to accommodate use is more extensive. The prescribed road work needed to support and meet project objectives, also needs to meet the long term goal of leaving these roads in a self-maintaining condition to sustain the roads for the future. Road maintenance items along these routes would consist of resurfacing, spot surfacing, drainage restoration, roadside brushing, reclaiming of clearing limits to restore sight distances, felling of danger trees along traveled routes bordering and within this project boundary. Danger trees which are felled would be removed from areas of substantial fuel loading and help reduce the potential of intensifying fire effects, in addition to providing defensible space along these main travel corridors. These trees would be available for fish and wildlife habitat improvement. In areas

deficit in larger woody debris, these trees could be left to benefit soils and habitat for insect and small mammal species. Danger tree reduction would be in accordance to FSM (Forest Service Manual) 7733 and region 6 Danger Tree Policy.

Table 160: Forest Service Collector and Non-Highway Safety Act System Roads – Road Work Needed

Road	Maintenance Level	From Mile	To Mile	Total Miles	Work Needed[1]
4110000	2	0.00	3.35	3.35	General Maintenance
4130000	2	0.00	4.80	4.80	
4606000	2	0.00	0.56	0.56	Resurface, General Maintenance
	2	0.56	5.40	4.84	
4609000	2	0.00	5.79	5.79	General Maintenance
4610000	2	0.00	4.40	4.40	Spot Surface, General Maintenance
4612000	2	0.00	3.20	3.20	
4615000	2	4.63	8.94	4.31	
4615000	2	0.00	4.63	4.63	
Total Miles				**35.88**	

1. ***General Maintenance:*** Brushing, Spot Surface, Restore & Clean Drainage, Blade and Shape Roadway, Fell Danger Trees, Clean Lead-outs; ***Resurface:*** Current road condition cannot support use; ***Spot Surface:*** Typically areas that need padded or ruts filled; ***Self-Maintaining:*** Construct and Repair Drainage.

FS Local Roads

Local roads in general are routes that are mostly native surfaced and receive very limited maintenance. These roads would receive a very limited amount of additional work to support this project. Maintenance items would consist of that work necessary to sustain this type of road during the life of the project. As this project nears completion, these roads would receive maintenance necessary to sustain a self-maintaining status. Construction and restoration of drainage and drainage structures (Rolling Dips, Waterbars and leadouts) are critical elements to achieve the desired effects; these structures would need to be armored to assure longevity. Other associated maintenance on these road types would include limited brushing, pre and post haul blade and shaping of roadway to improve drainage. Danger tree reduction would be in accordance to Forest Service Manual 7733.

FS Closed Roads

Roads that are categorized as maintenance level 1 (closed) would be utilized to the extent necessary to support project needs, with the expectation they would also be needed for future management activities. Closed roads are also used for other activities such as administrative purposes, permit administration, and fire suppression. Upon project completion the roads which were utilized would be returned to level 1 status and maintenance performed to return the road to a self-sustaining condition for future administrative needs. Additionally, maintenance level 1 roads that are not needed for project activities will be reviewed for closure failures and maintained as necessary (see Appendix E for road closure methods). No additional road closures will occur on the West Bend Project.

3.10.2 Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: Limited road maintenance would continue to occur where and when necessary to support routine road activity. Nothing beyond routine would occur except in the event of an emergency. Danger trees would continue to be fallen when they are identified as hazardous. Public

access throughout the West Bend project area is provided through about 150 miles of open roads in maintenance categories 2, 3, 4, and 5.

Effects Common to Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

Direct and Indirect Effects: There would be very little change in the present maintenance level 1-5 Forest road system as a result of this project. Use would most likely remain essentially the same, with any change in use associated with changes in Central Oregon population or visitor use. With rising maintenance costs and declining budgets it is expected that the extent of annual road maintenance would continue to decline except for priority segments.

Project activities such as hauling timber with log trucks can create impacts to the road system. During harvest activities, where necessary, road maintenance activities would be conducted on roads designated for use. As a direct effect, some roads that do not receive recurring maintenance, primarily low standard roads in the Maintenance Level 2 category, would see a higher degree in maintenance to the necessary extent for the project and for long-term effectiveness. This would result in both safe drivability and in the ability to handle surface runoff.

The type of work that would be expected as maintenance in timber sale contract provisions include: brushing for improved sight distances, removal of danger trees, blading and shaping of travel ways, cleaning culverts and ditches, restoring existing surface drainage features such as water bars and rolling dips. The drainage features would be constructed with armoring to ensure longevity.

Dust can be an issue when native-surface roads are used for haul. Dust abatement, primarily using water as the dust palliative, would be performed as necessary to maintain a relatively well-bonded road surface free of the highly erosive pulverized ash "flour" that can occur on native surface roads under heavy use conditions. This would have a secondary effect of providing safer driving conditions. The intensity of these effects is essentially the same for Alternatives 2-4.

Where ground-based yarding systems are used to remove logs to landings, temporary roads are customarily constructed to provide access to the landings that are not immediately adjacent to existing portions of the transportation system. Temporary roads (approximately 56 miles Alternatives 2 and 3, 42 miles Alternative 4) would be constructed primarily on flat ground (slopes < 10%) and excavation and construction of embankments would be negligible. Temporary roads would be built to low construction standards, with constraints of grade, curve radius, compaction, surfacing, and width being tailored to the minimum capabilities of the intended user vehicles. The temporary roads would subsequently be restored. Where railroad grades and other older logging features are still present, they will be used instead of creating new road surfaces. Effects to the public's access to National Forest Service lands, within the project area, are discussed in the Recreation section (FEIS beginning on page 329). Impacts to soil from temp roads are addressed in the Soils section (FEIS beginning on page 377).

Roads that fall within maintenance level 1 (closed) will be re-closed following project activities, and existing closures will be maintained or improved where closure failures are occurring (see Appendix E). Public access within the West Bend area will continue to be provided with over 150 miles of open roads in maintenance categories 2, 3, 4, and 5.

Cumulative Effects: Road system effects were analyzed at the project area scale. Past, present and reasonably foreseeable future activities listed in Table 26 and Table 27 were reviewed for potential cumulative effects. The present activity that may affect vehicle travel and access is the new Travel Management Rule and Motor Vehicle Use Map (MVUM). The MVUM and the associated rules will make enforcement of road closures and off-road prohibitions more straightforward. When combined with attention to fixing closure failures and closing unauthorized roads, these activities would result in a reduction in user-created roads and natural resource impacts from cross-country travel.

3.11 Recreation

3.11.1 Introduction

The demographic and recreational setting of the Deschutes National Forest, Deschutes County, and its relationship to state and national trends and conditions was recently documented in the Deschutes National Forest, Ochoco National Forest, and Crooked River National Grassland Travel Management Project Final Environmental Impact Statement (2011). The demographic and recreational conditions and trends descriptions are hereby incorporated by reference into this document and will not be repeated in detail here.

The West Bend project area includes over 139 miles of winter and summer trail and 12 developed recreation sites. The project encompasses popular recreation areas including the Phil's mountain bike trail system, the Swampy Lakes and Virginia-Meissner Nordic ski areas and parts of the Deschutes Wild and Scenic River corridor.

The project area contains trails used by hikers, mountain bikers, equestrians, snowmobilers, cross country skiers and snowshoers. Recreationists access the forest via the Meadow, Aspen, Big Eddy, Lava Island, and Dillon Falls river boating sites/ trailheads; Rock Viewpoint interpretive site; Phil's, Tumalo Falls and Shevlin Park trailheads, Virginia-Meissner, Swampy Lakes and Wanoga sno-parks/trailheads; and numerous undeveloped access points. The area has long been treasured by hunters, although increased recreation use over the past two decades has displaced some of this hunting use, especially in the densely trailed areas. There are dispersed campsites within the project area. The area supports many recreational special use events and outfitter/guide operations.

3.11.2 Regulatory Framework

Land and Resource Management Plan

The following forest-wide standards and guidelines related to the recreation experience inform how management activities proposed in the West Bend project area would be implemented; Figure 52, page 333, displays recreation sites in the context of these management areas.

Trail System Management

Goal: Maintain the existing trail system and provide additions or modifications to the system which will meet the increasing and changing demands in dispersed recreation. To the extent possible this system will provide trails of all difficulty levels, trails in visually appealing settings, and trails for those modes of travel appropriate for the Forest in both winter and/or summer.

TR-3: Trails will be located or relocated whenever possible where they will not be disrupted by developmental activities such as logging or road building. Where disturbance of a trail cannot be avoided cleanup should be concurrent. Reassurance markers and signing will be maintained to avoid inconveniencing trail users.

Wild and Scenic Rivers

Goal: Protect and enhance the outstandingly remarkable resource values found along these streams for present and future generations.

The Forest Plan for the Deschutes National Forest provides standards and guidelines for an array of land uses referred to as Management Areas. These standards and guidelines provide direction on providing, maintaining and protecting recreation infrastructure and experience during management activities. The Forest Plan also defines the Recreation Opportunity Spectrum (ROS) for areas across the Forest. ROS is a method for classifying types of recreation experiences available, or for specifying recreation experience objectives desired in certain areas.

The following Management Areas and standards and guidelines related to the recreation experience inform how management activities proposed in the West Bend project area would be implemented.

Deer Habitat – MA-7

Goal: Manage vegetation to provide optimum habitat conditions on deer winter and transition ranges while providing some domestic livestock forage, wood products, visual quality and recreation opportunities.

M7-1: Provide various dispersed recreation opportunities primarily for the activities of viewing wildlife, hunting, gathering forest products, and roaded camping.

Upper Deschutes Wild and Scenic River (Deschutes River) – MA-17a

Goal: Protect and enhance Outstandingly Remarkable Values, including resources which are significant elements of those values.

Outstandingly Remarkable Values: The reasons for designating the Deschutes River from Wickiup Reservoir to the confluence of the Columbia River include: "Outstanding scenic, recreational, cultural, geologic, wilderness, fish and wildlife as well as historic and botanical values exist in this area." Recreation is an Outstanding Remarkable Value because of the range of activities, the variety of interpretive opportunities, and the attraction of the river for vacationers from outside of the region.

Guidance for the Deschutes River in this section is from the Upper Deschutes Wild and Scenic River Plan FEIS (1996).

Front Country – MA-18

Goal: To provide and maintain a natural appearing forested landscape on the slopes of the northeast Three Sisters and Tam McArthur Rim while providing high and sustainable levels of timber production.

M18-4: Two years after management activities are concluded, they will not be obvious when viewed from significant viewer locations.

M18-21: Traditional informal campsites, hunter camps, or areas where concentrated recreation use occurs will be recognized as being significant in producing and utilizing dispersed recreation opportunities. Prescriptions for harvesting, cleanup, site preparation, and thinning will consider the environmental setting that contributes to the attraction of these sites for recreation purposes. The attempt will be made to maintain this attractive character during and after treatments.

General Forest – MA-8

Goal: to emphasize timber production while providing forage production, visual quality, wildlife habitat, and recreational opportunities for public use and enjoyment.

M8-1: Stands managed on developed recreation sites will be treated to retain the character that contributes to the value of the site for recreation.

M8-2: Traditional informal campsites, hunter campsites, or areas where concentrated recreation use occurs will be recognized as being significant in producing and utilizing dispersed recreation opportunities. Prescriptions for harvesting, cleanup, site preparation, and thinning will consider the environmental setting that contributes to the attraction of these sites for recreation purposes. The attempt will be made to maintain this attractive character during and after treatments.

Intensive Recreation – MA-11

Goal: To provide a wide variety of quality recreation opportunities within a forest environment where the localized setting may be modified to accommodate large numbers of visitors. (Undeveloped recreation opportunities may occur in this area).

M11-42 Prescribed fire may be used to reduce hazardous fuel concentrations and to form fuel breaks adjacent to high use, high fire occurrence areas. Prescribed burning can be done to enhance the recreation experience. Burning will be planned to have the minimum impact on recreation use or appearance of the area.

Winter Recreation

Goal: To provide quality winter recreation opportunities within a forest environment that can be modified for visitor use and satisfaction.

M13-5: Timber management will be designed to provide suitable conditions for winter recreation, however, timber will not be scheduled as part of the chargeable program. Rotation ages and silvicultural prescriptions can vary to meet recreation objectives. Clearcuts are acceptable to provide opening for snowplay areas or to open up vistas for visual purposes. Firewood cutting is permissible. Timber harvesting activities will normally be conducted outside of the winter recreation season. Timber harvesting is also permitted to address catastrophic situations such as fire or insect and disease damage but the primary objective even in these situations will be to improve winter recreation opportunities.

M13-14: Prescribed fire may be used to remove concentrations of material that hinder winter recreation activities and to reduce the risk of fire.

M13-15: Fuel treatment other than prescribed fire: The lowest cost option which meats the recreation, soil, water and fire objectives should be used.

Recreation Opportunity Spectrum

The Recreation Opportunity Spectrum (ROS) is a description of various attributes that contribute to a particular recreational setting. The ROS describes recreational settings in terms of the, "combination of physical, biological, social, and managerial conditions that give value to a place." (Clark and Stankey 1979). Figure 53, page 334, shows the ROS settings for the project area. The ROS settings that apply to the West Bend project include:

Roaded Natural – This is the setting for much of the project area. "The area is characterized by predominately natural-appearing environment with moderate evidence of the sights and sounds of humans. Such evidence usually harmonizes with the natural environment. Interaction among users may be low to moderate, but with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities. Large mammals tolerant of humans may be present; those not tolerant present infrequently. There is a prevalence of smaller species.[7]"

Roaded Modified – "This area is characterized by a setting that is heavily modified by human activity. Access is generally easy for highway vehicles. The setting is generally the result of intensive commodity production. There are no size criteria. Concentration of users is low, but there is considerable evidence of others. Users have a moderate degree of isolation from the sights and sounds of other people.[8]"

Semi-Primitive Motorized (Winter Only) – "Area is characterized by a predominately natural or natural-appearing environment of moderate to large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a sway that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is permitted. Wildlife species mid-range between those tolerant of human presence and those not.[9]"

1.10.3 Analysis Methods

The analyses of environmental effects to recreational resources included in this report are based on the following assumptions: Damage and/or change to recreation infrastructure scenery (as it affects the recreational setting), public access, public safety, recreation use/experience and revenues generated by the recreational special uses

[7] Deschutes National Forest Land and Resource Management Plan Appendix 2-1
[8] Ibid
[9] Ibid

(outfitter guides and events) and tourism are the attributes most affected by the proposed action and alternatives. And the effects of the action alternatives are based on assumptions that the recreational resource protection measures described in Chapter 2 of the West Bend Vegetation Project EIS would be utilized.

Elements analyzed include the following:

Recreation infrastructure:

- Damage and/or change to recreation infrastructure owned by the US Forest Service or privately owned and authorized under special use permit. This includes improvements such as buildings, signs and trails.

Scenery:

- Short, mid-term and long-term affects to scenic values including views, the physical recreational setting, and to people's perception of the "natural" quality of their recreational experience. Effects to scenery resources are fully documented in the Scenery Resources section of the EIS.

Access:

- Type and scope of access affected
- Timing or season when recreational access may be affected

Safety:

- Effects to the public's safety including ingress and egress to recreation areas and safety during the use of facilities and areas.

Recreation Use, Experience:

- Effect on recreation use and experience in an affected area
- Effect on recreation use and experience in other areas (e.g. displacement)

Revenue:

- Effects on revenue including permitted special uses (outfitter/guides and events) and tourism

Figure 52: Recreation Sites and Trails in the Context of the Deschutes National Forest Land and Resource Management Plan Management Area Allocations for the West Bend Project Area

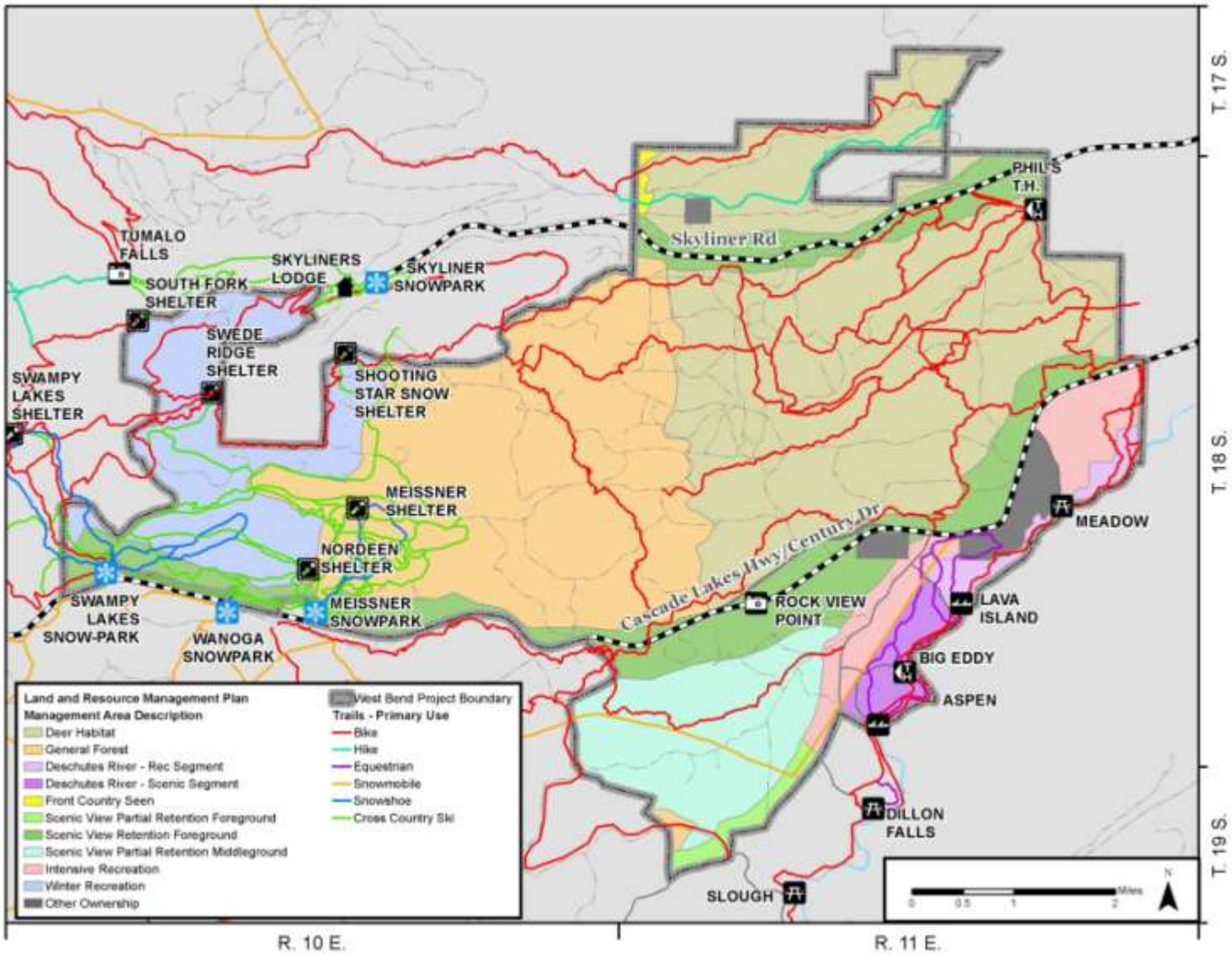
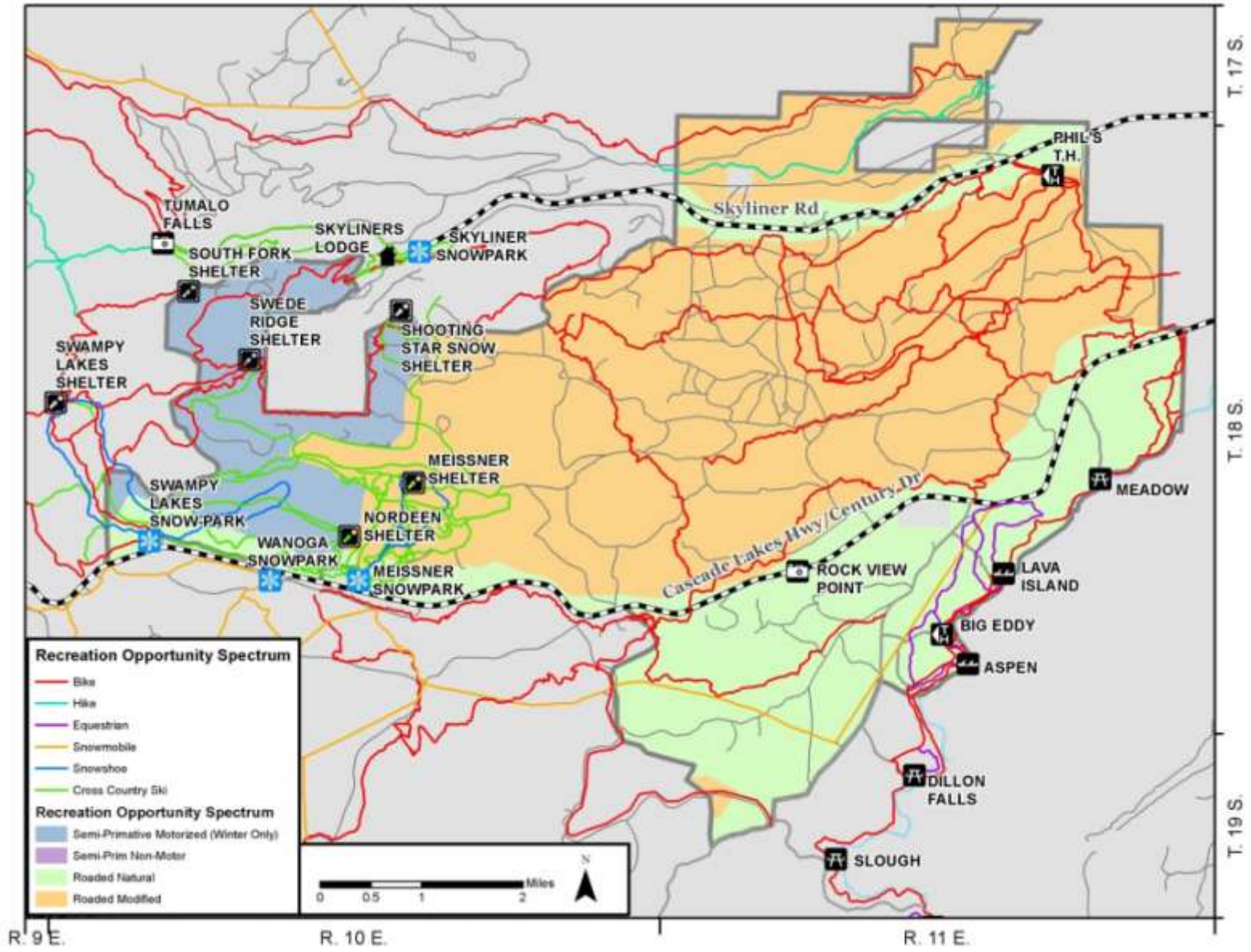


Figure 53: Recreation Opportunity Spectrum Classifications for the West Bend Project Area.



3.11.3 Developed Recreation – Sites

Existing Condition

There are a total of 12 developed recreation sites within the West Bend project area. Table 161, page 336, displays the type and capacity of the developed facilities and the LRMP Management Areas.

There are six sites that were designed primarily for summer use:

Phil's trailhead and trails have a primary use of mountain biking, also serving hikers and runners. Phil's is popular with locals and has become a tourist destination, one of the most popular trailheads on the Forest. On average, 43 vehicles utilize the parking area and adjacent areas on a daily basis during the prime seasons. On peak use days, over 100 vehicles park at the site. A site improvement project is scheduled to occur in 2014 that will pave and provide designated parking for 76 vehicles. This will occur in conjunction with the Skyliner Road repaving project. The most popular use seasons are spring and fall when the trails are less dusty, although weekends in the summer remain busy as well. Use in winter is by bikers and hikers if snow-free and by snowshoers if snow is present. Three special use permittees have used the trailhead to stage mountain bike demos, other permittees use the site to park and access the trail system (Project Record, Recreation Report, Table 7, page 26).

Rock View Point is a gateway to the Cascade Lakes Scenic Byway. The site offers interpretive signs and a trail that guides visitors to a vista that includes Lava Butte, lava flows and Paulina Peak.

The Upper Deschutes Wild and Scenic River Corridor is accessed from the following day-use areas within the project area. A recreation pass is required between May 1 and September 30. These sites are popular spring through fall:

Meadow day use area and trailhead is a popular area for picnicking. Hikers and mountain bikers use the site as a trailhead to access the Deschutes River Trail. Some boaters use the site as well.

Big Eddy trailhead is used by day-use visitors to watch rafts and boaters navigate the rapids and some boaters use the site for direct access to the Big Eddy rapids or as a take out to avoid the rapids. Hikers and mountain bikers use the site as a trailhead to access the Deschutes River trail.

Aspen boating site is a primary access point for rafting outfitters and guides is a popular put-in site for other boaters and rafters. Hikers and mountain bikers also use the site as a trailhead to access the Deschutes River trail.

Lava Island boating site is a primary take-out site for rafting outfitters and guides and popular with other boaters and rafters. Hikers and mountain bikers also use the site as a trailhead to access the Deschutes River trail.

There are six sites designed primarily for winter use:

Virginia-Meissner sno-park (Meissner Sno-Park) accesses the Nordic ski and snowshoe trails (primarily groomed) north of the Cascade Lakes Highway. The trails are maintained by Meissner Nordic, a local non-profit chapter of the Oregon Nordic Club. The sno-park is one of the most popular parking areas in the winter, often exceeding capacity on weekends. The site is planned to be expanded from 120 parking spaces in 2013 to accommodate 180 vehicles and will include a transit stop. A warming shelter is to be constructed in 2014. Summer use of the site is not encouraged and is low. An Oregon sno-park permit is required between November 1 and April 30. Skinny Skis food concession operates out of Virginia-Meissner Sno-Park.

Swampy Lakes sno-park accesses the un-groomed Nordic ski and snowshoe trails north of the Cascade Lakes Highway. The sno-park can accommodate 130 vehicles; however the parking lot does not generally reach capacity. The site is also used in the summer primarily for mountain biking. An Oregon sno-park permit is required between November 1 and April 30.

Meissner, Nordeen, Shooting Star and Swede Ridge shelters offer a destination and shelter from the elements for Nordic ski and snowshoers in the area. Visitors generally access the shelters from the Swampy Lakes and Meissner sno-parks. Swede Ridge and Shooting Star are also utilized in the summer. Winter shelters are a popular destination for events held in the winter under special use permit (Project Record, Recreation Report, Table 7, page 26).

Table 161: Developed Recreation Sites within the West Bend Project Area

Name	LRMP Management Area Description	Site Type	Capacity (vehicles)
Phil's T.H.	Deer Habitat	Summer Trailhead	Current: 25 Planned (2014): 76
Meadow	Deschutes River - Rec Segment	Summer Day Use and Trailhead	15
Lava Island		Boating Site	10
Big Eddy	Deschutes River - Scenic Segment	Summer Trailhead	15
Aspen		Boating Site	10
Rock View Point	Scenic View Retention Foreground	Viewpoint	10
Virginia-Meissner Sno-Park		Winter Sno-Park	Current: 120 Planned (2013): 180
Swampy Lakes Sno-Park		Winter Sno-Park	130
Meissner Shelter	General Forest	Winter Shelters	Primarily accessed by trail
Nordeen Shelter			
Shooting Star Shelter	Winter Recreation	Winter Shelters	Primarily accessed by trail
Swede Ridge Shelter			

3.11.4 Environmental Consequences – Developed Recreation

Alternative 1 (No Action)

Direct and Indirect Effects: Absent a major natural event that significantly alters the vegetation or geology; or a public health or safety risk that results in an unforeseen public use restriction; scenery, access, public safety and recreation use and revenue within the West Bend project area is unlikely to change in ways meaningful to consider in this analysis if no action is taken. The increased risk and the potential consequences of a wildfire is the greatest potential impact of taking no action.

Recreation Infrastructure: Recreation infrastructure including site identification signs, kiosks, toilet buildings and shelters would not be affected. These improvements would be subject to normal wear and tear over time. Unexpected events such as wildfire, accidents and vandalism may cause damage or change these improvements.

The greatest threat to recreation infrastructure would be from wildfire. No treatments would be conducted to reduce the existing high risk of wildfire that exists with thin the area. Wildfire could damage or destroy recreation infrastructure including site identification signs, kiosks, toilet buildings and shelters.

Scenery: Absent a wildfire burning through the area, the lodgepole pine forest would continue to die naturally or due to increased mountain pine beetle populations. In ponderosa pine stands, the LRMP standards and guidelines for maintaining and enhancing scenic views and creating opportunities to open views to showcase and encourage the growth of large old ponderosa pine would not be met. (Refer to Forested Vegetation, Fire and Fuels, and Scenery Resources sections).

The greatest potential effect to recreational scenery would be from wildfire. No treatments would be conducted to reduce the existing high risk of wildfire that exists within the area. Wildfire could significantly modify the vegetation and the scenery adjacent to and within the viewshed of developed recreation sites.

Access: The no action alternative would have no direct effects on the public's access to recreation sites. Current management would continue, including hazard tree removal.

In the event of a wildfire in the area, access to recreation sites may be disrupted or eliminated during and after the fire to maintain public safety. Wildfire could also damage or destroy recreation sites which could have a longer-term effect on access, and, in some cases, developed recreations sites may not be rebuilt. Effects to recreation activities may include restriction of the activity adjacent to the site, to access the same activity in the area via a different site, to participate in the same activity in the area at a different time, to participate the same activity in another area, or the inability to participate in the desired activity during the access disruption. The public may avoid areas not under a managed access restriction due to smoke and undesirable post-wildfire conditions.

Public Safety: Sunlight that could melt ice on roadways would continue to be obscured by trees during the winter. The public would continue to experience increased safety risks in the winter while traveling to winter destinations along Cascade Lakes Highway and Skyliners road. Ingress and egress along roads and trails would continue to be a public safety concern in the event of a wildfire.

Recreation Use, Experience and Revenue: Visitors, businesses and central Oregon residents would not gain from the long term benefits of healthy forests that are expected from those actions proposed in Alternatives 2-4. These benefits are expected to include forests that are more resilient to high intensity wildfire and large scale insect infestation providing for improved scenery and recreation experience, consistent economic base for a growing outdoor-recreation and tourism economy, and provision of recreation opportunities that enhance community livability.

In the event of a wildfire, during and following the event, recreation use, experience and revenues could be affected due to restriction of access to maintain public safety, avoidance of the area due to smoke, and undesirable post-wildfire conditions. Special use permittees ((Project Record, Recreation Report, Table 7, page 26)), outdoor recreation based businesses and central Oregon's outdoor recreation and tourism based economy may lose revenue. In addition to potential loss of government owned facilities, equipment and facilities owned and operated by the non-profit Meissner Nordic is stored in the Meissner area (including ski trail grooming equipment) could be lost in a wildfire.

Effects Common to Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

Direct and Indirect Effects: The proposed treatments that may affect developed recreation sites (Table 162) within the West Bend project area are the same in Alternatives 2-4.

Table 162: Proposed Treatments that may Affect Developed Recreation Sites within the West Bend Project Area

Site Name	Site Type	Treatment Unit	Overstory Treatment	Understory Treatment	Fuels Treatment
Phil's T.H.	Summer Trailhead	77	None	None	Mow/Burn
Meadow	Summer Day Use	none	None	None	None
Big Eddy	Summer Trailhead	409	Commercial Thin	PCT	Pile/Mow/Burn
Aspen	Summer Trailhead and Boating Site	None	None	None	None
Lava Island	Summer Trailhead and Boating Site	401	Commercial Thin	LFR	Pile/Mow/Burn
Rock View Point	Viewpoint	419	None	None	Mow/Burn
		420, 421	Commercial Thin	None	None
Meissner Sno-park	Sno-Park	328	Overstory Removal	PCT	Pile
Swampy Lakes Sno-Park	Sno-Park	341	Commercial Thin	PCT	Pile

Site Name	Site Type	Treatment Unit	Overstory Treatment	Understory Treatment	Fuels Treatment
Meissner Shelter	Winter Shelter	295	None	PCT	Lop and Scatter/Mow
Nordeen Shelter	Winter Shelter	309	None	None	None
Swede Ridge Shelter	Winter Shelter	None	None	None	None
Shooting Star	Winter Shelter	260	None	LFR	Pile/Mow

Effects to Key Attributes

Recreation Infrastructure: Recreation infrastructure including site identification signs, kiosks, fences, toilet buildings and shelters would be protected to the extent possible under all of the action alternatives as described in the resource protection measures (Chapter 2). If damage or destruction of a recreation improvement should occur due to project operations, the extent and cause of the damage would be assessed and the proper laws and policies would be followed to determine if and how the improvement would be repaired or replaced and if reimbursement is required.

Scenery: Each of the proposed treatments would affect the physical and therefore the scenic recreational setting. The direct effects to vegetation from each of the treatment prescriptions are detailed in the Forested Vegetation section of the EIS.

The following is a description of the general effects of the proposed treatments that may affect the scenic recreational setting of the developed recreation facilities.

Short-term Effects (0 to 3 years): Evidence of treatment operations including painted trees, slash, piles, tracks and temporary roads. Project design would ensure that these effects remain temporary. These Short-term effects could affect whether the sites are as attractive to some users as they had been in the past.

Mid-term Effects (3 to 10 years): Evidence of treatments including stumps and burned areas. Project design would reduce the impact of these mid-term effects.

Overstory removal (HOR) is proposed in the lodgepole pine stands surrounding Meissner Sno-park. Much of the area directly adjacent to the trailhead is mixed conifer, moving into lodgepole pine on the eastside of the site. Overall the scenery from this site will be improved by the removal of the dead and dying lodgepole overstory.

Long-term Effects (10 or more years): Reduced risk of high intensity wildfire and improved forest health would maintain the scenic quality surrounding these sites in the long-term.

In areas dominated by ponderosa pine, treatment would promote the growth of large, open ponderosa pine stands.

Big Eddy and Lava Island are located within Riparian Habitat Conservation Areas where riparian-dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines (see the Water Resources and Aquatic Species section in the EIS). Improved condition of these riparian areas overtime would improve the recreational scenery.

Access

Type and scope of access affected:

Access to developed recreation sites may be affected to maintain public safety. Effects may include disruption of services (e.g. outfitter and guide operations and cleaning/servicing or availability of toilets), access to the site, and/or closure of the site. Effects to access may occur when work is occurring directly adjacent to the site, in

areas surrounding the site, and/or along roads that access the site. Refer to Table 162, page 337, for sites that will likely be affected.

Effects to recreation activities may include restriction of the activity adjacent to the site, requirement to access the same activity in the area via a different site, requirement to participate in the same activity in the area at a different time, requirement to participate the same activity in another area, or the inability to participate in the desired activity during the access disruption. The duration of access disruption during overstory, understory and fuels treatments could last from a single day to several months.

Any treatment operations that would close the Big Eddy or Lava Island Falls sites during the boating and rafting use season could compromise public safety as these are popular take-out sites before areas with rapids and waterfalls. For that reason, a project design criteria was developed to ensure that safe access to these sites is maintained throughout the spring, summer and fall use seasons.

Timing or season when recreational access may be affected: To the extent possible, disruption to recreation access would be as limited as possible to maintain public safety and provide for safe and efficient treatment operations. Operations around any of the recreation sites except Meissner and Swampy Lakes Sno-parks may occur during any season (spring, summer, fall or winter) and will be based largely on operational restrictions to reduce wildlife impacts or operational efficiency. Timber operations around Meissner and Swampy Lakes Sno-parks would not occur during the winter season.

Safety: Treatments along Cascade Lakes Highway and Skyliners road would allow sunlight to reach the roads. During the winter months, the sunlight would reduce icing where treated for sunlight, making access to popular recreation destinations on these roads safer. The following units include road sun prescription: 22, 26, 36, 39, 44, 401, 449, and 450. These units border approximately 2.6 miles of Highway 46 and Forest Road 4601.

Alternatives 2-4 propose the same treatments adjacent to developed sites and the roads that access these sites resulting in reductions in fire hazards and improvements to public safety. These benefits are described in more detail in the Fire and Fuels sections of the EIS.

The public would be notified about when and where operations are occurring and sites would be properly signed to maintain public safety. Additional criteria ensure that the area will be left in a safe condition for public use.

Any treatment operations that close the Big Eddy or Lava Island Falls sites during the boating and rafting use season could compromise public safety as these are popular take-out sites before areas with rapids and waterfalls. For that reason a project design criteria was developed to ensure that safe access to these site is maintained throughout the spring, summer and fall use seasons.

Recreation Use and Experience: Changes in recreation use levels related to the proposed actions would be short term and localized. There would be no deviation from the Recreation Opportunity Spectrum criteria for any of the sites. The largest effect on recreation use would be due to treatment operations that affect access and/or the quality of the recreation experience (e.g. smoke and effects to scenery). The degree to which user preferences may lead to user displacement based on the short-term effects to the recreational setting is highly variable. Many recreationists would continue to recreate in an area despite the short-term effects. Many also appreciate the change in the vegetation to a more “fire safe” and ‘healthy forest” condition. In the mid to long-term, the proposed treatments would lead to a healthier forest condition that would benefit all recreation uses in the area.

To maintain public safety, a resource protection measure was developed to ensure safe access to Big Eddy and Lava Island river take-outs throughout the spring, summer and fall use seasons; therefore use related to river recreation is not expected to change. Day use (e.g. picnicking and trail use) may be affected when operations are occurring near the site or in the area. Visitors displaced from these sites for day use activities would likely use other nearby day use sites along the river or other area trails (trail use is analyzed in the subsequent sections).

The duration of a visit to Rock View Point is very short (less than a half-hour). This site generally is not a visitor’s primary destination; with visitors stopping at the site on their way to/from another primary destination.

While the availability of this site is a benefit to the overall recreation visit, if the site is not available it would not affect the recreation experience of most visitors and would not change use patterns beyond the site itself.

Treatment operations around Virginia-Meissner Sno-park, Swampy Lakes Sno-parks Meissner shelter and Shooting Star shelter would not occur during the winter season and would not affect the winter recreation Operations occurring in the spring, summer and fall in the area of Swampy Lakes Sno-park may affect access to the summer trail system (used primarily for mountain biking). Visitors displaced from the site would likely use other trailheads (effects to trail use is analyzed in the subsequent sections). Meissner and Shooting Star shelters are not a visitor's primary destination in the summer, and while the availability of this site is a benefit to the overall recreation visit, if the site is not available it would not affect the recreation experience of most visitors and would not change use patterns beyond the site itself.

Informational signage would be posted at sites prior to implementation. This information may include educational information that explains when treatments are occurring, where and why; before and after photos to help the public understand the short term nature of the first order effects of the treatment and the longer term goals of the project. Information on treatment locations and timing may also be posted on forest websites.

Revenue: Treatment operations in the Swampy and Meissner areas would not occur during the winter season and therefore should not have an effect on winter-related revenue tied to private operations in these areas. Access would be maintained to Lava Island and Big Eddy recreation sites, and therefore revenue related to river recreation and outfitted/guides should not be affected. No overstory or understory treatments are proposed for the area around Phil's trailhead, and any short term disturbances due to fuels treatments would not affect revenue.

Cumulative Effects -- Developed Recreation –Alternatives 2-4

Proposed and approved recreation enhancement projects would increase the range of recreation opportunities in the area including: expansion and improvement of Virginia-Meissner Sno-Park (including construction of a new warming shelter), expansion and improvement of Phil's trailhead, construction of the Cascade Lakes Scenic Byway Welcome Station, and construction of a new trailhead to access a new paved path between Bend and the Welcome Station along Century Drive.

The Bend Waterline project and the reconstruction of Skyliner road and Phil's trailhead will affect access to Phil's trailhead, Skyliners trailhead, Skyliners Lodge and Tumalo Falls day use area between 2013 and 2015. Activities related to these projects in combination with effects from the actions proposed in Alternatives 2-4 would present the greatest short-term cumulative effects to scenery, access, recreation experience and revenue. The greatest effect will be to access. It is planned that Tumalo Falls day use area will be closed to public access during portions of the waterline project, Phil's trailhead will be closed when the parking lot and access could be affected by delays during the reconstruction of Skyliner road.

Past, current and planned vegetation projects will improve forest health throughout the area and reduce the risk of large scale or high intensity wildfire. Effects to access, recreation use and revenue related to developed recreation sites have been minimal and would likely be minimal with this project.

3.11.5 Summer and Winter Trails

Existing Condition

There are nearly 139 miles of National Forest System summer and winter trails within the West Bend project area (Table 163). The following analysis characterizes trails based on 'trail designed use.' This is the use of a trail that requires the most demanding design, construction, and maintenance parameters. Other trail uses are permitted on all trails unless prohibited. For example, the Deschutes River trail designed use is mountain bike; however, hiking is also permitted on the trail. The 'managed uses' of a trail are those uses for which the trail is actively managed and maintained.

Table 163: Trails within the West Bend Project Area

Trail Designed Use	Miles
Hike	4.6
Mountain Bike	77.7
Equestrian	7.3
Cross Country Ski	36.8
Snowshoe	7.3
Snowmobile	5.2
Total	**138.9**

Summer Trails

Table 164, page 342, and Figure 54, page 343, display the type and mileage of the trails with the LRMP Management Areas for summer trails. The project area encompasses much of the popular Phil's and Tumalo/Swampy area trails as well as some of the most popular sections of the Deschutes River Trail. Trails in the area are maintained under volunteer agreement by Central Oregon Trail Alliance (COTA), Central Oregon Running Klub (CORK), DogPAC, Central Oregon Equestrian Trails (OET) and individual volunteers.

Hiking Trails: Trails open only to hikers/pedestrians include the Tumalo Creek and Rock Viewpoint trails.

Mountain Bike Trails: Trails characterized as mountain bike trails are also open to hikers and equestrian use (except for much of the Deschutes River trail within the project area, which is closed to equestrian use). Equestrian use on these trails within the project area is very low due to the level of mountain bike use. The trail systems falling within the project area include:

Phil's trail system: The area between Skyliner Road below Skyliners Lodge and Cascade Lakes Highway. Approximately 50 miles of trail system are used primarily by mountain bikers and hikers/runners, being popular throughout the spring, summer and fall. The best conditions are in the spring and fall months with more moisture and the trails are not dry and dusty. In the winter, trails accessed primarily off Skyliner Road are used by snowshoers, which is not a managed use of the trail system.

Mrazek trail: Includes the eastern half of the Mrazek mountain bike trail.

Tumalo/Swampy trail system: The trail system is north of Cascade Lakes Highway and west of the Phil's system. Approximately 10.4 miles of the trail system is used primarily by mountain bikers and hikers.

Wanoga trail system: The area between Cascade Lakes Highway, Forest Service road 41 and the Deschutes River. Approximately 5 miles of trail system is used primarily by mountain bikers.

Deschutes River trails: Encompasses the trail system south of Forest Service road 41 and north of the Deschutes River. Approximately 9.5 miles of the trail system falls within the project area. The trails are used primarily by hikers, mountain bikers and day users (picnicking/sightseeing).

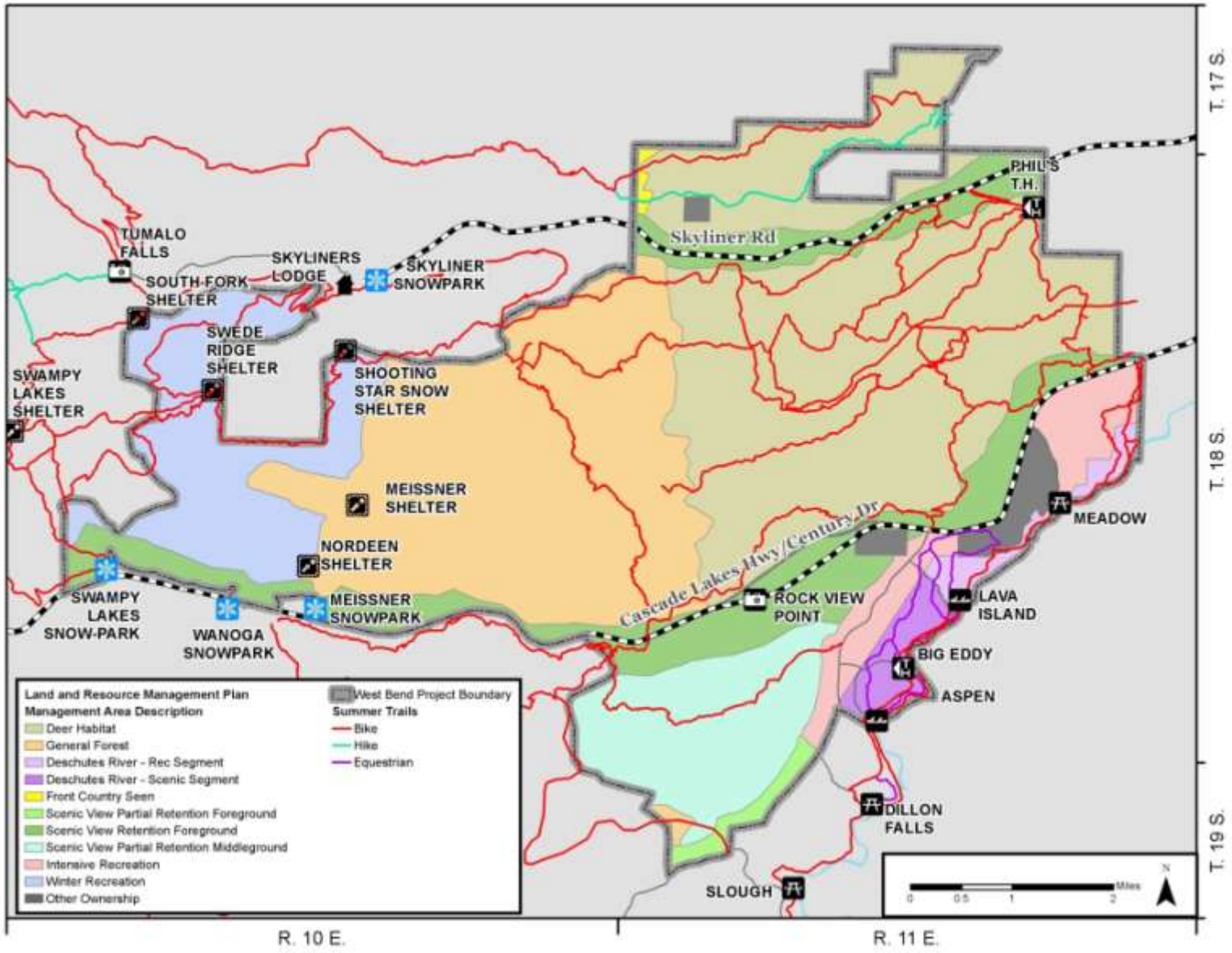
There is a growing amount of use between these trail systems, especially by mountain bikers. 'Shuttling' is also popular for mountain bikers, riders either receive a ride to the western-most parts of the trail system or use two vehicles to shuttle, and ride back into or towards Bend.

Equestrian Trails: There are approximately 7.4 miles of equestrian trails within the project area. The equestrian trails include the Deschutes River horse trails, Dillon Falls horse trail and the trails developed for use by the clients of the Seventh Mountain Resort (under special use permit, but open to the public).

Table 164: Summer Trails within the West Bend Project Area by LRMP Management Area

Summer Trails		
Trail Designed Use	**Management Area**	**Miles**
Hike	Deer Habitat	4.3
	Front Country – Seen	0.2
	Scenic View - Retention – Foreground	0.1
	Total Miles Within Project Area	**4.6**
Mountain BIKE	Deer Habitat	35.9
	Deschutes River - Recreation Segment	3.5
	Deschutes River - Scenic Segment	3.9
	Front Country – Seen	0.1
	General Forest	10.0
	Intensive Recreation	2.3
	Scenic View - Partial Retention - Middleground	3.2
	Scenic View - Retention – Foreground	9.2
	Winter Recreation	9.6
	Total Miles Within Project Area	**77.7**
Equestrian	Deschutes River - Recreation Segment	0.8
	Deschutes River - Scenic Segment	4.7
	Intensive Recreation	0.8
	Other Ownership	1.0
	Total Miles Within Project Area	**7.3**

Figure 54: Summer Trails within the West Bend Project Area by Land and Resource Management Plan Management Area



Winter Trails

Table 165 and Figure 55 display the type and mileage of the trails with the Land and Resource Management Plan Management Areas for winter trails. The project area encompasses the Meissner Nordic area and much of the Swampy Lakes Nordic area trails. Trails in the area are maintained under volunteer agreement by Central Oregon Nordic Club (CONC), Meissner Nordic, Snowbusters (a local snowmobile club under Oregon State Snowmobile Association) and individual volunteers.

Cross Country Ski and Snowshoe Trails: Trails characterized as cross country ski trails are also open to snowshoers. The trails include both groomed and ungroomed trails. The systems falling within the project area include:

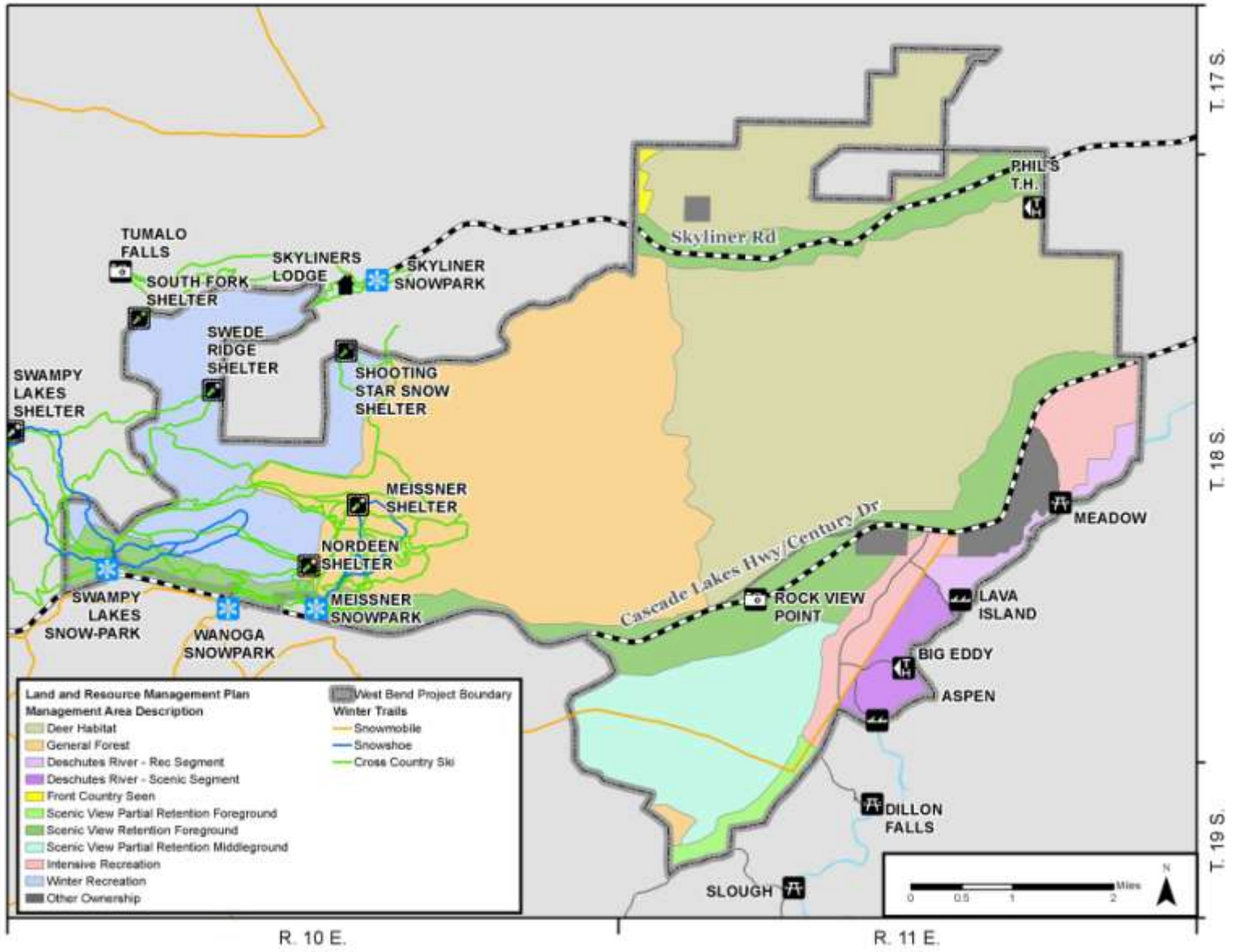
Swampy/Meissner system: Approximately 44 miles fall within the project area. About 7.2 miles are managed primarily for snowshoe and over twenty miles are groomed primarily for skate skiing.

Snowmobile Trails: Approximately 5.2 miles of snowmobile Trail #100-E is located within the project area. This trail follows Forest Service road 4100490 and the utility corridor. Due to the low elevation, snow conditions on the trail can be poor and the trail receives relatively low use compared the rest of the Wanoga snowmobile system

Table 165: Winter Trails within the West Bend Project Area by Land And Resource Management Plan Management Area

Winter Trails		
Trail Designed Use	**Management Area**	**Miles**
Cross Country Ski	General Forest	18.1
	Scenic View - Retention – Foreground	6.7
	Winter Recreation	12.0
	Total Miles	**36.8**
Snowshoe	General Forest	2.8
	Scenic View - Retention - Foreground	2.3
	Winter Recreation	2.2
	Total Miles	**7.3**
Snowmobile	Deschutes River - Recreation Segment	0.1
	Deschutes River - Scenic Segment	1.4
	Intensive Recreation	1.1
	Scenic View - Partial Retention - Foreground	0.4
	Scenic View - Partial Retention - Middleground	2.2
	Total Miles	**5.2**

Figure 55: Winter Trails within the West Bend project area by Land and Resource Management Plan Management Area



Permitted Recreation Events and Outfitter/Guides

Table 166: Recreation events and outfitter/guides that have been permitted to operate within the West Bend project area

Season of Use	Permit type	Permit Holder	Event Name	Permitted Uses	SUMMER TRAIL SYSTEM					WINTER TRAIL SYSTEM	
Summer	Event	Bend Adventure Race		Mtn. biking and trail running race					X		
Summer	Event	CO Running Klub	Dirty Half Marathon	Trail Running Race		X			X		
Summer	Event	CO Running Klub	Dirty 2nd Half	Trail Running Race							
Summer	Event	CogWild		Mtn. bike demos		X					
Summer	Event	Lay It Out Events	Happy Girls 1/2 Marathon	Running Race		X					
Summer	Event	Lay It Out Events	Haulin' Aspen	Trail Running Race	X	X					
Summer	Event	Lois Fox	Sunriver Classic	Horse Endurance Ride				X			
Summer	Event	Mudslinger Events	High Cascade 100	Mt. Bike Race				X			
Summer	Event	Mudslinger Events		24 Hr. Bike race/ride				X			
Summer	Event	Oyster Racing (Merrell)	Adventure Race	Mtn. bike and running race		X					
Summer	Event	Paul Thomasberg	Big Fat Tour	Group Bike Ride	X	X	X	X			
Summer	Event	Pine Mountain Bike Shop		Mtn. bike demos		X					
Summer	Event	Round About Enterprises	Super D/Enduro bike race	Mtn. Bike Race				X			
Summer	Event	Round About Enterprises	Super D/Enduro bike race	Mtn. Bike Race				X			
Summer	Event	Sunnyside Sports	Pickett's Charge	Mtn. Bike Race				X			
Summer	Event	Webcyclery Bike Shop		Mtn. bike demos		X					
Summer	Outfitter/Guide	Bend Endurance Academy		Mountain Bike Training	X	X	X	X			
Summer	Outfitter/Guide	Bend Metro Parks and Recreation District		Mtn. Biking and Hiking	X	X	X	X	X		
Summer	Outfitter/Guide	Central Oregon Community College		Mtn. Bike classes and Hiking	X	X	X	X	X		
Summer	Outfitter/Guide	Cog Wild Bicycle Tours, LLC		Mountain Bike Tours and shuttles	X	X	X	X	X		
Summer	Outfitter/Guide	Dirt Series Mt. Bike Camps Ltd.		Mountain Bike Training Camp		X					
Summer	Outfitter/Guide	Inn of the Seventh Mt., AUO		Horse Rides					X		
Summer	Outfitter/Guide	INNspired LLC		Rafting					X		
Summer	Outfitter/Guide	Mt. Bachelor Sports		Mountain Bike Training	X	X	X	X	X		

Season of Use	Permit type	Permit Holder	Event Name	Permitted Uses	SUMMER TRAIL SYSTEM					WINTER TRAIL SYSTEM	
		Education Foundation									
Summer	Outfitter/Guide	Sun Country Tours		Rafting					X		
Winter	Event	Oregon High School Nordic		Nordic ski races and practices						X	
Winter	Event	Tumalo Langlauf Club	Tour de Meissner	Nordic Race						X	
Winter	Outfitter/Guide	Bend Endurance Academy		Nordic Ski Training						X	
Winter	Outfitter/Guide	Bend Metro Parks and Recreation District		Nordic Skiing and snowshoeing						X	
Winter	Outfitter/Guide	Central Oregon Community College		Nordic Skiing and Snowshoeing						X	
Winter	Outfitter/Guide	Mt. Bachelor Sports Education Foundation		Nordic Training						X	

Alternative 1 (No Action)

Direct and Indirect Effects: See the direct and indirect effects of Alternative 1 to developed recreation.

Recreation Infrastructure: Recreation infrastructure including trail tread, bridges, puncheons, fords, waterbars and other drainage features, signs, fences, and other improvements related to the trail system would not be affected. These improvements would be subject to normal wear and tear over time. Unexpected events such as wildfire, accidents and vandalism may cause damage or change these improvements.

The greatest threat to trail infrastructure would be from wildfire. No treatments would be conducted to reduce the existing high risk of wildfire that exists with thin the area. Wildfire could damage or destroy trail infrastructure.

Scenery*:* Direct and indirect effects to scenery as described for developed recreation sites would be similar along trails.

Access: The general direct and indirect effects to access as described for developed recreation sites would be similar for trails.

In the event of a wildfire in the area, access to trails may be disrupted or eliminated during the fire and after the fire to maintain public safety. Wildfire could also damage or destroy trails which could have a longer-term effect on access. Trails may need to be reconstructed or rerouted with improved drainage to prevent resource damage and maintain the trail. Effects may include disruption of services (e.g. outfitter and guide operations and ability to maintain trails), reduced access or closure access of trailheads, and/or closure of trails. Effects to recreation activities may include restriction of the trail activity within the area, requirement to access the trail activity in the area via a different trailhead, requirement to participate in the same trail activity in the area at a different time, requirement to participate the same trail activity in another area, or the inability to participate in the desired trail activity during the access disruption. The public may avoid areas not under a managed access restriction due to smoke and undesirable post-wildfire conditions.

Public Safety: No treatments would be conducted to reduce the existing high risk of wildfire that exists with thin the area (Fire and Fuels section). Safe ingress and egress along roads and trails would not be improved or created, creating increased public safety concern in the event of a wildfire.

Recreation Use, Experience and Revenues: Direct and indirect effects to recreation use, experience and revenues as described for developed recreation sites under Alternative 1 would be similar for trails.

In the event of a wildfire, during and following the event, recreation use, experience and revenues could be affected due to restriction of access to maintain public safety, avoidance of the area due to smoke, and undesirable post-wildfire conditions. In the event of a wildfire, areas without vegetation and fuels treatment as proposed in Alternatives 2-4 are likely to experience larger and/or more intense wildfires and (EIS Fire and Fuels section) and greater effect to recreation use and revenue. Hesseln et al. (2004) found that demand for hiking and biking decreases as the burned area increases; with hiking demand decreasing from 1% at 1,000 acres to 7% at 100,000 acres and greater and biking demand decreasing from 1% at 1,000 acres to 17% at 100,000 acres and greater. As the percentage of burn increased from zero to 50%, hiking demand declined 1.5%, and biking demand declined 4.7%.

The 2012 Bend Area Summer Visitor Intercept Survey completed by Visit Bend reported that 33 percent of respondents reported their main purpose for visiting Bend was outdoor recreation and 40 percent reported their main purpose as leisure and sightseeing. Fifty-three percent reported participating in hiking/trail running, 15% participated in mountain biking and 18% in road biking (RRC Associates, Inc., November 2012). Many special use permittees (

Permitted **Recreation Events and Outfitter/Guides**

Table 166), outdoor recreation based businesses and central Oregon's outdoor recreation and tourism based economy may lose revenue.

Cumulative Effects – Summer and Winter Trails – Alternative 1 (No Action)

The cumulative effects to scenery, access, safety, recreation use, experience and revenues as described for developed recreation sites under Alternative 1 previously in this report would be similar for trails.

Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

Direct and Indirect Effects: The proposed treatments that may affect trails within the West Bend project area are largely similar in Alternatives 2-4 (Table 167 through Table 173) and vary slightly in the amount of trails that would be directly affected by proposed treatments as described below.

Table 167: Summary of Miles of Summer and Winter Trails Located in Units with Proposed Overstory Treatments

Summer and Winter Trails - **Total Miles Within Project Area (138.9 Miles)**			
Treatments	**Alternative 2 (Miles)**	**Alternative 3 (Miles)**	**Alternative 4 (Miles)**
Overstory Treatments			
Harvest Improvement (HIM)	1.2	1.2	1.2
Harvest Overstory Removal (HOR)	9.7	8.0	8.0
Seedtree Cut with Reserves (HCR)	13.2	13.2	13.2
Harvest Commercial Thin (HTH)	44.2	44.9	34.8
Total Miles	***68.3***	***67.3***	***57.2***
No Treatment	*70.6*	*71.6*	*81.7*
Understory Treatments			
Ladder Fuel Reduction	8.7	8.7	8.7
Pre-Commercial Thin (Mechanical)	1.6	1.6	1.6
Pre-Commercial Thin	39.1	38.3	34.9
Skid and Deck	10.7	10.7	7.8
Whip Falling	8.6	8.6	8.6
Total Miles	***68.7***	***67.9***	***61.6***
No Treatment	*70.2*	*71.0*	*77.3*
Fuel Treatments			
Lop & Scatter	10.9	10.9	10.9
Lop & Scatter/Mow	2.0	2.0	2.0
Lop & Scatter/Mow/Burn	0.7	0.7	0.6
Mow	5.2	5.2	5.2
Mow/Burn	42.7	44.2	45.3
Pile	14.1	14.1	14.1
Pile/Burn	0.4	0.4	0.4
Pile/Mow	5.3	5.3	5.3
Pile/Mow/Burn	23.7	22.9	20.7
Burn	0.4	0.4	0.4
Total Miles	***105.4***	***106.1***	***104.9***
No Treatment	*33.5*	*32.8*	*34.0*

Table 168: Summary of Miles of Hike/Pedestrian Trails that may be affected by Proposed Treatments

Hike/Pedestrian Trails - Total Miles Within Project Area (4.6 Miles)			
Treatments	**Alternative 2 (Miles)**	**Alternative 3 (Miles)**	**Alternative 4 (Miles)**
Overstory Treatments			
Harvest Commercial Thin (HTH)	1.0	1.0	0.7
No Treatment	*3.6*	*3.6*	*3.9*
Understory Treatments			
Ladder Fuel Reduction	0.3	0.3	0.3
Pre-Commercial Thin	0.7	0.7	0.3
No Treatment	*3.6*	*3.6*	*3.9*
Fuel Treatments			
Lop & Scatter/Mow/Burn	0.3	0.3	0.3
Mow/Burn	0.1	0.1	0.4
Pile/Mow/Burn	0.6	0.6	0.3
No Treatment	*3.6*	*3.6*	*3.6*

Table 169: Summary of Miles of Mountain Bike Trails that may be affected by Proposed Treatments

Mountain Bike Trails - Total Miles Within Project Area (77.7Miles)			
Treatments	**Alternative 2 (Miles)**	**Alternative 3 (Miles)**	**Alternative 4 (Miles)**
Overstory Treatments			
Seedtree Cut with Reserves (HCR)	1.6	1.6	1.6
Harvest Improvement (HIM)	0.8	0.8	0.8
Harvest Overstory Removal (HOR)	0.3	0.1	0.1
Harvest Commercial Thin (HTH)	33.8	34.4	24.9
Total Miles	***36.5***	***36.9***	***27.4***
No Treatment	*41.2*	*40.9*	*50.4*
Understory Treatments			
Ladder Fuel Reduction	5.7	5.7	5.7
Pre-Commercial Thin (Mechanical)	1.6	1.6	1.6
Pre-Commercial Thin	17.3	16.5	13.4
Skid and Deck	6.9	6.9	4.1
Whip Falling	1.3	1.3	1.3
Total Miles	***32.8***	***32.0***	***26.1***
No Treatment	*45.0*	*45.8*	*51.7*
Fuel Treatments			
Lop & Scatter	0.1	0.1	0.1
Lop & Scatter/Mow/Burn	0.4	0.4	0.3
Mow	3.7	3.7	3.7
Mow/Burn	33.9	35.4	36.1
Pile	3.5	3.5	3.5
Pile/Burn	0.3	0.3	0.3
Pile/Mow	2.6	2.6	2.6
Pile/Mow/Burn	18.3	17.5	15.8
Burn	0.1	0.1	0.1
Total Miles	***62.9***	***63.6***	***62.5***
No Treatment	*14.8*	*14.1*	*15.2*

Table 170: Summary of Miles of Equestrian Trails that may be affected by Proposed Treatments

Equestrian Trails - Total Miles Within Project Area (7.3 Miles)			
Treatments	**Alternative 2 (Miles)**	**Alternative 3 (Miles)**	**Alternative 4 (Miles)**
Overstory Treatments			
Harvest Commercial Thin (HTH)	3.6	3.6	3.6
No Treatment	*3.7*	*3.7*	*3.7*
Understory Treatments			
Ladder Fuel Reduction	1.3	1.3	1.3
Pre-Commercial Thin	2.3	2.3	2.2
Total Miles	***3.6***	***3.6***	***3.5***
No Treatment	*3.7*	*3.7*	*3.7*
Fuel Treatments			
Mow/Burn	2.5	2.5	2.6
Pile/Mow/Burn	3.5	3.5	3.4
Total Miles	***6.0***	***6.0***	***6.0***
No Treatment	*1.3*	*1.3*	*1.3*

Table 171: Summary of Miles of Cross Country Trails that may be affected by Proposed Treatments

Cross Country Trails - Total Miles Within Project Area (36.8Miles)			
Treatments	**Alternative 2 (Miles)**	**Alternative 3 (Miles)**	**Alternative 4 (Miles)**
Overstory Treatments			
Seedtree Cut with Reserves (HCR)	9.9	9.9	9.9
Harvest Improvement (HIM)	0.4	0.4	0.4
Harvest Overstory Removal (HOR)	8.2	6.7	6.7
Harvest Commercial Thin (HTH)	3.0	3.0	3.0
Total Miles	***21.5***	***20.0***	***20.0***
No Treatment	*15.3*	*16.7*	*16.7*
Understory Treatments			
Ladder Fuel Reduction	0.7	0.7	0.7
Pre-Commercial Thin	14.5	14.5	14.5
Skid and Deck	2.2	2.2	2.2
Whip Falling	6.9	6.9	6.9
Total Miles	***24.3***	***24.3***	***24.3***
No Treatment	*12.4*	*12.4*	*12.4*
Fuel Treatments			
Lop & Scatter	8.5	8.5	8.5
Lop & Scatter/Mow	1.7	1.7	1.7
Mow	1.0	1.0	1.0
Mow/Burn	2.8	2.8	2.8
Pile	9.4	9.4	9.4
Pile/Burn	0.1	0.1	0.1
Pile/Mow	2.3	2.3	2.3
Burn	0.1	0.1	0.1
Total Miles	***25.9***	***25.9***	***25.9***
No Treatment	*10.9*	*10.9*	*10.9*

Table 172: Summary of Miles of Snowshoe Trails that may be affected by Proposed Treatments

Snowshoe - Total Miles Within Project Area (7.3Miles)			
Treatments	**Alternative 2 (Miles)**	**Alternative 3 (Miles)**	**Alternative 4 (Miles)**
Overstory Treatments			
Seedtree Cut with Reserves (HCR)	1.7	1.7	1.7
Harvest Overstory Removal (HOR)	1.0	1.0	1.0
Harvest Commercial Thin (HTH)	1.0	1.0	1.0
Total Miles	***3.7***	***3.7***	***3.7***
No Treatment	*3.6*	*3.6*	*3.6*
Understory Treatments			
Pre-Commercial Thin	3.5	3.5	3.5
Skid and Deck	0.2	0.2	0.2
Whip Falling	0.4	0.4	0.4
Total Miles	***4.1***	***4.1***	***4.1***
No Treatment	*3.2*	*3.2*	*3.2*
Fuel Treatments			
Lop & Scatter	2.3	2.3	2.3
Lop & Scatter/Mow	0.3	0.3	0.3
Mow/Burn	0.6	0.6	0.6
Pile	1.2	1.2	1.2
Pile/Mow	0.2	0.2	0.2
Burn	0.2	0.2	0.2
Total Miles	***4.8***	***4.8***	***4.8***
No Treatment	*2.5*	*2.5*	*2.5*

Table 173: Summary of Miles of Snowmobile Trails that may be affected by Proposed Treatments

Snowmobile Trails - Total Miles Within Project Area (5.2Miles)			
Treatments	**Alternative 2 (Miles)**	**Alternative 3 (Miles)**	**Alternative 4 (Miles)**
Overstory Treatments			
Seedtree Cut with Reserves (HCR)	0.0	0.0	0.0
Harvest Overstory Removal (HOR)	0.2	0.2	0.2
Harvest Commercial Thin (HTH)	1.9	1.9	1.7
Total Miles	***2.1***	***2.1***	***2.9***
No Treatment	*3.0*	*3.0*	*3.2*
Understory Treatments			
Ladder Fuel Reduction	0.7	0.7	0.7
Pre-Commercial Thin	0.8	0.8	0.8
Skid and Deck	1.4	1.4	1.4
Total Miles	***2.9***	***2.9***	***2.9***
No Treatment	*2.2*	*2.2*	*2.2*
Fuel Treatments			
Mow	0.5	0.5	0.5
Mow/Burn	2.8	2.8	2.8
Pile/Mow	0.2	0.2	0.2
Pile/Mow/Burn	1.3	1.3	1.2
Total Miles	***4.8***	***4.8***	***4.7***
No Treatment	*0.4*	*0.4*	*0.5*

Effects to Key Attributes

Recreation Infrastructure: Recreation infrastructure including trail tread, bridges, puncheons, fords, waterbars and other drainage features, signs, fences, and other improvements related to the trail system would be protected to the extent possible under all of the action alternatives as described in the resource protection measures (Chapter 2). These protection measures were developed in coordination with trail stakeholder groups and groups that build and maintain trail under volunteer agreements. The measures include protection of trail defining trees and protection of the trail tread by limiting trail crossings for heavy machinery. If damage or destruction of a recreation improvement should occur due to project operations, the extent and cause of the damage would be assessed and the proper laws and policies would be followed to determine if and how the improvement would be repaired or replaced and if reimbursement is required.

Scenery: Alternatives 2-4 would have a direct effect on the scenery from activities such as cutting, skidding, and decking logs; piling and burning non-commercial woody material and logging-generated slash; operating heavy machinery around; and burning of areas within the vicinity of trails. Each of the proposed treatments would affect the physical and therefore the scenic recreational setting. The direct effects to vegetation from each of the treatment prescriptions are detailed in the Forested Vegetation section of the EIS.

The following is a description of the general effects of the proposed treatments that may affect the scenic recreational setting of trails.

Short-term Effects (0 to 3 years): Evidence of treatment operations including painted trees, slash, piles, tracks and temporary roads. Project design criteria have been developed for this project to ensure that these effects remain temporary (see Table 161, page 336). These short-term effects could affect whether the trails are as attractive to some users as they had been in the past.

Mid-term Effects (3 to 10 years) - Evidence of treatments including stumps. Project design criteria have been developed for this project to reduce the impact of these mid-term effects (Table 161, page 336).

Harvest overstory removal (HOR) and seed tree cuts with reserves (HCR) are proposed in the lodgepole pine stands in surrounding the Tumalo/Swampy and Swampy/Meissner trail systems. The goal of the prescriptions within these stands is to remove the dead standing lodgepole pine and the lodgepole pine overstory to promote a healthy single story lodgepole pine stand (see the Forested Vegetation section of the EIS). In Alternative 2, 22.6 miles of trail would be affected and 20.9 miles would be affected in Alternatives 3 and 4.

Understory lodgepole pine stands are in differing stages of growth. The effect to scenery would be most evident in the youngest stands. Removal of dead and dying trees would benefit the scenic values throughout the area. Some areas would also benefit from expanded viewsheds, including mountain views in some areas.

Project design and mitigation measures have been developed to maintain trees sufficient to designate and define trails and to shade some winter trails to help retain snow (Table 161, page 336).

Figure 56: Trails that may be affected by Proposed Overstory Treatments in Lodgepole Pine Stands

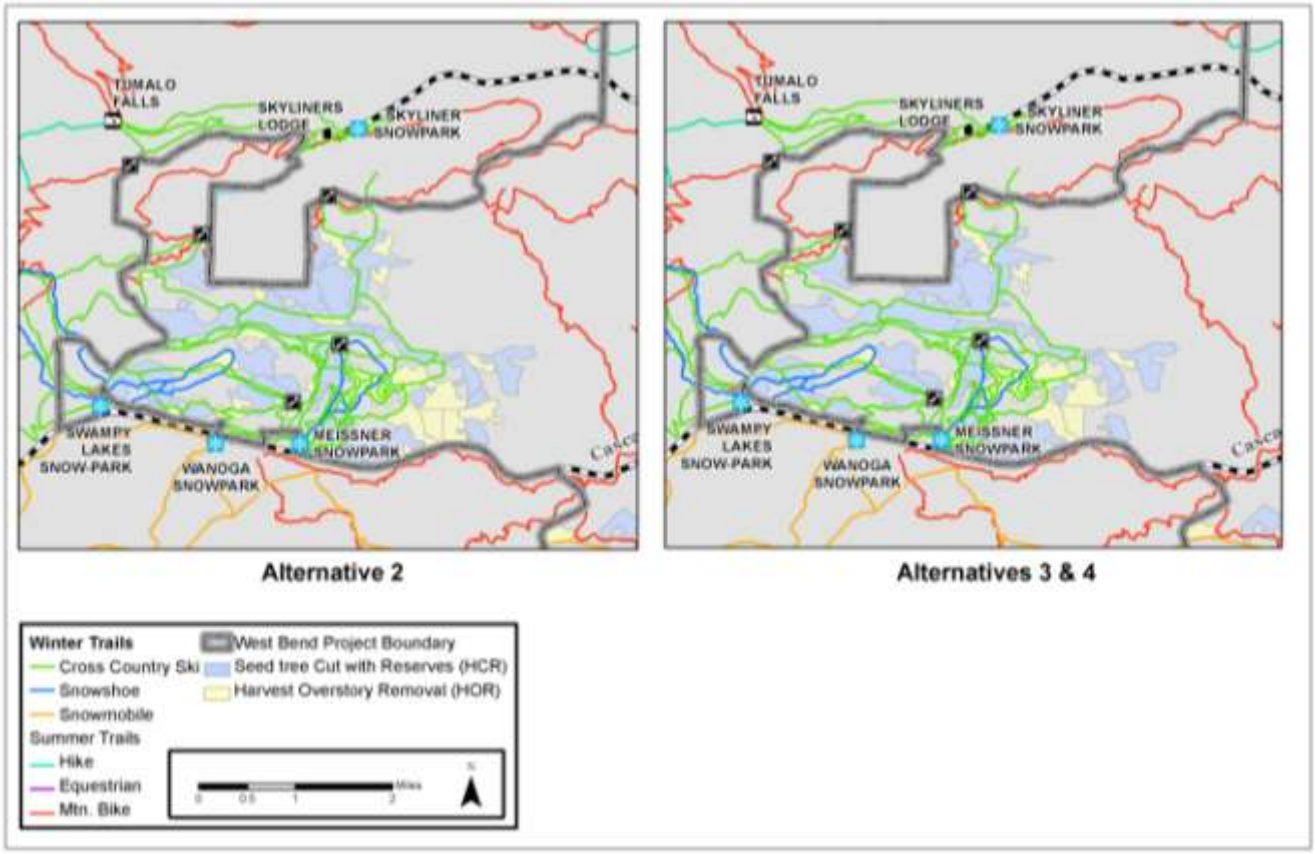


Table 174: Miles of Trails by Designed Used that may be Affected by Proposed Overstory Treatments in Lodgepole Pine Stands

Trail – Designed Use	Alternative 2 (Miles)	Alternatives 3 & 4 (Miles)
Mountain. Bike	1.8	1.5
Cross Country Ski	18.1	16.7
Snowshoe	2.7	2.7

Prescribed burning is proposed across most of the eastern portion of the project area. Once the treatment is completed across the area, the risk related to extreme hazard would be greatly reduced across the area. To the extent possible, trails would not be used as fireline leaving a condition of 'black' on one only one side of a trail. Areas with proposed burning may need to be burned twice in order to achieve the desired to reduce brush and encourage native grasses).

Figure 57: Trails that may be affected by Proposed Burning Treatment

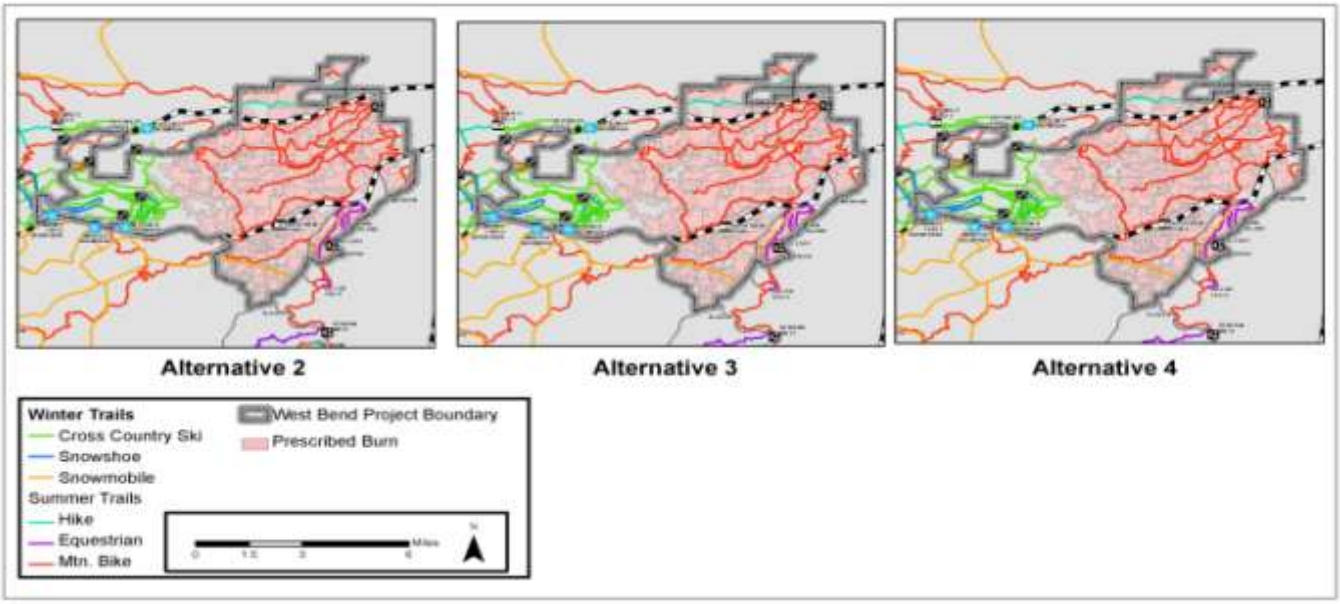


Table 175: Miles of Trails by Designed Used that may be affected by Proposed Burning Treatment

Trail – Designed Use	Alternative 2 (Miles)	Alternative 3 (Miles)	Alternative 4 (Miles)
Hike/pedestrian	1	1	1
Mtn. Bike	53	53.7	52.6
Equestrian	6	6	6
Cross Country Ski	3	3	3
Snowshoe	0.8	0.8	0.8
Snowmobile	4.1	4.1	4

Long-term Effects (10 or more years)

- Reduced risk of high intensity wildfire and improved forest health would maintain the scenic quality surrounding these trails in the long-term.
- In areas dominated by ponderosa pine, treatment would promote the growth of large, open ponderosa pine stands.
- An overall condition of a healthy forest would lead to a high level of sustained scenic values across the landscape.

Access

Type and scope of access affected

Access to developed recreation sites may be affected to maintain public safety. Effects may include disruption of services (e.g. outfitter and guide operations and cleaning/servicing or availability of toilets), access to the site, and/or closure of the site. Effects to access may occur when work is occurring directly adjacent to the site, in areas surrounding the site, and/or along roads that access the site (descriptions of the roads that are used for hauling and that are otherwise affected by the project are included in the Transportation section 3.10).

Reduced access to developed recreation sites can affect recreation beyond the use of the site and associated facilities. If a site is closed or access to the site is affected, the recreation activities associated

with the site may also be affected (effects on recreation activities associated with trails, roads and dispersed recreation activities are analyzed subsequent sections of the Recreation section. Conversely, access to developed recreation sites may be affected if treatments are occurring on or in the area of trails that these sites access.

Effects to recreation activities may include restriction of the activity adjacent to the site, requirement to access the same activity in the area via a different site, requirement to participate in the same activity in the area at a different time, requirement to participate the same activity in another area, or the inability to participate in the desired activity during the access disruption.

The duration of access disruption during overstory, understory and fuels treatments could last from a single day to several months.

Any treatment operations that would close the Big Eddy or Lava Island Falls sites during the boating and rafting use season could compromise public safety as these are popular take-out sites before areas with rapids and waterfalls. For that reason, a project design criteria was developed to ensure that safe access to these sites is maintained throughout the spring, summer and fall use seasons.

Hiking Trails: During treatment activities, hikers/pedestrians wanting to use the Tumalo Creek trail would likely be displaced to another area for similar activity. The duration of a visit to Rock View Point is very short (less than a half-hour). This site generally is not a visitor's primary destination; with visitors stopping at the site on their way to/from another primary destination. While the availability of this site and the associated trail is a benefit to the overall recreation visit, if the site is not available it would not affect the recreation experience of most visitors and would not change use patterns beyond the site itself.

Table 176: Miles of Trails by Hike/Pedestrian Trail System that may be affected by Proposed Treatments

Hiker/Pedestrian Trail System	Overstory Treatment By Alternative/Miles			Understory Treatment By Alternative/Miles			Fuels Treatment By Alternative/Miles		
	2	3	4	2	3	4	2	3	4
Tumalo Creek Trail	0.9	0.9	0.9	0.9	0.9	0.9	1	1	1
Rock Viewpoint Trail	Less than 0.1 mile			0	0	0	Less than 0.1 mile		

Mountain Bike Trails: Due to the number of mountain bike trails within close proximity, it is likely that visitors would be able to participate in mountain biking and other trail activities even if parts of the trail system are not accessible. Some trails are important connectors for loops or access to the larger system, disruptions in access to these trails would have a greater short-term effect on users. Treatments proposed on the Deschutes River trail, between Lava Island and south of Aspen Day Use site, may displace hikers and bikers from sections of the trail. Trail volunteers maintenance activities would also be impacted during operations.

Table 177: Miles of Trails by Mountain Bike Trail System that may be affected by Proposed Treatments

Mountain. Bike Trail System	Overstory Treatment By Alternative/Miles			Understory Treatment By Alternative/Miles			Fuels Treatment By Alternative/Miles		
	2	3	4	2	3	4	2	3	4
Phil's Trail System	26.7	26.7	19.1	20.8	20	15.3	45.6	45.6	45.3
Mrazek trail	2.8	2.8	1.2	2.5	2.5	1.2	4.1	4.1	4
Tumalo/Swampy Trail System	3.5	3.2	3.2	5.6	5.6	5.6	6.3	6.3	6.3
Wanoga Trail System	1.7	1.6	2.2	1.8	0.8	1.8	2.9	3.6	2.9
Deschutes River Trail System	2	2	1.9	2	2	1.9	4	4	4

Equestrian Trails: Equestrian users and clients of the Seventh Mountain Resort may be displaced from trails in the Deschutes River area during operations. Users would likely utilize river trails to the

south of the project area, utilize other forest trails, utilize trails under other ownership/jurisdiction, or may choose not to participate in the activity during the operational period.

Table 178: Miles of Trails by Equestrian Trail System that may be affected by Proposed Treatments

Equestrian Trail System	Overstory Treatment By Alternative/Miles			Understory Treatment By Alternative/Miles			Fuels Treatment By Alternative/Miles		
	2	3	4	2	3	4	2	3	4
Deschutes River Trail System	3.5	3.5	3.4	3.5	3.5	3.4	6	6	6

Cross Country Ski and Snowshoe Trails: Much of the cross country and snowshoe trails affected by the project fall within the Winter Recreation LRMP Management Area where the goal is to provide quality winter recreation opportunities within a forest environment that can be modified for visitor use and satisfaction. For this reason, a project design criteria has been developed to require that treatments are implemented outside of the winter use season. Therefore, recreational access should not be disrupted in the winter, however, trail maintenance activities by the Forest Service and volunteers may be impacted during operations.

Table 179: Miles of Trails by Cross Country Ski and Snowshoe Trail System that may be affected by Proposed Treatments

Cross Country Ski and Snowshoe Trail System	Overstory Treatment By Alternative/Miles			Understory Treatment By Alternative/Miles			Fuels Treatment By Alternative/Miles		
	2	3	4	2	3	4	2	3	4
Swampy/Meissner Trail System – Cross Country Ski (groomed)	15.7	15.1	15.1	17.1	17.1	17.1	18.7	18.7	18.7
Swampy/Meissner Trail System – Cross Country Ski (ungroomed)	5.9	5.1	5.1	7.1	7.1	7.1	7.2	7.2	7.2
Swampy/Meissner Trail System (snowshoe)	3.7	3.7	3.7	4.1	4.1	4.1	4.8	4.8	4.8

Snowmobile Trails: Due to the number of snowmobile trails within close proximity, visitors would be able to participate in snowmobiling and other trail activities even if parts of snowmobile Trail #100-E are not accessible. Snowmobilers and other winter users may be displaced from snowmobile Trail #100-E during operations. Due to the low elevation, snow conditions on the trail can be poor and the trail receives relatively low use compared the rest of the Wanoga snowmobile system. If the trail is closed in the winter, volunteers would not be able to groom the trail and snowmobilers would not be able to access the trail.

Table 180: Miles of Trails by Snowmobile Trail System that may be affected by Proposed Treatments

Snowmobile Trail System	Overstory Treatment By Alternative/Miles			Understory Treatment By Alternative/Miles			Fuels Treatment By Alternative/Miles		
	2	3	4	2	3	4	2	3	4
Wanoga Trail System	2.1	2.1	1.9	3	3	2.8	4.8	4.8	4.8

Timing or season when recreational access may be affected

To the extent possible, disruption to recreation access would be as limited as possible to maintain public safety and provide for safe and efficient treatment operations. To the extent possible, implementation of treatments will be designed to maintain access to the larger trail system.

Operations around any of the recreation trails except around the Meissner/Swampy winter trail systems may occur during any season (spring, summer, fall or winter) and will be based largely on operational restrictions to reduce wildlife impacts and operational efficiency. Timber operations around the

Meissner/Swampy trail systems would not occur during the winter season because many of these trails overlap the Winter Recreation LRMP Management Area. Areas with proposed burning may need to be burned twice in order to achieve the desired to reduce brush and encourage native grasses (EIS Fire and Fuels section).

The duration of access disruption during overstory, understory and fuels treatments could last from a single day to several months. Frequent visitors in these popular recreation areas may experience multiple disturbances to access over the next five to ten years due to the total number of trails affected and the span of time over which these treatments would occur. In addition, many areas with trails are scheduled to have multiple entries for treatment with overstory, understory and fuels treatments each taking place separately. Finally, fuels reductions treatments often require multiple treatments. In some cases this may require mowing followed up by burning in the following years or re-burning an area several years later to impede brush growth and promote the growth of grasses. While there are many trails and options to modify an individual's trip to gain the desired experience, visitors that use the project area often for recreation may experience several access disturbances over the course of the project.

Safety

Alternatives 2-4 propose largely the same treatments across and surrounding trails and the trailheads and roads that access these trails resulting in reductions in fire hazards, improved ingress and egress, and improvements to public safety. These benefits are described in more detail in the Fire and Fuels sections of the EIS.

After vegetation and/or fuels treatment, trails would be returned to a safe condition for the recreating public. Trail signs would be replaced as needed and hazards such as sticks/staubs within the trail prism or fall-zone would be removed.

Project design criteria have been developed to maintain public safety during operations by ensuring the public is notified about when and where operations are occurring and that sites are properly signed. Additional criteria ensure that the area will be left in a safe condition for public use.

Recreation Use and Experience

In general, changes in recreation use levels related to the proposed actions would be short term and localized and there would be no deviation from the Recreation Opportunity Spectrum criteria for any of the sites. The largest effect on recreation use would be due to treatment operations that affect access and/or the quality of the recreation experience (e.g. smoke and effects to scenery). The degree to which user preferences may lead to user displacement based on the short-term effects to the recreational setting is highly variable. Many recreationists have a reasonable understanding of the nature of change in the forest, and are willing to continue to recreate in an area despite these Short-term effects. Many also appreciate the change in the vegetation to a more "fire safe" and 'healthy forest" condition. In the mid to long-term, the proposed treatments would lead to a healthier forest condition that would benefit all recreation uses in the area.

In order to help visitors plan their visit around proposed operations, informational signage would be posted at the site prior to implementation. This information may include educational information that explains when treatments are occurring, where and why; before and after photos to help the public understand the short term nature of the first order effects of the treatment and the longer term goals of the project. Information on treatment locations and timing may also be posted on forest websites.

Revenue

Because many of the cross country and snowshoe trails affected by the project fall within the Winter Recreation LRMP Management Area where the goal is to provide quality winter recreation opportunities, a project design criteria has been developed to require that treatments are implemented

outside of the winter use season. In addition, while overstory treatments in lodgepole pine may affect the scenery in the short to mid-terms in limited areas with a young understory stand, this change in scenic value is not anticipated to modify the publics' use of the area, events held in the area or effect winter recreation revenue.

In the event of a wildfire, areas with vegetation and fuels treatment as proposed in Alternatives 2-4 are likely to experience smaller and/or less intense wildfires and (EIS Fire and Fuels section) and therefore less effect to recreation use and revenue. Hesseln et al. (2004) found that demand for hiking and biking decreases as the burned area increases; with hiking demand decreasing from 1% at 1,000 acres to 7% at 100,000 acres and greater and biking demand decreasing from 1% at 1,000 acres to 17% at 100,000 acres and greater. As the percentage of burn increased from zero to 50%, hiking demand declined 1.5%, and biking demand declined 4.7%.

The 2012 Bend Area Summer Visitor Intercept Survey completed by Visit Bend reported that 33 percent of respondents reported their main purpose for visiting Bend was outdoor recreation and 40 percent reported their main purpose as leisure and sightseeing. Fifty-three percent reported participating in hiking/trail running, 15% participated in mountain biking and 18% in road biking (RRC Associates, Inc., November 2012). Given the number of trails and roads in the area, all special use permitted outfitter/guides and events should be able to be accommodated, however their routes may need to be modified. Tourists and visitors should be able to modify their site visit if necessary and still find the recreation experience they desire. Visitors, businesses and central Oregon residents would gain from the long term benefits of healthy forests that are expected from the actions proposed in Alternatives 2-4. These benefits are expected to include forests that are more resilient to high intensity wildfire and large scale insect infestation providing for improved scenery and recreation experience, consistent economic base for a growing outdoor-recreation and tourism economy, and provision of recreation opportunities that enhance community livability.

Cumulative Effects – Summer and Winter Trails – Alternatives 2 - 4

A number of projects affecting trails have, are or will occur in the areas surrounding the West Bend project area. Proposed and approved recreation enhancement projects would increase trail-based recreation opportunities in the area including: expansion and improvement of Virginia-Meissner Sno-Park including construction of a new warming shelter, expansion and improvement of Phil's trailhead, construction of the Cascade Lakes Scenic Byway Welcome Station including a day use trailhead, construction of a tunnel under Cascade Lakes Highway near the intersection with Forest Road 41, proposed construction of a new trailhead and paved path between Bend and the Welcome Station along Century Drive, and a proposed mountain bike trail connecting Tyler's Traverse, Storm King and COD through the tunnel. Overall, these recreation enhancements should improve access, recreation experience and revenue and provide additional recreation opportunities, should access to existing trails be affected by proposed treatments.

The Bend Waterline project and the reconstruction of Skyliner road and Phil's trailhead will affect access to Phil's trailhead, Skyliners trailhead, Skyliners Lodge and Tumalo Falls day use area between 2012 and 2014. Activities related to these projects in combination with effects from the actions proposed in Alternatives 2-4 would present the greatest short-term cumulative effects to scenery, access, recreation experience and revenue. The greatest effect will be to access. It is planned that Tumalo Falls day use area will be closed to public access during portions of the waterline project, Phil's trailhead will be closed when the parking lot and access road are reconstructed and access throughout the area will burdened by construction delays during the reconstruction of Skyliner road.

In addition, the East Tumbull and Sparky projects has been implemented in areas surrounding the West Bend project area over the past several years, adding to the cumulative short to mid-term affects to scenery, disruptions in access, and modifications to recreation use and experience.

3.11.6 Dispersed Recreation

Existing Condition

Dispersed recreation includes recreation activities that take place outside of sites or areas that are developed or managed to concentrate recreation use.

Use of forest roads is important for access to dispersed recreation sites and trails, hunting and other activities like wildlife viewing, driving for pleasure, gathering forest products (firewood and mushrooms) and off-highway vehicle (OHV) use. Paved roads are popular for road biking.

Dispersed camping occurs throughout the project area, except within the closure area along the Deschutes River. Due to the lack of water, these sites are generally small and camping serves as a secondary activity (generally trail use is the primary recreation activity). They are located primarily within ponderosa pine and mixed conifer stands.

Driving for pleasure is a popular recreation activity and three of the most traveled forest roads, Cascade Lakes Highway (FS road 4600000), Skyliners road (FS road 4601000), and the Deschutes river access road (FS road 4100000), run through the project area. User created (unauthorized) roads and trails are illegal, but do occur within the project area. Use of these unauthorized roads and trails is prevented or discouraged with the use of boulders, signs and by pulling material (logs, brush, etc.) over the route.

Hunting was historically high use in the West Bend project area, however, with the expansion of the trail system and increase in use over the past 10 years, hunting use has declined greatly in most of the area. Other uses that are popular in the area include disc/frisbee golf, rock climbing/bouldering and skiing off-trail including limited opportunities for telemark skiing.

Alternative 1 (No Action)

Direct and Indirect Effects: See the direct and indirect effects of Alternative 1 to scenery, access, public safety, recreation use/experience and revenue for developed recreation and winter and summer trails, which are similar for dispersed recreation.

Recreation Infrastructure: Infrastructure is not developed for dispersed recreation except to maintain public safety or protect resources and generally includes signs, fences and boulders. These features would not be affected. These improvements would be subject to normal wear and tear over time. Unexpected events such as wildfire, accidents and vandalism may cause damage or change these improvements.

The greatest threat to recreation infrastructure would be from wildfire. No treatments would be conducted to reduce the existing high risk of wildfire that exists with thin the area. Wildfire could damage or destroy recreation infrastructure including site identification signs, kiosks, toilet buildings and shelters.

Safety: No treatments would be completed. Sunlight would continue to be more obscured by trees and not reach the roadways in areas of icing during the winter. The public would continue to experience increased safety risks in the winter while traveling along Cascade Lakes Highway and Skyliners road.

Recreation Use, Experience and Revenue: While management actions are taken to prevent and discourage the use of unauthorized roads and trails, without the action of obliterating (using machinery to de-compact soils) and additional boulder placement use of some well-established routes may continue.

No treatments would occur across slopes in the Swampy and Meissner areas. Skiers would not gain the ancillary benefit of having the vegetation on these slopes opened up, which is slopes that could be used for telemark skiing.

Effects Common to Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

Direct and Indirect Effects: See the direct and indirect effects of Alternatives 2-4 to scenery, access, public safety, recreation use/experience and revenue for developed recreation and winter and summer trails, which are similar for dispersed recreation.

Recreation Infrastructure: Infrastructure is not developed for dispersed recreation except to maintain public safety or protect resources and generally includes signs, fences and boulders. This infrastructure would be protected to the extent possible under all of the action alternatives as described in the resource protection measures (Chapter 2). Dispersed sites including campsites, parking areas and user created developments would not be protected and may be altered or destroyed by the proposed activities.

Safety: Treatments along Cascade Lakes Highway and Skyliners road would allow sunlight to reach the roads. During the winter months, the sunlight would reduce icing, making travel on these roads safer.

Recreation Use and Experience: While management actions are taken to prevent and discourage the use of unauthorized roads and trails, under the action alternatives additional obliteration (using machinery to de-compact soils) and boulder placement on existing user created routes would prevent or discourage use of unauthorized routes. Resource protection measures would use similar tactics to prevent temporary roads and skids roads developed or used for the project from becoming used by the public. Under Alternatives 2-4, treatments would occur across slopes in the Swampy and Meissner areas. Skiers would gain the ancillary benefit of having the vegetation on these slopes opened up, which is slopes that could be used for telemark skiing. The planned overstory and understory treatments on some slopes would be planned so that the spacing between trees would allow for terrain to telemark ski or 'make turns'.

Cumulative Effects

See the cumulative effects of Alternative 1 to scenery, access, public safety, recreation use/experience and revenue for developed recreation and winter and summer trails, which are similar for dispersed recreation.

The action alternatives may further reduce vegetative screening used by game animals such as deer and elk (see the wildlife section). Given the current effect of the expansion of the trail system and increase in recreation use of the area over the past 10 years, there may be a cumulative effect on the decreasing desirability of the area for use by hunters.

3.12 Scenery Resources

3.12.1 Introduction

This report addresses compliance with management direction for Scenic Views Management Areas classified in the Scenery Management System as High Scenic Integrity (Retention - VMS) and Medium Scenic Integrity (Partial Retention – VMS) Foreground and Middleground areas and Front Country Scenic Management Areas. Compliance with management direction for the Upper Deschutes Wild and Scenic River for outstanding and remarkable values for scenery, recreation, geology, hydrology, fisheries, vegetation, wildlife, and cultural resources and designation as a State Scenic Waterway.

3.12.2 Management Direction

The LRMP standards and guidelines for the Scenic Views Management Areas are described in terms of desired future conditions for various settings and how these are to be met by specified activities or actions. The Scenery Management System (SMS) is the methodology used by Forest Service landscape architects since 1996 to provide a visual impact assessment of effects to scenic resources which integrates social impacts to recreation visitors with physical impacts to the visitor experience.

This current and more holistic system includes the human element as an integral part of the ecosystem and has been the methodology used in place of the previous outdated Visual Management System (VMS) of 1974 which continues to be referenced in Forest Plans that have not yet been updated to reference the current SMS instead. To facilitate this change in methodology, both systems have been referenced by applying SMS and referencing VMS in parentheses such as High Scenic Integrity (Retention – VMS).

The Forest Service implementing regulations currently establish a variety of Scenic Integrity Levels for Scenic Views – MA9 (LMRP page 4-121). These standards and guidelines include:

- High Scenic Integrity Level – SMS - Natural Appearing Landscape (Retention – VMS) - MA 9, SV-1 Foreground, SV-3 Middleground
- Moderate Scenic Integrity Level - SMS - Slightly Altered Landscape (Partial Retention – VMS) - MA 9, SV-2 Foreground, SV-4 Middleground
- Low Scenic Integrity Level – SMS - Altered Landscape (Modification – VMS or General Forest) - MA 8, GFO within Foreground as well as Middleground

Scenery Management Objectives are defined in terms of Scenic Integrity Levels which describe existing conditions and whether the landscape is visually perceived to be “complete” or not. The most complete or highest rating for Scenic Integrity Levels means having little or no deviation from the landscape character that makes it appealing and attractive to visitors and local residents. In addition to describing existing conditions, Scenic Integrity Levels also describe the level of development allowed and ways to mitigate deviations from the area’s landscape character.

The goal of the Scenic Views Management Area (see Figure 2 in FEIS) is to provide high quality scenery representing the natural character of Central Oregon. The general theme and objectives of Scenic Views is for landscapes seen from selected travel routes and use areas to be managed to maintain or enhance the appearance of the areas being viewed. To the casual observer, results of activities will either not be evident or will be visually subordinate to the natural landscape.

Timber harvest is permitted but only to protect and improve the visual quality for stands in both the short-term and long-term time frames. Timber stands, which have remained unmanaged in the past because of their visual sensitivity, will begin receiving treatment to avoid loss of the stand to natural causes. Landscapes containing negative visual elements, such as skid roads, activity residue, or cable corridors, will be rehabilitated.

The desired condition for ponderosa pine is to achieve and maintain visual diversity through variation of stand densities and size classes. Large, old-growth pine will remain an important constituent, with trees achieving 30 inches in diameter or larger and having deeply furrowed, yellow bark characteristics.

For other species, the desired condition requires obtaining visual diversity through either spatial distribution of age classes and mix of species through density manipulation or openings, or through a mixture of age classes within stands. The Scenic Resources Specialist Report discusses the specifics of the desired future condition for the various species.

3.12.3 Analysis Methods

Methodology used for analyzing impacts to scenic resources is the Scenery Management System (SMS) which uses "Landscape Aesthetics: A Handbook for Scenery Management." Issued in 1996, this new handbook replaces "Agriculture Handbook 462 – The Visual Management System (VMS)" which was issued in 1974. While many of the basic inventory elements of the Visual Management System are retained, the Scenery Management System incorporates both the natural and human processes into the ideas of managing for ecosystems.

3.12.4 Affected Environment

Within the Scenic Views of the project area there are:

- 3,432 acres of Foreground classified as High Scenic Integrity – SMS (Retention – VMS) in Foreground and 2,030 acres of Middleground also classified as High Scenic Integrity – SMS (Retention –VMS). These areas are located along the scenic travel corridor of the Cascade Lakes National Scenic Byway which traverses west to east across the lower third of the project area, around Tumalo Falls and the City of Bend Watershed area in the northwest portion, and along the Wild and Scenic Deschutes River in the southeast portion of the project area.
- 509 acres in the Wild and Scenic River Management Area classified as High Scenic Integrity (Retention – VMS) in Scenic and Recreation segments.
- 65 acres of Front Country which are located to the north of Skyliners Road in the northern portion of the project area.
- 239 acres of Foreground classified as Medium Scenic Integrity – SMS (Partial Retention (VMS). Areas are located mostly along Road 41 close to the river recreation sites and along the scenic viewshed from vista points along Cascade Lakes National Scenic Byway looking toward Newberry National Volcanic Monument in the southwest portion of the project area.

Figure 58: Forest View along Cascade Lakes National Scenic Byway

Figure 59: Forest View along Cascade Lakes National Scenic Byway

Figure 60: Wild and Scenic Deschutes River – Scenic Segment

Figure 61: Junction of Cascade Lakes Scenic Byway and Road 41

Landscape Flows

Landscape flows occur throughout the project area. The social connectivity corridors for visitors are along the major scenic travel corridors; Cascade Lakes Scenic Byway, Road 4601 along Tumalo Creek, Road 41 and Road 45. These scenic travel corridors provide connections to the many non-motorized and motorized trails and recreation sites during both the summer and winter seasons. Wildlife migrations also occur seasonally across this landscape and often overlap and intersect with travelers and recreation visitors.

Landscape Analysis Design

By applying a Landscape Analysis Design (Apostle/Diaz) process to the project area, a comprehensive view is provided with overlays comprised of ecosystem functions, landscape flows, and physical, biological and social domains. The dynamics of the project area are defined by the Bend Municipal Watershed, the Deschutes Wild and Scenic River, scenic viewsheds to the Newberry National Volcanic Monument and along the Cascade Lakes National Scenic Byway transecting the project area, the city of Bend and its Forest interface, important deer and elk habitat, Tumalo Creek canyon, and adjacent private lands of Skyline Forest connecting west Bend with the Sisters area. Historic vegetation patterns, recent disturbance processes and changing climate conditions all combine to add other layers of how the project area is defined and then managed to a desired future condition (Landscape Analysis Design, Figure 83).

Scenic View Opportunities

The proposed Welcome Station parking area, expansions of existing sno-parks, and new sno-parks must continue to meet Scenic Views standards and guidelines for High Scenic Integrity (Retention – VMS). This will be achieved by continuing to maintain a visual buffer and vegetative screen especially in the Immediate Foreground area (0-300 feet) that effectively blocks views of parked vehicles from being seen from the Cascade Lakes National Scenic Byway. Scenic views of large old ponderosa pine and to Newberry National Volcanic Monument lava flows must be enhanced at viewpoints and segments along the Scenic Byway. Along Road 41 and Road 4601, Scenic Views standards and guidelines for Medium Scenic Integrity (Partial Retention – VMS) must also maintain visual screens or topography to screen parking areas and enhance views through to large old ponderosa pine.

3.12.5 Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: Effects to High Scenic Integrity (Retention) - Foreground and Middleground landscapes as well as Medium Scenic Integrity (Partial Retention) Foreground landscapes would be negative over time due to the overstocking of unmanaged stands, overall increased density, the appearance of increased numbers of dead trees with brown needles, fewer opportunities for the growth of large, old ponderosa pine, and continued lack of visual diversity in tree species and size class.

These landscapes would be visible from scenic travel routes and scenic viewsheds throughout the project area, and viewpoints such as the North Gateway on Cascade Lakes Scenic Byway and along the Deschutes River Trail. The long-term trend would be scenic quality continuing to deteriorate. Standards and guidelines for maintaining and enhancing scenic views and creating opportunities to open views to showcase and encourage the growth of large old ponderosa pine would not be met.

Effects Common to Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

Direct and Indirect Effects: Within High Scenic Integrity (Retention) in Foreground and Middleground landscape treatments will reduce the overstocking of unmanaged stands, decrease overall forest density, decrease dead trees with brown needles, create opportunities for growing and viewing large, old ponderosa pine, and improve visual diversity in tree species and size class. Immediate short-term effects of timber harvest include stumps, displaced soil, and scorched from underburning. Resource Protection Measures are included in all alternatives to limit the location of landings or skid trails in visibly sensitive areas and to minimize crowns scorch and removing flagging and unit markings (see p. 54).

Moderate Scenic Integrity (Partial Retention) in Foreground landscapes would be improved through the variety of treatments that would create mosaics similar to natural landscape patterns. These landscapes would be visible from scenic travel routes and scenic viewsheds throughout the project area. Over time,

without periodic re-entry to remove trees in overstocked stands, the trend would be for scenic quality to be reduced, possibly not meeting standards and guidelines for maintaining scenic views. The need to re-enter because of stand stocking will be dependent on the level of thinning that takes place now.

Scenic Views Management Area standard and guideline amendments are discussed in pp. 472-474. The Recreation section 3.11 addresses the scenic component of dispersed and developed recreation sites within the project area (pp. 328-361).

Cumulative Effects

There would be no cumulative effects throughout the project area of proposed treatments within Scenic Views Management Areas for High Scenic Integrity (Retention) in Scenic Views - Foreground and Middleground landscapes and Medium Scenic Integrity (Partial Retention – Foreground landscapes. Forest Plan standards and guidelines for scenic quality would be met due to decreased density, treatment of existing stands that would have eventual overstocking in the future, and enhanced visual diversity in species and size class. The action alternatives will cumulatively address and accomplish fuel treatments that will enhance scenic views as well as improve access to safety during potential wildfire situations.

3.13 Soils

3.13.1 Introduction

Interpretations and descriptions contained in this specialist report rely heavily on local information derived from the Deschutes National Forest's Soil Resource Inventory (SRI, Larson, 1976) and digital spatial data in the Forest Service's corporate Geographic Information System (GIS). These information sources were used along with topographic maps, aerial photographs, silvicultural reports, field-based reconnaissance, various related project reports, and agency directives to characterize local conditions and support analysis used to predict environmental consequences of the Alternatives. Actions addressed here include those associated with proposed timber harvest activities, silvicultural and forest health treatments, habitat enhancement, the presence and use of roads, mechanical fuels reduction, and prescribed fire.

3.13.2 Affected Environment

Roughly two-thirds of the West Bend Project area lie within the North Unit Diversion-Dam Deschutes River 10th-field watershed (HUC# 1707030104), and about one-third within the Tumalo Creek 10th-field watershed (HUC# 1707030105). It is about 10 miles long from east to west, and varies between about 3 to 7 miles in width from north to south.

Climate

Climate of the area is generally characterized by hot dry summers and cold moist winters. A notable degree of variation is evident from the western to the eastern margins of the project area due to a decline in elevation and an increase in the distance from the Cascade crest. These two factors produce stark temperature and precipitation gradients longitudinally across the project area.

Within the ten mile span from west to east, there is a 12 degree (F) difference between the mean July temperatures (70 to 82 degrees) and a 5 degree difference between the mean January temperatures (17 to 22 degrees). Inversely, average total precipitation from west to east diminishes from 49 inches to 12 inches (OSU 2011). About 54 percent of annual precipitation falls during the winter months in most years. Convective thunderstorms are fairly common in the spring and summer, and occur on average about 14 times a year in this part of the state. Frost can occur any time of the year anywhere in the project area, particularly at the higher elevations (WRCC 2011).

For the period of record, total average snowfall in the western portion of the project area near the Swampy Lakes snow park is about 79 inches, and about 33 inches in the eastern portion near Bend. Typically a persistent winter snowpack averaging 3 to 6 feet develops at the higher elevations in the western portion, while at the lower elevations near Bend a buildup of 1 to 2 feet may develop from time to time, but rarely persists for more than several weeks (WRCC 2011).

Landforms and Topography

The project area transitions from the east slope of the High Cascades down to the high lava plains. Elevation ranges between about 3,650 feet just south of Phil's trailhead to 6,230 feet at the top of an unnamed cinder butte just west of Vista Butte. Representative landforms are of both glacial and volcanic origin. The western portion of the area is comprised of glacial deposits overlying igneous rocks. Terrain is a mix of gentle to steep slopes on moraine features that are slightly dissected, and interspersed with small semi-buried cinder cones. Terrain in the central and eastern portion can be characterized as gentle to moderately sloped rolling lava ridges with a few prominent intervening confined drainageways that converge to gentle outwash fans. There are also some intervening steep, broken lava outcrops and ridges, and about a half-dozen buttes and cinder cones.

Notable channel features running west to east bisect the project area. The most prominent is Tumalo Creek canyon that runs through the northeast corner. A perennial stream, its canyon is about 100 feet deep, narrow, steep sided, and confined by formations of lava flows and volcanic tuff. There are another half dozen unnamed steep-sided confined drainageways. These are mostly relict outwash channels that were created by melt water from alpine glaciers of the last Ice Age. Most have not transported any surface or seasonal flow for hundreds of years and are dry, although water may flow at times in several reaches of two or three of them, or be present just below the surface. The lower end of the Kiwa Springs canyon is one such reach where there is seasonal surface flow in most years during the spring melt. In all of these drainages, any water that may flow disappears below the ground and does not connect to any other surface water feature.

General Distribution and Characteristics of Soils

The Deschutes National Forest's SRI (Larson 1976) sufficiently depicts the location, extent, and distribution of different soils mapped in the project area. They can be grouped into general categories based upon parent materials and landform. Overall soils across the project area have developed in relatively young volcanic materials, mostly coarse ash and pumice. Because soils are young, they have undergone little biogeochemical weathering and development. Parent materials and buried soils that underlie the ash and pumice are mostly associated with glacial deposits, basaltic lava flows, pyroclastic tuffs, and minor proportions of cindery colluvium. Table 181 displays general soil groups and their relative proportions in the project area.

Coarse ash and pumice materials are mostly air-born tephra that was ejected from Mt. Mazama (now Crater Lake) eruptions and deposited over a vast area in the Pacific Northwest beginning around 7,700 years ago. Known locally as Mazama ash, it's the principle constituent of the mineral surface soil across the majority (87%) of the project area. On average, depth of the ash and pumice varies from about 3 to 5 feet, although shallower phases are abundant where bedrock is at or near the surface. Surface soil horizons of Mazama consist primarily of non-cohesive (loose), medium to coarse sandy textures. Their bulk density is comparatively low, meaning that they are highly porous and easily worked by fine root development and penetration. They are very permeable and well drained. Their moisture regime transitions from udic (moist) at the higher elevations to the west, to xeric (dry) in the lower elevations to the east. The temperature regime of these soils transitions similarly from cryic (cold) in the west to frigid (seasonally cold) in the east. Subsurface soils are typically gravelly or rocky.

Table 181: General Soil Groups and Their Relative Extent

General Soil Groups	Percent of Project Area
Coarse ash over glacial deposits – gentle to moderate slopes	44
Coarse ash over mixed glacial and igneous materials – gentle to moderate slopes	37
Coarse ash over igneous and pyroclastic materials – gentle to moderate slopes	6
Sensitive Soils	13

Depth of the topsoil (the A horizon) in the Mazama ash averages 4 inches on lodgepole pine and mixed conifer dominated sites and 4 to 6 inches on Ponderosa pine sites. Depth of undisturbed organic horizons, the litter and duff, is variable. On Ponderosa pine sites there is typically about 2 inches of litter over 2½ inches of duff, or humus. On lodgepole pine and mixed conifer sites depths are less on average, with about 1½ inches of litter over 1½ to 2 inches of humus. Accumulation and decomposition of organic layers is slower on the colder lodgepole pine and mixed conifer sites.

Because of the properties, characteristics, and productivity of the ash mantled soil groups in the project area, they function to provide a number of important ecosystem processes. They serve as a good growing medium that store and cycle nutrients and water, furnish habitat for beneficial soil biota and symbionts, provide filtering and buffering that moderate flux, produce biomass, and support and regenerate a contiguous forest cover. They are capable of yielding fully stocked forest stands, and soil

quality is favorable for forest ecosystems and associated land use. Generally, they are not overly sensitive to ground disturbance, they possess few limitations, and they are relatively resilient. But due to variability, there are some notable differences in soil sensitivity, limitations, and resilience which affect their ability to recover from disturbance.

Soil productivity in the project area is strongly correlated to precipitation, although topographic position, aspect, soil depth, and subsoil texture are also key factors. Soil productivity across the majority (57%) of the area is considered to be moderate, mostly in the heart of the project area where all of the general soil groups are present. Here, precipitation is adequate to supply growth and soil depth is generally favorable for storing water available for uptake. But soils in this part of the project area also tend to dry out in late summer, limiting the amount of soil-water available for uptake late in the growing season.

Sites expressing the highest productivity are located in the western one-third of the project area where the annual precipitation is the greatest (about 22% of the project area). Typically these are sites where soils are deep and consist of 3 to 4 feet of Mazama ash overlying glacial till and that support mixed conifer stands with ponderosa pine. Buried subsoils of this soil group are somewhat finer textured with slightly lower permeability, making them capable of storing soil-water that's available for plant uptake longer into the growing season.

The ash covered glacial deposits of the western third of the project area exhibit the greatest capability of moisture retention because they are deep and the permeability rate in their buried subsoils is slower than at the surface. They also receive on average the greatest amount of annual precipitation. Both these factors contribute to their overall resilience. Although these soils are not particularly sensitive to ground disturbance they can be very rocky in places, which can limit the effectiveness of efforts to ameliorate heavy compaction or hinder planting.

Sites exhibiting the lowest productivity are located mostly on the eastern edge of the project area where annual precipitation is the lowest (about 21 % of the project area). These are the lower, nearly level ponderosa pine sites with slight eastern and/or southern aspects. Soils are moderately deep or shallow and consist of ash over glacial outwash or other gravels and coarse sands. Permeability of both the surface and subsoil is rapid or very rapid, making these soils droughty. Other low-site ground includes frost pockets, rock outcrops, uneven broken lava flows, and several butte tops or slopes underlain by coarse pumice or cinders.

The droughty ash-mantled soils on the eastern margins of the project area are the least resilient. They are not overly sensitive to ground disturbance such as compaction or displacement. But because they are droughty, and the average annual precipitation there is low, excessive losses of surface organics and effective ground cover can diminish their site productivity. Their litter and duff layers are essential to retention of soil moisture and providing a substrate for beneficial soil biota such as symbiotic mycorrhizal fungi, both of which are key factors in maintaining site productivity on droughty sites.

The degree to which all of the ash-mantled soils are susceptible to surface erosion, compaction, and displacement is fairly homogeneous. Depending on the severity of slope, the inherent surface erosion potential of the ash-mantled soils is low to moderate. This is primarily attributed to their sandy textures, high permeability and infiltration rate, and the dominant gentle terrain. But also because there are few surface water features and an absence of connected drainage networks to erode through soils. The susceptibility to compaction is also low to moderate, primarily due to low bulk density and the coarse and medium textures. There is also a degree of natural recovery over time from compaction due to freeze-thaw action, root penetration, good drainage, and the activity of soil fauna and macrobiota. Recovery can be considerable where the degree of compaction is not heavy or overly hardened. Susceptibility to displacement is moderate to high depending on moisture status and slope. When dry, the topsoil of ash-mantled soils or pumice is easily displaced by ground disturbance, particularly on steep slopes.

Some soils in the Pacific Northwest exhibit a high potential for developing hydrophobic conditions as a result of high severity fire. Intense heat can alter certain organic components in the soil, which causes hydrocarbons to coat and sometimes bridge individual soil particles, thus preventing absorption and reducing pore space that causes soils to become temporarily water repellent. If widespread, water repellency has been shown to indirectly increase the potential for runoff and overland flow, leading to accelerated surface erosion (DeBano 1981).

The majority of the soils in the eastern third of the project area do not exhibit hydrophobic tendencies, primarily because they are inherently low in soil organic carbon, so the concern there for wildfire to induce water repellency is low. Soils in the western two-thirds of the project area however have a slightly higher potential for developing water repellency after wildfire because they have more soil organic carbon. Sites where snowbrush and green-leaf manzanita are primary components of the understory are the most susceptible, or in mixed conifer stands where thick and dense organic layers have developed over the soil surface. If high intensity fire on these sites denuded effective ground cover, they could be prone to hydrophobicity and accelerated erosion in response to a high precipitation or runoff event.

Sensitive Soil Types

There are other ash-influenced soils in the project area. But they are different, primarily due to the landform characteristics that they occur on. They react differently to ground disturbance, and are more sensitive to it. Recovery from disturbance can be prolonged and long-term site productivity easily diminished. Considered to be sensitive, these soil types include shallow broken, uneven lava flows and ridges, drainageways, frost pockets, and steep slopes (>30%).

Soils across about 13 percent of the project area are considered to be sensitive to disturbance (Sensitive Soils map, Figure 85, page 578). Sensitive soils lack resilience, which limits their capability to fully recover and function after disturbance. Maintaining or enhancing their intrinsic productivity necessitates conservation or restorative actions. Table 182 displays the groups of sensitive soils that occur and their relative extent.

Table 182: Sensitive Soil Groups and Their Relative Extent

Sensitive Soil Groups	Percent of Project Area
Broken, uneven lava flows and ridges	4
Confined drainageways – wet and dry, gentle to steep slopes	3
Frost Pockets – gentle slopes	<1
Buttes – moderate to steep slopes	3
Other Steep Slopes	3
Total	13

Broken and uneven lava flows and ridges that have been mapped comprise about 4 percent of the project area. They are generally long linear features oriented west to east and located in the eastern half of the project area or adjacent to the Deschutes River or Tumalo Creek. Most are forested to varying degrees. Forested lavas primarily support stands of ponderosa or mixed pine, some are capable of supporting and producing fully stocked stands, while on others trees only grow in small patches or singly and are widely spaced. They are atypical in that even though soil depth is shallow or barren, trees are often able to take hold because of the presence of available moisture that can collect in the fissures and crevices of the highly fractured basalt. Capability, productivity, sensitivity, and resilience are highly variable on a site by site basis. Typically, the broken and steep lava flows along with those that are mostly barren are unsuitable and excluded from forest management activities. In many cases they are inaccessible to heavy equipment. Where there is enough of an ash overburden and the relief is gentle stands are accessible to ground-based harvest equipment. Due to shallow conditions, soils on these features are sensitive to compaction and displacement.

Confined drainageways are the notable west to east oriented narrow ravines or small gorge features. The most prominent is Tumalo Creek, which was identified during the preparation of the LRMP to be unsuitable for timber production. These are sensitive to ground disturbance due to either steep side slopes or the presence of water near the surface. While they exhibit moderate to high productivity, they are susceptible to compaction, displacement, and accelerated erosion. Recovery from detrimental soil disturbance on these sites would be prolonged, but most offer operational challenges due to terrain and are typically excluded from mechanical operations.

There is one confined drainage-way that is particularly noteworthy, and unlike most of the others it is connected to a surface water body downstream. Defined by a headwater cirque (concave amphitheater shape that is open on the downhill side), it includes a unique forested wetland located on the western margin of Tumalo Lake. Located on adjacent private property the lake is fed by the headwater cirque and wetland that drain to it, feeding its outlet stream which is a perennial tributary to Tumalo Creek. Due to the high water table, the forested wetland in the bottom of the cirque would be very susceptible to ground disturbance, and there is observable evidence that some manner of disturbance occurred there many years ago. But at present there are no roads or trails leading there, and its inaccessibility has left it untouched since.

There are a few frost pockets, mostly in the western portion of the project area. They are low-lying lodgepole pine depressions in cold air drainages where annual average soil temperature is comparatively lower. Additionally their litter, duff, and topsoil horizons (layers) are thin. Though their extent is minor frost pockets are particularly prone to an excessive loss of organic material when disturbed which can induce droughty conditions and reduce soil biota essential for nutrient conversion on these cold sites. Effective ground cover can be easily displaced. Resilience to ground disturbance is low, and inherent productivity after disturbance can be substantially diminished for the long-term.

There are a half dozen buttes in the project area; they are moderately steep to steep ($\geq$30%) and consist mostly of colluvium of coarse cinder materials, or mixed cinders and ash. Generally more shallow at the top and deeper at the bottom, soils on the buttes are typically non-cohesive and loose. Northern aspects, particularly at the higher elevations receive higher precipitation and a melting snow pack provides available water longer into the growing season. Permeability of soils on the buttes is very high, thus surface erosion potential is only moderate despite the severity of slope. Soils are very susceptible to displacement on the sideslopes, and ground disturbance from heavy equipment can truncate topsoil and organic horizons easily. A notable phenomenon of cinder derived soils on steep slopes greater than 60 percent is their inherent potential to creep downhill by gravitational and other natural forces. Called soil creep, it is a very slow and imperceptible form of mass wasting that can be greatly exacerbated by disturbance and loss of organic layers and vegetative cover. Soils on the buttes are not considered to be very resilient although it is moderately higher on the northern aspects. Recovery of inherent productivity after disturbance could potentially be prolonged and southerly aspects are particularly susceptible to brush invasion.

Other steep slopes ($\geq$30%) occur in the western and northwestern portions of the project area, and along certain reaches of the Deschutes River (3% of project area). The former consist of ash over glacial deposits. Productivity on north aspects is generally high due to precipitation and the available moisture that is retained in the buried glacial till. Southern aspects can be droughty and invaded by brush after disturbance. Where slopes exceed 40 percent, soil creep is pronounced and underlying rocky glacial till is sometimes exposed. Litter, duff, and topsoil horizons are often thin and mixed. The extent of effective ground cover is patchy in places and easily displaced. These slopes are very sensitive to ground disturbance. North aspects are more resilient than southern ones, but recovery of inherent productivity from disturbance can be impeded due to thin organic and A-horizons and the propensity for soil creep. In many instances slopes are too steep for ground-based equipment and considered inoperable.

There are steep slopes along certain portions of the Deschutes River reach on the southeastern boundary of the project area. They are short in length and comprised of coarse ash over basalt. Although annual precipitation is low, productivity is moderate to high because of the riparian influence and greater available soil moisture. They support fairly diverse plant communities. Because of the loose non-cohesive soil properties, the steepest slopes can exhibit a fair rate of soil creep. Like all steep slopes they are susceptible to ground disturbance. But they are moderately resilient, because of riparian diversity, and capable of recovering from disturbance. Their sensitivity is to displacement and accelerated erosion due to slope; which from a management standpoint is a concern given their proximity to the river.

Several unmapped inclusions, or small areas of contrasting soil types, were encountered during field reconnaissance. They include two shallow wet draws where there are high water tables and stands of aspen, a seasonally ponded wet meadow, and a confined narrow stream bottom with gentle to moderately steep side slopes. These sites are ecologically important because they are some of the few interior riparian zones where water is stored in the project area, and they are high in organic content. They have no connection with other surface water features, making them isolated riparian stringers. Productivity is high on these sites due to the presence of year-round available water. But because they are wet they are susceptible to heavy compaction and deep rutting (i.e., puddling) by ground-based mechanical operations. Their hydrologic status along with their function of water storage and conveyance is also easily disrupted. Ground disturbance could alter inherent permeability and infiltration, possibly resulting in accelerated erosion, conversion to a drier site condition, channelization, or diminished site productivity.

Existing Soil Conditions

Soil quality is the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation (USDA 2012). Soil quality can be dynamic. Soil properties can change depending on how it is managed. Management choices can affect soil organic matter, soil structure, soil depth, and water and nutrient holding capacity. Soils respond differently to management depending on the inherent properties of the soil and the surrounding landscape.

Soil Conditions

Ground disturbing activities have the potential to cause detrimental soil conditions which can adversely affect the long-term productivity of a site. Soil quality across more than 85 percent of the West Bend project area has been affected by previous management. The degree of management that has occurred since the early 1900s has been extensive, in large part due to the proximity to Bend. Railroad logging, ground-based mechanical logging, reforestation and plantation establishment, reconstruction and continued use of roads, and other forest related management activities have occurred periodically for decades. Several wildfires, prescribed fire, and slash pile burning have also resulted in a measure of ground disturbance, as has firewood woodcutting, off-highway vehicle use, and mountain bike trail expansion. These activities combined have resulted in a degree of ground disturbance of which a portion is considered to be detrimental.

Prior to the 1980s soil quality standards, best management practices (BMP's), and mitigation measures were less developed and not as effective at limiting and containing detrimental soil impacts as they are now. The degree of ground disturbance was often greater than what is typically acceptable by today's standards. Since then natural recovery from impacts has occurred to some degree depending on the inherent productivity of a site; however residual impacts remain and are detectable in many of the extensively managed stands. Detrimental soil conditions most commonly associated with the extensive land use that has occurred include heavy compaction, displacement, excessive removal of organic materials, and a minor degree of severely burned soils (for definitions refer to Forest Service Handbook, section 2520.8-1, 1998 in the Appendices).

Heavy compaction and displacement were nearly always observed where there were old railway lines, roads, landings, primary skid trails, old mechanically scarified plantations, and trails (i.e., hiking or mountain bike); or where numerous repeated passes of heavy equipment had occurred. Along the dry eastern fringe of the project area, topsoil and organic horizons have been displaced or depleted on some sites where old railroad logging activities or wildfire have occurred. Severely scorched soils were observed only at a few isolated spots where large log pieces had burned, such as where slash has been burned on old landings.

It is estimated that roughly 70 percent of the project area has been subject to two or more management entries using ground-based equipment. Sampling data in the project area indicate that the extent of detrimental soil conditions in extensively managed stands is at least 10 percent and in many cases greater. Stands entered fewer times tend to exhibit a lesser extent of detrimental soil conditions. As displayed in Table 183. The extent of detrimental soil conditions across about 29 percent of the project area is considered to be low (i.e., less than 10%). The remaining 69% is considered moderate (i.e. 10-20%). displays estimates of the extent of detrimental soil conditions within individual stands.

Table 183: Extent of Detrimental Soil Impacts across the Entire Project Area

Soil Condition Class	Range of Detrimental Soil Conditions	Percent of Project Area with Stands in a Designated Soil Condition Class[1]
1	Less than 10%	29
2	10-20%	61
3	Greater than 20%	10

[1] Soil Condition Class 1-3 is a range of estimated detrimental soil conditions from best to worst.

Soil quality has been degraded where detrimental soil conditions persist, and long-term site productivity is diminished on those sites. The consequence is diminished tree growth on these surfaces. Roads that are part of the travel network (i.e. system roads) have been converted to a non-forest status. Other sites such as non-system roads, un-restored landings, and primary skid trails will remain heavily compacted and recovery will be prolonged. Detrimental impacts are also long-lasting where they have been incurred on sensitive soil types.

Except for those sites where detrimental soil conditions persist, soil quality across the majority of the project area is still in relatively good condition (i.e., soil condition classes 1 and 2). The extent of detrimental soil conditions are less than 20 percent across 90 percent of the project area. Soils are functioning to support and maintain long-term site productivity. If they have been subject to disturbance or if they support densely stocked stands where growth has slowed they are in a status of either recovery or stasis. Due to their productive capability and resilience they retain their function and capability despite the high level of extensive management, serving as a growing medium, storing and cycling nutrients and water, producing biomass, and supporting or regenerating a contiguous forest cover.

Restoration efforts such as road obliteration and subsoiling have taken place to offset some of the detrimental ground disturbance, mostly on decommissioned roads, as well as old landings and primary skid trails. Old landings and primary skid trails have been subsoiled across about 15 percent of the project area over the past fifteen years to ameliorate the effects of heavy compaction and to facilitate site preparation for natural regeneration and tree planting.

Sensitive soils have been affected by past management and land use. Mostly in the confined drainageways, on moderately steep slopes, and in frost pockets where ground-based operations were feasible; but much less so on the very steep and rocky slopes where operational limitations thwarted management. Though management occurred on some sensitive soils, mostly in the eastern portion of the project area, operations over the last several decades have avoided them as standard practice. So the extent of detrimental conditions on the sensitive soils that were affected is low to moderate on average (i.e., soil condition class 1 & 2). Most have not been disturbed by logging activities since before the

1980s. There is also about 7 miles of roads and 17 miles of trails that cross over sensitive soil types, where the ground has been committed to infrastructure and recreational objectives. The majority of the road miles are small segments crossing over forested lavas or confined drainageways, while most of the trail segments are located down drainageways or along the confines of the Deschutes River and Tumalo Creek. The latter are a combination of mountain bike, horse, and hiking trails.

There is a stand condition of special note in the project area. In the 1950s and 60s mechanical scarification was used to reduce the influence of competing vegetation that was hindering the establishment and growth of tree seedlings, primarily heavy brush that had invaded in the late 1940s after railroad logging and wildfires. Roughly 2,700 acres were scarified using bulldozers, most of which were planted with seedlings afterward to either establish new plantations or to interplant in existing young stands. Planting was often concurrent with the scarification operation, typically accomplished with the use of tree planting machines that were pulled by a dozer. The extent of ground disturbance that resulted from the mechanical scarification was substantial, often altering surface terrain features so that afterward the ground resembled terracing, particularly on slopes. Compaction can still be observed on scarified sites however it is not considered to be detrimental. This was due to dozers making only one or two passes over the same piece of ground, and there was no need to repetitively scarify once brush was removed and trees were planted. As a peripheral benefit, the moderate degree of compaction and the level-terraced planting row could have acted to decrease water loss despite the high infiltration rates inherent to the coarse ash soils, contributing to moisture retention further into the growing season than typical.

Displacement on the other hand was nearly ubiquitous on the scarified acres. Surface organics (i.e., litter and duff) and top soil were mixed together and scraped and re-deposited into berms between the planting rows. During field reconnaissance, mixed humus and topsoil horizons were observable in the berms. It is believed that the degree of displacement that resulted from scarification was mostly detrimental, and likely to have diminished inherent site productivity initially. But removal of the brush provided the newly planted seedlings with full access to available soil resources and site occupancy without competition. For over 40 years soil function on the machine scarified sites has been recovering. Their nutrient status has improved as a result of an increase in the production and turnover of roots, litter, and soil biota. In that time the inherent resiliency of the soils has been such that they have continued to support growth of the young stands, which have remained fully stocked and exhibited moderate to high growth rates. Due to that resilient capacity, these stands now have grown dense and closed, and competition among individual trees for soil resources, light, and growing space has become limiting.

Created Openings, Roads, and Trails

There have also been about 152 acres of openings created in the project area. Most were created for rock sources of varying kinds (pits). The large pit used by ODOT near the intersection of the Cascade Lakes Scenic Byway and FSR 41 is still in use. Many of the other large pits, such as those along the eastern edge of the project area or just south of Phil's trailhead are no longer in-use. Smaller pits, particularly those that are cinder sources, are located on small buttes and used periodically as the need arises. The floors of pits are hardened surfaces that are no longer capable of supporting trees, and will remain as non-forested patches until otherwise scheduled for reclamation sometime in the future. One other opening that could be expected to persist across the landscape includes the utility corridor that bisects the project area south of the Cascade Lakes Scenic Byway.

There are roughly 185 miles of both open and closed inventoried system roads, and some of them are seasonally closed from November to April on deer winter range. There also is a notable amount of un-inventoried non-system roads. System roads represent soils where land use has been dedicated to the transportation infrastructure, converted to a semi-permanent non-productive condition. Heavily compacted, they are no longer used as growing sites. Over the last several decades, about 4 to 6 percent

of the original total road miles have been permanently decommissioned, where soils are recovering and slowly reverting back to productive growing sites, or have been converted to trails where they remain dedicated to other uses such as mountain bike riding. Some of the closed and decommissioned roads have been breached by motorized users, where recovery and re-vegetation has been thwarted.

There are nearly 90 miles of designated single-track dirt trails that average about 2-foot wide in the project area. They are mostly mountain bike trails (87%), but there are also some horse and hiking trails along the Deschutes River. Trail surfaces are part of the infrastructure where soils have been dedicated to a recreation use. Their surfaces are heavily compacted and they have been converted to a non-vegetated condition. Trails are expected to remain in that condition for as long as they are used. The trails are popular and provide a need that precludes using them as growing sites.

Woodcutters and mountain bike users have created narrow non-system paths and trails that have caused a minor extent of detrimental ground disturbance. In the lodgepole stands of the central and western portions of the project area woodcutters have repeatedly driven short distances into unroaded sites with dead trees to cut firewood. There are non-system mountain bike trails and jumps that also have been created in the project area. Overall, these impacts account for a very small degree (less than 0.5 percent) of the total extent of detrimental soil conditions. Some of the impacts they create will be long-lasting, particularly on sensitive soils like steep side slopes of buttes.

Surface Erosion

Surface erosion potential is inherently low across the majority of the project area, except on the steeper slopes where it is rated as moderate. Erosion rates are not currently accelerated to a noteworthy degree as a result of all the past activity. Natural re-establishment of grasses, forbs, brush, tree regeneration, and reforestation has acted to effectively provide ground cover. The presence of hardened surfaces has induced a minor degree of accelerated erosion on certain sloped road segments where runoff is intercepted or there are exposed cut-banks. Small gullies have formed or cut-bank ravel is observable. Segments are located on both collector and secondary spur routes, of which the affected length is estimated to be about 2 percent of the total road miles in the project area. In nearly every circumstance there is little risk of sediment delivery to any surface water feature. One notable exception is just uphill on either side of the FSR 4606 crossing Tumalo Creek there are steep cut banks where dry ravel fills the ditch. The likelihood is high that some measure of sediment from these road segments is deliverable to Tumalo Creek when there is a heavy runoff event, which occurs occasionally in some years. The amount of sediment delivered is believed to be minimal because the location of the crossing is in a zone of low precipitation where heavy runoff events are infrequent, and because the stream reaches below are known to be free of turbidity impairments.

Coarse Woody Debris

The amount and distribution of downed coarse woody debris (CWD) has also been affected by all of the forest management activities that have occurred. CWD functions to retain moisture and moderate soil temperature. It provides habitat that supports a diversity of fungi and macro/micro invertebrates that are beneficial to soil quality, help assimilate organic carbon, and facilitate nutrient cycling. Quantities of CWD are low in some stands, particularly ponderosa pine stands in the eastern portion that were railroad logged and then thinned in the 1960s, and in some of the older scarified plantations that were established after wildfires. Attempts to retain sufficient quantities of CWD in managed stands have been a standard Best Management Practice (BMP) implemented to varying degrees over the last several decades depending on residual amounts. Overall, there are sufficient quantities of existing and future CWD to contribute to soil function and quality across most of the western half of the project area, and in the dense overstocked stands where insect mortality is occurring. But in many of the extensively managed young ponderosa stands of the eastern half CWD is not overly abundant. Recruitment from standing residual trees will recur and serve as a future source.

3.13.3 Soil Resource Protection

Protecting and conserving soil resources has been a long standing objective relative to management on National Forests. At a national level, direction has been in place for decades in Forest Service Manual 2550 that, depending on the region, translates into specific standards and guidelines that are defined in the Land and Resource Management Plans (LRMP) of individual National Forests. Generally, these objectives are aimed at maintaining or enhancing long-term site productivity so that the inherent capability and function of soil resources to support forest or range plant communities and provide for ecosystem services (ex. nutrient cycling or water storage) is enduring.

At smaller scales, achieving these objectives entails methods and practices that are implemented at the project level when activities are taking place. Referred to as Best Management Practices (BMPs), these are typically standard methods of operations intended to either avoid or minimize unwanted impacts (i.e., detrimental soil disturbance). They may become even more refined at the site-level, where project design is tailored to particular conditions and specific features of the local landscape.

Application of broad-scale conservation objectives, coupled with the implementation of site-level design and protection measures is intended to contain the accrual of detrimental soil impacts that can occur as a result of ground disturbing activities, and limit their extent to an acceptable degree. Together these are the principle means for protecting and conserving soil resources so that long-term site productivity is assured.

Forest-Wide Standards and Guidelines

The Deschutes National Forest Land and Resource Management Plan (LRMP, USFS 1990) defines standards and guidelines (S&Gs) intended specifically to maintain long-term site productivity and minimize or prevent undesirable impacts to soil resources on its lands. Those most applicable to the proposed activities associated with the West Bend project area include the following S&Gs paraphrased from Chapter 4, pages 70 and 71 of the LRMP:

SL-1. Management activities will be prescribed to promote maintenance or enhancement of soil productivity. The potential for detrimental soil damages will be specifically addressed through project environmental analysis.

SL-3. Leave a minimum of 80 percent of an activity area in a condition of acceptable productivity for trees and other managed vegetation following land management activities.

SL-4. Any sites where this direction cannot be met will require rehabilitation.

SL-5. The use of mechanical equipment in sensitive soil areas will be regulated to protect the soil resources.

SL-6. In order to minimize erosion by water and wind, ground cover objectives should be met within the first 2 years after an activity is completed.

Central to these S&Gs is the containment or rehabilitation of detrimental soil disturbance. Definitions of the types of detrimental soil impacts expected are listed in the Appendices, but essentially they are a kind of disturbance that adversely affects the inherent capability of the soil to function, impairing long-term site productivity. Not all ground disturbance however is considered to be detrimental or long-lasting, and there is a degree of detrimental soil impacts that are unavoidable and considered acceptable. In view of the S&Gs, particularly SL-3, the extent of detrimental soil disturbance considered to be acceptable is 20 percent of an activity area, which is also stated in Forest Service Manual Regional Guidance (FSM 2520, regional supplement 1998). Beyond that degree, it is to be contained by either avoidance or prevention (i.e., project design or BMPs), or ameliorated through mitigation (mitigation is addressed in this report as a subsection of Section 4, Environmental Consequences). Provisions in the regional direction also address circumstances when a proposed activity would occur in an area where

the extent of detrimental soil conditions exceeds the 20 percent mark. In this case, post-operation detrimental soil conditions should not exceed what they were prior to the activity.

Project Design Criteria and Best Management Practices

Practices listed in Chapter 2 are oriented toward avoiding or minimizing detrimental soil disturbance and are specific to achieving the LRMP S&Gs for soil resources. Project Design Criteria (PDCs), which are typically site specific, can differ between alternatives depending on the proposed activities. An example might be to defer timber harvest on sensitive soils in one alternative to avoid detrimental disturbance, while in another plan for timber harvest on sensitive soils but mitigate detrimental soil impacts by subsoiling afterward. PDCs can also be a useful tool for minimization, such as requiring winter harvest operations on select activity areas to reduce ground disturbance because the extent of existing detrimental soil conditions is already high.

PDCs and BMPs intended to minimize ground disturbance are usually implemented at the same time and place of an activity. While PDCs are more site- or condition-specific, BMPs are considered standard operating procedures and apply to all activities. Some are intended specifically to minimize ground disturbance. A common example would be to re-use existing landings in an activity area rather than create new ones.

PDCs that address specific soil concerns in the West Bend project area as well as BMPs are listed in Chapter 2 beginning on page 52. Primary concerns include: areas where the extent of detrimental soil disturbance is already moderate to high (i.e. >10% of an activity area), which accounts for about 71 percent of the project area and includes some sensitive soils. PDCs to be employed where these concerns prevail are intended to provide a greater level of protection than standard BMPs. The analysis of the effects of the proposed activities assumes the implementation of BMPs and PDCs. Effects displayed in the analysis assume implementation of activities under guidance of these PDCs and BMPs.

3.13.4 Environmental Consequences

Scope of this analysis is to evaluate impacts to soil resources that could be expected as a result of either implementing or not implementing forest management activities being proposed in the West Bend project area. Activities analyzed include those associated with both commercial and non-commercial mechanical treatments of the forest overstory and understory, hand treatments in the forest understory, and prescribed fire. In general the purpose of treatments is to hasten the development of older forest structures, improve forest health, reduce fuel loads, protect values at risk, and eradicate some invasive weeds. Most of the activities would be various thinning treatments, many in dense overstocked stands of small to medium diameter trees where natural wildfire has been excluded. Other activities or connected actions that may be currently ongoing in the project area are also considered. Findings predict the direct, indirect, and cumulative effects based upon scientific analysis, relevant research, professional judgment, and well-established cause-and-effect relationships between natural resource management and soil response on the Deschutes National Forest.

Methodology and Assumptions

Analysis of the anticipated effects to soil resources was conducted using a methodology that is essentially qualitative, but with a quantitative component. The quantitative extent of detrimental soil conditions was estimated using sampling data, field reconnaissance, GIS analysis, and aerial photographic interpretation; which also functioned as the basis for deriving and validating assumptions and inferences. Effects to soil quality were determined qualitatively based upon select physical and biological properties fundamental to the sensitivity and resilience of soils to certain types of disturbances. Factoring both the quantitative extent of detrimental soil conditions with the qualitative assessment of response to disturbance served as the method for predicting the potential effects to soil quality.

Generally, thinning of dense stands is considered a means of enhancing the dynamic productivity of a site. In overstocked stands the demand on soil water, nutrient capital, and growing space are at a premium. Tree growth is slowed measurably by competition for these resources along with light. Thinning overstressed stands can improve a site's growing environment and enhance the availability of soil resources for the remaining vegetation (Busse et al 2008; Busse and Riegel 2005; Oliver and Larson 1996; Busse et al. 1996). If the extent of detrimental soil conditions that result from ground-based mechanical treatments is kept to a minimum, thinning could benefit long-term site productivity. Thinning however is not usually considered an ameliorative treatment that is expressly used to mitigate or offset the extent of detrimental soil conditions caused by ground disturbance from heavy equipment.

Overstory treatments would be commercial timber harvest activities where mechanized cutting and skidding of logs would necessitate a landing and skid trail network, and in places temporary roads for product transport. Overstory treatments in dense, overstocked stands typically require a post-harvest understory treatment to remove small diameter, non-commercial trees followed by slash abatement. Combined, these are the activities that transmit the greatest potential for direct effects to soil resources that can increase the extent of detrimental soil conditions.

This sequence of operations can take years to complete. If slash is treated mechanically and piled using heavy equipment then a stand can be subject to multiple machine entries in a sequence. These are the types of operations where ground disturbance is greatest and notable increases in the extent of detrimental soil conditions can be expected. Non-commercial thinning treatments or fuels reduction may also use heavy equipment and cause increases. For successive mechanized treatments, mitigation, BMPs and action-specific design criteria are usually necessary to contain detrimental soil conditions from increasing beyond an unwanted level. For management sequences that involve multiple machine entries and that occur in previously treated stands, maintaining soil quality often requires amelioration of detrimental soil impacts afterward. Due to the multi-year nature of sequenced treatments however, and the timing and availability of funding, mitigation may not occur until 5 years or more post-harvest.

Non-mechanized treatments such as precommercial thinning, or thinning to reduce ladder fuels are typically a sequence of hand treatments where ground disturbance is negligible. Heavy equipment and machinery are not always used. Prescribed fire and pile-burning are generally considered to be similarly light-handed, primarily because the scope and magnitude of safety practices, control methods, contingency plans, burning procedures, and smoke regulations typically result in a light severity burn. Underburning is also used to emulate a more natural disturbance regime, and is a means for re-introducing fire to forest types more inherently adapted and prone to frequent, low-intensity wildfire. Underburning is typically used as a tool for the long-term maintenance of the understory to prevent the build-up of ladder fuels, and generally occurs 2 to 10 years after harvest. Often it is preceded by a fuels reduction treatment such as mowing to facilitate control of fire behavior, burn intensity, and duration.

Effects to soil resources from the combination of thinning and underburning is a trade-off for the effects that could be realized if wildfire were to burn with extreme behavior and intensity in dense overstocked stands where fire has been excluded. In the dense overstocked stands, wildfire could cause prolonged and intense heating, resulting directly in detrimentally burned soil conditions. Soil organic matter, essential nutrients, and biota could be volatilized; indirectly leading to a long-term decline in site productivity. The accumulation of organic biomass could remain diminished over the long-term, especially on sites where productivity is low. Re-colonization by soil organisms would occur slower since new plant growth and soil organics would take longer to reestablish and accumulate. In turn, essential nutrients, particularly nitrogen that had been volatilized as a result of intense heat, would take longer to replenish than a light intensity burn.

High severity fire could also severely compromise soil ecological diversity; diminishing soil function, truncating well-established nutrient cycling pathways; and leading to eventual site occupancy by single pioneer plant species that could be slower to develop into a more diverse composition. Sites of marginal

productivity could be converted to a non-forest status over the long-term as competing vegetation, and possibly invasive plants colonize burned over ground; particularly sensitive soils (i.e., droughty, low precipitation, shallow rocky soils, steep south-facing slopes, and frost-prone soils). An extreme wildfire event could potentially expose bare soils over large areas, subjecting them to accelerated erosion, particularly from periodic runoff events and wind. Severe fire effects could necessitate costly rehabilitation efforts and decrease future options for maintaining and enhancing soil quality.

In contrast prescribed burns are typically low intensity and low severity fires that are implemented 2 to 10 years after thinning to curtail the build-up of re-growth, in-growth, and detritus such as brush, small trees, and fine fuels. Except for leave patches that have been retained, canopy conditions have been opened up by previous thinning so they are less prone to intense and severe crown fire. Prescribed underburns are planned so that flame intensity and burn duration are controlled and limited. The majority of the larger trees (typically $\geq$8") are intended to be retained.

Variation of burn intensity is intended to be minimal, ranging primarily between low and moderate levels with smaller patches occasionally burning hotter. Often there are also an abundance of unburned patches where the continuity of the understory and fuel bed is irregular. There is hazard associated with underburning. Even though underburning can enhance site productivity by reducing understory competition, and it could reduce the threat of losing a dense stand by intense wildfire, there is a risk of losing control. Should an underburn "get away" and burn too hot, it could denude the effective ground cover, exposing bare soil that could lead indirectly to accelerated surface erosion. Additionally, without a measure of recovery of the understory, the advantageous effects of root and litter production and turnover, and the increase in soil biota would be truncated, lessening the capability to cycle available essential nutrients (Busse et al 1996).

Detrimental soil conditions resulting from prescribed underburns are typically low, with the extent of severe soil scorching being proportional to the severity of fire at the soil surface, and the location, concentration, arrangement, and soundness of larger fuels close to or in contact with the soil surface such as old stumps and downed logs. Certain sensitive soils such as droughty sites, frost pockets, and shallow rocky soils; or highly disturbed sites can be an exception where prescribed fire can have deleterious effects on productivity and function. Monitoring data on the Bend-Fort Rock District indicate that the extent of detrimental soil burning resulting from prescribed fire averages less than 5 percent. Central to these findings is that much of the underburning is typically conducted after mechanical treatments have removed the bulk of the slash and biomass that was on-site prior to initial entry. Detrimentally burned soil conditions after prescribed underburns are typically only observed where large, dead, partially sound fuels have burned hot for a long duration.

Soil organisms are essential to long-term site productivity (Borchers and Perry. 1990). Invertebrates such as earthworms and insects; microbiota such as bacteria, algae, protozoa, rotifers and nematodes; symbiotic organisms such as nitrogen-fixing bacteria and mycorrhizal fungi are instrumental in the cycling and transformation of nutrients available for plant uptake. Organic matter in litter, duff, and topsoil horizons serve as the medium where soil biota and organisms thrive. Effects of prescribed underburning to soil nutrient status and soil biota are proportional to the depth and extent of forest floor consumed (McNabb and Cromack 1990). Light intensity burns characteristically only char the top several inches of the litter and duff without consuming them entirely across large contiguous patches. Because the degree of heat becomes less lethal to soil biota with depth, unconsumed organic matter and surviving plants on the forest floor and in the soil surface provides refuge where surviving organisms and seeds can re-colonize and germinate. Fine detritus from intact overstory trees annually shed needles and twigs where they begin to re-develop, or contribute to an effective ground cover.

Microorganisms, particularly symbionts like nitrogen-fixing bacteria and mycorrhizal fungi help restore soil function by re-assimilating and converting essential nutrients such as nitrogen into forms available for plant uptake and facilitating nutrient cycling. Immediately following light intensity fire there is an

initial release of cations and nutrients into the char and ash from combusted plant tissues for soil microorganisms to utilize and take advantage of (USDA 2005). In fire adapted ecosystems where the regime is historically characterized by short return intervals this contributes to the capability of soil biota to recover quickly so that negative effects of low intensity fire to their diversity and function are low. After prescribed underburning their ability to assimilate, convert, cycle, and fix nutrients should become fully functional in the near-term. Effects of light intensity underburning to the inherent nutrient status of soils would be expected to diminish in the short term as long as some proportion of the understory vegetation is retained.

The potential for light intensity underburning to induce water repellency (i.e., hydrophobicity) is low. In the eastern third of the project area soils are not susceptible to hydrophobicity. Soils in the western two-thirds are more susceptible, but only in the event of a high intensity wildfire. Light intensity prescribed fire would not be expected to induce hydrophobic conditions. If a high intensity wildfire occurred, soils on steep slopes in the western portion of the project area would be the most prone to hydrophobicity and potential high runoff and accelerated erosion.

Ground disturbance from mechanically mowing brush is considered to be negligible. Equipment types used are typically relatively light-weight and have either small rubber tracks or over inflated agricultural tractor tires that exert a low ground effect. When operating, mowers generally work back-and-forth in strips like mowing grass in a yard. They usually pass over a piece of ground only once to mow it. Their low ground effect coupled with few passes results in minimal ground disturbance.

Due to the variability of ground disturbance in the West Bend project area, the quantitative extent of detrimental soil conditions was characterized for this analysis by categorizing them into condition classes. Soil condition classes represent a range of the aerial extent of detrimental soil conditions. Expressed as a percentage, the proportion of each class was estimated for every delineated unit or stand. Three soil condition classes were defined, they are:

- Soil Condition Class 1: 0 to 10 percent detrimental soil conditions
- Soil Condition Class 2: 10 to 20 percent detrimental soil conditions
- Soil Condition Class 3: greater than 20 percent detrimental soil conditions

The upper limit of condition classes were based on LRMP direction relative to maintaining 80 percent of an activity area in a condition of acceptable productivity (LRMP 1990). Further stratifications were based upon the sensitivity of data to be able to estimate the gradations of detrimental soil conditions and their extent. These gradations then became a method for assessing the relative risk of a particular treatment or activity to increase the extent of detrimental soil conditions to a level that compromises soil quality and long-term site productivity. Units estimated to have a high proportion of their acreage in the uppermost condition class were identified as having the greatest potential for incurring a level of detrimental soil impacts that put at risk the productivity standards set forth in the LRMP.

There is an important detail about soil condition classes to be aware of. Though they convey an estimate of the range of detrimental soil conditions that extend across an activity area, they also passively imply the extent of soil conditions that are ***not*** detrimental. If for example an activity area is designated to be in soil condition class 2, meaning detrimental soil conditions comprise less than 20 percent of its area, then the converse is that soil conditions across at least 80 percent of that unit's area are in good condition. This reflects the variability of effects that is typical after ground disturbance, whereby detrimental conditions are associated with the intensity of the impact. For ground-based operations detrimental soil impacts are inextricably tied to the routes and repetitiveness of travel by heavy equipment such as the network of roads, landings, and skid trails needed for logging. Relative to fire, detrimental soil impacts are associated with the areas where burn severity and duration were the greatest. Thus after an activity there is a proportion of the unit not heavily disturbed so overall the impacts could be low or nominal.

Estimates of the extent of detrimental soil conditions constitute direct effects, which primarily include heavy compaction, detrimental displacement, and excess removal of organic material. Sites where these impacts most commonly occur are roads, landings, and primary skid trails. Sensitive soils and extensively managed sites are the most prone to ground disturbance.

Direct effects such as detrimental soil conditions can indirectly affect soil quality further. For the West Bend project indirect effects were assessed qualitatively. Indirect impacts to soil quality were assessed by evaluating the cause-and-effect relationships between ground-disturbing activities and alterations to physical and biological soil characteristics that can lead to on-site losses to productivity at a later time; or off-site impacts such as sedimentation to water quality. Although this is a simplistic approach, it serves as a first approximation of potential indirect effects useful for comparing alternatives.

Indirect effects of proposed activities are primarily associated with adverse impacts to soil quality that translate to a decline of site productivity that persists into the future. This is an indirect effect in that it emerges after the direct impact on the ground. Indirect effects relative to soils that are translated off-site as a consequence of concentrated disturbance are typically associated with erosion and sedimentation. For the West Bend project area, the inherent surface erosion potential across the project area is predominantly low. Accelerated erosion is not considered to be an issue of primary concern because soils and the underlying bedrock are very porous, infiltration rates are rapid, and the drainage network is mostly disconnected and lacking surface features. Furthermore, intense highly erosive runoff events in the area do not commonly occur. There are very few linkages between the road and stream networks. Thus issues and concerns relative to road-related erosion and the indirect effects of sediment delivery are slight for the West Bend project.

Cumulative effects were analyzed qualitatively. They were assessed by evaluating existing detrimental soil conditions in relation to where proposed activities would occur. Detrimental soil conditions exist in most previously managed stands, some of which are proposed to treat again. Not all ground disturbances in previously managed stands however are detrimental. But where re-entry treatments are proposed a proportion of the existing low level disturbance will be exacerbated to some degree. Cumulatively the past, present, and reasonably foreseeable actions in the project area where ground-disturbing activities have overlapped one another constitute the basis for analysis. Ameliorative factors such as avoidance, mitigation (ex., subsoiling, fertilization, mulching, etc.), and recovery were then factored in. Simplistically, the cumulative assessment can be represented as the following qualitative sequence, which can be used to evaluate the probability of a unit's soil condition class increasing or decreasing as a result of a proposed activity:

- (existing + predicted effects) – (avoidance + minimization + mitigation + natural recovery)

A basic assumption to the approach was the use of a recovery factor. Based upon sampling and field reconnaissance, units where management had occurred more than 20 years ago it is inferred that the degree of heavy compaction, and especially detrimental displacement, has been alleviated somewhat, depending upon the treatment that had occurred and the soil type. Recovery from heavy compaction and displacement occurs by the combined processes of water movement, wetting and drying, frost action, daily temperature fluctuations, root growth, the actions of soil biota and biogeochemical processes, organic inputs, windthrow, burrowing animals, and time. While the assumption cannot be strictly applied across all the acreage treated 20 years prior, field sampling suggests that in some stands where older, extensive ground-based logging methods had occurred, the extent of detrimental soil conditions was less than 5 percent. Exceptions to the recovery factor assumption are present. Particularly on sensitive soils on steep slopes, shallow rocky sites, and frost pockets with very low organics and thin topsoil horizons, and older clearcut and seed tree harvest units where dozer scarification or dozer slash piling had occurred. Old landings, primary skid trails, and abandoned spurs tend to remain heavily compacted. Spatial data of past activities from the corporate database and historic aerial photographs were vital to determinations of previously managed sites.

Analysis of the direct and indirect effects was conducted at the unit scale. Units can be individual stands of trees or larger delineations of multiple stands where similar treatments are proposed. Units are the areas where ground impacting activities would occur. Cumulative effects were analyzed at the unit scale. They were also considered qualitatively at the project level, particularly in relation to soil function to discern potential effects to ecosystem services across the landscape.

Data from sampling and field reconnaissance can be found in the Appendices along with unit-specific concerns.

Alternative 1 (No Action)

Direct and Indirect Effects: Under the No Action alternative, ground-disturbing activities related to the proposed treatments would not occur. Measurable increases in the extent of detrimental soil conditions as a direct result of mechanical ground-based operations would not happen. Soil quality would not be expected to be diminished, but would remain compromised where existing detrimental soil conditions prevail such as roads, trails, previously used landings, and former primary skid routes. Other than the extent of existing detrimental soil conditions, soil quality across the majority of the project area would remain in good condition (i.e., the extent of detrimental soil conditions would remain below 20 percent in 90% of the stands in the project area) despite the high level of prior extensive management. Detrimental conditions on sensitive soils would remain low to moderate, and no further mechanical ground disturbance would be expected to occur on them. Natural recovery from past impacts would slowly continue unabated.

Soil quality has been degraded where detrimental soil conditions persist, and long-term site productivity is diminished on those sites. The consequence of which, is indirectly a greatly reduced rate of tree growth. Forest Service Roads that are part of the travel network have been converted to a non-forest status. Other sites such as trails, little used non-system roads, un-restored landings, and primary skid trails will remain heavily compacted and recovery will be prolonged.

Opportunities to alleviate detrimental soil compaction as a result of proposed activities on existing landings and skid trails that would have been designated for reuse, would not be pursued. Funding for soil restoration projects would not be readily available through harvest-generated revenue. Existing detrimental conditions from past ground disturbance would remain in a status of lengthy natural recovery for several decades. Sites where subsoiling occurred to alleviate detrimental compaction would continue to recover at an enhanced rate as root development improves and soil function recovers.

Thinning and underburning that could increase soil productivity on a dense and overstocked site by alleviating competition would not occur. Wildfire suppression efforts, particularly in heavy fuel types such as dense stands, would continue. The densely stocked stands of fire-excluded forest that characterize more than 50 percent of the project area would become predisposed to intensified disturbance including competition-induced stress and mortality, and a high potential for bark-beetle invasion. In the absence of naturally recurring wildfire, an abundance of standing dead trees and a heavy loading of downed coarse woody debris would continue to slowly accumulate. The build-up of biomass and dense, heavy fuels could put the stands at a high risk of high intensity wildfire if initial suppression attempts become foiled. In the dense overstocked stands, high severity fire could cause prolonged and intense heating if ablaze, resulting directly in detrimentally burned soil conditions.

Soil organic matter, essential nutrients, and biota could be volatilized during high intensity fire; indirectly leading to a near-term decline in site productivity. The re-growth and accumulation of organic biomass could remain deterred over the long-term, especially on highly disturbed sites and sensitive soil types. Recovery of soil quality from existing detrimental soil conditions could be set-back for decades. An extreme wildfire event could potentially expose bare soils over large areas, subjecting them to accelerated erosion, particularly from periodic heavy runoff events.

The situation could become exacerbated in the western half of the project area where soils are moderately susceptible to induced hydrophobicity by high severity fire. Hydrophobicity temporarily disrupts soil function by altering its capability to retain and store water. Infiltration could be temporarily reduced, substantially heightening the potential for accelerated erosion from even normal runoff events. Indirectly, accelerated erosion diminishes soil quality and site productivity by removing the growing medium.

Severe fire effects could necessitate costly rehabilitation efforts and decrease future options for maintaining and enhancing soil quality. Soil ecological diversity could be severely compromised; diminishing soil function, truncating well-established nutrient cycling pathways; and leading to eventual site occupancy by single pioneer species that are slower to develop symbiotic relationships with beneficial soil organisms. Sites of marginal productivity could be converted to a non-forest status over the long-term as competing vegetation, and possibly invasive plants colonized severely burned over ground; particularly sensitive soils (i.e., dry, shallow rocky, steep south-facing slopes, and frost-prone soils).

The opportunity to improve soil quality by treating select stands would not occur. Two distinctive stand types in the project area would not get treated, including young plantations that were established in the 1960s, and certain riparian stands adjacent to individual reaches of the Deschutes River. Without thinning, growth rates and soil productivity in the plantations would decline as competition for nutrients, light, and growing space increased. Vertical and horizontal differentiation of trees would remain sluggish, and stand diversity would be delayed until intensified disturbance occurred naturally. The ability to enhance growth and soil productivity through active management in the plantations could be lost. Inherent soil productivity would become over-utilized and resilience under-utilized. Soil function would be committed to supporting a stagnant stand condition at risk of loss or reversion to poor forest health, rather than the development of a young stand into a vigorous mid-aged structural stage.

Similarly, inherent soil productivity in the dense riparian stands would also remain committed to an overstocked condition. The ability to enhance riparian diversity and health would not be captured in the near-term. Soil function would not be committed to promoting large-tree development and old growth characteristics. Instead, soil function would be committed to supporting dense stand conditions where the overstocked understory would be in competition with the overstory, which potentially could inhibit the ability of the large, old ponderosa pines to withstand bark-beetle attack.

There would be no new temporary roads created, and no closed roads temporarily re-opened. Road maintenance and repair would continue at the current level and improvements to primary haul routes or problem sites would only be pursued on a site-by-site basis as needed. Certain segments of secondary roads with drainage control problems could remain unrepaired for years. Accelerated erosion would continue during periodic runoff events from these segments. But because there are only a couple of locations where the road network is connected to the drainage network, and there are very few water bodies the indirect impact to water quality or aquatic habitat from sedimentation would remain low.

Off-road trailing by woodcutters, OHV users, and mountain bike riders would continue to occur in the area. Most is expected to recur along the routes where use has already been occurring. It can be expected that a small measure of new ones will be created despite discouragement by the Forest Service. Woodcutters will continue to focus on dense lodgepole stands in the western half of the project area, and OHV users will continue entering closed or old decommissioned roads. Mountain bike riders will continue using the few created trails that are scattered around, particularly around certain buttes and ridges. Although a very small degree of the overall existing detrimental soil disturbance, user created trails will affect a few areas where there are sensitive soils, particularly on steep slopes.

Except where detrimental conditions prevail, soils across the majority of the project area would continue functioning to support and maintain long-term site productivity. Detrimentally disturbed sites or those that support densely stocked stands where growth has slowed will remain in a status of either slow

recovery or stasis. Other than those sites however, the inherent productivity and resilience of the soils will help to maintain their functional capacity to serve as a growing medium, storing and cycling nutrients and water, producing biomass, and supporting or regenerating a contiguous forest cover of various plant communities.

In the absence of an extreme wildfire, effective ground cover would persist and protect soils from erosive forces, and slowly continue to develop where it is lacking due to previous disturbance. Needle-fall, seed, and detritus from live trees would contribute to the recruitment and maintenance of litter, duff, and soil organic material. Trees, brush, forbs, fungi, and algae would gradually begin reoccupying bare sites except on surfaces occupied by open roads and some once-used landings. Fine and coarse woody debris would continue to accumulate. Organic inputs and biological processes that maintain and cycle soil nutrients essential for plant growth would continue to function and develop at current levels.

Effects Common to Alternatives 2, 3, and 4

Direct and Indirect Effects: Similarities between the three Action Alternatives include the types and extent of treatments they propose. All three propose to thin trees and reduce biomass across the majority of the West Bend project area. Although there are differences in the way each alternative proposes to do so, stands that are being proposed for mechanical treatment and common to each of the Action Alternatives comprise about 73 percent of the project area. Each Action Alternative would propose treatments that if implemented would result in roughly 95 percent of the area having undergone some form of forest management at least once since the 1910s. About 90 percent of the proposed treatments of each alternative would enter stands that have been treated previously. For this reason, the potential for increasing the extent of detrimental soil conditions in many of the stands proposed for treatment is high for each of the Action Alternatives. Table 184 displays the amount of area where the risk of increasing the extent of detrimental soil conditions beyond 20 percent of an activity unit would be high.

Table 184: Percent of Treatment Acres Common to the Action Alternatives Where the Extent of Detrimental Soil Conditions is Moderate, Moderately High, or High

Treatment	Percent of Treatment Acres
Mechanical Overstory and/or Understory Treatments	47
Activity Units with Sensitive Soils[2]	21
Non-mechanical Understory Treatments or Underburning	11

[1]Soil Condition Classes 2 and 3
[2]Partially overlaps the mechanical overstory and understory treatments

As a direct result of conducting overstory and understory treatments on previously treated areas, the potential for the extent of detrimental soil conditions to increase above 20 percent is high on about 47 percent (12,260 acres) of the project area. These include about 220 of the activity units or portions of them where the extent of detrimental soil conditions is already moderate or high (i.e. soil condition classes 2 and 3), or there are sensitive soils. Of particular note is a subset within this of an estimated 5,360 acres where existing detrimental soil conditions are estimated to be high and prescribed treatments include both mechanical harvest and mechanical post-harvest activities. Common to the Action Alternatives these are the units where the risk of direct effects diminishing soil quality is the greatest, potentially reducing inherent long-term site productivity and the capability of the soil to support a fully stocked healthy forest. Application of BMPs, PDCs, and mitigation would be necessary to contain detrimental soil conditions and to maintain or restore soil quality to pre-treatment conditions.

Also, within these acres are included two distinctive stand types: about 1,690 acres of young ponderosa pine plantations that were established in the 1960s following mechanical scarification, and about 274 acres where portions of units are adjacent to certain individual reaches of the Deschutes River (portions of units 401, 409, and 410). The former is notable because of the extent of ground disturbance that had occurred as a result of the past scarification, while the latter is important due to potential influence on

riparian and aquatic resources. Since the risk is high for direct ground disturbance to potentially diminish soil quality in these stands; the application of BMPs, PDCs, and mitigation measures (that are specific to them) would be necessary to contain the extent of detrimental soil conditions.

For the scarified plantations, ground disturbance from back-to-back mechanized entries would be contained using BMPs and PDCs so as to minimize impacts to the ongoing recovery of soil function so that the beneficial response of thinning to site productivity can be realized. For the portions of the units adjacent to the Deschutes River, ground disturbance from back-to-back mechanized entries would also have to be contained using BMPs and PDCs so as to minimize impacts within the riparian zone and to reduce the potential for indirect effects to impact aquatic and water resources off site.

Proposed treatment acres common to the Action Alternatives that have a proportion of them underlain by sensitive soil types amount to about 21 percent of the project area (Table 184). It is estimated that the extent of detrimental soil conditions are moderate to high (i.e., soil condition classes 2 and 3) on about one-third of those acres (~1,800). Sensitive soils most at risk include side slopes in draws, slopes on buttes, and slopes with pronounced soil creep where resilience to ground disturbance is low and detrimental impacts can be long-lasting. Avoidance measures will omit the majority of these acres from operations so that mechanical operations will be deferred from them. It is common practice for example to exclude the steepest slopes (that are greater than 200 feet in length) from activity units.

Treatments where only non-mechanical understory activities are planned and existing detrimental soil conditions are estimated to be moderate to high (i.e., soil condition classes 2 and 3) amount to 11 percent of the project treatment acres. The extent of detrimental soil conditions would not be expected to increase appreciably on these acres because these are hand treatments, and ground disturbance would be negligible. Hence, mitigation would not be necessary for these non-mechanical treatments. Included in these activities is underburning.

Underburning is prescribed in many of the units that have been treated previously and where the extent of detrimental soil conditions is moderate to high (i.e., soil condition classes 2 and 3). In particular are those in the dry ponderosa pine sites north of Tumalo Creek and along the far eastern margin of the project area where effective ground cover and the litter layer is patchy as a result of extensive past management. There is potential that underburning could combust what remains of the surface organics, which are important for moisture retention and nutrient cycling on these dry sites. BMPs and PDCs would be implemented to insure a light intensity burn that aims to conserve remnant surface organics and minimize effects to them. Beneficial effects of underburning would be simultaneously realized by reducing understory competition and releasing an initial flush of essential nutrients that would maintain or possibly benefit site productivity.

Mechanical overstory and mechanical understory treatments would also occur in activity units across about 17 percent of the area where the extent of detrimental soil conditions is comparatively low (i.e., soil condition classes 1 and 2). These are primarily units where there has been little past management, or where many years have passed since the last entry. Detrimental soil conditions would be expected to increase as a result of ground-based operations in these units but their extent would be contained by implementing BMPs and PDCs to minimize them. Mitigating the effects of detrimental soil conditions across these acres would not be imperative to meet LRMP standards, although it could enhance soil quality on affected areas.

All existing open (155 miles) and closed (30 miles) roads in the project area constitute a semi-permanent conversion to a non-forest status, where soils have been committed to a non-productive use. The road system would remain as the infrastructure providing access for the variety of forest users. Due to its extent no new roads would be needed to augment the existing system. But to access many of the proposed units, segments of closed roads would need to be temporarily reopened and some small non-system spur roads re-built. Closed roads to be re-opened are part of the existing system converted to a non-productive use. Combined, it is estimated that on average the road system accounts for about 1 to 5

percent of the extent of detrimental soil conditions in most of the project's previously managed activity units.

Certain segments of the existing road system that would be used for haul routes and access to activity units would be maintained and /or reconstructed as directed by standard contractual requirements for harvest operations. These would include segments where there are signs of accelerated surface erosion Drainage would be improved so that runoff would be routed to minimize concentration of intercepted runoff and abate accelerated erosion. Sediment that was generated would be diminished and transport off-site thwarted.

Many units lack adequate access, and there would be a need for constructing a notable amount of new temporary roads. An estimated 39 miles of temporary roads are proposed for Alternatives 2 and 3 and 42 miles for Alternative 4 to access approximately 100 of the proposed activity units. To minimize new disturbance about 8 of those miles would be located on old abandoned spur roads and an estimated 17 miles would be located on former temporary spurs, or on old primary skid trails. Soils on old travel surfaces that are to be re-used would revert from a status of recovery back to a detrimental condition. Surfaces that would constitute new temporary road miles would increase the extent of detrimental soil conditions and directly convert soils to a non-productive status for the life of their use in the units they traverse. In about 30 of those units, the extent of detrimental soil impacts is already high.

The total acreage of temporary roads would amount to less than 1 percent of the project area. It would be temporarily additional to the extent of the overall area of the existing road system, which occupies about 3 percent of the project acreage. New temporary spurs would be minimally constructed as is feasible. Most would be less than 0.5 miles in length and scheduled to be obliterated and restored when no longer needed for operations. Restoration would be expected to occur within 5 years of project completion and would entail measures to hasten recovery of soil function such as de-compacting the surface, dispersing slash and organic materials over the top, and hiding or barricading access.

About 6 miles of temporary roads in the western one-third of the project area would be constructed on soil types that are very rocky, cold, and covered seasonally with a winter snow pack. Restoration or obliteration of temporary road surfaces on these soils would necessitate an excavation of the tread to achieve de-compaction. Heavily compacted rocky soils are not typically good candidates for standard methods of obliteration, and due to their cold temperatures and short growing season slow to re-vegetate. Temporary use of these soils as a road surface would indirectly diminish their inherent long-term site productivity.

About 2.5 miles of planned temporary road segments would be located on sensitive soil types, mostly in several of the steep-sided draws in the southern portion of the project area. Because these landform positions are low within relict drainageways, hardened surfaces located in them would be prone to intercepting runoff from spring snowmelt that could result in accelerated erosion. BMPs that route intercepted runoff and disperse it to minimize concentrated flow would be applied so that only a minor degree of sediment deposition would be expected at the base of sloped segments, intersections with other roads, and the outlet ends of waterbars. Indirect effects off-site however would be minimal since there are no connections between these draws and a surface water body. Erosion would primarily affect the road tread, and would persist for the life of the road.

Off-road trailing by woodcutters, OHV users, and mountain bike riders will continue to occur in the area. Use of most of these routes could be expected to continue. Units opened by thinning are at risk of an increase in user-created trails, and it can be expected that a small measure of new ones would be created as a result of thinning dense stands and as temporary roads are still in use. Woodcutters will continue to focus on dense lodgepole stands in the western half of the project area. The extent of woodcutter trails would not be expected to increase noticeably because treatments would reduce the amount of dead and dying timber available as firewood. A few lodgepole stands along roads in the western portion of the project may remain untreated, and could continue to be sites woodcutters use as

long as standing dead trees are available. But since the majority of the project area will have been treated, new trailing created by woodcutters would not be expected to increase appreciably except maybe in leave patches, and tracks that currently exist would remain.

OHV use in the project area is not widespread compared to other areas on the DNF, and there is little evidence of extensive illicit use. Observational and anecdotal evidence from around the Bend-Fort Rock Ranger District indicates that OHV users tend to capitalize on closed and temporary roads and primary skid trails, using them to extend or create new trail networks, especially when in close proximity to residential areas. But the majority of terrain in the project area is not particularly attractive to OHV users except for a powerline corridor that bisects the southern portion and several rock pits. So a notable increase in user-created OHV trails and impacts to soil resources is not anticipated. A segment of mountain bike riders will continue using the few user-created trails that are scattered around, particularly on certain buttes and ridges. Some individual mountain bike users will capitalize on newly opened up stands and create new tracks, but since there is an extensive and heavily used designated trail system in place, illicit trails are not expected to impart a major impact on soils. Overall, user created trails will affect some additional areas, but the effect would be considered very small by comparison.

About 12 percent of the project area (3,220 acres) would be leave areas common to the Action Alternatives (excluding private land and non-forest). Unlike small sites where due to a mitigation tactic they might be excluded from an activity unit for such things as wetlands or omitting steep slopes greater than 30 percent, these are areas where there would be no mechanical overstory, understory, or fuels treatments of any kind. The extent of detrimental soil conditions in leave areas would not increase as a result of either of the Action Alternatives. Included within these leave areas would be 571 acres of the sensitive soils in the project area. Also included would be approximately 230 acres of stands where the extent of detrimental soil conditions is high, of which nearly 30 acres are on sensitive slopes of draws.

Leave areas could be considered an avoidance practice, where soils would not be affected by planned treatments. Soil conditions would remain fully functional or in a status of gradual unabated natural recovery where detrimental conditions persist from prior disturbance. In portions of leave areas that have never been treated previously (about 32 percent of leave patches) dense heavily stocked stands would remain and site productivity would continue to be diminished by competition. Though soils would not be affected by treatments, their capacity would be utilized to its maximum. But overall, soils would continue to function to support the processes of stand dynamics.

Thinning and underburning that indirectly could increase the productivity of dense and overstocked stands by alleviating competition would not occur in these leave blocks. There would not be a reduction of heavy fuel accumulations in the dense stands. Densely stocked stands of timber that characterize most of the blocks could be at risk of uncharacteristic disturbance including competition-induced stress and mortality, and a potential for infestation. In the absence of naturally recurring wildfire, an abundance of standing dead trees and a heavy loading of downed coarse woody debris would continue to slowly accumulate. The build-up of biomass and dense, heavy fuels would put the stands at a risk of wildfire that could become extreme. In the dense overstocked stands, high severity fire could cause prolonged and intense heating if ablaze, resulting directly in a total loss of the stand and some detrimentally burned soil conditions where large logs and stumps were consumed. Effective ground cover could be denuded, accelerating surface erosion and soil creep of exposed soils.

Certain leave areas in the project are of particular note and avoid sensitive soils. The canyon of Tumalo Creek would remain untreated. Treatments above it would not extend over the edge of the slope break down into it. Reaches and protection buffers adjacent to the Deschutes River would also remain untreated. Another leave area would be the slopes of the glacial trough that rise above Tumalo Lake, and the forested wetland on the lake's west end. Both are unique terrain and sensitive soil features that the project proposes to avoid. There would also be substantial areas around Vista Ridge that would be avoided, including the forest around a small pond on its western end. Much of the steep slopes on the

north and east side of the ridge are also leave areas. Combined, these are avoidance patches where soils would remain as is.

Except where there are detrimental conditions, soils across the majority of the project area would continue functioning to support and maintain long-term site productivity despite which Action Alternative is implemented. The extent of detrimental soil conditions would increase to moderate (i.e. soil condition class 2) where impacts were low prior to planned treatments. The extent of detrimental soil conditions would remain low to moderate (i.e., soil condition class 2) in activity units where only understory hand treatments would occur. In leave areas, the extent of detrimental soil conditions would not increase. Additive to these are the portions of units where, despite the condition class, soils are relatively undisturbed. Because even if the soil condition class is estimated to be 4 (i.e., the extent of detrimental soil conditions is 10 to 20 percent of an activity area), the converse is that the majority of soils in the unit are not in a detrimental condition.

Due to their productivity and resilience, most soils will retain their capability, serving as a growing medium, storing and cycling nutrients and water, producing biomass, and supporting or regenerating a contiguous forest cover of diverse age groups. Sites most at risk of not meeting LRMP S&Gs include planned mechanical treatments near sensitive soils such as steep slopes in draws and on buttes, and stands where the extent of detrimental soil conditions is currently high as a result of previous treatments. Combined both of these circumstances apply across an estimated 40 percent of the project area and are common to the Action Alternatives. Where the extent of detrimental soil conditions would be expected to exceed LRMP S&Gs, mitigation in the form of de-compaction of heavily disturbed surfaces would be applied to alleviate heavy compaction resulting from mechanical disturbance. De-compaction practices would help to hasten the recovery of soil function on temporary roads, skid trails, and landings.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: Alternative 2 proposes treatments across 85 percent of the project area. Primary objectives of treatments would be to maintain and enhance forest health and site productivity, and reduce fuel loading. The Alternative's most distinguishing feature is that a prevailing thinning prescription of moderate density would be universally applied in the ponderosa pine and mixed conifer, and would not entail variable density treatments. Table 185 displays soil disturbance indicators exclusive to Alternative 2.

The extent of the total disturbance footprint would be the greatest of the Action Alternatives, but only by a nominal degree (33 acres). The additional acres exclusive to Alternative 2 do not include sensitive soils. Individual stand prescriptions however would result in more commercial harvest treatments, and more harvest treatments followed by mechanical understory or fuels treatments. As a result, Alternative 2 would propose the greatest amount of mechanical treatments in units where the extent of detrimental soil conditions is currently high. These would be acres exclusive to Alternative 2 (~219 acres), and additional to those common to all of the Action Alternatives. These are additional units where the risk of direct effects diminishing soil quality from mechanical operations is greatest. Restoration activities would be necessary to restore soil quality to pre-treatment conditions and contain the extent of detrimental soil conditions.

Table 185: Soil Disturbance Indicators Exclusive to Alternative 2

Percent area treated	85	Highest footprint acres of the Action Alternatives, but only by 33 acres
Exclusive mechanical treatment acres where detrimental soil conditions are moderately high or high	12,830	Most of the action alternatives, but only slightly higher than Alternative 3
Leave blocks and untreated acres	3,220	Base amount of leave area, none exclusive

Alternative 2 would retain the base amount of leave blocks and retention areas. These would be common to all three of the Action Alternatives as described in the section previous to this. There would

be no accrual of detrimental soil impacts as a result of mechanical operations on these sites. Included in these would be areas where the extent of detrimental soil conditions is high and recovery from prior impacts would continue unabated. Sensitive soils and unique features in these leave areas would be avoided and remain undisturbed.

Alternative 3

Direct and Indirect Effects: Alternative 3 proposes treatments across 84 percent of the project area. Primary objectives of treatments would be to maintain and enhance forest health and site productivity, reduce fuel loading, and enhance habitat for wildlife and sensitive plants. The Alternative's most distinguishing feature is that the thinning prescription would be a range of variable density thinning in the ponderosa pine and mixed conifer, and would include small openings. Table 186 displays soil disturbance indicators exclusive to Alternative 3.

The extent of the total disturbance footprint would be slightly less than Alternative 2, but only by a nominal amount (33 acres). Individual stand prescriptions however entail fewer commercial harvest treatments, and a greater percentage of non-mechanical treatments. As a result, Alternative 3 would propose fewer (~219 acres) mechanical treatments in units where the extent of detrimental soil conditions is currently high. These would be additional areas where recovery from previous impacts would gradually continue.

Table 186: Soil Disturbance Indicators Exclusive to Alternative 3

Percent area treated	84	Nearly identical with Alternative 2, slightly fewer treatment acres
Exclusive mechanical treatment acres where detrimental soil conditions are moderately high or high	12,611	Slightly fewer acres than Alternative 2
Leave blocks, untreated acres, and retention	3,453	Additional 233 acres retention for wildlife and sensitive plants

There would also be a total of 233 acres of retention for wildlife habitat objectives additional to the leave blocks common to the Action Alternatives. These are a mix of individual stands and leave blocks within treatments. Included in them would be 95 acres where the extent of detrimental soil conditions is high. Within a proportion of these prescribed burning and/or mowing could occur. These too would be areas where recovery from previous impacts would continue. There would not be any additional sensitive soils that would be avoided in the retention areas.

Alternative 4

Direct and Indirect Effects: Alternative 4 proposes treatments across 83 percent of the project area. Primary objectives of treatments would also be to maintain and enhance forest health and site productivity, reduce fuel loading, and enhance habitat for wildlife and sensitive plants. The Alternative's most distinguishing feature is not only variable density thinning with openings, but also additional wildlife retention objectives in the dry ponderosa pine. Table 187 displays soil disturbance indicators exclusive to Alternative 4.

The extent of the total disturbance footprint for Alternative 4 would be the least of the Action Alternatives. Individual stand prescriptions entail the fewest commercial harvest treatments, and a greater percentage of non-mechanical treatments, particularly underburning. As a result, Alternative 4 would propose 2,400 fewer acres than Alternative 2 of mechanical treatments in units where the extent of detrimental soil conditions is currently high. These would be additional areas where recovery from previous impacts would gradually continue.

Table 187: Soil Disturbance Indicators Exclusive to Alternative 4

Percent area treated	83	Least of the Action Alternatives
Exclusive mechanical treatment acres where detrimental soil conditions are moderately high or high	10,430	Least of the Action Alternatives
Leave blocks, untreated acres, and retention	3,917	Additional 464 acres retention for wildlife and sensitive plants, the most acres of the Action Alternatives

There would also be a total of 464 acres of retention for wildlife habitat objectives additional to the leave blocks common to the Action Alternatives. These are a mix of individual stands and leave blocks within treatments. Included in them would be 160 acres where the extent of detrimental soil conditions is high. Within a proportion of these prescribed burning and/or mowing could occur. These too would be areas where recovery from previous impacts would continue. Included would be about 200 acres of additional sensitive soils that would be avoided.

Because this Alternative proposes the fewest treatment acres, there would be about 14 fewer miles of temporary roads needed. The disturbance footprint of temporary roads would be the lowest of the Action Alternatives, as would be the extent of road-related detrimental soil conditions. The need for post-operation soil rehabilitation on temporary roads would also be the least.

Cumulative Effects

Cumulative effects to soil resources were analyzed qualitatively by evaluating the past, present, and reasonably foreseeable actions in the project area where ground-disturbing activities would overlap one another. Effects were assessed at two scales, the unit and the project area. Focally, and at the unit scale these would be sites where there are existing detrimental soil conditions from previous management and re-entry is planned. Equally to be factored are sites where restoration and mitigation activities such as subsoiling or soil amendments have occurred to ameliorate detrimental conditions.

At the project level, cumulative effects were also considered relative to whether or not soils were functioning to their capability and providing ecosystem services across the landscape, because soil types can differ markedly in their response to management. More broad-scale in context it is a look at how the capability to produce biomass and maintain a contiguous forest of diverse complexity has been affected. Inherent soil productivity, regulation of nutrient cycling and availability, and water storage are some important ecosystem services that in turn indirectly support beneficial uses such as habitat for a variety of wildlife species, recreational opportunities, and wood products for human use.

If implemented treatments would result in more than 95 percent of the area having undergone some form of forest management at least once since the 1960s. About 90 percent of the proposed treatments would enter stands that have been treated previously. For this reason, the potential for cumulatively accruing detrimental soil conditions in many of the units planned for treatment is high.

Not all ground disturbances in previously managed stands is detrimental, a proportion is low level disturbance. Light and moderate levels of disturbance are detectable where ground-based operations have occurred in the past. Entering these sites again can exacerbate lower-level disturbance so that it is transformed to a detrimental soil condition. Units where the detrimental soil conditions are currently high are especially at risk of cumulative effects, where without mitigation, inherent soil quality and productivity could be diminished.

As a result of intensive management in the past the extent of detrimental soil conditions is moderate, or high (i.e., soil condition classes 2 and 3) on about 47 percent of the treatment acres. The extent of detrimental soil conditions could be expected to increase in these units as a result of re-entering them, as the cumulative impact of recurring ground disturbance over the same area would be realized. Units

where mechanical harvest and post-harvest treatments (including mechanical slash abatement) would be most prone to cumulative effects that would exceed LRMP S&Gs. Minimizing the cumulative effect through PDCs, BMPs, and mitigation would be necessary to maintain a condition of acceptable productivity across 80 percent of each of the affected activity units where the current extent of detrimental soil conditions is high (see Appendix E for a unit listing).

New units that would be treated and where detrimental soil conditions are low or moderately low would account for about 17 percent of the project area. PDCs and BMPs could contain and minimize the extent of detrimental soil conditions, but there would nonetheless be impacts from ground disturbance that would be detrimental where it was nonexistent before. A new skid trail network would be created, including some new landings and primary skid routes. These would be sites where new detrimental soil conditions would be added to the project area, remaining until mitigated.

Treatment acres common to the Action Alternatives that have a proportion of them underlain by sensitive soil types amount to about 21 percent of the project area. It is estimated that the extent of detrimental soil conditions are moderate or high (i.e., soil condition classes 2 and 3) on about one-third of those acres (~1,800). Re-entry by proposed treatments would occur on the majority of them. Sensitive soils most at risk are steep slopes and draws, particularly those that have been harvested previously where dozer slash-piling, dozer scarification, or intense wildfire had occurred. Additionally there are about 2.5 miles of temporary roads that would be built in sensitive draws. The risk of diminishing soil quality as a result of recurring mechanical treatments and construction of temporary roads would be high and cumulative effects potentially long lasting. Thus implementing PDCs, BMPs, and mitigation would be paramount to maintaining soil quality on sensitive soils and minimizing cumulative effects.

Prescribed underburning would typically occur 2 to 10 years after treatments are completed. Intent of underburning is to maintain a low fuel condition in the understory. Often there has been a period of recovery after a treatment prior to the re-introduction of fire. In-growth and re-growth of the understory that has occurred during that time, along with an accumulation of detritus, litter, and effective ground cover contributes to the recovery of soil disturbance. Underburning could reset that recovery back to a post-disturbance condition, and above-ground biomass could be substantially reduced if low burn intensity were not achieved. Units where the extent of detrimental soil conditions was high or where sensitive soils occurred would be most prone to a cumulative impact that arrests recovery of nutrient status and inherent site productivity for the short-term, particularly heavily disturbed dry pine sites in draws and the steep slopes prone to soil creep in the northwestern portion of the project area.

The presence and use of the road system would continue, where soils have been converted to a non-forest condition. Near-future improvements planned for Forest Road 4601 (Skyliner) would widen it, committing a little more ground to a non-forest status, as did a few repairs to Forest Road 42. But the road system accounts for less than 1 percent of the project area where soil productivity has been altered semi-permanently. New temporary roads would add another 56 miles, which is notable in relation to the percentage of new area affected (<1%). Some of them would be located on old abandoned spurs, minimizing new disturbance. Temporary roads would remain in a detrimental status until restored and converted to a status of recovery.

Firewood cutting and OHV use have contributed a small percentage to the accrual of detrimental soil impacts too. Off-road firewood use could be curtailed some since many of the source stands would be treated and the wood removed, but a slight amount of use would be expected to continue. On the other hand OHV and mountain bike use could increase because dense forested stands would be opened up, giving sight to new opportunities for user created trails. Although a very small component of cumulative effects, both of these uses contribute to affected sites that are identifiable. Some of the woodcutting has affected sensitive areas, while the OHV and mountain bike use has affected sensitive slopes.

Combined, all these site impacts over the past 50 years have affected soils across the project area, and are indicative of an area that is heavily used by a variety of users. There have been however a

substantial amount of improvements and restoration too. Thinning and removal of diseased or bark-beetle infested timber and thinning in young stands has occurred across much of the project area (>25%). These activities have served to enhance site productivity by alleviating competition and improving growth rates, and they have reduced high fuel loading lowering the risk of loss to wildfire. Tree planting has also occurred across much of the area, particularly the ponderosa pine sites, to hasten stand establishment. These activities have imparted a degree of positive effect that offsets some of the cumulative accrual of detrimental soil conditions.

Road improvements and on-going maintenance continue to minimize effects of intercepted runoff on primary travel routes. Erosion attributed to road-concentrated runoff is a notable problem on some segments. There have been a lot of road segments decommissioned (4% to 6% of original miles), where soils have been de-compacted. Currently soils are in a status of recovery to eventually convert them back to a productive status. Additionally, landings and primary skid trails have been subsoiled on about 15% of the project area, ameliorating heavy compaction, restoring natural infiltration, and enhancing rooting capability. Roadside eradication of noxious and invasive weeds along Forest Road 41 and in rock pits has also occurred to help maintain native health of native vegetation. These too are activities that have imparted a degree of positive effect that offsets some of the cumulative accrual of detrimental soil conditions.

Despite all of the extensive management in the project area soils across the majority of the project area would continue functioning to support and maintain long-term site productivity, except where there are detrimental conditions. The extent of detrimental soil conditions would remain moderate (i.e. soil condition class 2) across about 14 percent of the project area where impacts were low or moderately low prior to planned treatments. In another 5 percent the extent would be low to moderate (i.e., soil condition classes 1 and 2) because only understory hand treatments would occur. Another 13 percent of the area would be in leave areas where the extent of detrimental impacts would not increase. Additive to these are the portions of units where, despite the condition class, soils are intact. Because even if the soil condition class is estimated to be 3 (i.e., the extent of detrimental soil conditions >20 percent of an activity area), the converse is that the majority of soils in the unit are not in a detrimental condition (cumulative detrimental soil conditions in these activity units would be restored following treatments). Due to their productivity and resilience most soils will retain their capability, serving as a growing medium, storing and cycling nutrients and water, producing biomass, and supporting or regenerating a contiguous forest cover of diverse age groups.

Mitigation and Restoration

Measures to avoid or minimize unwanted impacts to soil resources are primarily BMPs and PDCs, which are addressed in Chapter 2 of this FEIS. They are standard operating procedures as well as specific measures that are prescribed on a project-by-project basis. Mitigation is a practice in which a restorative action is needed to ameliorate unavoidable adverse effects. In this context those would be the extent of detrimental soil conditions accrued in activity units where it is already high. Without mitigation, achieving LRMP S&Gs would not be feasible, and less than 80 percent of some activity areas would be in a condition of acceptable productivity. Or stated in the converse, the extent of detrimental soil conditions would exceed 20 percent of the activity areas without post-harvest mitigation. Mitigation would be necessary to restore soil quality. For a listing of specific unit concerns see Chapter 2 Resource Protection Measures and Appendix D.

Restoration would consist of de-compaction of hardened surfaces, obliterating temporary roads, and possible soil amendments (i.e. mulch) in dry pine sites where the extent of detrimental soil conditions is high. Subsoiling would be used as a means for reducing the extent of detrimental soil conditions by ameliorating heavy compaction on landings and converging segments of primary skid trails. In some cases particularly in dry pine sites mulch, wood chips, or slash mats could be added as a protective ground cover and soil amendment where feasible. All of the temporary roads would be reclaimed as

well. This would entail de-compacting the road surface, installing waterbars as needed, and hiding their entry or barricading it. Those in dry pine sites could also be covered with a layer of mulch or wood chips across their surface.

Activity units where mitigation would be necessary are those where existing detrimental soil conditions are high. These include 12,260 acres or about 220 units where mechanized treatments would occur, and in some them there are sensitive soils on steep slopes or in draws. These are units where ground-based disturbance could be expected to increase the extent of detrimental soil conditions beyond the 20 percent standard, and impacts would need to be mitigated in order to maintain soil quality and inherent productivity.

Unavoidable Adverse Impacts

Unavoidable adverse impacts would be focused where ground disturbing activities would be repetitive. Impacts would primarily be associated with the skid trail network needed for ground-based operations, where detrimental soil conditions would be incurred. The skid trail network would include landings, primary skid trails, and temporary roads where use by heavy equipment and truck traffic would be concentrated. These would be converted to a temporary non-vegetated status, and the removal of organic layers and topsoil along with detrimental compaction would impair site productivity and soil quality unless impacts were mitigated.

Short-Term Effects versus Long-Term Productivity

Overstory and understory treatments and post-project underburning constitute ground disturbing activities. Direct effects range from light and moderate levels of disturbance to detrimental soil impacts such as heavy compaction, accelerated erosion, or an excess removal of organic material. Throughout the sequence of treatments, light and moderate ground disturbance would occur over a considerable amount of area in an activity unit. While not severe enough in magnitude or extent to be considered detrimental these are sites where travel by heavy equipment has been limited, or where low intensity underburning has only lightly or moderately charred the litter and surface organics. Although the ground has been disturbed, soil quality has not been degraded to the point that long-term site productivity is diminished. Soils where ground disturbance has been light or moderate would be expected to retain their inherent capability and function as a growing medium that continues to produce biomass and support forested plant communities.

Management activities would remove a substantial amount of above-ground biomass from the forest in the first several activities in the treatment sequence. There would also be a considerable amount that remains on-site, both at the unit scale and at the project level. At the unit scale the majority of the litter and duff layer would remain after treatment, except in temporary roads, landings, and primary skid trails. Ground cover including forbs, brush, and seedlings would too. Thinning would remove on average upwards of 40 to 60 percent of the trees, meaning that 60 to 40 percent would be retained. After release growth rates would increase and stand productivity be enhanced as stands that are opened up would have renewed vigor. Competition for available soil nutrients, water, growing space, and light would be less. Because of an increase in available light understory development would flourish. In the absence of detrimental soil conditions, inherent productivity would stimulate re-growth, in-growth, and recruitment of individual plants. Above-ground biomass would slowly accumulate and build, providing recruitment of detritus to the litter and duff layers for future assimilation into topsoil organics that fuel soil biota and their function to cycle nutrients. Surface organics would also continue to promote retention of soil moisture.

Across the project area, untreated areas and leave blocks would continue to be sources of seed, litter, and forest cover in various structural stages. Proposed treatments would capture site growing potential through release of competition. Unencumbered sites would continue to produce forest vegetation across the entire project area. With the exception of roads that have been committed to a non-productive use

and where detrimental soil conditions occur. The inherent productivity and resiliency of the soils in the project area would maintain soil quality and long-term site productivity.

To access many of the proposed units, segments of closed roads would need to be temporarily reopened and about 46 miles of temporary spurs built. Closed roads to be re-opened are part of the existing system that converted ground to a non-productive use. They would remain even if re-closed after operations. Temporary roads will be a new short-term soil impact where productivity will be impaired until restored (i.e., within 5 years after close of operations). Once restored those surface would revert back to a condition where they would become capable of becoming productive.

Irreversible and Irretrievable Commitment of Resources

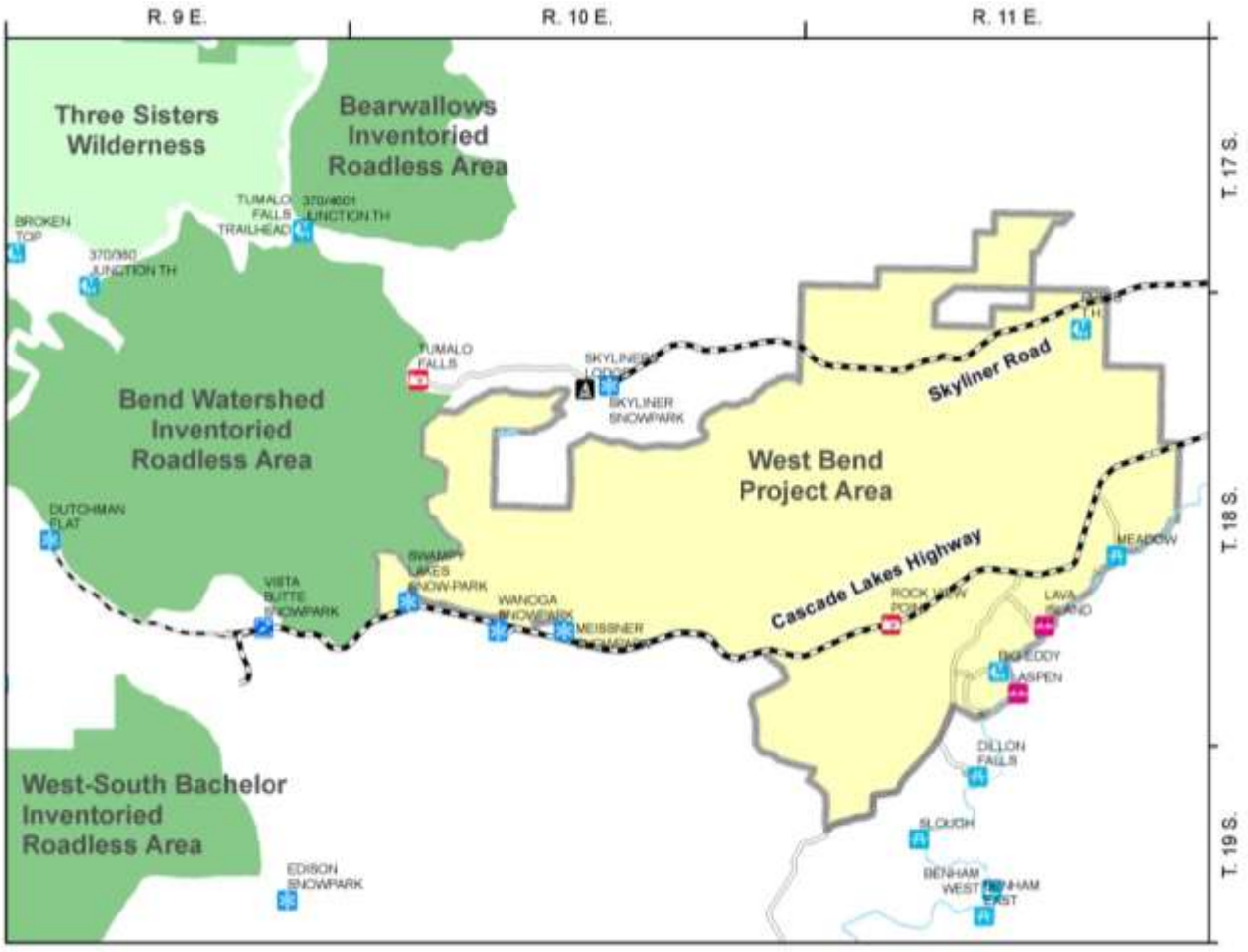
Due to its extent no new roads would be needed to augment the existing system. All existing open and closed roads in the project area constitute a semi-permanent conversion to a non-forest status, where soils have been committed to a non-productive use. The road system would remain and function as the infrastructure providing access for the variety of the forest users. Paved arterial roads would be expected to serve as primary ingress/egress routes through the forest for the long-term, as would the gravel and native surfaced collector routes. Some local spurs and minor roads could be considered redundant in the future and subject to decommissioning, restoring their surface so that soil can recover and become productive. Future decommissioning would be determined on a project-by-project basis.

3.14 Wilderness, Potential Wilderness Area Inventory, Inventoried Roadless Areas, and Other Undeveloped Lands

3.14.1 Introduction

This section analyses wilderness areas, potential wilderness area (PWA) inventory, Inventories Roadless Areas (IRAs) and other unroaded or undeveloped lands.[10] Appendix A of the PWA is located in the project record and provides additional narrative and maps in support of the potential wilderness inventory analysis. The area for each of these analyses is the 25,696 acre West Bend project area located to the west and adjacent to the urban growth boundary of Bend, Oregon.

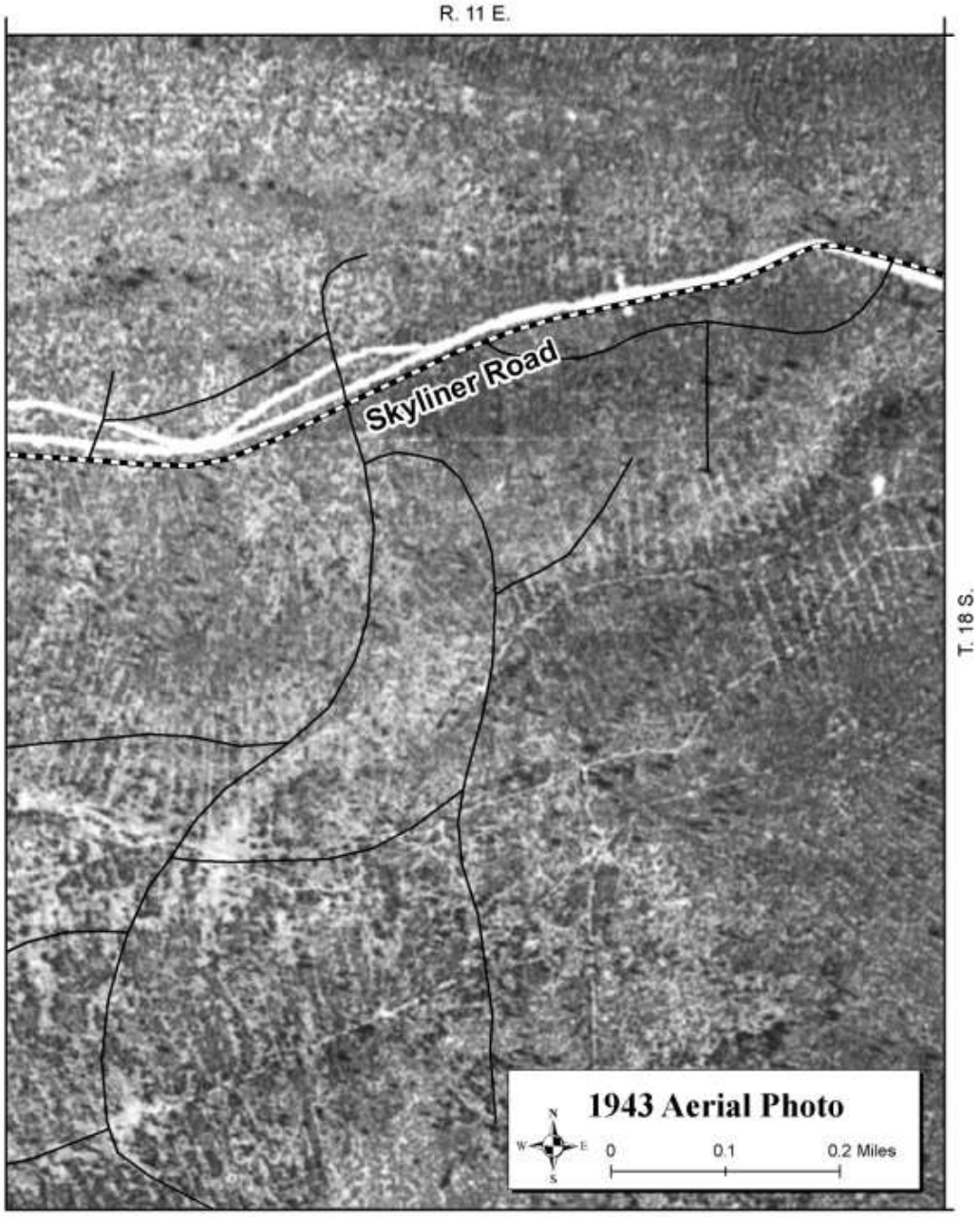
Figure 62: Location of Inventoried Roadless Areas and Wilderness in Proximity to West Bend



Much of the West Bend project area was private timberlands prior to becoming National Forest System lands and was clearcut logged in the 1920s. Large ponderosa pine that was once abundant on the landscape is now rare. Trees that have grown back are now about 80-90 years old and very dense where thinning has not occurred. Areas that appear somewhat natural today retain evidence of the past logging activities. Figure 63, displays a portion of the project area that has evidence of past harvest activity.

[10] The term 'other undeveloped lands' is presented and used in this document to provide a consideration for lands that do not contain roads and evidence of timber harvest.

Figure 63: 1943 Aerial Photo Showing Evidence of Skid Trail Systems within a Portion of West Bend



3.14.2 Management Direction

Wilderness

A wilderness area is designated by congressional action under the Wilderness Act of 1964 and other wilderness acts. Wilderness is undeveloped Federal land retaining primeval character and influence without permanent improvements or human habitation (Deschutes Forest Plan, page G-16).

Inventoried Roadless Areas

Inventoried Roadless Areas (IRAs) are areas identified in the 2001 Roadless Area Conservation Rule. Maps, and any subsequent revisions, are contained in Forest Service Roadless Area Conservation Final Environmental Impact Statement, Volume 2, dated November 2000, held at the National headquarters office of the Forest Service. These areas were set aside through administrative rulemaking and have provisions, within the context of multiple use management, for the protection of IRAs. Most IRA boundaries are nearly identical to those identified as 'Roadless Areas', referred to in the 1982 planning rule (36 CFR 219.17) and identified by the Forest Plan and the Final Environmental Impact Statement (FEIS), Appendix C. Some localized, minor differences in boundaries may exist.

Potential Wilderness

Areas of potential wilderness are identified using inventory procedures found in Forest Service Handbook (FSH) 1909.12, Chapter 70, section 71. The inventory is conducted by the Forest Service with the purpose of identifying potential wilderness areas (PWAs) in the National Forest System. The National Forest System Land and Resource Management Planning Rule (currently the 1982 Rule, 36 CFR §219.17) directs that roadless areas be evaluated and considered for wilderness recommendation during the forest planning process.

Potential wilderness areas are not a land designation decision, they do not imply or impart any particular level of management direction or protection, they are not an evaluation of potential wilderness (section 72), and lastly they are not preliminary administrative recommendations for wilderness designation (section 73). The inventory of PWAs does not change the administrative boundary of any IRA.

Typically, PWAs substantially overlap, and/or are contiguous with IRAs. PWAs may also be contiguous with designated wilderness. Some newly inventoried PWAs may be stand-alone areas that were not identified as 'roadless areas' in Appendix C of the 1990 Deschutes Forest Plan and 'inventoried roadless areas' as identified in a set of maps in the 2001 Roadless Area Conservation Rule (RACR). PWAs overlap IRAs only where those acres of land are consistent with the inventory criteria (FSH 1909.12, Chapter 70, section 71) and may extend beyond IRA and wilderness boundaries consistent with inventory criteria.

Other Undeveloped Lands

These acres of land have no history of harvest activity, do not contain forest roads[11], and are not designated as a wilderness area, identified as an IRA or included in the potential wilderness inventory as assessed for this project. They are areas that may be unique on the landscape. These areas may have values associated with them such as scenery, cultural resource values, and unfragmented habitat. These acres have no recorded previous roads or harvest activities located in them.

[11] Forest road – A road wholly or partly within or adjacent to and serving the National Forest System that the Forest Service determines is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources. Road – A motor vehicle route over 50 inches wide, unless identified and managed as a trail (36CFR §212.1).

3.14.3 Wilderness

Affected Environment

There are no designated wilderness areas within, nor directly adjacent to the project planning area. The closest designated wilderness is the Three Sisters Wilderness located approximately three miles to the northwest of the planning area. The Three Sisters Wilderness was designated by Congress in1964. Approximately 78,913 acres of the 226,793 acre wilderness are located on the Deschutes National Forest (Figure 62). The rest of the wilderness is located on the Willamette National Forests (LRMP, Appendix 4).

A Class 1 airshed designation does not allow human-caused activities outside the wilderness to adversely affect air quality within the wilderness. The Class 1 airshed, Three Sisters Wilderness, is located adjacent and to the northwest of the project area.

Smoke Management (refer to FEIS, Fire/Fuels section and the Clean Air Act, page 118, within the Fire/Fuels section) is regulated by the Oregon Department of Forestry according to the Oregon Smoke Management Plan Oregon Revised Statutes 477.013. The policy of the plan is to improve the management of prescribed burning as a forest management and protection practice; and to minimize emissions from prescribed burning consistent with the air quality objective of the Interim Air Quality Policy on Wildland and Prescribed Fires, Federal Clean Air Act, and the State of Oregon Clean Air Act Implementation Plan developed by the Department of Environmental Quality under ORS 468A.035 [1989 c.920 s.2].

By law, the Forest Service is required to follow directions of the State Forester in conducting prescribed burning. This is to assure compliance with all aspects of the Clean Air Act. This is to be done in conjunction with ODF to adhere to the Oregon Smoke Management Plan

Environmental Consequences

All Alternatives

Direct, Indirect and Cumulative Effects

The West Bend project activities would have no effect on the wilderness character, including solitude, because of the distance to the nearest treatment unit (approximately three miles). No activities would occur adjacent or within any designated wilderness.

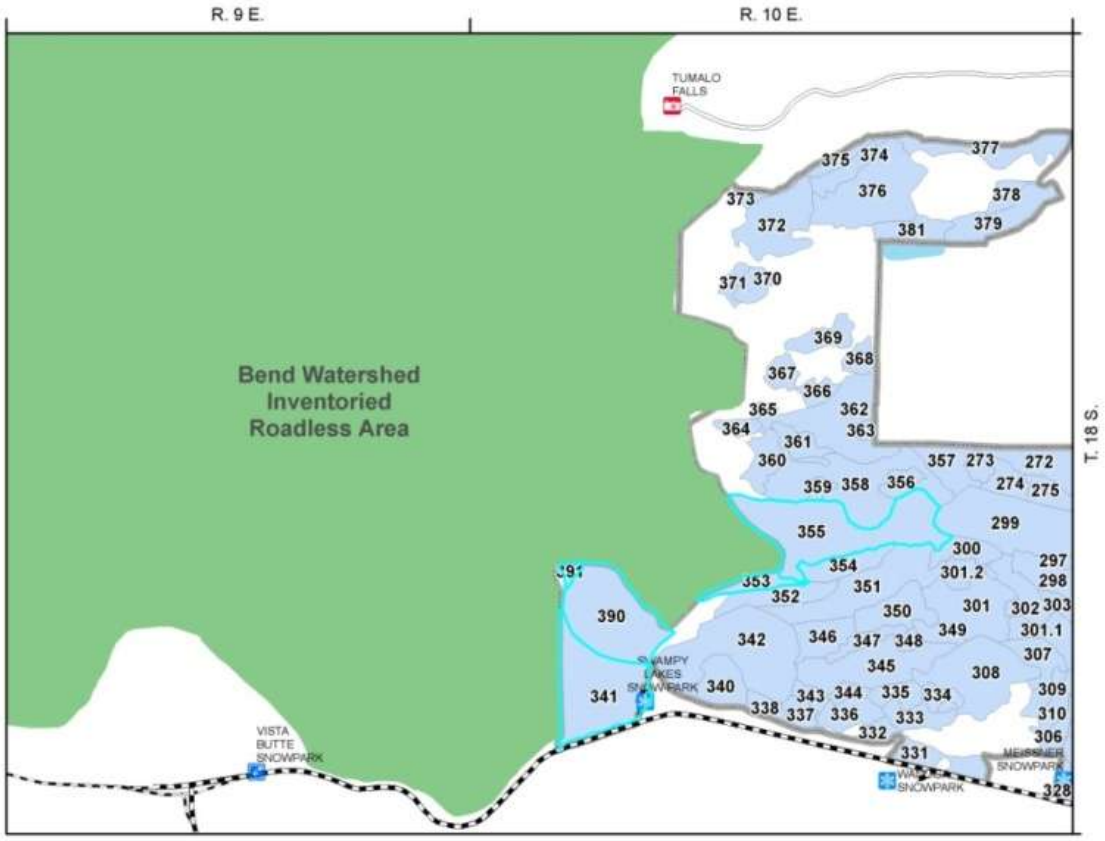
All burning activities must comply with National Ambient Air Quality Standards and would be conducted under the rules and regulations of the Oregon Smoke Management Plan administered by the Oregon Department of Forestry. Rules and regulations limit the amount and timing of all burning activities. Such activities would be conducted only when prevailing and predicted wind patterns would not result in measurable impacts to either the Three Sisters Wilderness class I airshed or the Bend Designated Area. The prevailing winds tend to be either a westerly or northwesterly flow, away from these areas.

3.14.4 Inventoried Roadless Areas

Affected Environment

While the project area does not overlap any IRAs, three IRAs are within the vicinity of the West Bend project area (Figure 62). The West-South Bachelor IRA is located 2.7 miles southwest and the Bearwallows IRA is located 2 miles northwest of the project area. The Bend Watershed IRA is located immediately to the west, adjacent to the project area (Figure 64).

Figure 64: Treatment Units Directly Adjacent to the Bend Watershed IRA (Units 341, 353, 355, 390, 391)



Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: There would be no direct effects to IRAs under the No Action alternative. The affected environment would remain unchanged, except by natural processes. Biological and ecosystem functions would continue. The landscape would likely continue developing complex fuel loads. A wildfire may burn more extensively and kill more trees within upland forest stands which would result in larger acreages of blackened landscapes and higher risk for wildfire to reach the wildland urban interface. These conditions may also make these areas more susceptible to large-scale tree mortality from insects and disease.

Alternative 2 (Proposed Action), Alternative 3, Alternative 4

Table 188: Treatment Units Directly Adjacent to the Bend Watershed IRA

Unit	Overstory Treatment	Understory Treatment	Fuel Reduction Treatment	Acres
341	Commercial Thin	PCT	Pile and Burn	111
353	Seedtree Cut	PCT	Pile and Burn	17
355	Seedtree Cut	PCT	Pile and Burn	145
390	-----	-----	MST/Underburn	108
391	-----	PCT	Lop and Scatter	5
Total Acres				**386**

Direct and Indirect Effects: Due to the distance to the West-South Bachelor and Bearwallows IRAs, the West Bend project would have no direct, indirect, or cumulative effects to these IRAs. No harvest activities or construction of road or other permanent developments would occur within the IRA and project activities would be too far away to be detected by anyone within either of these IRAs.

Five treatment units lie adjacent to the Bend Watershed IRA (units 341, 353, 355, 390 and 391) (Table 188 and Figure 64) and several other treatment units are located nearby. During treatment activities there may be temporary noise and smoke disturbances within the Bend Watershed IRA. Timber and fuels treatments within the areas surrounding and adjacent to the three IRAs may reduce the risk of large-scale tree mortality from insects, disease, or wildfire within these IRAs and spread of wildfire from the IRA into wildland urban interface.

Cumulative Effects

The West Bend project area does not overlap any IRAs and there are no other known past, present, or foreseeable projects proposed in the West Bend project area that would build roads or harvest or cut trees within IRAs, therefore there are no cumulative effects to IRAs.

3.14.5 Potential Wilderness Area (PWA) Inventory

Methodology for PWA Inventory for the West Bend Project

The West Bend project area and an adjacent two miles were inventoried for potential wilderness utilizing the criteria in FSH 1909.12, section 71. Areas qualify for placement on the PWA inventory if they meet the statutory definition of wilderness. Areas are evaluated and are eligible for inclusion in the inventory if the area meets either criteria 1 and 3, or criteria 2 and 3 below:

1. Areas contain 5,000 acres or more.
2. Areas contain less than 5,000 acres, but can meet one or more of the following:
   a. Areas can be preserved due to physical terrain and natural conditions.
   b. Areas are self-contained ecosystems, such as an island, that can be effectively managed as a separate unit of the National Wilderness Preservation System.
   c. Areas are contiguous to existing wilderness, primitive areas, Administration-endorsed wilderness, or potential wilderness in other Federal ownership, regardless of their size.
3. Areas do not contain forest roads (36 CFR 212.1) or other permanently authorized roads, except as permitted in areas east of the 100th meridian (see FSH 1909.12, section 71.12).

FSH also provides guidance when it is acceptable to include areas with past management actions. FSH 1909.12, section 71.11 (9) states that timber harvest areas where logging and prior road construction are not evident may be included in the inventory.

Corporate database information was used to determine if areas qualified to be included in the inventory using past harvest and tree cutting operations and road construction. Satellite imagery and historic photos were also utilized to determine if previously harvested areas and roads were present but not captured in the corporate databases. Geographic Information System (GIS) analysis was utilized to identify areas with no previous tree cutting operations, including any roadside hazard tree removal or firewood cutting, and with no evidence of road building. The area of analysis was extended to approximately two miles beyond the West Bend project boundary to determine if larger areas meeting the inventory criteria were present adjacent to the project area.

The methodology and rationale used to inventory and identify areas eligible for inclusion in the PWA inventory within the West Bend project planning area are located in the Project Record, Appendix A, Table 2. Maps included in Appendix A, Project Record, show a visual progression of the inventory process, final results, and proposed project activity, if any, which would occur in these areas. PWAs included in this inventory are displayed in Figure 65, and Table 189.

Affected Environment

The inventory process resulted in 279 polygons ranging in size from 1 acre to 6,520 acres (Appendix A, Project Record). Two hundred seventy-five polygons do not meet the PWA criteria because they are not contiguous with an IRA, are part of a larger ecosystem, and none are separate, self-contained ecosystems, such as found on an island surrounded by water. None can be separately preserved due in part because of their small size, and the fact that they are part of the larger ecosystem distributed throughout the project area. Most polygons contain evidence of past logging and roads and will not be brought forward as PWAs. These areas will be considered as undeveloped lands in the analysis that follows.

Four polygons meet the criteria for potential wilderness (Figure 65 and Table 189). Three polygons are located wholly outside of the West Bend project area. Two of these polygons (246 and 248) are located adjacent to the Bearwallows IRA. The third polygon (128) is not associated with an existing Wilderness or IRA, comprised of the large lava beds located east of the Deschutes River, largely within the Newberry National Volcanic Monument. The fourth polygon (244) includes areas contiguous with and a portion of the Bend Watershed IRA. Portions of this polygon are within the West Bend project area.

Table 189: Polygons Meeting FSH 1909.12, Section 71 for Inclusion in the PWA Inventory; Polygon #244 Overlaps Project Area.

Polygon	Acres	Acres in project area	Inventory Criteria
128	3,991	0	**2a.** Area can be preserved due to physical terrain and natural conditions Large lava bed located east of the Deschutes River and largely within the Newberry National Volcanic Monument.
244	**6,489**	**372**	2c. Areas are contiguous to existing wilderness, primitive areas, Administration-endorsed wilderness, or potential wilderness in other Federal ownership, regardless of their size. Bend Watershed IRA and contiguous undeveloped areas
246	74	0	**2c.** Areas are contiguous to existing wilderness, primitive areas, Administration-endorsed wilderness, or potential wilderness in other Federal ownership, regardless of their size. Undeveloped areas contiguous to Bearwallows IRA
248	48	0	**2c.** Areas are contiguous to existing wilderness, primitive areas, Administration-endorsed wilderness, or potential wilderness in other Federal ownership, regardless of their size. Undeveloped areas contiguous to Bearwallows IRA
Total	**10,602**	**372**	

Figure 65: Polygon 244 is Included in the Potential Wilderness Inventory and Includes a Portion of the Bend Watershed IRA and Areas Contiguous with the IRA within the Project Area.

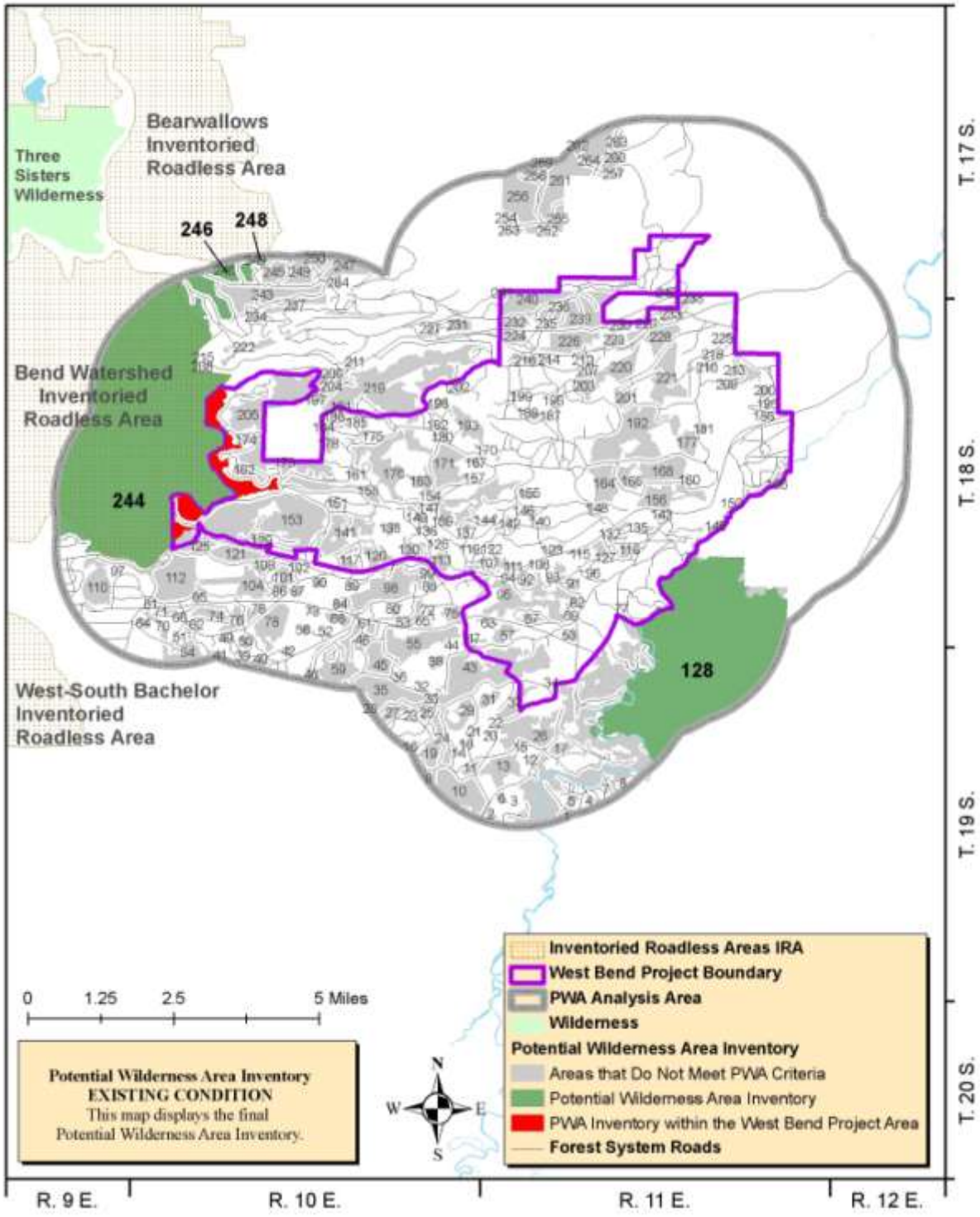
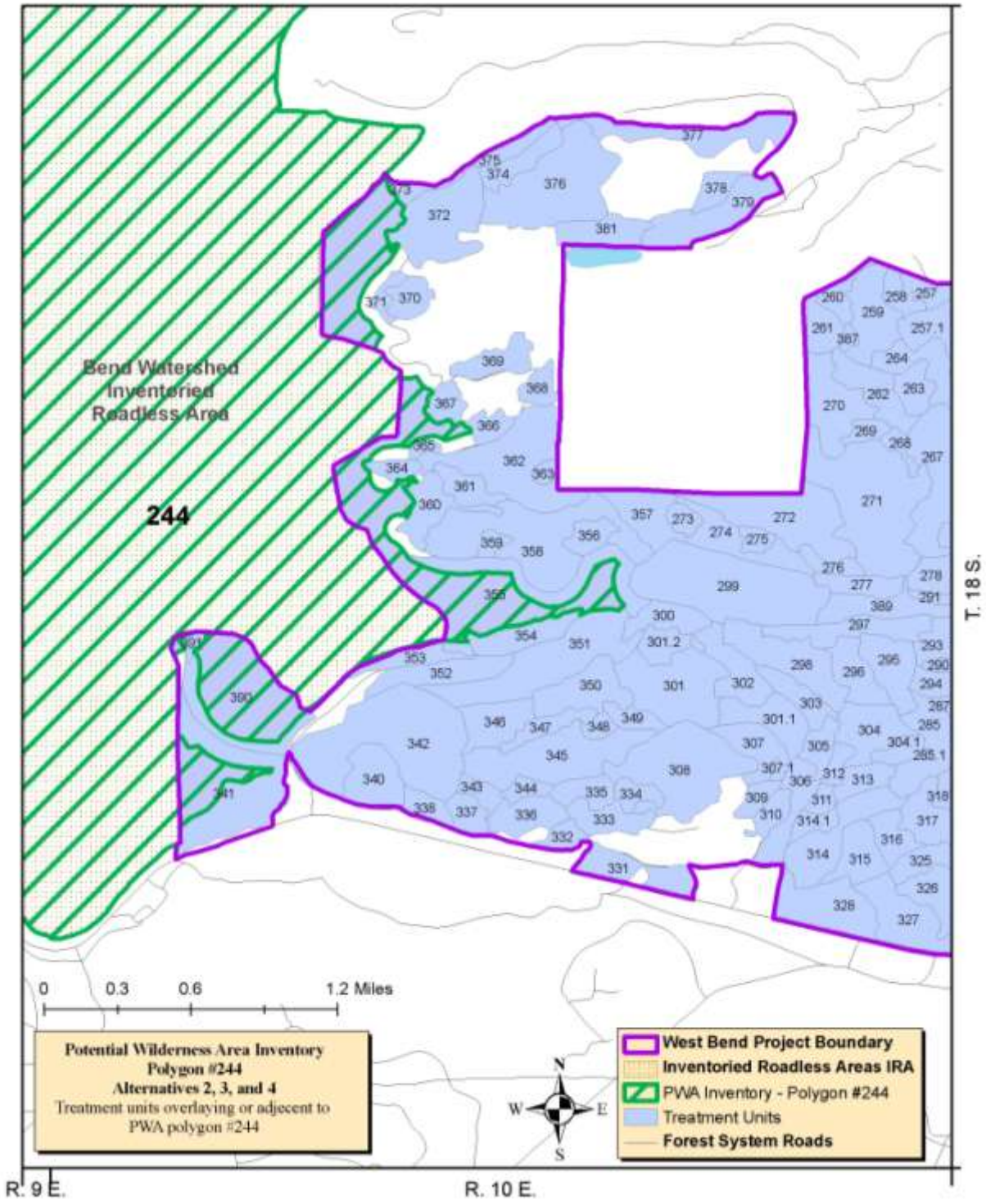


Figure 66: West Bend Treatment Units within or Adjacent to PWA Polygon #244



Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: There would be no direct effects to the four polygons identified as eligible for inclusion in the potential wilderness inventory because no activities would occur in the project planning area with the implementation of this alternative. The affected environment would remain unchanged, except by natural processes. Biological and ecosystem functions would continue. The landscape would likely continue developing complex fuel loads. A wildfire may burn more extensively and kill more trees within upland forest stands which would result in larger acreages of blackened landscapes compared to prescribed fires. There may also be increased risk for fires to spread into the wildland urban interface. The areas may also be more susceptible to large-scale tree mortality from insects and disease.

Effects Common to Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

Vegetation and Fuels Reduction Treatment Descriptions

Table 190: Vegetation and Fuels Treatment Units and Acres that Overlap with PWA Polygon #244

Alternatives 2, 3 and 4						
PWA Polygon	**Acres**	**Unit**	**Acres**	**Overlap Acres**	**Treatments[1]**	**Meets PWA Criteria**
244	6,489	**341**	**111**	**35**	**HTH, PCT, Pile**	**No**
		355	**145**	**36**	**HCR, PCT, Pile**	**No**
		390	108	82	MST/Burn	Yes
Overlap acres within polygon #244				**153**	**-----**	**-----**

1 HTH = commercial thinning; HCR = Seed tree cut with reserves; PCT = Pre-commercial thinning; MST = Mechanical shrub treatment.

Direct and Indirect Effects: The majority of the acreage of fuels treatments overlapping PWA polygon #244 would also receive overstory and/or understory treatments.

Treatments on 71 acres include thinning and salvage of dead lodgepole pine. These activities would leave evidence of stumps, skid trails, and landings precluding the availability of these areas from being included in the PWA inventory. In these units, temporary road access would not be necessary. Treatments in units adjacent to areas within the PWA inventory may present temporary noise disturbances during the implementation of overstory and understory treatments. For a more thorough description of these prescriptions, refer to Chapter 2 or the Vegetation section of Chapter 3 in the West Bend EIS.

Fuels treatments within unit #390 that overlaps the PWA inventory would not change composition and structure of vegetation (Refer to EIS, Chapter 3, Forest Vegetation). Unit #390 would continue to be eligible for inclusion in a future potential wilderness inventory. Until grasses, brush, and herbaceous species recover, burned areas would display a blackened color. Few overstory trees would be expected to be killed.

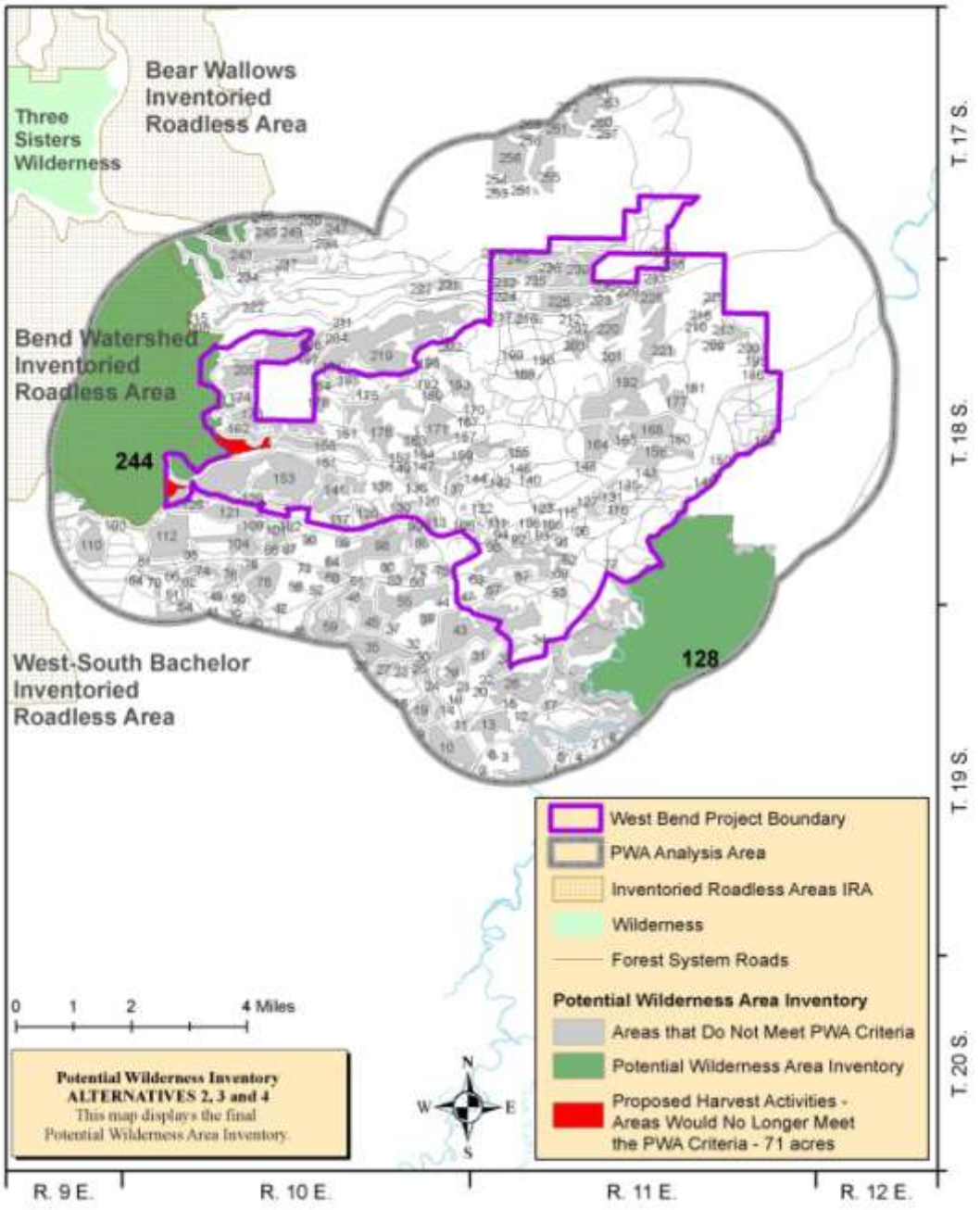
The construction of handline would include cutting of small diameter trees and snags that pose a hazard to workers. Trees cut during handline construction would not be removed from the site. The sight of tree stumps left after handline construction could affect the natural appearing landscape and the inclusion of these acres along the fireline where tree cutting occurred in a future PWA.

Pruning of trees and MST would retain the visual effects of lop and scatter for one or two years following treatment. Outside the burned areas, conditions would remain unchanged except by natural processes. Treatments in units adjacent to areas within the PWA may present temporary noise and smoke disturbances during the implementation of fuels treatments.

Cumulative Effects - Alternatives 2, 3, and 4

There are no other known past, present, or foreseeable projects proposed in the West Bend project area that would build roads or harvest or cut trees within areas that meet the PWA inventory criteria, therefore there are no cumulative effects to PWA inventory.

Figure 67: Areas that would no longer meet PWA Criteria due to Proposed Harvest Activities – Alternatives 2-4



3.14.6 Other Undeveloped Lands

These acres of land have no history of harvest activity, do not contain forest roads[12], and are not designated as a wilderness area, identified as an IRA or included in the PWA inventory as assessed for this project. They are areas that have no obvious previous activity and are "leftover" areas from other analysis. For example, but not limited to, these areas may have been too steep, in between roads and harvest areas, or too wet. These areas may have values associated with them such as scenery, cultural resource values, and unfragmented habitat because of the lack of evidence of harvest or roads. These acres have no previous roads or harvest activities located in them. Isolated polygons of other undeveloped lands were identified as an outcome of the PWA inventory process. These polygons did not meet inventory criteria for the PWA inventory and they are not included in IRAs or Wilderness.

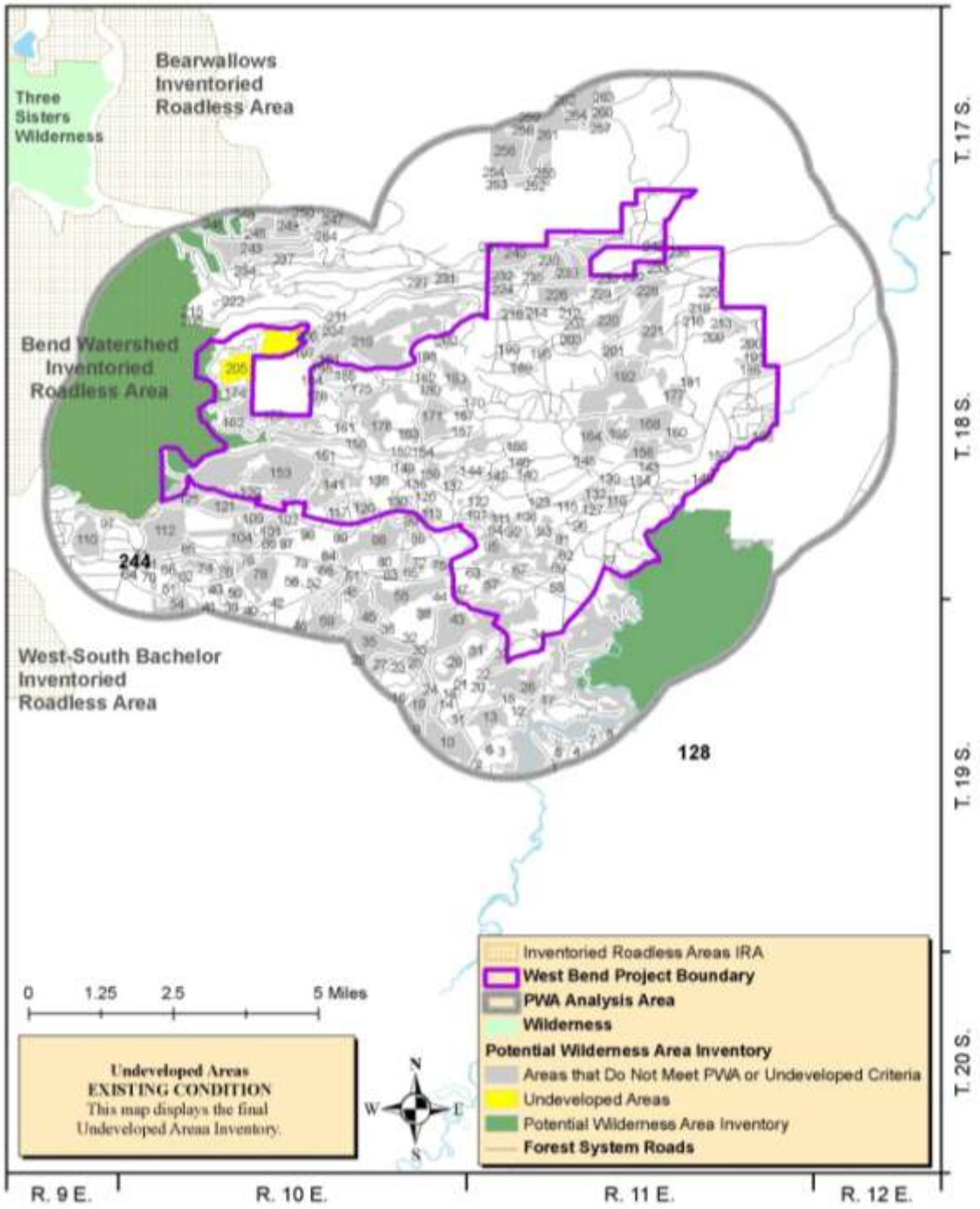
The Environmental Impact Statement discloses impacts to a number of resources sensitive to the construction of new forest roads or from our system of existing roads. A road is defined and criteria and methods for inventorying a road conform to agency policy. Definitions and inventory criteria do not change project to project, Forest to Forest; they are common agency-wide.

Affected Environment

One polygon, #205 (320 acres) is considered undeveloped. It did not meet criteria for PWA inventory. Much of this polygon is on steep slopes and there is no evidence of previous harvest or roads. The area includes mixed conifer stands with ceanothus and manzanita, with some of the stands characterized as northern spotted owl connectivity stands. There are small areas of riparian vegetation adjacent to the pond that is located on private land.

[12] Forest road – A road wholly or partly within or adjacent to and serving the National Forest System that the Forest Service determines is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources. Road – A motor vehicle route over 50 inches wide, unless identified and managed as a trail (36CFR §212.1).

Figure 68: Polygon #205 meets the criteria for undeveloped lands, including the absence of both roads and Evidence of Past Harvest.



Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: No changes would occur to the areas identified as undeveloped. Habitat conditions and areas of solitude would remain the same as the current condition. Biological and ecosystem functions would continue. The landscape would likely continue developing complex fuel loads. A wildfire may burn more extensively and kill more trees within upland forest stands which would result in larger acreages of blackened landscapes compared to prescribed fires. The areas may also be more susceptible to large-scale tree mortality from insects and disease.

Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

Understory treatments consisting of pre-commercial thinning (PCT) and ladder fuel reduction (LFR) are proposed on 10 acres that overlap polygon #205 (Table 191, Figure 69). No overstory treatments are proposed. For descriptions of PCT, MST, and piling slash refer Page 404.

Ladder fuel reduction (LFR) involves mechanically cutting understory trees to a minimum of 20' spacing, 25' spacing being the ideal. LFR treatments are designed to reduce ladder fuels, thus reducing the potential for crown fire initiation. Wider spacing also allows for better success in treating surface fuels with mowing and burning.

Fuel reduction treatments consisting of mechanical shrub treatment (MST) and slash and natural fuels piling (Pile) are proposed on 10 acres that overlap polygon #205 (Table 191, Figure 69).

Table 191: Vegetation and Fuels Treatment Units and Acres that overlap with PWA polygon #205

All Action Alternatives						
Polygon	**Acres**	**Unit**	**Acres**	**Overlap Acres**	**Treatment**	**Meets PWA Criteria**
205	320	376	92	1	PCT, Pile/Burn, MST	N
		377	48	9	PCT, Pile/Burn, MST	N
Overlap Acres Within Polygon #205				**10**	**-----**	**-----**

Direct and Indirect Effects

Precommercial thinning and ladder fuel reduction these areas would leave readily evident small stumps. This may preclude 37 acres from being considered undeveloped areas but there would be no large stumps, no skid trails, or temporary roads. For a more thorough description of these prescriptions, refer to Chapter 2 or the Forested Vegetation section of Chapter 3. Activities in other treatment units located adjacent to polygon #205 may have short term noise and disturbance effects while work in these areas is in progress.

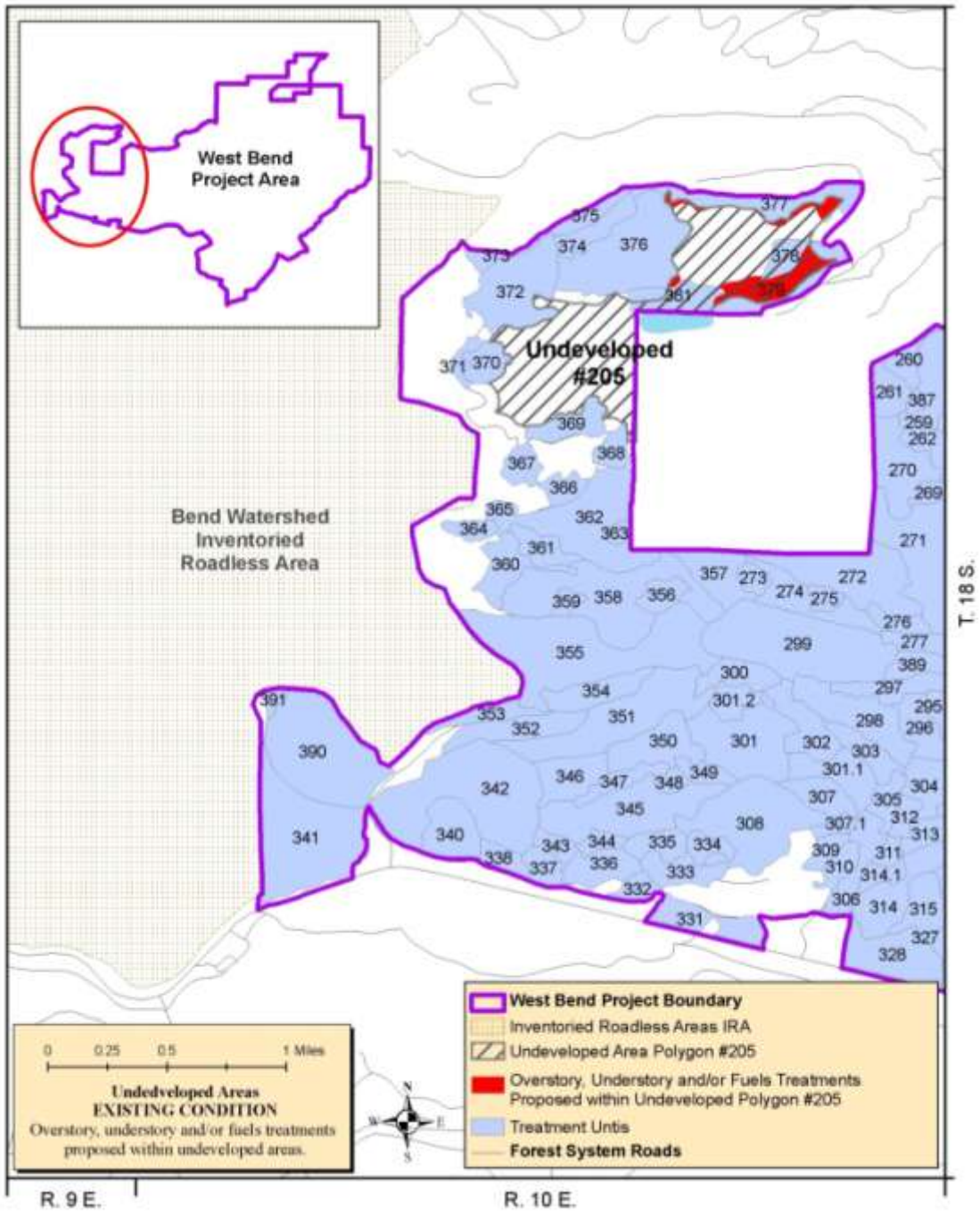
Fuels treatments within the areas that overlap undeveloped polygon #205 would change composition and structure of vegetation (EIS, Chapter 3, Vegetation Management). The visual effects of mowing and piling/burning would be evident for one or two years after the treatment.

The fuels treatments, alone, would likely not preclude these areas from meeting the criteria for undeveloped lands. However, these same areas overlapping undeveloped polygon #205 would also receive pre-commercial and ladder fuels reduction understory treatments. These 37 acres of understory treatments would not meet the criteria for undeveloped areas. Additionally, activities in other treatment units located adjacent to polygon #205 may have short term noise and disturbance effects while work in these areas is in progress.

Cumulative Effects

There are no other known past, present, or foreseeable projects proposed in the West Bend project area that would build roads, harvest or cut trees or otherwise change the undeveloped characteristics of polygon #205.

Figure 69: Treatment Areas Proposed on Acres Meeting Criteria for Undeveloped Lands. (Unit 379 has been dropped from treatment).



3.14.7 Uninventoried Roadless Areas Identified by Oregon Wild

In the early 2000s the interest group Oregon Wild conducted an inventory across Oregon, including the Deschutes National Forest, to determine areas that are unroaded, using inventory criteria they developed for their purposes. A map of Oregon Wild's uninventoried roadless areas was provided in response to the scoping letter for the proposed action for the West Bend project.

Affected Environment

As assessed in the FS PWA inventory, much of the West Bend project area was private timberlands prior to becoming National Forest System lands and there is very little area that has not been heavily harvested in the past. Areas that appear somewhat natural today retain evidence of logging that took place decades ago.

Approximately 978 acres of the area Oregon Wild has identified as Tumalo Creek uninventoried roadless area falls within the West Bend Project Area (Figure 70), with 334 acres not meeting the criteria for either the PWA inventory or undeveloped lands. These areas include areas long existing roads that likely have evidence of roadside hazard tree removal or firewood cutting, and evidence of road building (Figure 72 and Figure 73). Much of the area within the West Bend project area is intersected by PWA inventory polygon #244 or undeveloped polygon #205. The Oregon Wild uninventoried roadless areas overlap the PWA inventory or undeveloped lands are analyzed in the previous discussions, and the remaining analysis considers only those areas outside of the previously analyzed areas.

Figure 70: Oregon Wild Tumalo Creek Uninventoried Roadless Area with IRAS, PWAS, and Undeveloped Lands

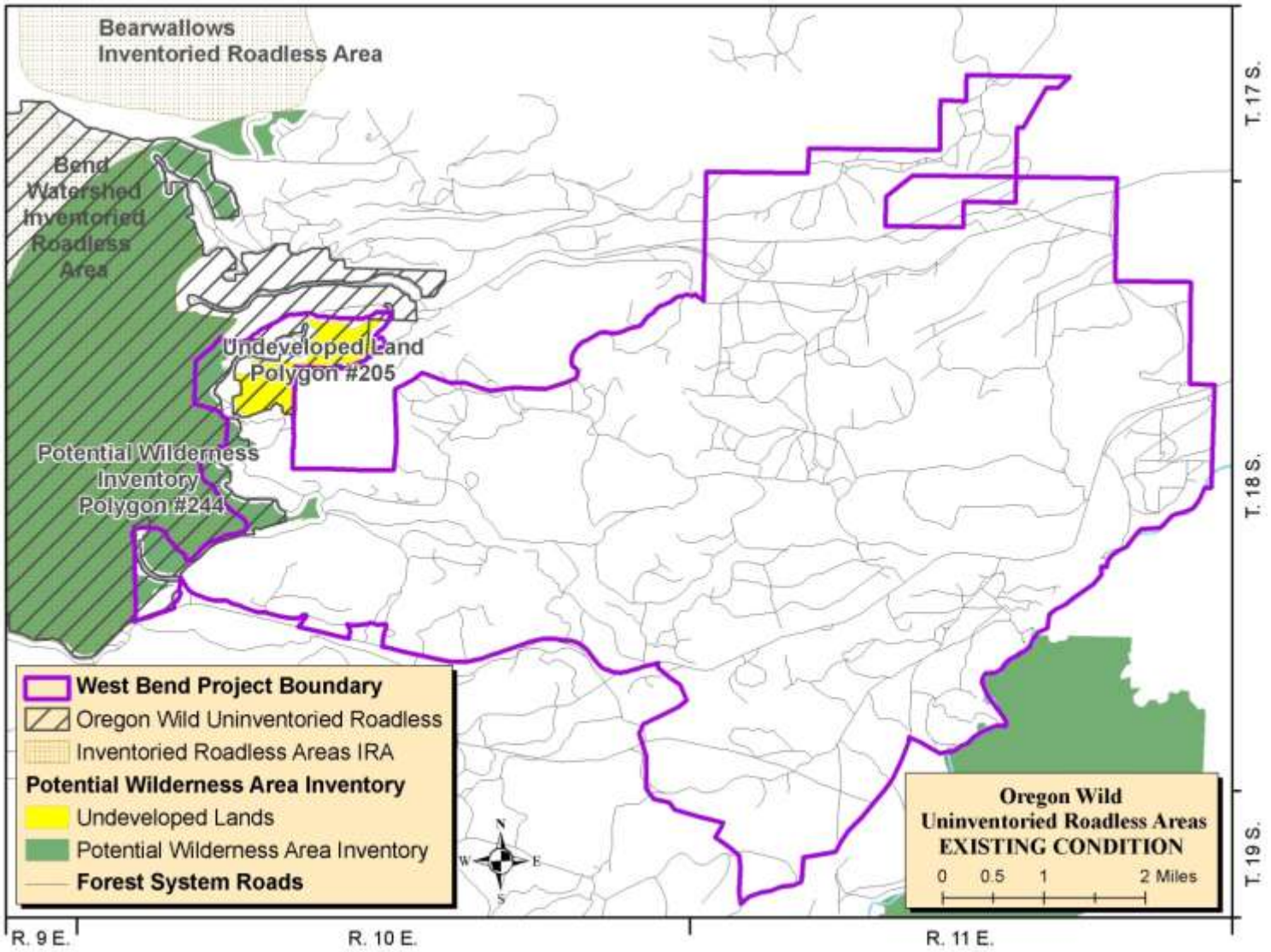


Figure 71: Oregon Wild Tumalo Creek Uninventoried Roadless Area – Outside IRAS, PWAS, and Undeveloped Area

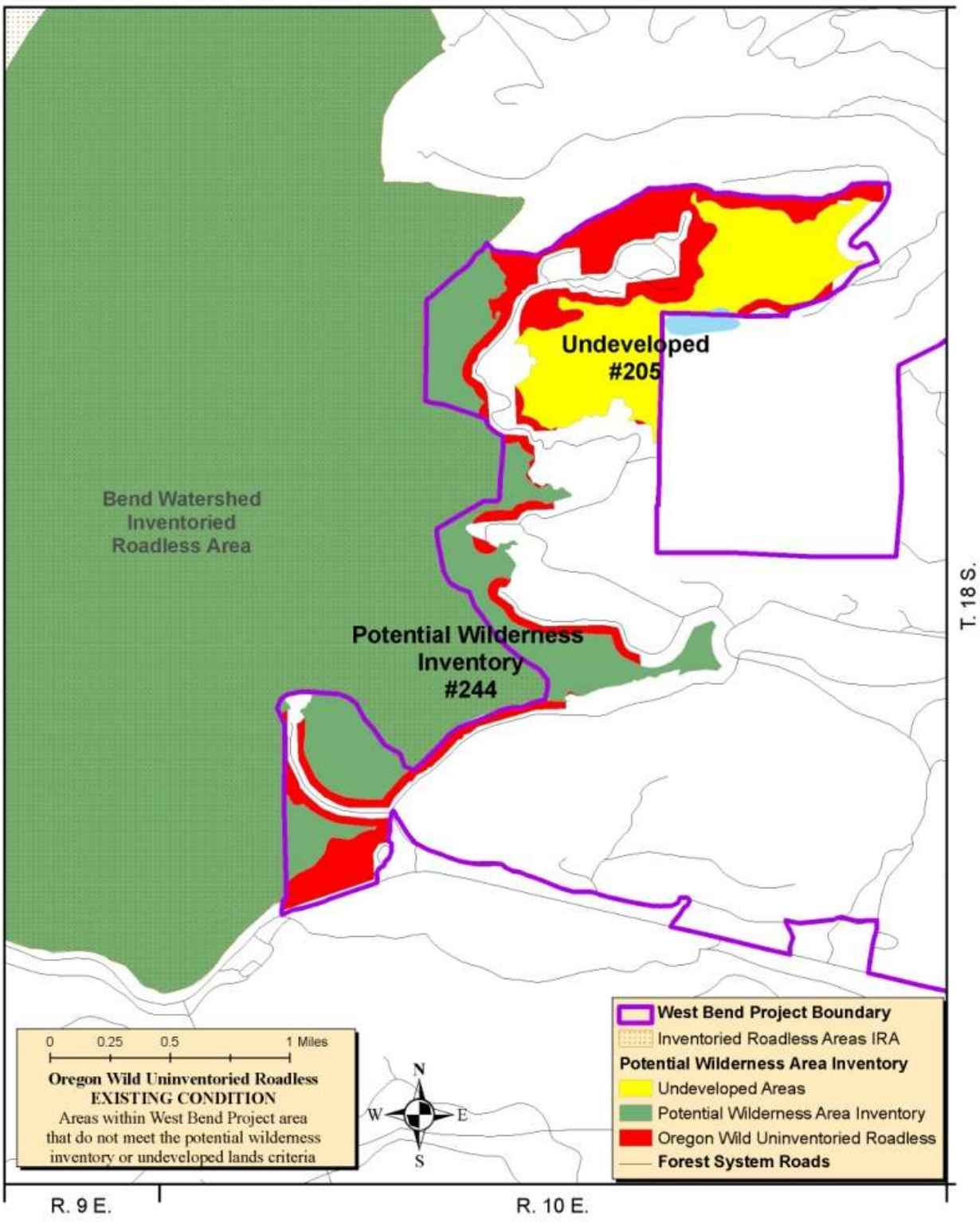


Figure 72: Areas Outside Of IRAS, PWAS, and Undeveloped Areas that have Evidence of Roads, Past Harvest or Other Stump Producing Activities

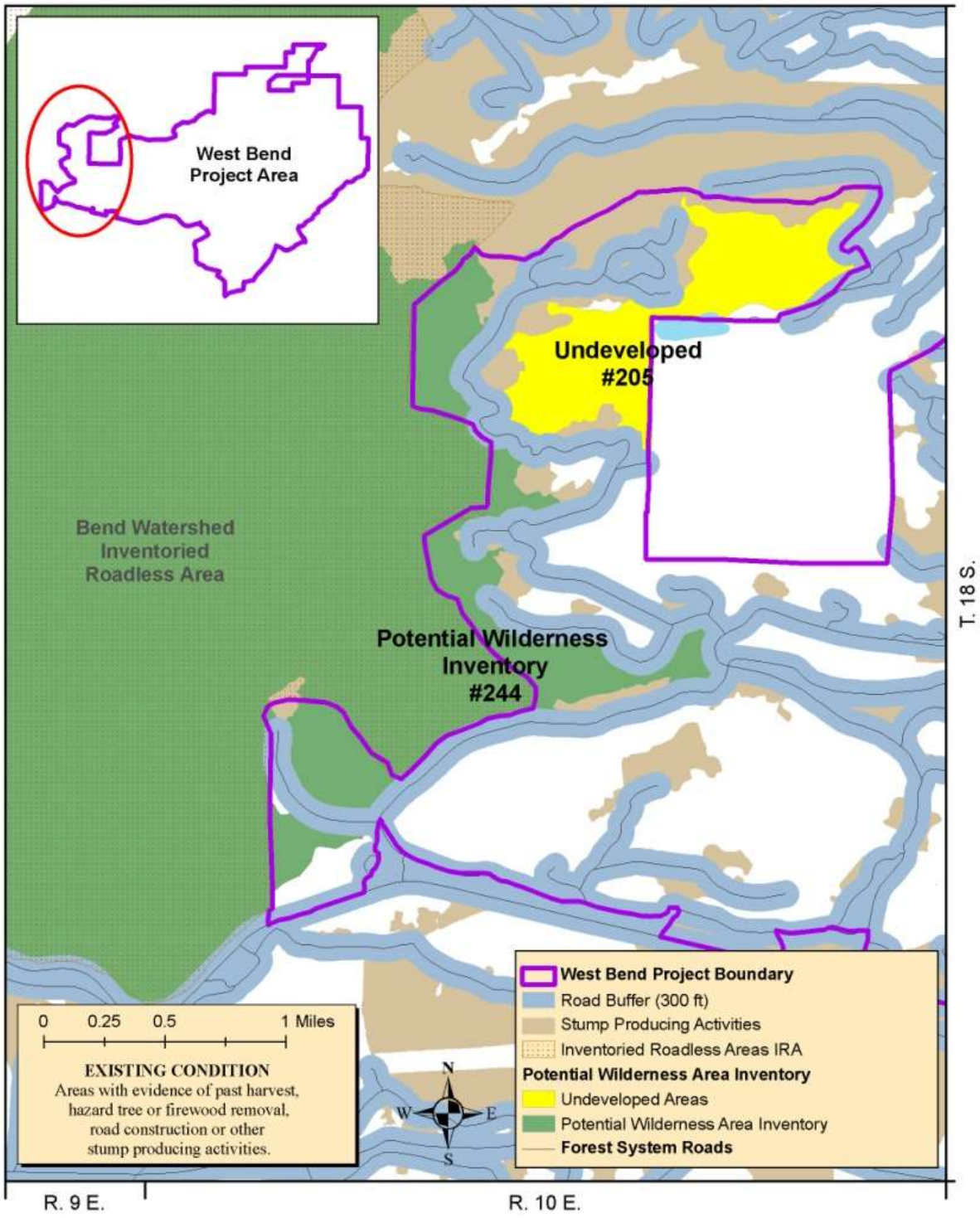


Figure 73: Technology, such as LIDAR, was also used to identify existing roads and developments.

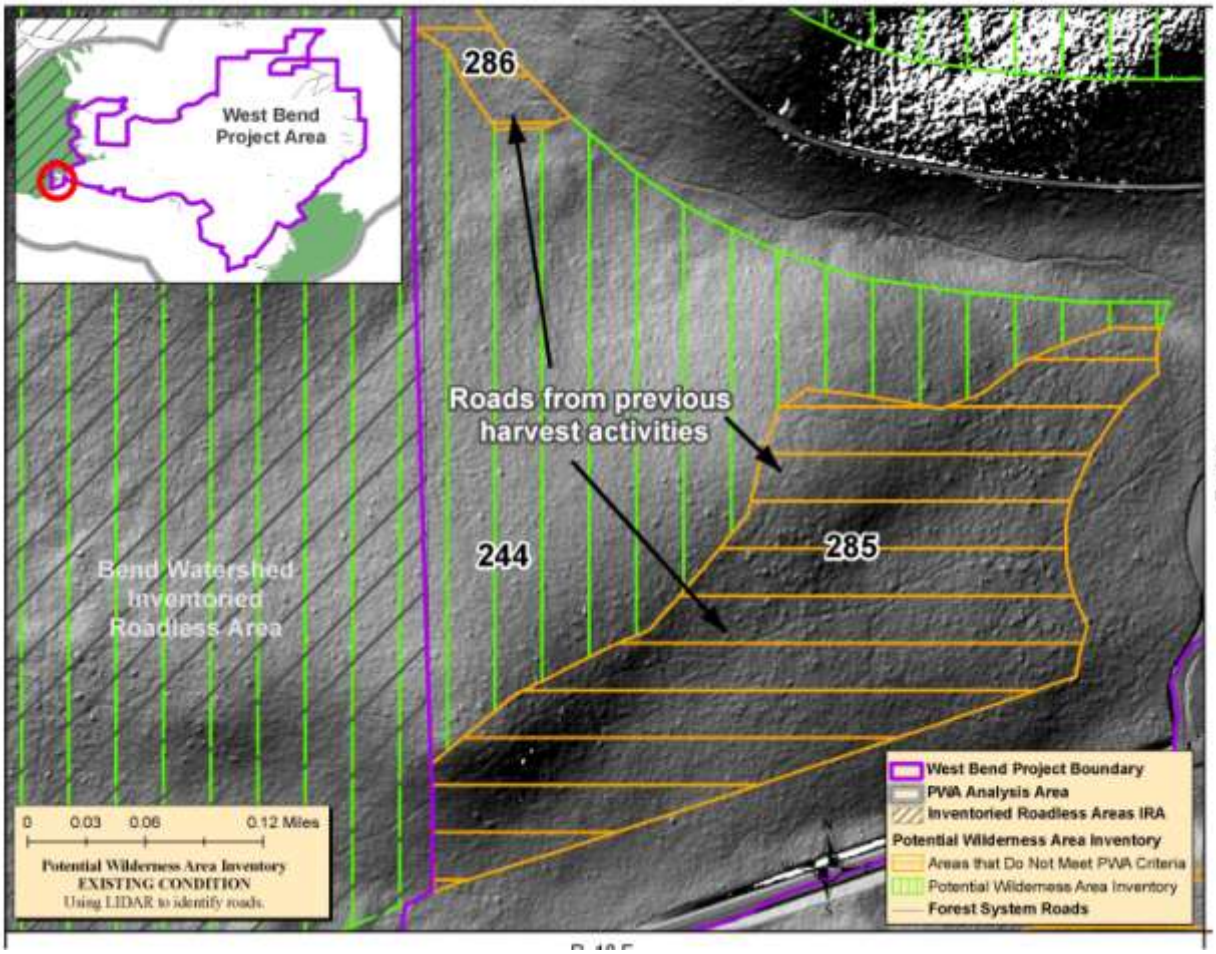
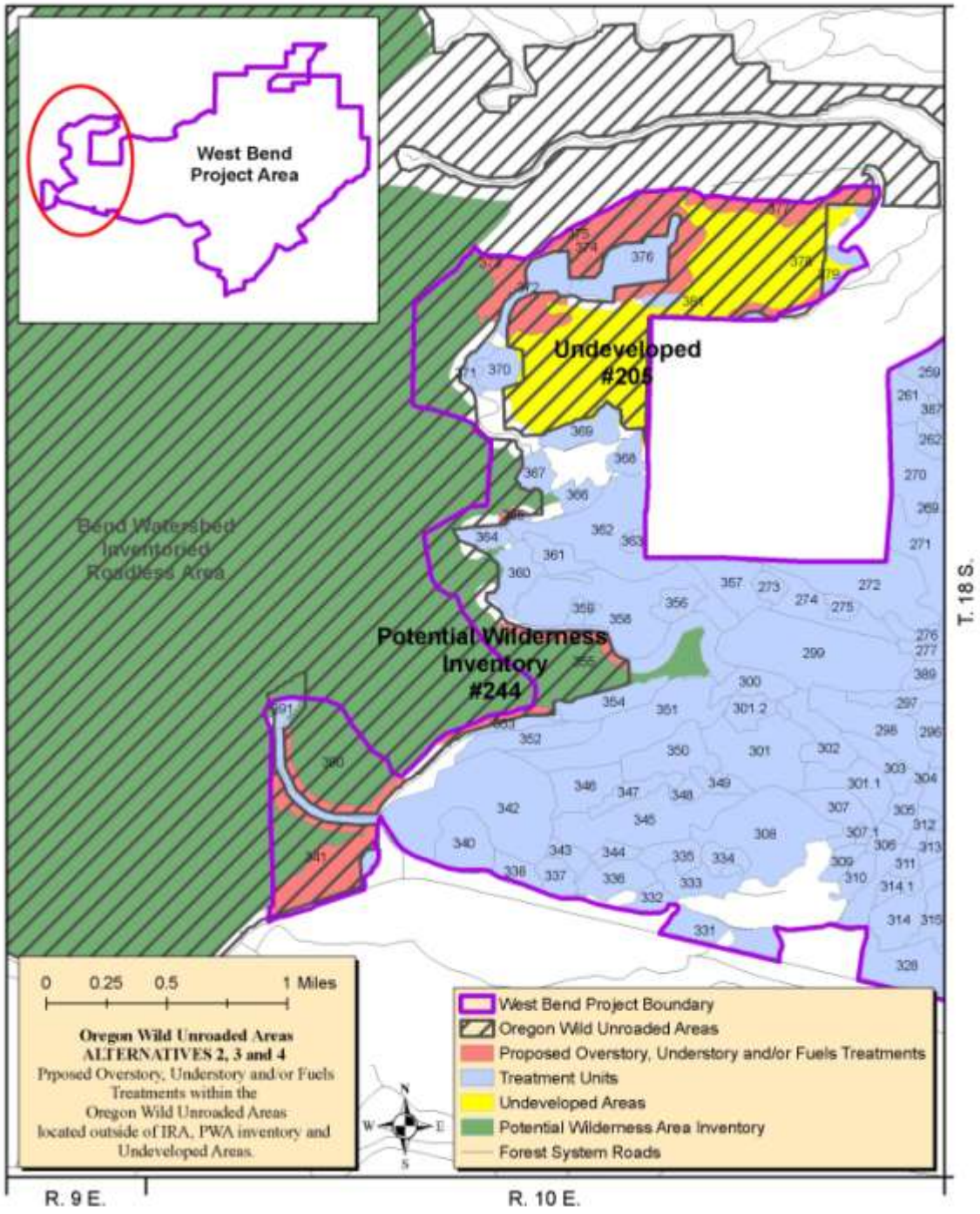


Figure 74: Proposed Treatment Areas Located within Oregon Wild Uninventoried Roadless Area (Tumalo Creek) Located Outside IRAS PWA Inventory Polygons, and Undeveloped Lands



Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: No changes would occur to the areas identified as uninventoried roadless by Oregon Wild. Habitat conditions and areas of solitude would remain the same as the current condition. Biological and ecosystem functions would continue. The landscape would likely continue developing complex fuel loads. A wildfire may burn more extensively and kill more trees within upland forest stands which would result in larger acreages of blackened landscapes compared to prescribed fires. The areas may also be more susceptible to large-scale tree mortality from insects and disease.

Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

Under all action alternatives, understory vegetation treatments are proposed on 233 acres of the Tumalo Creek uninventoried roadless area (Table 192). Fuels treatments would occur on 270 acres, which would include all understory (233 acres) and overstory (84 acres) treatments as listed in Table 192.

Table 192: Treatment Units and Acres, within or Adjacent to Oregon Wild Uninventoried Roadless Area, that do not meet the Criteria for PWA or Undeveloped Lands.

Alternatives 2, 3 and 4						
Roadless Area	**Unit**	**Unit Acres**	**Overlapping Acres**	**Treatments and Acres**		
Tumalo Creek	341	111	60	HTH	PCT	Pile/Burn
	353	17	8	HCR	PCT	Pile/Burn
	355	145	16	HCR	PCT	Pile/Burn
	365	5	3		LFR	Pile/Burn
	367	14	1		PCT	Pile/Burn; MST
	372	64	39		PCT Mech	Pile/Burn; MST
	373	9	9		PCT Mech	Pile/Burn
	374	20	20			MST
	375	14	14		PCT Mech	Pile/Burn; MST
	376	92	48		PCT Mech	Pile/Burn; MST
	377	48	35		PCT Mech	Pile/Burn; MST
	390	108	17			MST/Burn
Treatment Acres not meeting criteria for PWA or undeveloped lands			**270**	**84**	**233**	**270**

Direct and Indirect Effects

Commercial thinning of these areas would leave readily evident stumps, skid roads, and landings. However, previous analysis demonstrates that these areas have already been affected by previous harvest and roads construction activities. For a more thorough description of these prescriptions, refer to Chapter 2 or the Vegetation section of Chapter 3 of the FEIS.

Fuels treatments that overlap the Oregon Wild uninventoried roadless areas may change composition and structure of vegetation (EIS, Chapter 3). For a few years burned areas would display a blackened color until grasses, brush, and herbaceous species recover. Dead trees, particularly small trees (saplings to poles), would be evident over a 5 to 10-year period. Few overstory trees are expected to be killed.

Outside the burned areas, the conditions described in the affected environment for the PWA would remain unchanged except by natural processes. Burning would require the construction of handline which would include the cutting of some small diameter trees, snags that pose a hazard to workers, and pruning of other trees incidental to prescribed burning activities. This could cumulatively change density, composition, and structure of vegetation. Trees cut during handline construction would not be

removed from the site. The sight of some random tree stumps left after handline construction incidental to prescribed burning activities could affect the natural appearing landscape and affect the ability of these acres along the fireline where tree cutting occurred to be included in a future PWA inventory along the fireline. The visual effects of mowing and, to a lesser extent, lop and scatter would be evident for one or two years after the treatment.

The majority of the acreage of fuels treatments overlapping the Tumalo Creek uninventoried roadless area would also receive overstory and/or understory treatments. Two units, units #374 and # 390, would only receive fuels treatments and would likely continue to meet Oregon Wild's criteria for their uninventoried roadless areas.

3.15 Heritage Resources

3.15.1 Introduction

This section will describe the desired condition, existing condition, evaluate the effects of the alternatives, and describe any mitigation or monitoring that is recommended for Heritge Resources

3.15.2 Regulatory Framework

Management direction for historic properties (prehistoric and historic cultural artifacts, sites, features, and districts) is found in the Deschutes National Forest Resource Management Plan, in the Forest Service Manual section 2360, in federal regulations 36CFR64 and 36CFR800, and in various federal laws including the National Historic Preservation Act of 1966 (as amended), the National Environmental Policy Act, and the National Forest Management Act. In general, the existing management direction asks the Forest Service to analyze the effects on historic properties when considering projects that fall within the Forest's jurisdiction. Further direction indicates that the Forest Service will determine what historic properties are present on the Forest, evaluate each resource for eligibility to the National Register of Historic Places (NRHP) and protect or mitigate effects to properties that are eligible.

Relevant Forest Plan Standards and guides include:

CR-2 which states that historic properties located during inventory will be evaluated for eligibility to the NRHP.

CR-3 states that in concert with inventories and evaluations the Forest Service will develop thematic National Register nominations and management plans for various classes of historic properties.

CR-4 indicates that project level inventories or the intent to conduct such shall be documented through environmental analysis for the project.

3.15.3 Desired Condition

The desired condition for historic properties is not clearly stated in the Forest Plan but are implied this document's Standards and Guides and Monitoring Plan. These goals are to know the location and extent of all historic properties on the Forest, to have evaluated each one for its eligibility to the NRHP, and to have developed management plans and/or mitigations for eligible properties that would provide protection.

3.15.4 Affected Environment

From 1979 to 2006, within the current project analysis area, forty-three previous Forest Service projects have been inventoried for historic properties. Twenty of these surveys were conducted and documented sufficiently to be used as an adequate survey for this project. These previous surveys varied in size from one acre to about 6,000 acres and covered a total of 12,000 acres.

Recent surveys in July of 2010 covered an additional 2,000 acres of the project area for a total of 14,000 acres inventoried, or approximately 55% of the 25,700 acre analysis area and 80% of the 17,605 acres proposed for treatment area.

Through these past surveys, 124 historic properties were located and recorded. Of these sites; 66 are prehistoric in nature and 58 are the historic remains of railroad logging camps. Until the State Historic Preservation Officer (SHPO) report is written for this project, it is unknown how many of these 124 sites are considered eligible for evaluation to the NRHP. The site evaluations completed will be conducted by applying the criteria for eligibility in 36CFR60.4.

The Warm Springs, Paiute, and Wasco Tribes from The Confederated Tribes of the Warm Springs (CTWS) Reservation of Oregon are the known tribes with historic associations to this area. The project area is within lands ceded to the Federal Government by The CTWS Reservation of Oregon under treaty in 1855 and ratified by Congress in 1859. The Warm Springs Tribes were contacted as part of the NEPA analysis for this project.

A number of the known sites within the West Bend project area have been impacted by dispersed recreation such as hiking, OHV use, and camping sites. Other sites have been damaged by roads established in historic and recent times, past fires and firefighting suppression efforts, and past vegetation management activities. Several sites have undetermined source disturbances or natural disturbances. Overall, approximately 80% of the known sites reflect past disturbance. Many of the sites have more than one impacting agent so the numbers of "impacts" above exceed the number of sites impacted.

3.15.5 Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: Because there would be no action, there would be no direct effect to any cultural resources. Indirectly, effects would occur from unmanaged fuels consumed during a wildfire event. By not treating the fuels, burn temperatures are likely to be extreme, thus endangering cultural/heritage resource sites and artifacts. The analysis value of obsidian artifacts for chronology and sourcing information would be compromised by extreme temperatures. Metal, ceramic, and glass artifacts would be further oxidized, fractured, or destroyed, becoming more brittle and/or heavily damaged. Organic materials such as wood, shell, bone, antler, horn, leather and fabric may be consumed by fire or altered by smoke. Physical damage or destruction of artifacts or sites during wildfire suppression activities could occur, such as fire lines, temporary roads, staging areas, or other disturbances from machinery and vehicles placed within a site's boundaries. Loss of site and artifact integrity can result from displacement, compaction, churning, and mixing of surface and subsurface soils and deposits of archaeological materials, either historic or prehistoric.

Changes in road configurations, construction of new roads, and management level following a wildfire can affect heritage resources, such as sites becoming more vulnerable to looting and vandalism due to easier access. This effect applies even if closure or rehabilitation of the temporary road directly impacts a site. The loss of surface litter from high intensity wildfire and increased hydrophobic soil conditions can cause erosion from runoff of surface water. Erosion across sites can remove artifacts and deposits sediment from uphill slopes.

Alternately, obscuring vegetation does lend a certain level of protection to otherwise high visibility objects on the ground surface. In the event of a large wildfire, much of this vegetation would be removed by burning or during suppression activities such as fire line construction. Higher visibility of sensitive materials at cultural resource sites would then be more vulnerable to looting and theft.

Alternative 2 (Proposed Action),Alternative 3, and Alternative 4

Direct and Indirect Effects: Under the proposed action for the West Bend project, a combination of mowing (mastication) of fuels, the thinning of trees, and underburning are proposed in various combinations depending on the conditions in different parts of the project area. Sixty-seven archeaological sites are known to exist within the proposed activity units.

By type of treatment, the following mitigation measures will avert potential effects to historic and prehistoric sites that are eligible or unevaluated. In units to be underburned, avoid burning over sites that are historic or both historic and prehistoric, no line construction through or mop up within historic or prehistoric sites. No piles should be built for burning within eligible or unevaluated sites, whether historic or prehistoric. Mowing should avoid all historic sites, and will minimize the turning and

manuvering of the equipment in prehistoric site areas. Precommercial thinning by hand (chainsaw) will not effect historic or prehistoric sites but mechanical thinning and machine piling should avoid all eligible and unevaluated sites, both historic and prehistoric. Commercial thinning, if utilized, should exclude all eligible and unevaluated sites from treatment units, landings, temporary roads, and skid trails.

Where sites need to be avoided by project activities, an archaeologist will mark the area to be avoided prior to implemenation layout or design. Avoidance areas will be marked in contractor files or maps as area to be avoided and not as archaeological sites. All areas to be avoided or otherwise within activity units should be monitored by an archaeologist once during implementation and after implementation has been concluded to confirm that avoidance measures were implemented and effective.

Cumulative Effects

Under all action alternatives, any and all effects are expected to be avoided with protection measures; therefore, there would be no cumulative effects.

3.16 Aquatic Species and Water Resources

3.16.4 Summary of Key Findings

Aquatic Topic #1: Water Quantity Vegetation and fuels treatments proposed under Alternatives 2, 3, and 4 would not measurably affect water quantity. Calculated Equivalent Clearcut Area (ECA) values for the three action alternatives are 4.4%, 4.3%, and 3.7% of the North Unit Dam-Deschutes River watershed for Alternatives 2, 3 and 4 respectively. For the Tumalo Creek watershed, the ECA values are 2.7%, 2.6%, and 2.0% for Alternatives 2, 3, and 4, respectively. These ECA values would not change the volume, timing, or duration of peak flows in either watershed.

Aquatic Issue #2: Water Quality Vegetation and fuels treatments proposed under Alternatives 2, 3, and 4 would not measurably affect water quality. The Oregon Department of Environmental Quality 303(d) list parameters of temperature, sedimentation, turbidity, chlorophyll a and dissolved oxygen for the Deschutes River, and the temperature parameter for Tumalo Creek would not be further degraded from any of the action alternatives.

Aquatic Issue #3: Fisheries The Deschutes River, Tumalo Creek, Tumalo Lake Creek, and the South Fork of Tumalo Creek are inhabited by Columbia River Basin (CRB) redband trout , a Forest Service Region 6 Sensitive Species. A Biological Evaluation determined that Alternatives 2, 3, and 4 would have **No Impact** to CRB redband trout, while Alternative 1 **May Impact Individuals or Habitat**, but Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species. There would be **No Impact** to two sensitive species aquatic invertebrates; A Caddisfly and Indian Ford Juga, from any of the alternatives as there is no potential habitat within the project area. None of the 4 RMOs of INFISH applicable to a forested system are being met under present conditions. The action alternatives include vegetation and fuels treatments within the RHCA of the Deschutes River that would benefit the attainment of two of the RMOs in the future (large woody material and water temperature). There would be **No Adverse Effect** to Chinook salmon Essential Fisheries Habitat from implementing any of the action alternatives.

None of the action alternatives would adversely affect the Fishery Outstandingly Remarkable Value of the Deschutes River, or adversely affect wetlands, floodplains, or Chinook salmon Essential Fisheries Habitat.

3.16.1 Introduction

The West Bend Project action alternatives would use a combination of vegetative and fuels treatments to restore watershed conditions, function, and diversity. Additionally, the action alternatives would reduce the risk of high severity wildfires, reduce the risk of insect and disease outbreaks, and protect the urban population of Bend east of the area.

The project area is located west of Bend and is within the 101,224 acre North Unit Diversion Dam-Deschutes River 10th field watershed (HUC 170703010402) and the 38,004 acre Tumalo Creek 10th field watershed (HUC 170703010502). A total of 20,824 acres are within the North Unit Diversion Dam-Deschutes River watershed and 4,877 acres are within the Tumalo Creek watershed. Refer to Table 193.

Watershed Condition Framework

The Watershed Condition Framework (WCF) is a national effort by the Forest Service to establish a consistent, comparable, credible, process to help focus and prioritize watershed health and function restoration efforts at the 12th field scale (sub-watershed). Watershed condition describes the health of the hydrologic and soil functions in the watershed as indicated by physical and biological characteristics. A core set of 12 nationally consistent physical and biological indicators were used by an interdisciplinary team in the assessment. Sub-watersheds were classified into three categories:

- Class 1 (Functioning Properly) sub-watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition.
- Class 2 (Functioning at Risk) sub-watersheds exhibit moderate geomorphic hydrologic, and biotic integrity relative to their natural potential condition.
- Class 3 (Impaired Function) sub-watersheds exhibit low geomorphic hydrologic, and biotic integrity relative to their natural potential condition.

Sub-watersheds within the West Bend Project area exhibit some deviation from the natural potential condition, tending toward Class 2 overall (Functioning at Risk). The indicators most deviated from the natural potential condition are water quality and water quantity related to altered stream flow regimes, and vegetation conditions resulting in elevated Fire Condition Class ratings indicating potential for altered hydrologic and sediment regimes. The action alternatives of the West Bend Project apply vegetation and fuels management prescriptions to reduce the Fire Condition Class ratings on areas west of Bend, which in turn would reduce the overall WCF rating.

Table 193: Watershed and Sub-watershed Acres within West Bend Project

Watershed	Sub-watershed (12th field)	Hydrologic Unit Code	Sub-watershed Acres	Sub-watershed Acres within Project Area Boundary	Current WCF Class Rating
North Unit Dam-Deschutes River	Overturf Butte-Deschutes River	170703010406	31,374	7,195	2.1
	Lava Island Falls-Deschutes River	170703010405	12,517	9,300	1.6
	Benham Falls-Deschutes River	170703010403	22,663	4,329	1.7
Tumalo Creek	Upper Tumalo Creek	170703010501	20,766	856	1.7
	Lower Tumalo Creek	170703010502	17,238	4,021	1.9

Groundwater flow direction in the Deschutes basin above and near Bend is influenced by complex, underlying geology, and is not closely associated with the surface topography in some areas. Groundwater movement within the project area is generally easterly or northeasterly from the higher elevations on the western side of the project area toward Bend and the Deschutes River (Lite and Gannett 2002). Precipitation in the West Bend project area, primarily snowfall, ranges from greater than 40 inches annually in the higher elevations in the west to near 14 inches at the lower elevation eastern portion. Evapotranspiration of groundwater is rare in this area of the basin (Gannett et al. 2001). Groundwater level fluctuations in the basin are driven primarily by decadal climatic cycles (Gannett et al. 2001).

Overview of Streams in Project Area

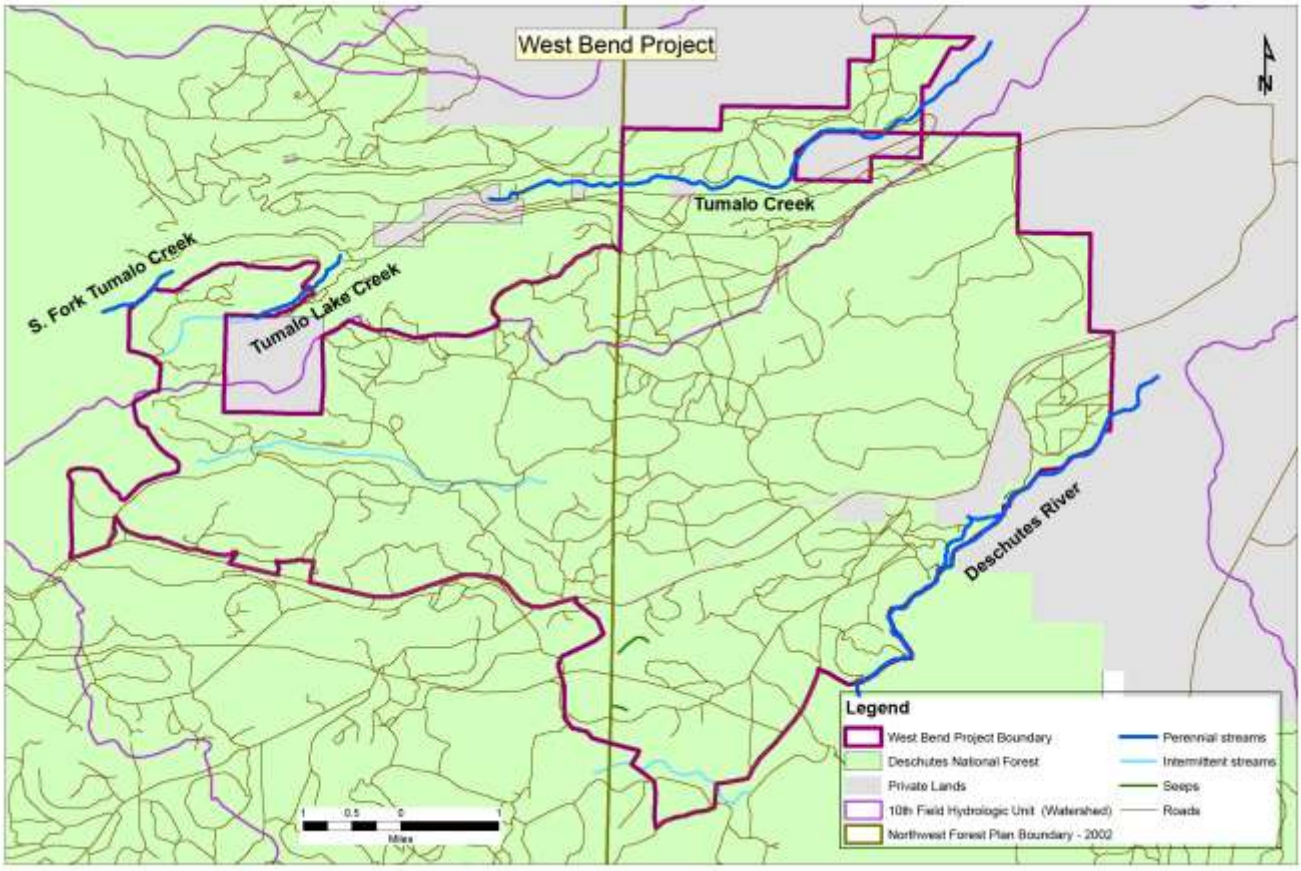
The following table lists perennial and intermittent streams that are located with the project area and several characteristics of each stream.

Table 194: Stream Channels within the West Bend Project Area

Stream	Watershed	Flow Regime	Stream Class	Mean annual discharge	Stream miles in Project Area	Land Management Area
Tumalo Creek	Tumalo Creek	Perennial	2	102 cfs	2.4	INFISH
Tumalo Lake Creek		Perennial	2	2.6*	0.6	NWFP
South Fork Tumalo Creek		Perennial	2	8.3*	0.25	NWFP
Intermittent		Intermittent	4	Unknown	0.9	NWFP
Deschutes River	North Unit Dam-Deschutes River	Perennial	2	1372 cfs	4.8	INFISH
Intermittent		Intermittent	4	Unknown	3.8	NWFP
Intermittent		Intermittent	4	Unknown	0.9	INFISH
Seeps		N/A	N/A	N/A	0.5	INFISH

*Estimated median discharge (HDR, 2012).

Figure 75: Perennial and Inventoried Stream segments within or near the West Bend Project Area.



Deschutes River

The West Bend Project includes lands adjacent to the west bank of the Deschutes River from the Forest Boundary at river mile 172.0 upriver to river mile 176.8, forming the southeast boundary of the project area, and is within Segment 4 of the Upper Deschutes Wild and Scenic River. Discharge is controlled approximately 50 miles upriver at Wickiup Dam (river mile 226.7) to support irrigated lands in Central Oregon. The Deschutes River is included on the Oregon Department of Environmental Quality list of

water quality impaired waterbodies (303(d) list) for several parameters, which are discussed below under the Water Quality section. Vegetation and fuels activities are proposed within the Riparian Habitat Conservation Area (RHCA) of the Deschutes River.

Tumalo Creek

Tumalo Creek flows through the northern area of the project area, and includes river miles 6.2 to 6.7 and 7.9 to 9.8. Tumalo Creek has its source off the flanks of the Cascade Mountains to the west, primarily from Broken Top Mountain. Several springs contribute to the discharge but snowmelt is also a major contributor to the annual water yield. Rain-on-snow events in the spring and fall are not uncommon. The City of Bend continuously diverts spring water destined for Tumalo Creek to support municipal water demand. During approximately July to early October, Tumalo Creek stream flows are augmented by water diverted from the adjoining Soda Creek watershed to support downstream irrigated lands within the Tumalo Irrigation District. Tumalo Creek from river mile 0.0 to 12.5 is included on the 2010 Oregon Department of Environmental Quality list of water quality impaired waterbodies (303(d) list) for water temperature. No vegetation or fuels management activities are planned within the RHCA of Tumalo Creek.

Tumalo Lake Creek

This small riffle-dominated stream drains Tumalo Lake on private land and enters Tumalo Creek, known unofficially as Tumalo Lake Creek. The average bankfull width is less than 4 feet and average gradient is 5.7%. The annual discharge is estimated at 2.6 cfs (HDR, 2012). Fuels treatments are proposed within the Riparian Reserve.

Intermittent Channels

An intermittent channel is defined as any non-permanent flowing drainage feature having a defined channel and evidence of annual scour or deposition. This includes what are sometimes referred to as ephemeral steams if they meet these two physical criteria (USDA/USDI 1994).

The landscape within the project area, because of the highly permeable soils, lacks surface water. A GIS query totaled 47.8 miles of intermittent channels. A field review found that many intermittent channels included in the GIS database and identified on USGS maps did not actually exist. This is typical of many areas of the Bend/Ft. Rock Ranger District. An update to the stream layer within the project area based on field review totaled 4.7 miles of intermittent channels. Vegetation and fuels activities are proposed within the RRs/RHCAs of intermittent streams.

Lakes

There are no natural lakes within the project area, but the project boundary borders the north side of Tumalo Lake (16 acres) which is located primarily on private lands. One small, shallow pond (1 acre) is located in the western portion of the project area. There is a small reservoir (3.5 acres) located on private land near the Deschutes River. There are no activity units within the RRs of these waterbodies.

Wetlands

There are a few small wetlands within the project area (GIS Deschutes Wetland layer) totaling 46 acres, primarily associated with the Tumalo Lake and Tumalo Lake Creek area in the northern portion of the project area. There are also two small seeps in the southeast portion of the project area that total approximately 0.5 miles total length and comprise approximately one acre of wetland each. Vegetation and fuels management activities are proposed within the RRs/RHCAs of wetlands with associated design features for protection of these resources.

Land Management Activities Potentially Affecting Water Quantity, Water Quality, and Aquatic Habitat and Populations

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 evapo-transpiration 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. Prescribed fire generally has low severity effects and reduced hydrologic effects compared to wildfire. Mowing of underbrush generally has minor hydrologic effects to a watershed, as ground cover is retained. Some soil compaction occurs during these operations.

Hydrological effects from vegetation management activities as described above do not typically occur within the project area due to the lack of overland flow. Runoff is a relatively small component of the total water budget in the Upper Deschutes River basin due to the high infiltration rates of the highly permeable volcanic soils (Gannett et al. 2001). The fractured nature of the lavas allows rapid movement of groundwater to lower elevations. Surface water drainages are limited in the Upper Deschutes River basin, and are primarily spring-driven. Outside of the Deschutes River, which forms part of the project boundary, and Tumalo Creek, there is very little perennial surface water within the West Bend Project area.

The long-term sustainability of fisheries and other aquatic species populations depends largely on habitat conditions and water quality, both of which are influenced by activities that occur instream, on the floodplain, and within the uplands of the watershed. Land use activities, such as vegetation and fuels management, road construction, and recreation have potential to adversely affect fish and other aquatic species populations and 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.

Roads can affect streams directly by accelerating erosion and sediment loadings, by altering channel morphology, and by changing the runoff characteristics of watersheds (Furniss et al., in Meehan 1991). Mass soil movements and surface erosion are primary processes for sediment delivery to streams. Roads can alter the runoff characteristics of watersheds by decreasing infiltration, interception and diversion of subsurface flows, and increasing the stream network. Hydrologic characteristics of the stream may change, such as volume of peak flows. Other effects from the road system include failure of road fills and culverts, and accelerated scour and blocked fish passage at culverts (Furniss et al., in Meehan 1991). Mass soil movements associated with roads and culvert failures have not occurred within the project area. There has been a negligible increase in the stream network from roads. Sediment delivery to streams within the project area is limited by gentle slopes and high soil infiltration rates.

Road density within the 12th field sub-watersheds of the West Bend Project area is approximately 3.87 miles per square mile, and 2.1 miles per square mile within the RRs/RHCAs. There are no road crossings of perennial streams or rivers within the project area, and 5 crossings of intermittent channels. Although the crossing of Tumalo Creek on road 4606 is just beyond the project boundary, steep

approach slopes on the unpaved road allow infrequent overland flow of water and road sediments to Tumalo Creek. Inputs of water and sediment are minimal.

The road network (Table 195) within the project area has had minimal effects on sedimentation to streams, fish passage, and increasing the drainage network because of the lack of surface water, gentle to moderate slopes near streams, lack of roads within the RR-RHCAs, and high infiltration rates of soils that absorb road run-off.

Table 195: Summary of Existing Roads in RHCAs and RRs

Stream Crossings and Routes in RHCAs and RRs	Existing Condition	Alternative		
		2	3	4
Total Miles of Routes in RHCAs and RRs	2.25	2.25	2.25	2.25
Total miles of designated closed roads in RHCAs/RRs	0	0	0	0
Total miles of open OHV trails in RHCAs/RRs	0	0	0	0
Total miles of designated closed OHV trails in RHCAs/RRs	0	0	0	0
Total number of open road stream crossings	5	5	5	5
Total number of closed road stream crossings	0	0	0	0
Total number of open OHV trail stream crossings	0	0	0	0
Total number of closed OHV trail stream crossings	0	0	0	0

The project area was extensively logged 70-90 years ago. Past major vegetation management projects within the watershed that are documented in the database date back to the late 1960s. Much of the past activity removed large volumes of ponderosa pine, fir, and lodgepole pine. These projects each implemented various activities including salvage of dead and dying timber, commercial harvest, commercial and non-commercial thinning, prescribed underburning, closing and decommissioning of roads, and mechanical treatment of shrubs. Most recently, the East Tumbull and Katalo Vegetation Management Project prescribed vegetation and fuels treatments within the West Bend Project area. Minor vegetation management projects have included day use area and roadside hazard tree removals, and campground and snow-park construction. These minor projects have had no to minimal effect on the hydrology of Deschutes River, Tumalo Creek and tributaries, and intermittent channels. They have not affected peak flows or water temperature. An Equivalent Clearcut Acreage (ECA) value for the existing conditions for the West Bend Project was not generated but likely falls below a threshold where hydrologic effects have resulted because of the groundwater-driven nature of the watershed (See Cumulative Effects section). In addition, less than 4% of the North Unit Dam-Deschutes River watershed has experienced wildfire in the past 50 years, the largest being the Awbrey Hall Fire which burned about 2,800 acres within the watershed. Past fires in the Tumalo Creek watershed, such as the 1979 Bridge Creek Fire, may have had short term effects by increasing stream flow but vegetation recovery since that time has increased ground cover and water retention so effects are presently diminished.

3.16.2 Regulatory Framework

The principle regulatory framework governing management of watershed and fisheries resources on the Deschutes National Forests (DNF) for this analysis includes:

- National Forest Management Act of 1976 (NFMA)
- Deschutes National Forest Land and Resource Management Plan (USDA 1990)
- Northwest Forest Plan (USDA/USDI 1994) NWFP
- Inland Native Fish Strategy (USDA 1995) INFISH
- Federal Water Pollution Act (Clean Water Act) as amended
- State of Oregon's Implementation of the Clean Water Act

- Executive Order 11988 - Management of Floodplains
- Executive Order 11990 – Management of Wetlands
- Executive Order 12088 – Federal Compliance with Pollution Control Standards

The National Forest Management Act of 1976 (NFMA) requires that the Forest Service manage for a diversity of fish habitat to support viable fish populations (36 CFR 219.19). Direction is also included in the Deschutes National Forest Land and Resource Management Plan (Forest Plan), which was amended by the Inland Native Fish Strategy (INFISH) and the Northwest Forest Plan (NWFP). The amendments include direction regarding stream and fish habitat protections measures.

LRMP Standards and Guidelines (S & G's) relevant to the aquatic and riparian resources include RP 1 –8, RP-10-16, RP 33-35, RP-47, FI-5, and WT 1-2, WT-2, and are incorporated by reference (USDA, 1990). In general, they provide for maintenance or enhancement of floodplains, riparian areas and riparian-dependent resources, water quality, fish habitat, and require Water Quality Best Management Practices.

A portion of the project area is within the corridor of the Upper Deschutes Wild and Scenic River. An environmental impact statement and Comprehensive Management Plan (river plan) were completed in 1996. Management will be guided by the River Plan (Management Area 17a). Standards and Guidelines from the River Plan that are applicable to the proposed project are listed below:

- Standard: Riparian areas will be managed to support riparian dependent species. Upland forests will be characterized by disturbances which mimic the effects of periodic occurrence of small, low intensity fires, to perpetuate a mosaic of stand structures and ages and reduce the risk of high intensity fires.
- Guidelines, incorporated by reference, include G-4, V-5, and V-9 through V-13, and V-15 through V-18. These include the use of Best Management Practices to protect water quality and provisions for fuels and silvicultural treatments.

NWFP: Management direction of the NWFP requires delineation of Riparian Reserves, where riparian-dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines (S&Gs). Riparian Reserve S&Gs applicable to the project area are TM-1, FM-1, FM-4, and RA-3(USDA/USDI 1994). A total of 8,947 acres of the project area are within the boundaries of the NWFP, with Administratively Withdrawn and Matrix allocations. Riparian Reserves overlay these allocations. Within the NWFP boundary, there are a total of 0.85 miles of perennial streams, 4.7 miles of intermittent channels, and 195.2 acres of Riparian Reserve within the project area (Table 196).

Table 196: Riparian Reserve Categories in West Bend Project Area

Waterbody	Riparian Reserve Category	Stream Miles	Total Riparian Reserve Acres
South Fork Tumalo Creek	Fish bearing stream	0.3	12.5
Tumalo Lake Creek	Fish bearing stream	0.6	10.0*
Intermittent channels	Seasonally flowing or intermittent streams, wetlands less than 1 acre, and unstable and potentially unstable areas	4.7	116.3
Wetlands	Constructed ponds and reservoirs, and wetlands greater than 1 acre	NA	45.0*
Lakes	Lakes and natural ponds	NA	11.4
Totals	**All**	**5.6**	**195.2**

*Approximately 34 of these acres are along Tumalo Lake Creek

Refer to the Project Record, Aquatic Species Water Resources Report, Appendix A for complete descriptions of the Riparian Reserve Categories.

INFISH: National Forest System Lands within the project area east of the NWFP are managed under INFISH. Management direction within INFISH requires Riparian Habitat Conservation Areas (RHCAs) to be delineated for watersheds. They are similar in function to Riparian Reserves as described above. Specific S&Gs applicable to RHCAs include TM-1, FM-1, and FM-4. A total of 16,754 acres of the project area are within the INFISH boundary. Within the INFISH boundary, there are a total of 7.2 miles of perennial streams, 1.4 miles of intermittent channels including two seeps, and 482 acres of RHCAs within the project area (Table 197).

Table 197: Riparian Habitat Conservation Area Categories in West Bend Project Area

Waterbody	Riparian Reserve Category	Stream Miles	Total RHCA Acres
Deschutes River	Category 1- Fish bearing stream	4.8	218.0
Tumalo Creek	Category 1- Fish bearing stream	2.4	215.0
Wetlands	Category 3- Ponds, lakes, reservoirs, and wetlands greater than 1 acre	NA	31.0
Intermittent channel/seeps	Category 4- Seasonally flowing or intermittent streams, wetlands less than 1 acre, landslides, and landslide-prone areas	1.4	18.4
Totals	**All**	**8.6**	**482.4**

Refer to the Project Record, Aquatic Species Water Resources Report, Appendix A for complete descriptions of the Riparian Habitat Conservation Area Categories.

Language of S&Gs TM-1, FM-1, and FM-4, are similar between the NWFP and INFISH, and are listed below:

- *NWFP TM-1(c):* "Prohibit timber harvest, including fuelwood cutting, in Riparian Reserves except as described below. Riparian Reserve acres shall not be included in the calculations of the timber base.

  c. Apply silvicultural practices for Riparian Reserves to control stocking, reestablish and manage stands, and acquire vegetation characteristics needed to attain Aquatic Conservation Strategy objectives."

  INFISH TM-1(b): "Prohibit timber harvest, including fuelwood cutting, in Riparian Habitat Conservation Areas except as described below:

  b. Apply silvicultural practices for Riparian Habitat Conservation Areas to acquire desired vegetation characteristics where needed to attain Riparian Management Objectives. Apply silvicultural practices in a manner that does not retard attainment of Riparian Management Objective and that avoids adverse effects on inland native fish."

- *NWFP FM-1:* "Design fuel treatment and fire suppression strategies, practices, and activities to meet Aquatic Conservation Strategy objectives, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuels management activities could be damaging to long-term ecosystem function."

  INFISH FM-1: "Design fuel treatment and fire suppression strategies, practices, and actions so as not to prevent attainment of Riparian Management Objectives, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management actions could perpetuate or be damaging to long-term ecosystem function or inland native fish."

- *NWFP FM-4:* "Design prescribed burn projects and prescriptions to contribute to attainment of Aquatic Conservation Strategy objectives."

  INFISH FM-4: "Design prescribed burn projects and prescriptions to contribute to the attainment of the Riparian Management Objectives."

Federal Water Pollution Act (Clean Water Act) and Oregon State Water Quality Standards

The Clean Water Act stipulates that states are to adopt water quality standards. Included in these standards are provisions for identifying beneficial uses, establishing the statutes of beneficial uses, setting water quality criteria, and establishing BMPS to control non-point sources of pollution. The "no net increase" criterion is a provision in the Oregon Water Quality Standards for high priority water bodies prior to approval of a Total Maximum Daily Load (TMDL). Oregon Water Quality Standards designate beneficial uses for the Deschutes River. The following are beneficial uses and are based on the section of river from above the Bend Diversion Dam from Oregon Department of Environmental Quality - Table 130A, Designated Beneficial Uses, Deschutes Basin:

- Fish and Aquatic Life, Fishing, Public Domestic Water Supply, Private Domestic Water Supply, Water Contact Recreation, Industrial Water Supply, Irrigation, Wildlife and Hunting, Boating, Livestock Watering, and Aesthetic Quality.

The beneficial uses for Tumalo Creek are the same as above, but include hydropower. These beneficial uses are based on the section of the Deschutes River (including tributaries) from Pelton Regulating Dam to the Bend Diversion Dam.

Federal Executive Order 12088 ensures Federal compliance with applicable pollution control standards. The rules are also incorporated as BMPS in Oregon Water Quality Standards.

Federal Executive Order 11988 provides for the protection and management of floodplains. The rules are also incorporated as BMPS in Oregon Water Quality Standards.

Federal Executive Order 11990 provides for the protection and management of wetlands. The rules are also incorporated as BMPS in the Oregon Water Quality Standards.

3.16.3 Analysis Methods

The objective of the aquatics analysis is to disclose the potential effects of the proposed project and its alternatives on watershed and fisheries resources in the two watersheds within the project area. The Deschutes River and Tumalo Creek will be used as the focus of the analysis area for direct, indirect, and cumulative effects. The analysis of the aquatic species and hydrological resources was driven by three primary issues. The issues related to hydrological and aquatic resources were identified during public scoping and internal review and are listed below. Public concerns were focused on protection of fisheries habitat, riparian areas, stream shade, and water quality. Issues were used to drive Project Design Features, which are designed to avoid, minimize or reduce potentially adverse impacts to water quantity and quality, riparian areas, and fisheries populations and habitat. Quantitative analyses and professional judgment were used to evaluate the issue measures by comparing existing conditions to the anticipated conditions from implementing the four alternatives.

Aquatic Topic #1- Water Quantity: Fuels and vegetation management activities have the potential to affect water quantity by causing 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.

The effects to water quantity (stream low) were assessed by analyzing the potential for increase in the stream network and overland flow to stream channels. In addition, an assessment was made of potential for an increase in stream flows from a reduction in evapo-transpiration from vegetation management treatments. The Equivalent Clearcut Acreage methodology was a tool used to assess changes.

Aquatic Topic #2 – Water Quality: Fuels and vegetation management activities have the potential to affect water quality by modifying stream processes by mass movements of sediment, bank destabilization from vegetation removal, riparian vegetation disturbance, 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. Suspended sediment, temperature, dissolved oxygen, and nutrients are parameters of water quality that could potentially be affected by vegetation management and fuels reduction activities.

The effects to water quality considered sediment and water temperature, and was assessed by acres within RHCAs and Riparian Reserves located near perennial and intermittent stream channels and proximity to water.

The focus of the analysis of effects to water quality was the Deschutes River and Tumalo Creek, the two major streams in the project area and each included on the ODEQ 303(d) list for one or more water quality parameters (refer to Table 201).

Aquatic Topic #3 – Fisheries: Hydrologic, stream morphology, and water quality changes from vegetation and fuels management ultimately influence fish and other aquatic species habitat and fish populations. Fuels and vegetation management have the potential to adversely affect fish and other aquatic species habitat and populations in the short and long term.

Effects to fisheries will focus on effects to the Region 6 sensitive species redband trout, and will be tied closely to the analysis of #2 and #3 above.

Past activities in the watershed are included in the Past, Present and Reasonably Foreseeable Future Projects, Table 26 and Table 27. Past activities were included in the analysis of the existing conditions for water quantity, water quality, and fish habitat and populations. The analysis also considered the effects to Wild and Scenic River eligibility of the Deschutes River, Wetlands and Floodplains (Executive Orders 11988 and 11990), effects to Essential Fish Habitat of the Magnuson-Stevens Fishery Conservation Act, and effects to the Riparian Management Objectives of INFISH and the ACSOs of the NWFP.

The analysis considered data from a 2005 stream survey of Deschutes River, 1999 survey of Tumalo Creek, Oregon Department of Fish and Wildlife (ODFW) and Deschutes National Forest fisheries records, 1976 Deschutes National Forest soil resource inventory, GIS generated data, aerial photography, water temperature data, and stream flow data from USGS and Oregon Water Resource Department operated gaging stations on the Deschutes River and Tumalo Creek, and the 2011 Region 6 Regional Foresters Special Status Species List. Numerous publications were researched and used in determining effects.

Cumulative effects analysis considered past, present, and reasonably foreseeable activities (Tables 26 and 27). The Equivalent Clearcut Area (ECA) methodology was used to help evaluate potential cumulative watershed effects that might occur at the 10th field watershed scale from implementing action alternatives.

Water Quantity

Existing Condition

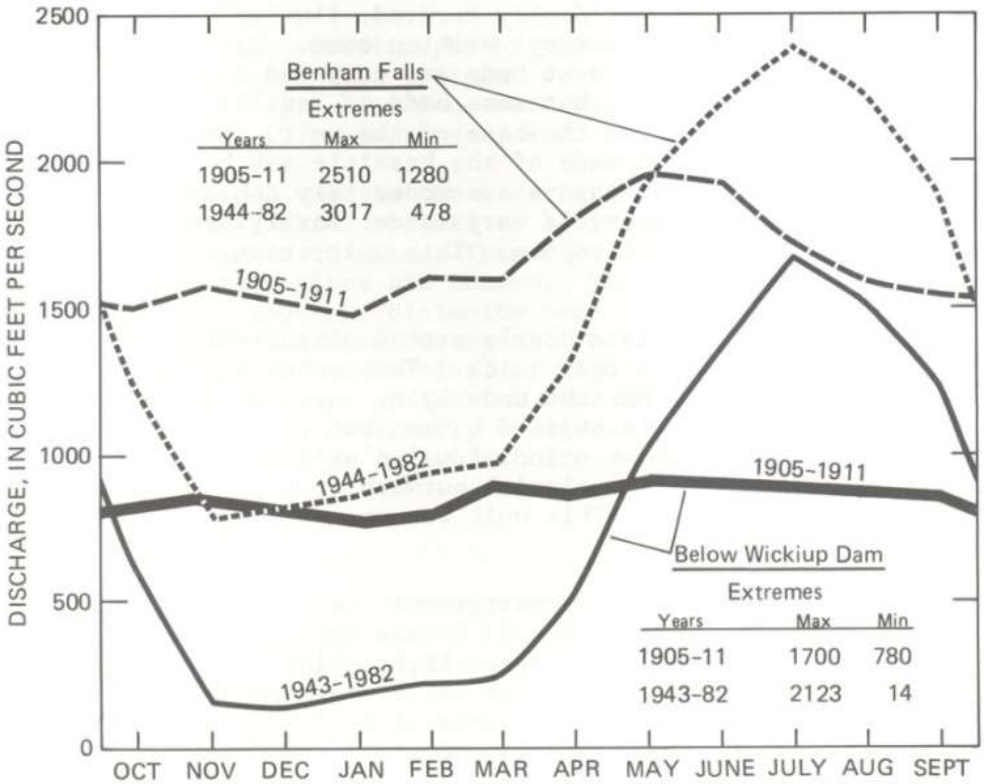
Deschutes River

The West Bend Project includes lands adjacent to the west bank of the Deschutes River from the Forest Boundary at river mile 172.0 upriver to river mile 176.8. River flows are controlled at Wickiup Dam, located approximately 50 miles upriver of the project area, to meet irrigation needs downriver. Numerous spring-dominated streams supply the majority of the discharge to the Deschutes River, which, prior to regulation, was known for its remarkably stable flow regime, with an annual discharge

ranging from approximately 1000 cfs to 1600 cfs (USDA 1996). During drought years, flows may drop below 450 cfs for the winter months. During the summer, flows may reach 3000+ cfs (USDA, 1996). For the period of record of 1907 – 2011, typical winter discharge, when water is being stored in upriver reservoirs, had a mean monthly discharge of 674 cfs , while summer mean monthly discharge to support irrigation averaged 2294 cfs, with a mean monthly annual discharge of 1372 cfs. (All discharges measured approximately 5 miles upriver of the project area at Benham Falls, river mile 181.5, gage 14064500).

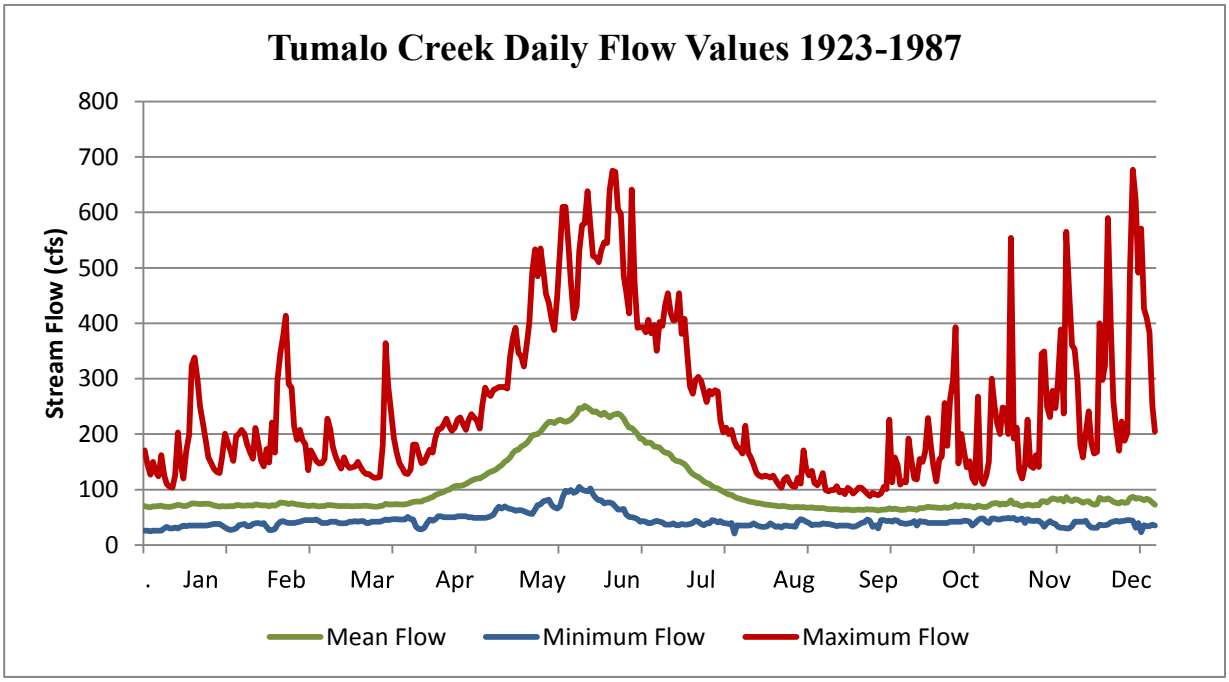
Bankfull discharge, historic and present, are significantly less than would be expected for a basin this size (Rosgen 1998), indicating significant infiltration to groundwater. Gannett (2001) reported analysis of past flow data between Benham Falls and Lava Island (7.5 miles downriver) revealed a water loss to the surrounding substrate, averaging 83 cfs based on monthly mean flows for a period of record from 1945-1965. A portion of this reach runs adjacent to the West Bend project area. Loss from this reach cannot be calculated beyond 1965 as the gage below Lava Island was discontinued. However, losses can be calculated for the reach from Benham Falls to Bend from 1945 to 1995. Based on monthly mean flows the average loss was calculated to be 89 cfs. Detailed analysis of historical gage records indicates most of this loss occurs at Lava Island Falls, with minimal loss occurring in other areas within this reach. The loss around Lava Island Falls is most likely in response to a deeper water table and a very young, highly permeable lava flow from the eruption of Lava Butte about 7,000 years ago. This event diverted the river and now forms much of the east bank and some of the falls along this reach. The Deschutes River flows approximately 1.5 miles over this formation at Lava Island Falls. The rate of leakage in this reach, from Benham Falls to Bend, far exceeds that of any other losing stream reach in the Upper Deschutes Basin. This area is an important source of groundwater recharge in the Basin.

Figure 76: Average monthly discharge in the Deschutes River near Wickiup Dam and at Benham Falls, before and after closure of Wickiup Dam (Cameron and Major 1987).



Tumalo Creek: Tumalo Creek has a base flow in the fall or winter of about 50-60 cfs, and a typical snowmelt period results in a peak flow of around 300-350 cfs in late May or June. Occasionally there are late fall rain-on-snow events. The mean annual discharge is approximately 102 cfs (period of record 1923-1987 from OWRD gage 14073001 near river mile 2.8). Bridge Creek, a tributary to Tumalo Creek upstream of the project area, is a municipal source of water for the City of Bend, with a constant diversion of 18.2 cfs. Water unused by the City, typically ranging from 1 cfs to 10 cfs, is returned to Tumalo Creek below the West Bend project area at river mile 5.4. A proposal to replace the aging pipelines is currently under environmental review. Flow regulation at the Bridge Creek diversion facility proposed under the new system would enable the diversion rate to match demand, at times augmenting stream flows in Tumalo Creek compared to existing conditions. Although vegetation and fuels management activities are proposed under all 3 action alternatives on the uplands above Tumalo Creek in the West Bend Project, there are no planned activities within the Riparian Reserves. Tumalo Creek flows through a canyon with steep sideslopes within the project area. All management activities in the proximity of Tumalo Creek would occur outside of the canyon on gentle to moderate slopes.

Figure 77: Maximum, Minimum, and Mean Flow Values for Tumalo Creek[1]



1. Maximum, minimum, and mean flow values for Tumalo Creek. Flow includes a compilation of in-stream flow and flow from the Columbia Southern canal. Data do not include water use by the City of Bend.

South Fork Tumalo Creek: The project boundary is adjacent to 0.25 miles of the South Fork of Tumalo Creek from rm 0.7 to 0.95. The median discharge is approximately 8.3 cfs (HDR 2012). There are no project activities proposed within the Riparian Reserve of this stream. Unit 373 abuts the Riparian Reserve where mechanical pre-commercial thinning and piling activities are proposed on 9 acres under all three action alternatives.

Tumalo Lake Creek: The project area includes approximately 0.5 miles of Tumalo Lake Creek. The median discharge is approximately 2.6 cfs (HDR 2012). Ladder fuels reduction is proposed within the Riparian Reserve (unit 379).

Intermittent Channels: The intermittent channels in the project area have bankfull widths less than 4 feet and discharges less than 2-3 cfs. They have no surface outlet to any perennial stream or lake, with

the exception of a channel feeding Tumalo Lake. Vegetation and fuels treatments are proposed adjacent to or within RHCAs/RRS of sections of these channels.

Alternative 1 (No Action)

Timing and Volume of Peak/Base Flows and Water Yield.

Direct and Indirect Effects: The timing and volume of peak and base flows and the total water yield of the Deschutes River are primarily influenced by climatic conditions and the operation of the dam at the outlet of Wickiup Reservoir to meet downriver irrigation needs. Flows in the Upper Deschutes Basin are also influenced by the complex geology of relatively recent glacial and volcanic activity. On numerous occasions lava from Newberry and Lava Butte Volcanoes have dammed and pushed the river to the west. In areas where the upper Deschutes River cascades over and along lava flows, like that of Lava Butte, the stream tends to lose surface water to groundwater, as these lava formations are relatively young and highly permeable (Gannet et al 2001). As discussed earlier, the Deschutes River within the project area is classified as a losing reach.

The flows of Tumalo Creek are influenced by City of Bend water withdrawals, TID diversions during irrigation season, and climatic conditions. There would be no direct effects to peak flows and water yield to the streams within the project area from selecting the No Action alternative. Any changes in peak flows and water yield would be the result of natural climatic variations and water storage or diversion practices, or other causes.

Over time, continued forest health deterioration and fuels build-up within the project area could lead to high severity wildfires that have the potential to change peak/base flows and water yield because of decreased infiltration. Changes in flow would depend on variables such as size, timing, location, and severity of fire, and climatic conditions post-fire. A fire of high severity, which results in severe heating of soils, reduces ground cover and can form a water repellant layer (hydrophobic) that restricts infiltration and percolation, can result in increased surface runoff.

Wildfire Scenario

Severely burned soils are more likely to occur in the mixed conifer and lodgepole pine stands than the ponderosa pine dominated stands because of the greater ground fuels accumulation. The potential for hydrophobicity of the ash dominated soils within the RRs/RHCAs of the project area is generally considered to be low in the ponderosa pine dominated eastern half of the project area but higher in the mixed conifer dominated western half (See Soils section for more information). In addition, reduced evapo-transpiration and interception by the tree canopy after a wildfire could compound runoff (Ice 2003). However, hydrologic changes would be limited and may be immeasurable because of the groundwater dominated nature of the landscape due to highly permeable soils. It is unlikely measurable increases in stream flow would occur in the Deschutes River, where ponderosa pine stands are dominant and potential for high severity fire and resultant hydrophobic soils is low. The large volume of stream flow of the Deschutes River would dissipate effects from small increases in stream flow attributable to the effects of wildfire.

The only scenario that would result in any measurable increase in stream flows of Tumalo Creek as a result of wildfire within the project area is if the steep sideslopes of the Tumalo Creek canyon burn at high severity. A measurable increase in stream flow resulting from wildfire could occur in the small perennial or intermittent channels.

Proposed activities that would occur within the RHCA and Riparian Reserves are presented in Table 198.

Effects Common to Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

The management activities proposed under these alternatives with potential to affect stream flows are described in the Alternative Descriptions (EA, Chapter 2), and are summarized below. The treatment units located within RRs/RHCAs or near streams and wetlands are identical for the 3 action alternatives:

To summarize proposed treatments and units within the RHCA and Riparian Reserves:

- Commercial harvest within the RHCA of the Deschutes River, utilizing machinery such as a feller-buncher conducting whole tree yarding. Small tree hand-thinning (<10" dbh) would also occur. Treatments would occur within 3 units of ponderosa pine dominated stands totaling approximately 37 acres within the RHCA. Machine piling, mowing, pile burning, and underburning would occur within these units (Activity units 401, 409, 410). Actual acres treated would be less due to recreation trail setbacks.
- Small tree hand-thinning (less than 10" dbh), handpiling and handpile pile burning within approximately 12 acres of the RHCA where commercial activities are excluded. (Activity units 401,409, 410).
- A combination of commercial harvest, small tree thinning, handpiling, handpile burning, mowing, and underburning would occur within approximately 105 acres of RRs/RHCAs (11 acres RHCA, 94 acres RR) of intermittent stream channels. Because of the project design feature restricting machinery to 50 feet or greater from intermittent channels, the actual acres with commercial harvest will be less than 105 (portions of 18 activity units).
- Small tree thinning (ladder fuels reduction) and handpiling would occur within approximately 41 acres of a forested wetland (Riparian Reserve) adjacent to Tumalo Lake Creek (Activity unit 379).
- A combination of commercial harvest, small tree hand thinning, piling, mowing, and underburning within approximately 7 acres of the RHCA of two seeps, which are areas of high soil moisture (Activity units 451, 456, 464, 498). Only hand treatments would occur where soil moisture is high.

Table 198: Summary of Vegetation and Fuels Treatments within Riparian Reserves (under NWFP) or RHCAs (under INFISH) within the West Bend Project Area.

Waterbody Type	Name	Land Mgt.	EA Unit	Silviculture Prescription	Activity Type	Secondary Treatment	Fuels treatment	RR/RHCA Acres*	Benefit to RR or RHCA
Perennial Stream	Tumalo Lake Cr.	NWFP	379	_	_	LFR	Pile	41.1	FB
Perennial stream	Deschutes River	INFISH	401	60 BA Thin	HTH	LFR	Pile/mow/ burn	11.0	I&D, LT, FB
Perennial stream	Deschutes River	INFISH	409	60 BA Thin	HTH	PCT	Pile/mow/ burn	24.0	I&D, LT, FB
Perennial stream	Deschutes River	INFISH	410	60 BA Thin	HTH	PCT	Pile/mow/ burn	14.0	I&D, LT, FB
Intermittent	_	INFISH	483	_	_	PCT	Pile	3.2	RM
Intermittent	_	INFISH	482	Skid and deck	_	Skid and deck	Mow/burn	1.6	RM, FB
Intermittent	_	INFISH	480	60 BA Thin	HTH	PCT	Pile/mow/ burn	1.7	I&D, LT, FB
Intermittent	_	INFISH	481	_	_	_	Mow/burn	0.6	FB
Intermittent	_	INFISH	487	60 BA Thin	HTH	PCT	Pile/mow	4.2	I&D, LT, FB
Intermittent	_	NWFP	278	60 BA Thin	HTH	_	Mow/burn	0.3	I&D, LT, FB
Intermittent	_	NWFP	277	HOR	HOR	PCT	Lop & Scatter/ mow	4.1	RM, FB
Intermittent	_	NWFP	291	HCR	_	Mow	Mow	12.5	RM, FB
Intermittent	_	NWFP	213	60 BA Thin	HTH	_	Mow/burn	3.1	I&D, LT, FB
Intermittent	_	NWFP	212	60 BA Thin	HTH	_	Mow/burn	6.7	I&D, LT, FB
Intermittent	_	NWFP	292	Seed tree	HCR	_	Mow	0.2	RM, FB
Intermittent	_	NWFP	214	HOR	HOR	PCT	Lop & Scatter/ mow	1.1	RM, FB
Intermittent	_	NWFP	281	60 BA Thin	HTH	_	Mow	0.3	I&D, LT, FB
Intermittent	_	NWFP	299	Seed tree	HCR	Whip	Lop & Scatter	20.7	RM
Intermittent	_	NWFP	355	Seed tree	HCR	PCT	Pile	14.8	RM
Intermittent	_	NWFP	216	Seed tree	HCR	Whip	Pile	14.7	RM
Intermittent	_	NWFP	289	Seed tree	HCR	Whip	_	10.7	RM
Intermittent	_	NWFP	389	Seed tree	HCR	Whip	pile	4.7	RM
Seep	_	INFISH	498	Aspen	HIM	LFR	_	3.8	RM, FB
Seep	_	INFISH	451	60 BA Thin	HTH	LFR	Pile/burn	0.5	I&D, LT, FB
Seep	_	INFISH	456	Seed tree	HCR	Whip	Mow/burn	0.5	RM, FB
Seep	_	INFISH	464	60 BA Thin	HTH	PCT	Mow/burn	2.1	I&D, LT, FB
Total RR/RHCA Acres Proposed for Treatment								**202.2***	

*Actual acres treated would be less due to stream buffers identified in project design features above.
I&D = reduce insect and disease risk; LT = encourage large tree development; RM = re-establish and manage stands to acquire desired vegetation characteristics
FB= change fire behavior to reduce risk of crown fire

Timing, Duration, and Volume of Peak/Base Flows and Water Yield.

Direct and Indirect Effects: Alternative 2, 3, and 4 would include vegetation management and fuels activities, including commercial thinning, on nearly 200 acres of RRs and RHCAs within the project area. Management activities would occur within 49 acres of the RHCA of the Deschutes River, including up to 37 acres of commercial thinning and up to 12 acres of non-commercial thinning of ponderosa pine stands. Fuels treatments would also occur on these same acres. The 49 acres represent 22% of the total RHCAs of the Deschutes River within the project area. Riparian Reserve treatments would occur adjacent to Tumalo Lake Creek, where activities are limited to ladder fuels reduction and pile burning occurring within 41acres. There are no treatments proposed within the RHCAs of Tumalo Creek, the intermittent channel that feeds Tumalo Lake, or the South Fork of Tumalo Creek. Adjacent to Tumalo Creek, vegetation and fuels management activities are only proposed on areas outside of the steep canyon sideslopes that Tumalo Creek drains. The intermittent streams and seeps within the project area where RRs/RHCAs treatments would occur have no surface connection to perennial streams or rivers, as surface flow goes subterranean in the porous landscape.

Operation of ground-based equipment, including within RRs/RHCAs, has potential to increase soil compaction that could increase runoff to streams. Harvest of live trees reduces evapo-transpiration which can increase available water to streams. However, any additional water yielded as a result of reduced evapo-transpiration from vegetation management activities would be expected to rapidly move into the groundwater rather than into streams. Soil types within the RHCA units adjacent to the Deschutes River are dominated by Landtype XD, which is a combination of landtypes 36, 6A, and 56 (USDA 1976). These soils are generally excessively drained with a rapid rate of permeability. Surface soil erosion potential and sedimentation yield potential to streams are both low. Surface soils are composed of primarily pumice and ash.

Figure 78: Deschutes River RHCA, Including Trail

Figure 79: Deschutes River RHCA

Based on the character of the soils and hydrogeology of the West Bend Project area, and the design of the proposed activities including Best Management Practices (BMPs), there would be no measurable direct and indirect effects to the timing, duration, or volume of peak and base flows, and water yield, of the Deschutes River, Tumalo Creek, Tumalo Lake Creek, intermittent channels, or the South Fork of Tumalo Creek for Alternatives 2-4. Two small seeps in the project area which total approximately 0.5 miles in length may see a short term (less than 10 years) slight increase in soil moisture, as less water would be taken up by vegetation after thinning. Regrowth of vegetation, including the targeted aspen stands, would eventually increase water uptake. Infiltration of precipitation may be decreased in localized areas where soils become compacted as a result of management actions, such as at landings which would be located outside of RRs and RHCAs. Puddling of water is unlikely because of the sandy-textured soils. The compacted areas at landings would not add to an increase in the stream drainage network as they would occur on flat to gentle ground. Should overland flow leave a compacted area, it is likely to be absorbed in the highly permeable soils prior to entering a stream channel. Post-project sub-soiling would alleviate much of the areas with detrimental soil compaction.

There would be no measurable direct or indirect effects to the stream systems water quantity (timing and duration of peak stream flows, total water yield) as a result of implementing the three alternatives summarized below:

- Highly permeable volcanic surface soils allowing high infiltration of precipitation.
- Lack of runoff and stream surface water in the project area, even in areas of moderate and steep slopes. The youthful and fractured nature of the volcanic results in rapid infiltration of precipitation and snowmelt, resulting in a lack of drainage development (Lite and Gannett 2002). Project area is dominated by groundwater flow.
- Past management in the project area and adjacent lands has only minimally increased the stream drainage network, therefore not measurably increasing surface flows to stream channels There are no road crossings of any perennial streams in the project area and 5 crossings of intermittent channels.

- High infiltration rates limits volume of precipitation that can be evaporated near the surface or taken up by plants as it moves through the soil to the groundwater. Post-project sub-soiling would increase infiltration rates in disturbed areas.
- Precipitation is limited in the eastern half of the project area, approximately 14 inches annually at the most eastern edge.
- Design of project activities, BMPs, and management requirements to protect soil and water resources would limit overland flow and an increase in the stream network. A stream buffer for commercial operations, prohibition of landings and temporary roads within RRs and RHCAs, and restoration of disturbed soils are Best Management Practices that would limit overland flow of water and sediment to stream channels.

Although the proposed activities would have limited activities within the RRs/RHCAs under all 3 action alternatives, they reduce the likelihood of wildfire with the associated severity of fire effects (hydrophobic soils, decreased ground cover, severely burned soils) entering RRs/RHCAs by treating vegetation and fuels across the landscape. The potential for severe effects from wildfire within RRs/RHCAs is decreased over that of the No Action alternative, thus decreasing the potential for changes in peak/base flows or water yield in streams, primarily small drainages. As described under the No Action alternative, the potential for changes in peak flows would be limited by the highly porous soils on the landscape.

Cumulative Effects – Water Quantity

Cumulative Effects for hydrologic and fisheries resources are bound in space by the 10th field watershed and in time by a 50 year hydrologic recovery period. The Equivalent Clearcut Area (ECA) methodology is a tool used to determine where cumulative watershed effects might occur at the 10th field watershed scale. For the West Bend Project, most of the activities for the action alternatives occur within the North Unit Diversion Dam-Deschutes River Watershed. The ECA methodology is defined as a watershed index of snowmelt and evapo-transpiration 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).

The influential factor in computing ECA is the amount of area altered by land management activities or factors, such as wildfires or timber harvest. The amount of area that can be described as a clearcut is defined in terms of the density of residual vegetation. Each particular land use area is assigned a "clearcut equivalent factor" (CEF), which is multiplied by the area disturbed to arrive at an ECA value (Bettinger et al. 1998). For example, clearcuts and roads are generally given a CEF value of 1.0, and partial cuts are given a CEF from 0.0 to 1.0, depending on the density of residual vegetation. The more open the unit is, the more it emulates the snowmelt and evapo-transpiration rates of a similar stand that is clearcut. Over time, through regrowth of vegetation, the stands become hydrologically recovered. A time frame of 50 years for complete hydrologic recovery has been used for pine dominated stands on the Bend/Ft. Rock Ranger District based on personal communication with Troendle in 1999.

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. A value for the existing conditions for the watershed is generated from the past activities. Present and Reasonably Foreseeable activities, which are similar in nature to past activities, are then accounted for in the calculation of the ECA value for the existing condition. Although this is just one tool to assess possible cumulative effects, its use is limited for the Upper Deschutes River basin because of its groundwater-driven nature. Activities on this landscape are unlikely to reflect measurable changes in hydrologic characteristics such as timing and volume of peak flow, and water yield. ECA thresholds for the North Unit Diversion Dam-Deschutes

River and Tumalo Creek watersheds are unknown, but are expected to be at the high end of the range and would likely be above what Troendle and King observed due to the groundwater nature of the watersheds.

Increases in peak flows can lead to streambank instability. The major streams within both watersheds of the West Bend Project area exhibit relatively high bank stability. The 2005 stream survey of the Deschutes River found bank stability to be high (98.3% within Reach 2 - See Table 205 of stream attributes below). The fluctuating stream flows within the Deschutes River as a result of water management, which are somewhat tempered in this reach compared to upriver reaches, would have a far greater influence on bank stability than any increase in peak flows associated with implementation of any of the action alternatives. Stream bank stability of Tumalo Creek is also high, other than within the Bridge Creek Fire area. A stream survey in 1999 found that bank stability ranged from 91.4% to 94.8% from Skyliner Bridge at river mile 12.7 downstream to river mile 3.4. Recreational use was a contributor to stream bank instability (USDA 1999).

An ECA value for the existing conditions for the two watersheds within the West Bend Project (North Unit Dam-Deschutes River and Tumalo Creek) were not generated but likely fall below thresholds where hydrologic effects have resulted because of the groundwater-driven nature of the watersheds.

For the West Bend Project, the ECA calculation for the three action alternatives were based on vegetation treatments, both overstory and understory, but did not consider mowing and underburning which have minor effects to the ECA calculation.

Table 199: ECA Calculation for the Action Alternatives – North Unit Diversion Dam-Deschutes River Watershed

Treatment Activity	Acres by Alternative			ECA Coefficient	Total ECA Acres by Alternative		
	2	3	4		2	3	4
HCR	1,744	1,744	1,744	0.4	698	698	698
HIM	165	165	165	0.2	33	33	33
HOR	814	585	585	0.2	163	117	117
HTH	9,236	9,219	7,612	0.3	2,771	2,766	2,284
LFR	1,375	1,375	1,375	0.01	28	28	28
PCT	4,578	4,552	4,028	0.02	137	137	121
PCT Mech	8	8	8	0.05	0	0	0
Skid and Deck	1,945	1,945	1,464	0.3	584	584	439
Whip	1,162	1,162	1,162	0.001	1	1	1
Final ECA Acres					4,414	4,362	3,720
ECA %*					**4.4***	**4.3***	**3.7***

*ECA % calculated by dividing Final ECA acres by 101,224 acres (watershed acreage for North Unit Diversion Dam-Deschutes River)

ECA Calculations for the 101,224 acre North Unit Diversion Dam-Deschutes River watershed by alternative are:

- Alternative 2: 4,414 acres, 4.4% of the watershed.
- Alternative 3: 4,362 acres, 4.3% of the watershed.
- Alternative 4: 3,720 acres, 3.7% of the watershed.

These increases to the existing condition ECA are slightly higher than those calculated for other recent vegetation management projects on the Bend/Ft. Rock Ranger District. However, because of the groundwater dominated watershed the changes in peak flows and subsequent stream bank erosion would not be observed. Control of the flows at Wickiup Dam is much more of a factor in determining peak and base flows than changes in the ECA.

Table 200: ECA Calculation for the Alternatives 2-4 – Tumalo Creek Watershed

Treatment Activity	Acres by Alternative			ECA Coefficient	Total ECA Acres by Alternative		
	2	3	4		2	3	4
HCR	6	6	6	0.4	2	2	2
HIM	16	16	16	0.2	3	3	3
HOR	8	0	0	0.2	2	0	0
HTH	2,753	2,753	2,004	0.3	826	826	601
LFR	139	139	139	0.01	3	3	3
PCT	1,885	1,772	1,185	0.02	57	53	36
PCT Mech	226	226	226	0.05	11	11	11
Skid and Deck	355	355	338	0.3	107	107	101
Whip	6	6	6	0.001	0	0	0
Final ECA Acres					1,010	1,005	758
ECA %*					**2.7***	**2.6***	**2.0***

*ECA % calculated by dividing Final ECA acres by 38,004 acres (watershed acreage for Tumalo Creek)

ECA Calculations for the 38,004 acre Tumalo Creek watershed by alternative are:

- Alternative 2: 1,026 acres, 2.7% of the watershed.
- Alternative 3: 988 acres, 2.6% of the watershed.
- Alternative 4: 760 acres, 2.0% of the watershed.

These totals are unlikely to result in changes in stream flows of Tumalo Creek.

From the table of Past, Present and Reasonably Foreseeable Future Projects, reasonably foreseeable activities such as roadside and developed site hazard tree removals, trail construction, construction of Cascade Lakes Welcome Station, Phil's Trailhead Expansion, Meissner SnoPark Expansion, Bearwallow Firewood, Rocket vegetation management, City of Bend Surface Water Improvement Project, and Skyliner Road Construction would result in less than 20 total acres of live tree harvest, inconsequential to the calculated ECA values for Alternatives 2-4 for both watersheds.

Water Quality

Clean Water Act

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 and BLM 1999). A draft WQRP has been developed for the Little Deschutes 8th field sub-basin.

Beneficial uses are documented according to criteria developed by the Oregon Department of Environmental Quality, (ODEQ 1998). A beneficial use is a resource or activity that would be directly affected by a change in water quality or quantity. Water quality standards are established to protect the beneficial uses of the State's waters. Beneficial uses are designated by basin. The beneficial uses for the basin above Bend include public domestic water supply, private domestic water supply, industrial water supply, irrigation, livestock watering, fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, and aesthetic quality (Table 130A, ODEQ 2012). Water quality for beneficial uses is maintained and protected through the implementation of the Deschutes National Forest Plan Standards and Guidelines including Best Management Practices (BMPs), NWFP and INFISH Standards and Guidelines, the Aquatic Conservation Strategy of the NWFP, and the Riparian Management Objectives of INFISH.

Existing Condition

Deschutes River

The regulated flow upriver of the project area at Wickiup Dam is the largest influence on water quality of the Deschutes River within the project area. The altered flow regime has led to increased riverbank erosion, widening of the channel, and reduced water quality and fish habitat in reaches downriver of Wickiup Dam (USFS 1996). These effects are most evident in the river upstream of the confluence with Fall River, which is approximately 25 miles upriver 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, including within the project area.

The altered flow regime has likely led to the Deschutes River's inclusion on the 2010 Oregon Department of Environmental Quality (ODEQ) list of water quality impaired water bodies (303(d) list) under the Clean Water Act. Other factors that may contribute to water quality impairment are upriver private land development and associated septic drain fields, which are considered to be a source of oxygen demanding bacteria (USFS 1996), developed and dispersed recreational sites, and recreational activities including motorized boating. These activities have resulted in elimination or reductions 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. ODEQ has split the Deschutes River into management reaches. The river reach that most closely fits the project area includes river mile 168.2–189.4. The parameters within this reach for which standards are not met are dissolved oxygen all year (non-spawning), turbidity spring and summer, Chlorophyll a summer season, high water temperatures all year (non-spawning), and sedimentation, undefined season.

Tumalo Creek

Water in the Tumalo Creek watershed is generally known to be cold and clean. The high quality water that is diverted into Bend's municipal water system comes mostly from spring systems at the headwaters of the watershed. The Upper Tumalo Creek 12th field sub-watershed is included as a Tier 2 Key Watershed in the NWFP. The lack of recent disturbance and restricted land use within the municipal watershed has helped to maintain the quality and beneficial uses of these waters. The beneficial uses and water quality status of water in the Tumalo Creek watershed are identified by Oregon Department of Environmental Quality (ODEQ) in Appendix C Below the Bridge Creek intake, water quality has been somewhat compromised by disturbance through wildfire (Bridge Creek Fire – 1979), road building, timber harvest, residential development, recreational developments and activities (see Past, Present, Reasonably Foreseeable Activities section). This has contributed to variable levels of channel disturbance, increased sediment, and increases in temperature. Although restoration activities in the upper three miles of Tumalo Creek have contributed to improved channel, floodplain, and riparian vegetation conditions, ODEQ has listed Tumalo Creek as being water quality impaired for temperature below River Mile 12.5 - downstream of Tumalo Lake Creek (ODEQ Water Quality Assessment – Oregon Integrated Database, http//www.deq.or.us/wq/assessment/rpt2010/search.asp).

Tumalo Lake Creek

Water quality information is limited on this small stream that drains Tumalo Lake. The stream is well-shaded. Water temperatures ranged from 50° to 66° F. during a stream survey in July of 1996. This stream is not a 303(d) stream.

Table 201: Oregon Department of Environmental Quality 2010 List of Water Quality Impaired Waterbodies within the West Bend Project Area (303(d) List)

Waterbody	River miles	Parameter	Season	Status
Deschutes River	110.8-223.3	Temperature	Year Around (non-spawning)	Category 5; TMDL needed; 303(d)
Deschutes River	116-222.2	Dissolved Oxygen	January 1 – May 15	Category 5; TMDL needed; 303(d)
Deschutes River	171.7-223.3	Dissolved Oxygen	Year Around (non-spawning)	Category 5; TMDL needed; 303(d)
Deschutes River	168.2-189.4	Chlorophyll a	Summer	Category 5; TMDL needed; 303(d)
Deschutes River	168.2-189.4	Sedimentation	undefined	303(d)
Deschutes River	168.2-189.4	Turbidity	Spring/summer	303(d)
Tumalo Creek	0.0-12.5	Temperature	Year Around (non-spawning)	Category 5; TMDL needed; 303(d)

From:ODEQ Water Quality Assessment – Oregon Integrated Database, http//www.deq.or.us/wq/assessment/rpt2010/search.asp).

Alternative 1 (No Action)

Direct and Indirect Effects: There would be no direct effects to water quality, including the ODEQ 303(d) list parameters for Tumalo Creek or the Deschutes River. Any changes in water quality would be the result of natural climatic variations or other causes.

Indirect effects to water quality, including the 303(d) list parameters, could occur, increasing the likelihood of two potential risk scenarios:

- A stand replacing wildfire, including within the RRs/RHCAs of the Deschutes River and other streams,
- Insect damage to timber stands within the RRs/RHCAs.

Stand Replacing Wildfire Scenario

No Action increases the likelihood of a high severity wildfire, including within the RRs/RHCAs of the Deschutes River, Tumalo Creek, and other streams. There is potential for adverse effects to water quality when a high severity wildfire occurs. Approximately 52% of the Deschutes River RHCA acres in the project area are in Fire Condition Class 2 or 3 (Deana Wall, Fire/Fuels Specialist). The zone of riparian vegetation adjacent to the Deschutes River and Tumalo Creek within the project area is generally narrow (frequently less than 20 feet), composed of sedges, grasses, shrubs, and hardwoods. There are areas along the Deschutes River where the riparian vegetation is much wider, up to approximately 200 feet. The riparian area would likely experience fire behavior and severity similar to upland conditions where it is narrow, but would be expected to have less severity where riparian areas are wider. Following is a description of effects to water quality should stand replacing wildfires occur near the Deschutes River, Tumalo Creek, and other streams.

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 stream channels, 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. This research was conducted on small 1st and 2nd order streams, similar perhaps to Tumalo Lake Creek, but considerably smaller than Tumalo Creek or the Deschutes River. Summer maximum water temperatures have been shown to remain significantly elevated for at least a decade following wildfire (Dunham et al. 2007). The 1979 Bridge Creek Fire eliminated nearly all shade for about 3.5 miles along Tumalo Creek. No continuous water temperatures of Tumalo Creek were collected prior to the fire, therefore no pre and post fire comparison is available.

Effects to dissolved oxygen: During the course of wildfire 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 streams. Rashin and others (2006) found that windthrow trees were a minor contributor to the total extent of chronic (long term small inputs) sediment delivery from harvest sites. 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 or Tumalo Creek that would measurably increase turbidity. Chronic 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. Effects would likely be greater in Tumalo Creek than the Deschutes River because of steep sideslopes that increase the potential for overland flow of sediments. Highly permeable soils and flat to gentle slopes 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 (Shakesby and Doerr 2006) that could increase turbidity until riverbank vegetation and stability recover. Decreased riverbank stability was evident on Tumalo Creek after the 1979 Bridge Creek Fire.

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. Fine sediment volumes within the substrate of Tumalo Creek may show a measurable increase after several years.

Effects to chlorophyll a: During the fire, ash and smoke could introduce nutrients (nitrogen and phosphorus) to the streams. After the fire, overland flow of sediment and organic debris could introduce additional nutrients (nitrogen, phosphorus, organic carbon). 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 along the Deschutes River is limited by lack of slope and highly permeable soils. Overland flow is more likely adjacent to Tumalo Creek.

Insect and Disease Scenario

With No Action, the ponderosa pine dominated stands within the RHCA of the Deschutes River would be at increased risk of insect damage and reduced vigor and growth (see Vegetation section of the EA). Presently the stocking exceeds the Upper Management Zone in all 3 of the RHCA units (401, 409, 410). These 2nd growth stands have not previously been thinned and fire has been excluded. These stands are currently at risk of insect and disease damage. Increased mortality of trees would reduce shade, potentially increasing water temperature, and would in turn increase the severity of wildfire effects discussed above.

Effects Common to Alternative 2 Proposed Action, Alternative 3, and Alternative 4

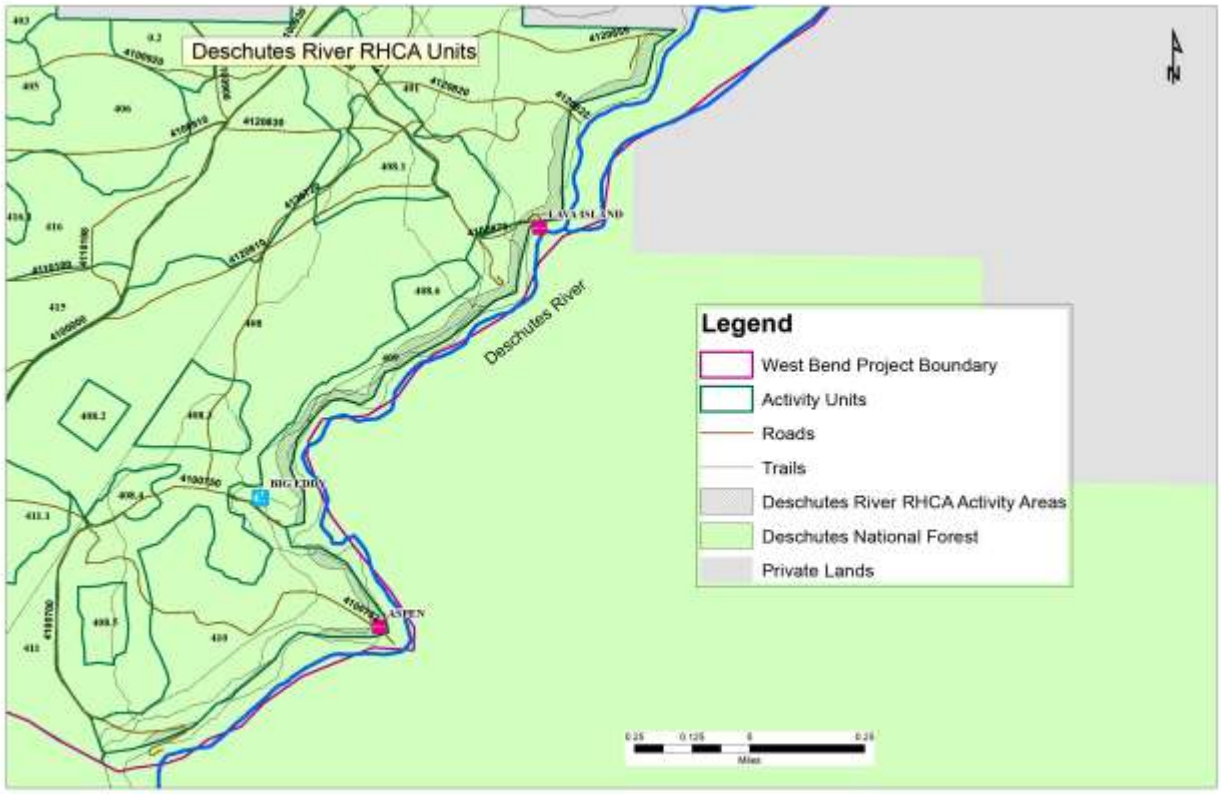
Alternatives 2, 3, and 4 reduce potential for two risk scenarios occurring within the RRs/ RHCAs within the project area; high severity wildfire and insect and disease outbreaks within tree stands. Effects to aquatic resources under both of these scenarios were described above under the No Action alternative. Thinning of stands and reducing ladder fuels within the RRs/RHCAs would change fire behavior from a crown fire to a lower intensity surface fire, make the RRs/RHCAs more fire resilient, and increase the vigor and growth of residual trees. Presently the stocking exceeds the Upper Management Zone in the RHCA units along the Deschutes River. Most of the activities within this RHCA would occur in stands dominated by ponderosa pine where the treatment objective is to maintain or increase ponderosa pine dominance and continue development toward large tree structure.

Large trees would be maintained and large tree structure would be promoted, which would in turn improve some additional shading of the Deschutes River and provide for future recruitment of instream large wood meeting the INFISH standard (greater than 12” diameter, greater than 35 foot length). The INFISH Riparian Management Objectives (RMOs) of large woody debris and water temperature, which are not met under existing conditions, would benefit from the management actions, and the attainment of the RMOs of pool frequency and width/depth ratios would not be prevented. The water temperature RMO would benefit from an improvement in shade over time with the development of large tree structure, but may not result in measurable differences in water temperature because of the large size of the Deschutes River, the relatively small amount of RHCA treated under the action alternatives, and most treatments would occur back from the river where benefits to shade would be minimal. Instream recruitment of large wood would also be limited using the same reasoning. More discussion on RMOs is found later in this document in the INFISH Compliance section.

Table 202: Deschutes River RHCA Treatment Units Summary

Unit	Total Unit Acres	Alternatives 2,3 and 4 – RHCA Acres		Length parallel to Deschutes River (miles)
		Commercial Harvest Acres	Non-Commercial Harvest Acres	
401	151	11	0	0.6
409	40	21	3	1.0
410	95	5	9	1.0
Totals	**286**	**37**	**12**	**2.6**

Figure 80: Treatment Units within RHCA of the Deschutes River



Changes and Effects: Past experience has shown that logging operations near streams have potential to disturb ground cover and soils, facilitating overland flow of sediments to streams. Overland flow of sediment to streams can affect water quality by increasing turbidity and fine sediment volumes of stream substrates, which in turn can affect fish and other aquatic life habitat. The actual RR/RHCA acres implemented on the ground for the vegetation management activities listed in Table 202, above will be approximately 10% less after accounting for wildlife leave areas, recreational trails, and cultural resource sites.

Rashin and others (2006) studied effects of timber harvesting on sedimentation of streams in Washington State. Sediment routing surveys found that 19 of 22 sites had no sediment delivery by the 2nd year following harvest by heavy equipment when a stream buffer was used. The only three sites that exhibited any chronic sediment input were where streams were crossed by timber yarding practices. This practice would not occur under any alternative in the West Bend Project. The stream buffers in the study had one-sided widths ranging from 23-216 feet, with an average width of 82 feet, and 75%

between 33 and 115 feet. Near-stream slopes ranged between 4-75%, with half of the sites greater than 36% slope. Near-stream slopes within treatment units under Alternatives 2 and 3 of the West Bend Project are nearly all less than 20%, with considerable areas less than 10%. The authors concluded from their study that a 33 foot setback of ground disturbance from streams prevented sediment delivery to streams from about 95% of harvest related erosion features. The buffers were thought to be effective in limiting sediment delivery in that they keep the active erosion sites away from the immediate streamside area and that they intercept and filter sediment from upslope erosion sites, as long as drainage is not concentrated in gullies, channels, or equipment skid trails. As much as possible, equipment skid trails would be perpendicular to the hillslope near the Deschutes River and avoid long uphill runs to limit potential for overland flow of sediments to the river (BMP Veg-4).

Lakel and others (2010) concluded from a study of streams in Virginia that stream buffers as little as 25 feet were effective in limiting sedimentation after timber harvest but recommended a minimum of 50 feet.

The machinery setback is approximately 100 feet for the Deschutes River and 50 feet for intermittent channels. Sediment delivery to streams as a result of management actions would be none to negligible. This is because of the project design features including the machinery buffer and the logging systems design, slope restrictions for machinery, gentle to moderate slopes near streams, high infiltration rates and low erosion potential of soils. Riparian vegetation and ground cover would be protected to provide filtering capacity and streambank stability. The majority of near stream vegetation management activities would occur along an intermittent channel that has no surface connection to a perennial stream or lake.

Hand thinning of trees less than 10” dbh near the Deschutes River (with prescribed setbacks) would reduce potential instream recruitment of wood in the short term (20 years) as some of these trees may eventually become windthrows. However, these trees, being of small diameter, would not be large enough to meet the INFISH definition of large woody debris (>12” diameter, 35’ length) until attaining several more years of growth, and would provide little benefit to fisheries habitat in the meantime.

Fuels would be reduced across the landscape under all action alternatives, lowering potential for stand replacing wildfires. Wildfire is expected to eventually enter the West Bend Project area, including within the RHCAs and riparian areas, but the proposed treatments under both alternatives would break up the continuous fuels, lowering the intensity and severity of wildfire and associated adverse effects to resources, including soils and riparian areas. Reduced fuel loadings across the landscape, including within RHCAs, would improve the efficiency of fire suppression efforts and limit the potential adverse effects of wildfire to water quality, particularly water temperature from loss of shade, and limit adverse effects to the water temperature parameter for which the Deschutes River is listed. By increasing the effectiveness of fire suppression and reducing the spread of wildfire, these alternatives also reduce the risk of toxic fire retardant reaching aquatic systems during fire-fighting operations.

Historically, the fire regime and fire behavior in the RHCA of the Deschutes River was similar to areas outside of the RHCA where the zone of riparian vegetation is narrow. Here, riparian areas long the stream likely burned at a similar intensity and severity as upland areas. Fire played a role similar in ecosystem function within the RHCA as it did outside of the RHCA. Most of the RHCA stands along the Deschutes River within the project area are ponderosa pine dominated and would have a Fire Regime I classification (low severity).

Underburning is proposed within the RHCA of the Deschutes River to return a natural process that would aid in creating a fire resilient landscape. Fire Condition Class 1would be restored or maintained in most of the RHCA. Underburning and handpile burning within the RHCA would reduce ground cover and some of the coarse woody debris. The underburn is expected to burn in a mosaic pattern, leaving areas of ground cover untouched. Reduced ground cover can lead to increased overland flow of sediments to streams, increasing turbidity and sedimentation of stream substrates. Implementing BMPs

such as stream setbacks for ignition and piling, and burning under conditions that limit consumption of ground cover and coarse woody debris, would result in none to negligible overland flow of sediment to the Deschutes River. Arkle and Pilliod (2009) found no detectable changes in periphyton, macroinvertebrates, amphibians, fish, and riparian and stream habitats after a prescribed fire in stream corridors when compared to unburned reference streams. The prescribed fire occurred in ponderosa pine forests in Idaho. Beche et al (2005) studied effects of a prescribed fire within a riparian area of a stream in Colorado in a mixed conifer forest. Conclusions were that the fire either had no impacts or short term (<1 year) impacts to the stream and its riparian zone.

Alternatives 2, 3, and 4 reduce the potential for indirect effects to occur as described above under the No Action alternative. The project design features prescribed under both action alternatives are designed to avoid, minimize, or rectify potentially adverse effects to water quality, including the 303(d) list parameters. These include stream setbacks buffers for mechanized equipment, underburning ignitions, and handpiling, tree height based restrictions for thinning, and logging system requirements.

Management activities outside of the RRs/RHCA would incorporate project design features, especially soils design features that would limit effects to the RRs/RHCA, especially overland flow of water and sediments.

ODEQ 303(d) Parameters

Deschutes River: temperature, sedimentation, turbidity, dissolved oxygen, and chlorophyll a

Stream temperature is driven by the interaction of site conditions, weather, riparian vegetation, and the input of radiant energy to a stream system. Solar radiation is the most important source of radiant energy affecting stream temperature (Brown 1969; Beschta 1997, in USFS, BLM 2012). Effective stream shade is defined as the total solar radiation blocked over a twenty-four hour period (USFS, BLM 2012). Stream shading is broken down into two zones, primary and secondary. The period of greatest solar radiation occurs between 10:00 am and 2:00 pm (USFS, BLM 2012). 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 2012).

For slopes less than 30% (typical of slopes near the Deschutes River) and tree heights of 60-100 feet, the primary shade zone distance is a minimum 50 feet from the stream edge (USFS, BLM 2012). Shade is maintained in the primary shade zone for the action alternatives by height-based cutting restrictions described under BMP Veg-3. Small tree thinning and ladder fuels reduction would occur within the primary shading zone. However, there would be no effect to shade within the primary shade zone from ladder fuels reduction and thinning of trees less than 10” dbh. Stand data from near the Deschutes River in the West Bend Project area has shown that ponderosa pine trees less than 10” diameter at breast height (dbh) are less than 60 feet tall.

Under the action alternatives to meet the desired silvicultural prescription, trees may be cut when: (1) over 60 feet tall if 50 feet or more from the river; (2) between 20 and 60 feet tall if 28 feet or more from the river; and (3) less than 20 feet tall between 12 and 28 feet from the river. No cutting would occur within 12 feet of the river.

Effects to shading in the secondary shading zone would be none to negligible as there is still an overstory present and the “tree behind a tree” concept. Trees left after thinning would increase in growth, vigor, and height. Susceptibility to insect and disease would be reduced. Eventually trees

would reach their site potential height of approximately 100 – 120 feet and shade would be maximized, potentially decreasing water temperatures, but benefits may be immeasurable.

Despite vegetation and fuels treatments within the RHCAs of the Deschutes River, effective stream shade would be maintained under this alternative, therefore not adversely affecting water temperature.

Tumalo Creek: temperature

No vegetation management activities would occur within the RHCA of Tumalo Creek, therefore there would be no effects to water temperature.

Dissolved oxygen

Water temperatures affect dissolved oxygen concentrations. The action alternatives maintain or improve water temperatures of the Deschutes River, therefore maintaining or increasing dissolved oxygen.

Turbidity and sedimentation

There would be none to negligible effects to overland flow of sediments to the Deschutes River within the project area from the action alternatives, therefore there would be no short or long term measurable increase in turbidity and sedimentation from implementing these alternatives Riparian vegetation would be left intact to filter potential surface run-off and overland flow of sediments. Vegetation and fuels treatments near the Deschutes River are generally on flat to moderately sloped terrain (77.6% of RHCA less than 20% slope), which, along with permeable soils and abundant ground cover, limits surface run-off as a result of management activities (Table 203). In some areas where ground disturbing activities would occur, the ground slopes away from the river (negative slope), with no potential for overland flow of sediments to the river.

Table 203: Slope of the Deschutes River RHCA within the West Bend Project

Slope	0-9%	10-19%	20-29%	30-39%	>39%
% of RHCA	56.5%	21.1%	12.6%	5.8%	4%

Chlorophyll a

Within the Deschutes River, 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 from any of the action alternatives.

Cumulative Effects – Water Quality

The altered flow regimes of the Deschutes River and Tumalo Creek are the factors that most influences water quality. Ongoing recreational use of trails, OHV use, and campgrounds contributes minimal sediment to streams. There would be no measurable cumulative effects to water quality by implementing any of the three action alternatives.

The project design of the three action alternatives including management requirements and Best Management Practices were structured to minimize cumulative effects. The design of Alternatives 2, 3 and 4 includes stream buffers for machinery operation and harvest, slope limitations, and logging systems requirements within RHCAs and RRs to limit potential adverse impacts to water quality. No new system roads are planned. Some closed roads would be temporarily re-opened. Between 42 and 56 miles of temporary roads will be built (depending on alternative), with nearly half the miles occurring on land previously disturbed. None of the temporary roads are within RRs or RHCAs. Landings are also located outside of RRs and RHCAs.

Aquatic Species Habitat and Populations

Biological Evaluation for Aquatic Species

It is Forest Service policy to avoid all adverse impacts to threatened and endangered species and their habitats, except when it is possible to compensate adverse effects through alternatives identified in a biological opinion rendered by the U.S. 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 (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 effects 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 in the National Environmental Policy Act process by conducting biological evaluations to determine their potential effect of all programs and activities on these species (FSM 2670.32). 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 findings of biological evaluations are to be documented in a decision notice, or if applicable, in official files.

Contents of the BE are included here and describe the effects to sensitive aquatic species associated with the West Bend Project. The 2011 Region 6 Regional Foresters Special Status Species List was reviewed.

Summary of Findings for Proposed, Threatened, Endangered, and Sensitive Species:

Sensitive Species: Inland Columbia Basin redband trout; A Caddisfly; Indian Ford Juga.

Table 204: Aquatic Species and Effects Determinations for all Alternatives

Species	Scientific Name	Status	Occurrence	Effects Determination
Inland Columbia Basin redband trout	*Oncorhynchus mykiss gairdnerii*	S	D	**Alt. 1-MIIH Alt. 2,3,4 - NI**
Indian Ford Juga	*Juga hemphilli ssp.*	S	N	**Alt. 1,2,3,4 - NI**
A Caddisfly	*Rhyacophila chandleri*	S	N	**Alt. 1,2,3,4-NI**
Chinook Salmon EFH	*Oncorhynchus tshawytscha*	MS	HN	**Alt.1,2,3,4-NAE**

Acronyms: Status

E	Federally Endangered
T	Federally Threatened
S	Sensitive species from Regional Forester's list
C	Candidate species under Endangered Species Act
MS	Magnuson-Stevens Act designated Essential Fish Habitat

Acronyms: Occurrence

HD	**Habitat Documented** or suspected within the project area or near enough to be impacted by project activities
HN	**Habitat Not** within the project area or affected by its activities
D	Species **Documented** in general vicinity of project activities
S	Species **Suspected** in general vicinity of project activities
N	Species **Not documented** and not suspected in general vicinity of project activities

Acronyms: Effects Determination

NI	No Impact
MIIH	May Impact Individuals or Habitat, but Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species
WIFV	Will Impact Individuals or Habitat with a Consequence that the Action May Contribute to a Trend Towards

	Federal Listing or Cause a Loss of Viability to the Population or Species
BI	Beneficial Impact

Acronyms: Essential Fish Habitat (EFH; Magnuson-Stevens Act)

NAE	No Adverse Effect
AE	Adverse Effect

Existing Condition – Fisheries and Other Aquatic Species Habitat and Populations

Historic Fish Populations: Historic native fish populations in the Deschutes River within the project area included Inland Columbia River Basin (CRB) redband trout (*Oncorhynchus mykiss gairdneri*), 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). Inland CRB redband trout may have been the only native fish historically present in Tumalo Creek and its tributaries. Bull trout may have been present but there are no documented records.

Present Fish Populations: The Deschutes River within the project area has populations of redband trout, rainbow trout, brown trout, eastern brook trout, three-spined stickleback, mountain whitefish, and sculpin. Since Wickiup Dam is unscreened, other fish species found in Wickiup Reservoir may pass through this section of the Deschutes. These species include kokanee salmon, brown bullhead, and tui chub. Populations of Inland CRB redband trout and eastern brook trout are found within the section of Tumalo Creek within the project area. Further downstream, brown trout also occupy the lower 4 miles.

Inland CRB redband trout, a sub-species of rainbow trout, are included on the December, 2011 Region 6 Sensitive Species List. They have interbred with various hatchery stocks of rainbow trout within the Deschutes River and Tumalo Creek. Evaluation of the genetic make-up of the redband trout of the Deschutes River near the project area revealed 7.2% hatchery rainbow genetic contribution, i.e., on average, the fish were 92.8% pure redband (Phelps, et al, 1996). Evaluation of the genetic make-up of the Tumalo Creek redband has revealed little introgression with stocked rainbow trout (Matala et al. 2007).

Fisheries are regarded as an Outstandingly Remarkable Value in Segment 4 of the Deschutes River, in part because of the trophy brown trout (*Salmo trutta*) fishery (USFS 1996). 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 (USFS 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 (USFS 1996).

See the Upper Deschutes Wild and Scenic River Environmental Impact Statement (1996), Tumalo Creek Watershed Analysis (2008) and the ODFW Upper Deschutes River Sub-basin Plan (1996) for additional information on the fisheries resource.

Fisheries Habitat: The redband trout has habitat requirements similar to other salmonids. There are resident, fluvial and adfluvial populations. They typically occupy habitats with temperatures in the 50-65º Fahrenheit range, but some desert dwelling populations have adapted to survive temporary exposure up to 85º Fahrenheit. In the stream environment, they seek cover provided by large woody material, undercut banks, boulders, depth, and turbulence. They can be found in desert stream environs as well as those with forested canopies. They require clean gravels for spawning, preferably in the 0.25" - 2.0" range.

Deschutes River: The river section within the project area was stream surveyed by Deschutes National Forest staff in 2004. The project area is located within Reach 2 of the survey, which was from river mile 172.0 to 180.3. The average width was 167 feet at bankfull stage. The river is generally wide and relatively shallow, as the width/depth ratio averaged 56.3. The substrate is composed of sand, small gravel, and some boulders. Habitat type is dominated by pools (76%) with the remainder riffle habitat (23%) and side channels (1%)(Data taken from a 2004 Deschutes National Forest Stream Survey, Reach 2). Bank erosion evident in upriver reaches is not as prevalent in this reach, as winter flows are moderated by the upriver discharges of the Little Deschutes River, Spring River, and Fall River.

Instream large woody material is limited throughout much of the West Bend project area, with a total of only 9.8 pieces/mile meeting INFISH standards (>12" diameter and >35' length) within Reach 2 of the stream survey, well below the minimum of 20 pieces/mile recommended by INFISH. The riparian zone width is highly variable. There are areas of sedge and willows over 200 feet wide in some areas, but many other riparian areas are narrow (5-10 feet), the vegetation community quickly transforming into a drier upland types consisting of ponderosa/lodgepole pine and bitterbrush. In other areas, large boulder screes separate the river from the uplands. The riparian vegetation is generally in fair condition, except at boat ramps, dispersed campsites, and occasional areas of bank erosion.

Deschutes River bottom substrates have high volumes of fine sediments (sand and silt), a result of widespread erosion of riverbanks in upriver reaches. 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).

Table 205: Summary of Stream Attributes – Deschutes River Stream Survey 2004

Reach	Miles Surveyed	Sinuosity	Channel Gradient %	Pool Habitat %	Pools/mile	Ave. bankfull width (feet)	Bankfull W/D Ratio	Pieces Large Wood/mi (INFISH)	Bank Instability %
2	8.42	1.1	0.8	75.2	2.9	166.8	56.3	9.8	1.7

Two aquatic invertebrates included on the December, 2011 Region 6 Foresters Sensitive Species List that have been documented or suspected on the Deschutes National Forest; A Caddisly (*Rhyacophila chandleri)* – suspected, and Indian Ford Juga (*Juga hemphilli ssp.)* – documented.

- **Caddisfly (*Rhyacophila chandkeri*)**

Existing Population and Habitat

This species of caddisfly is known only from Siskiyou Co., California, and Lane and Deschutes counties, Oregon, and is a recent addition to the 2011 Region 6 Sensitive Species List. It is thought to be a rare species that is very patchily distributed, and apparently highly localized where it does occur (Wisseman pers. comm. in USDA and USDI 2005). Its range is thought to be in the Cascade Mountains of Oregon and California. It is associated with very cold, larger spring-fed streams (Wisseman pers. Comm. in USDA and USDI 2005). There is no specific information available on threats to this species or its habitat. Activities that degrade water quality or increase water temperatures would likely have negative impacts on this species (USDA and USDI 2005).

Although listed as Suspected on the Deschutes National Forest, this species was reportedly collected in 1982 from Tyee Creek and Devils Lake on the Deschutes National Forest, Bend/Ft. Rock Ranger District (Giersch 2002). This species may exist elsewhere on the forest in headwater spring habitats but sampling for marcroinvertebrates has mainly been limited to larger streams and river sections on the Deschutes National Forest and this species was not identified in those samples.

- **Indian Ford Juga (*Juga hempilli ssp.*)**

Existing Population and Habitat

An aquatic snail, *Juga hemphilli ssp.* was added to the 2011 Region 6 Sensitive Species List and is a new (undescribed) subspecies which somewhat resembles *Juga (Juga) hemphilli maupinensis* in its relatively large size (~25mm) (Frest & Johannes 1995). As a whole, *Juga hemphilli* is known from the headwaters of the Columbia River in British Columbia, the Columbia River Gorge of Oregon and Washington, and the Deschutes River system in Oregon (NatureServe 2009).

Although this new subspecies may have been historically widespread in the upper Deschutes system, it is currently known from a single site: Indian Ford Creek, near Indian Ford Campground in the Deschutes National Forest, Deschutes County, Oregon (Frest & Johannes 1995). No abundance estimates have been made for this subspecies, but according to NatureServe (2009), *Juga hemphilli* is declining (10-30%).

The habitat for this subspecies is considered to be streams and spring-seeps (Duncan 2008). The only known site is a medium-sized spring-fed creek, where the subspecies was found in mixed basalt cobble-mud substrate (Frest & Johannes 1995). Macrophytes and epiphytic algae are rare at the site, and the site is considered almost monospecific as far as snails are concerned (Frest & Johannes 1995).

Threats include any factors tending to downgrade water quality, including nutrient enhancement, grazing, and water diversions, would negatively impact this taxon.

Alternative 1 (No Action)

Direct and Indirect Effects: 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 redband trout. Effects to habitat or populations would be from natural causes, fish management actions, or other causes.

Wildfire Scenario

The No Action alternative could have adverse direct effects to fish populations and habitat in the case of high severity wildfire. 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). Large fires within the project area are unlikely to result in significant mortality of redband trout and other fish in the Deschutes River because of the large size and resiliency to sudden changes in temperature. In Tumalo Creek, cool temperatures and swift velocities would temper effects to redband trout from rising water temperatures and minimize potential for direct mortality. Local extinctions are highly unlikely.

Indirect effects to fish habitat and populations, including redband trout, could occur under a wildfire scenario, especially if they burn with high intensity and severity within RRs and 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) studied small order streams and summarized changes in macroinvertebrate communities are generally restricted to the first 5-10 years.

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). Surface soils along the Deschutes River are dominated by pumiceous loamy sands and sands (Landtype 46 – Deschutes National Forest Soil Resource Inventory). 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.

Due to the potential for adverse effects, this alternative **May Impact Individuals or Habitat (MIIH)** of redband trout, but would not lead a loss of population viability or create a significant trend toward federal listing.

There would be **No Impact (NI)** to the A caddisfly and the Indian Ford Juga as there is no known habitat or populations within the project area.

Effects Common to Alternatives 2, 3, and 4

Direct and Indirect Effects: Fish habitat and populations are largely influenced by water quality, water quantity, and timing of stream flows. Water quality and water quantity are maintained under this alternative, therefore maintaining these important components of fish habitat, including that of the sensitive species redband trout. Fuels are reduced and suppression effectiveness is increased which would reduce the potential for fires of high intensity and severity to adversely affect riparian areas and stream channels. As a result, riverbank stability, shade, future long term large wood recruitment to channels, and spawning gravels are maintained along areas of the Deschutes River and Tumalo Creek. There would be no direct effects to fish habitat or populations under this alternative. Effects to habitat or populations would be from natural causes, fish management actions, or other causes. An indirect effect of implementing this alternative would be reducing the potential for short term gain in large wood recruitment as a result of wildfire.

Under current conditions, some stands within the RHCA of the Deschutes River and adjacent to the RHCA of Tumalo Creek are overstocked and at risk of insect and disease infestations which could lead to increased fire risk. This alternative reduces stocking levels of tree stands that decreases the risk of insect and disease infestations. Along the Deschutes River, the treatments would increase growth rates and vigor of trees that provide shade and future large wood recruitment. Because there would be no

measurable direct or indirect effects to water quantity, water quality, or habitat, this alternative would have **No Impact (NI)** to redband trout.

There is no known habitat for the Indian Ford juga and A caddisfly. Field surveys targeting these species have not been conducted, but populations have not been observed during aquatic macroinvertebrate sampling across the Deschutes National Forest. A caddisfly is unlikely to occur in the project area because of the lack of spring habitats. Indian Ford juga is unlikely to occur in the project area because it is considered to only exist at one locale. Should either of these species be present in the project area, BMPs such as wetland and stream buffers would protect populations and habitat. The action alternatives would have **No Impact** (NI) to A Caddisfly and **No Impact (NI)** to Indian Ford juga.

Essential Fish Habitat

There would be no effects to Chinook salmon Essential Fish Habitat from this alternative. There are no present or historical records of Chinook salmon populations in the Deschutes River or Tumalo Creek within the West Bend Project area.

Cumulative Effects

The altered flow regime and the elevated water temperatures are two of the main factors influencing fish and other aquatic species populations and habitat. A limited harvest of trout is allowed on streams within the project area (except for brook trout where there is no limit or size of fish), which may reduce the abundance of trout populations. There would be no measurable cumulative effects to aquatic species habitat and populations, because of no measurable cumulative effects to water quality and quantity. These alternatives reduce the potential for wildfire that could reduce shade and long term large woody material recruitment, and potentially severely burn within RRs/RHCAs, especially within mixed conifer stands, that could have short and long term adverse effects to overhead cover, streambank and channel stability, spawning gravel quality, and large wood recruitment.

Wild and Scenic Rivers

Existing Condition

The entire portion of the project area that borders the Deschutes River (river mile 172 to river mile 176.8) is within Segment 4 of the Upper Deschutes Wild and Scenic River corridor (Management Area 17a), specifically within sub-Segments 4E and 4F. Management of the corridor is guided by the River Plan.

River Segment 4 is classified as a Recreational River. Outstandingly Remarkable Values (ORVs) for Segment 4 that are to be protected or enhanced by resource management activities are Geologic, Fishery, Vegetation, Wildlife, Cultural, Scenic, and Recreation.

Alternative 1 (No Action)

Direct and Indirect Effects: The No Action alternative would have no direct effects to the Fishery ORV of the Deschutes River. There is increased risk of wildfires under this alternative which may affect the Fishery ORV as described above under the Aquatic Species and Habitat Section.

Effects Common to Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

Direct and Indirect Effects: Alternatives 2 and 3, and 4 propose overstory, understory, and fuels treatments on 478.5 acres within the Wild and Scenic River corridor of the Deschutes River. Alternatives differ little in proposed treatments (Figure 81). The fishery ORV is protected under the action alternatives. There would be no direct or indirect effects.

Figure 81: Treatment Units within the Upper Deschutes Wild and Scenic Corridor within West Bend Project Area

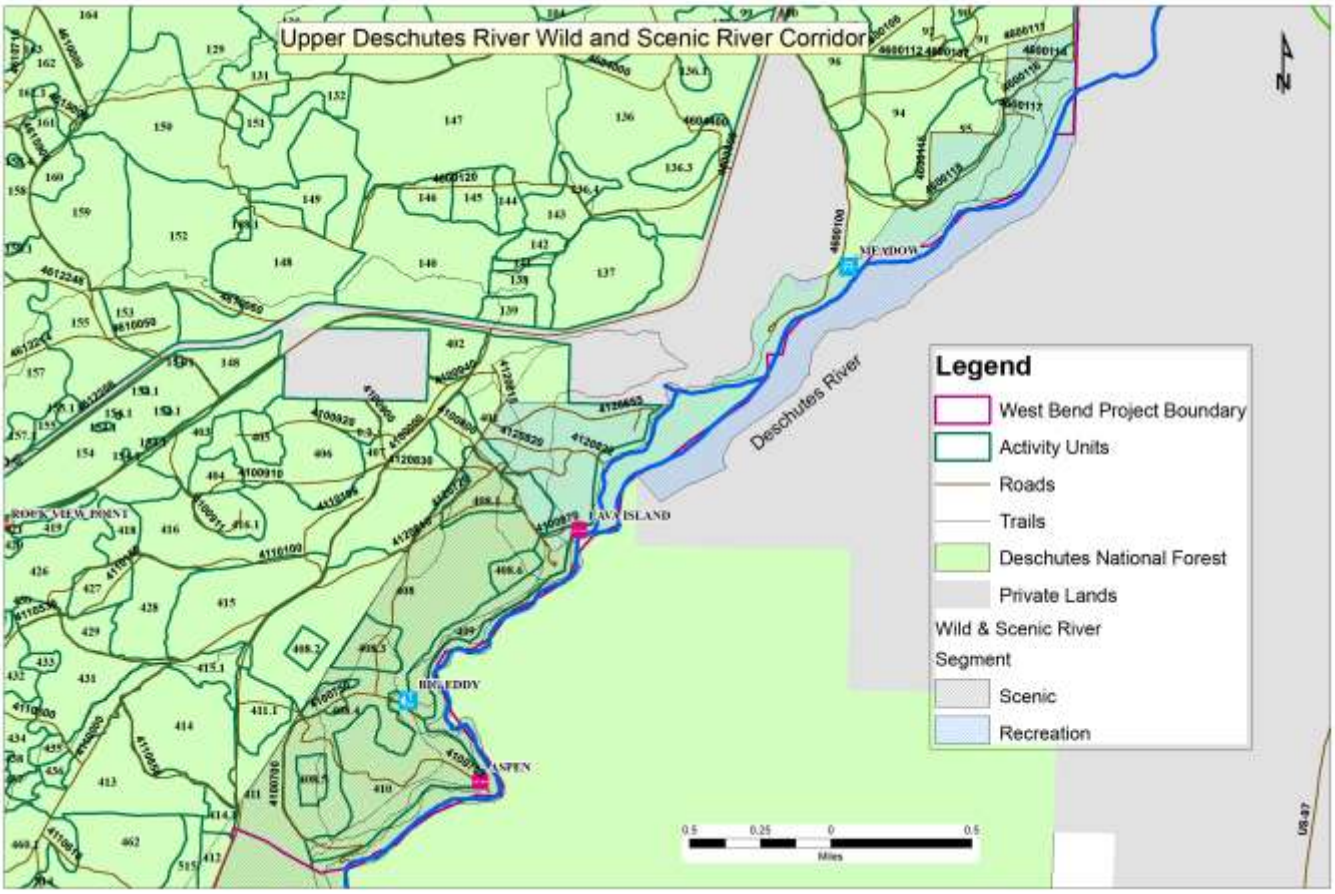


Table 206: Activities within Upper Deschutes Wild and Scenic River Corridor

Unit	Unit Acres	Acres in W&S Corridor	Overstory Treatment by Alternative			Harvest Code	Understory Rx	Fuels Rx
			2	3	4			
91	71	20	N/A					Mow
95	53	22	60 BA Thin			HTH	PCT	Pile/Mow/Burn
401	151	96	60 BA Thin	Road Sun		HTH	LFR	Pile/Mow/Burn
408	304	205	N/A					Mow/Burn
409	40	40	60 BA Thin			HTH	PCT	Pile/Mow/Burn
410	95	95	60 BA Thin			HTH	PCT	Pile/Mow/Burn
478	32	0.5	Skid and Deck			Skid and Deck	Skid and Deck	Mow/Burn
Total Acres in W&S Corridor		**478.5**						

Cumulative Effects

There would no cumulative effects from implementing any action alternative since there are no direct or indirect effects to the Fishery ORV.

INFISH Riparian Management Objectives (RMOs)

Riparian Management Objectives Compliance

The Riparian Management Objectives (RMOs) from INFISH are listed below in Table 207. 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. The RMOs applicable to a forested system are pool frequency, water temperature, width/depth ratio, and large woody debris. Under existing conditions, none of the objectives are being met. The West Bend Project is within reach 2 of the Deschutes River, surveyed from Meadow Camp upriver to the Benham Falls footbridge, a distance of 8.42 miles.

Pool frequency: Even under historic conditions prior to flow regulation, pool frequency was most likely not met. The average bankfull width of the Deschutes River in the project area is 167 feet. According to Table A-2 from INFISH, there should be between 9 and 12 pools per mile. Under existing conditions there are 2.9 pools per mile. This value likely approximates the historic frequency. Spring-fed systems often have low pool frequencies, and are dominated by glide habitats or long pools. The stream survey determined that the reach was dominated by pool habitat (75%). Low pool frequency but high percentage of pool habitat is typical of the Deschutes River above Bend. The action alternatives would not have an effect on pool frequency and would not retard the attainment of this RMO.

Water temperature: The state water temperature standards are not being met as described earlier. Much of the Deschutes River upriver of Bend also does not meet the state standards. The action alternatives would not measurably affect water temperature. In the long term, development of large tree structure in the RHCA as prescribed under the action alternatives would increase shade but benefits to water temperature may be immeasurable. The action alternatives do not retard the attainment of this RMO.

Large woody debris: This feature is not met under existing conditions, as there is less than 20 pieces of woody debris per mile (presently 10 pieces per mile) for the reach surveyed. Considering the riverbanks within this reach have large areas of wetland or lava flows, large wood is expected to be lower. Much of the Deschutes River upriver from Bend does meet this objective. The action alternatives would not affect large woody debris. Hand thinning of trees < 10" dbh near the Deschutes River (with prescribed setbacks) would reduce potential instream recruitment of wood in the short term (20 years) as some of these trees may eventually become windthrows. However, these trees, being small diameter, would not be large enough to meet the INFISH definition of instream large woody debris (> 12" diameter, 35' length) until attaining several more years of growth, and would provide little potential benefit to fisheries habitat in the meantime. In the long term, residual trees within approximately 125 feet of the river would have increased survival and growth, providing large tree structure for future large woody debris recruitment, benefitting this RMO.

Width/depth Ratio: The existing width/depth ratio within the project area determined from cross-section surveys is 23.7:1, exceeding the less than 10:1 ratio objective listed in INFISH. This ratio has likely increased since flow regulation began more 60 years ago at Wickiup Dam. Width has increased 20% during this time (Deschutes NF, 1996). However, the ratio was likely not under 10:1 prior to regulation. Spring-fed systems often have naturally high width/depth ratios. Width/depth ratios generally exceed 20:1 for reaches of the Deschutes River upriver of Bend. The project would not affect the width/depth ratio of the Deschutes River, and would not retard the attainment of this RMO.

Table 207: Interim Riparian Management Objectives (RMOs) – (Table A-1 in INFISH)

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 (all systems)	<10, mean wetted width divided by mean depth

Table 208: Interim objectives for pool frequency – (Table A-2 in INFISH)

Wetted width (feet)	10	20	25	50	75	100	125	150	200
Pools per mile	96	56	47	26	23	18	14	12	9

Aquatic Conservation Strategy Objectives

Most of the project area is within the North Unit Diversion Dam-Deschutes River watershed, and less than half of this area is within the lands managed under the NWFP. Water features that intersect this watershed, the project area, and the NWFP are limited to one intermittent channel less than 4 miles in length that has no surface connection to a perennial stream or lake.

A portion of the project area is also within the Tumalo Creek watershed, and again, less than half of this area is within the boundaries of the NWFP. Water resources that intersect this watershed, the project area, and the NWFP are limited to one small intermittent stream and two small perennial channels within this watershed. Refer to Table 194 and Figure 75. The following is an analysis of the effects to the ACS objectives at the watershed scale for both of the 10th field watersheds, North Unit Diversion Dam – Deschutes River and Tumalo Creek, and also at the local scale. The vegetation and fuels management activities within RRs/RHCAs are identical for all three action alternatives.

ACS Objective 1: Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

The action alternatives contribute to a restorative effect on Objective 1 by reducing and changing the arrangement of fuel loadings across broad areas of the landscape within both watersheds, including areas within and adjacent to RRs. Additionally, treatments would increase stand structural diversity, moving closer towards conditions historically present on the landscape. Treatments would occur within five12th field sub-watersheds. Outside of RRs, treatments would be in stands dominated by ponderosa pine and in mixed conifer stands with components of ponderosa pine, white fir, and lodgepole pine. Treatments within Riparian Reserves would be primarily within mixed conifer and lodgepole pine stands.

The action alternatives would increase fire suppression safety and control and reduce the severity of adverse effects to forest resources including aquatic systems. Treatments would reduce the risk of large acreage wildfires by changing fire behavior in the ponderosa pine dominated stands from a crown fire to a surface fire of lower intensity and severity. In the mixed conifer stands, dense stand structures and continuous ground fuels would be disconnected and fragmented. Treatments would provide benefits to

the area by reducing the potential for wildfire to enter, including the nearby City of Bend municipal watershed. The patch sizes being treated under all action alternatives are similar to historic wildfires that reduced and influenced the arrangement of fuels across the landscape. Alternatives 2 and 3 treat a similar number of total acres (overstory and understory) across the landscape but differ in the acres per activity type. Both Alternative 2 and 3 treat more total acres than Alternative 4, potentially providing more protection to aquatic systems.

The action alternatives would increase the diversity of stand structure present on the landscape. Thinning treatments would generally move stand structures from multi-story structures to the single-story stand structures that were more common with historic disturbance regimes. Similar increases in mixed conifer small single-story stand structures would be realized with all action alternatives.

Treatments proposed in Riparian Reserves are consistent with the Northwest Forest Plan standard and guideline for timber management in these areas (TM-1, pages C-31 and C-32). Alternative 2, 3 and 4 propose identical treatments and treatment acres within Riparian Reserves. With all 3 action alternatives, the predominant form of management includes a combination of thinning live trees to control stocking and acquire desired vegetation characteristics (primarily ponderosa pine stands), overstory removal and seed tree activities in lodgepole stands to promote single-storied stands, thinning of plantations, and understory treatments such as pre-commercial thinning, ladder fuels reduction, mowing and underburning. Treatments are designed primarily to maintain existing structural and compositional diversity while increasing resiliency to disturbance events such as fire. Stocking level control would help maintain or improve the vigor of residual trees, which would be expressed in the rate of height and diameter growth and the retention of live crown.

Project design features, including Best Management Practices, were developed to retain desirable habitat components in the treated stands within RRs, such as no treatment buffers machinery buffers, no new road construction, no log landings, and no steam crossings. Project design criteria and mitigation measures are described previously in this EIS. Historic and current conditions of vegetative and aquatic systems are found in the EIS under the Forest Vegetation and Water Resources/Aquatic Species sections.

ACS Objective 2: Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include flood plains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

The fuels reduction and vegetation treatments proposed under all action alternatives in the West Bend Project are spread across 5 sub-watersheds. The three action alternatives would help maintain lateral, longitudinal and drainage network connections both within each watershed and between the 5 sub-watersheds by protecting floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia by reducing and changing the arrangement of fuel loadings and increasing stand structural diversity across the landscape, including areas within and adjacent to Riparian Reserves. Reducing and altering the arrangement of fuel loadings would reduce the severity of adverse effects to waterbodies and riparian areas during a wildfire. At the landscape scale these alternatives were designed to develop a landscape scale pattern of more complex and diverse stands, with increased tree vigor and growth.

Riparian Reserve treatments would include riparian buffers along all stream courses to maintain a high level of connectivity along stream courses, and would include untreated gaps between units to provide a diversity of habitats for riparian dependent species. Riparian Reserve treatment would maintain floodplains, tributary streams, and other wetlands through riparian buffers and other project design criteria and mitigation measures.

ACS Objective 3: Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

The physical stream and lake attributes are listed under Chapter 3, Water Resources and Aquatic Species. Although stream bank stability has been compromised in upriver areas of the Deschutes River, stability is high within the project area. Within the Tumalo Creek watershed, streambank stability of Tumalo Creek and tributaries was compromised by the Bridge Creek Fire but is now recovering. Stream bank stability is likely within the range of natural variability for both watersheds. Within the North Unit Diversion Dam – Deschutes River watershed, there is only one stream channel (intermittent) within the NWFP boundary. Here, the equipment restriction buffer of 50 feet, restriction of skid trail crossings, and restriction of temporary road building and log landings in Riparian Reserves would maintain and protect riparian vegetation and stream banks in the immediate short and long term. No new roads would be constructed and temporary roads would be rehabilitated. None of the temporary road construction is within Riparian Reserves. Within the Tumalo Creek watershed, the only project activities planned within a Riparian Reserve are along Tumalo Lake Creek. Activities would be small tree thinning and piling by hand to reduce ladder fuels. No-cut buffers and a setback for handpiles have been applied to maintain shade and also streambank stability. By reducing excessive fuel loadings across the landscape including within Riparian Reserves, the action alternatives would reduce the potential damage to the physical integrity of aquatic systems by wildfire. Fires of high intensity and severity are likely under existing conditions, which could damage streambank vegetation and soils within and outside the project area, potentially leading to long-term streambank instability. All 3 action alternatives would meet Objective 3 at both the watershed and local scale in the short and long term.

ACS Objective 4: Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Water quality conditions within the West Bend Project area are described under Water Quality, page 442. No water quality information is available on the intermittent stream channels found within the two watersheds. Water temperature data collected on the South Fork of Tumalo Creek and Tumalo Lake Creek within the Tumalo Creek watershed indicates these streams are likely within the natural range of variability. Effects to water quality were discussed in detail for the action alternatives under Water Quality, page 442. The action alternatives would contribute to maintaining the current water quality conditions addressed in Objective 4 at both the local and watershed scale. Ground disturbance can lead to overland flow of sediments to streams. Ground disturbance from machinery would only occur along one stream that is intermittent with no outlet to perennial water. There would be no immediate short term or long term effects to turbidity or sedimentation as a result of proposed management activities under all action alternatives. None of the temporary road construction involves Riparian Reserves. Water quality would also be maintained by implementing project design features including Best Management Practices (protection of wetland vegetation and streams with no-harvest buffers and no log landings within Riparian Reserves, locating skid trails and log landings on well-drained sites away from wet areas). The action alternatives were developed to minimize the potential for sediment to enter streams as a result of temporary roads, landings, skid trails, burn piles, and logging practices. There are no measurable short or long term effects expected to water quality within any stream within the two watersheds.

ACS Objective 5: Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Erosion potential and the stream flow regimes that sediment regimes are influenced by are described under Water Quantity, page 430 and Water Quality, page 442. Within the North Unit Diversion Dam-

Deschutes River, the sediment regime for the Deschutes River is likely outside of the natural range of variability because of the changed flow regime and associated upriver bank instability. Other streams within the North Unit Diversion Dam-Deschutes River watershed are likely within the natural range of variability due to the relatively undisturbed nature of these small streams. The sediment regime within the Tumalo Creek watershed is likely within the natural range of variability. Overland flow of sediments from the Bridge Creek Fire has diminished over time as vegetation has recovered. In addition, restoration work on Tumalo Creek has increased stream bank stability. The action alternatives maintain Objective 5 at the project scale by minimizing sediment input to streams through project design criteria including Best Management Practices, (see #4 above) relative to harvest and associated activities (see above under Objective 4 and within the EA under Issue Measure #2 for discussion on water quality). The sediment regime would not be further degraded within the North Unit Diversion Dam-Deschutes River watershed and would remain within the natural range of variability for the Tumalo Creek watershed. At the watershed scale changes in the overall sediment rates would not be detectable given the high variability in natural rates of sediment input (both watersheds).

At the project scale, based on observations of past Deschutes National Forest vegetation management projects with similar prescriptions, riparian buffers (no equipment within 100 feet of high water mark of streams on some past projects – Dilman Project, EA 2001, no equipment within 75 feet of riparian vegetation – Snow Project EA, 2007) and soils, there is no evidence that the action alternatives would alter the sediment regime in the immediate short or long term. There is only one stream (intermittent) within the NWFP boundary that would have adjacent ground disturbing activity. With the designation of the heavy equipment buffers, overland flow of sediments to this stream would be eliminated or negligible. Over the long term, the stands receiving thinning are expected to produce more vigorous stand conditions that would promote slope and streambank stability.

ACS Objective 6: Maintain and restore in-stream flows sufficient to create and restore riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration and spatial distribution of peak, high, and low flows must be protected.

Stream flow regimes are described under Water Quantity, page 430. Surface water is limited in the North Unit-Diversion Dam and the eastern half of the Tumalo Creek watershed due to the highly permeable soils. The largest streams systems within the project area are outside of the NWFP boundary. Stream flows for the Deschutes River are outside the natural range of variability due to the altered upriver flow regime. Other streams within this watershed are within the natural range of variability. Within the Tumalo Creek watershed, stream flows within Bridge Creek, Middle Fork of Tumalo Creek, and portions of Tumalo Creek are outside the natural range of variability due to diversions for municipal drinking water and irrigation water. Bridge Creek is the most affected stream. Other streams are within the natural range of variability

The action alternatives would maintain the current instream flow conditions described in Objective 6 at both the project and the watershed scales as described previously in the EA under Water Quantity, page 430. The action alternatives would not affect peak and base flows, or the total water yield in the immediate short or long term. The stream systems receive substantial spring flow due to the hydrogeology of the volcanic-influenced watersheds. Tree removal may result in reduced evapo-transpiration rates, allowing more water in the soils to be available for groundwater-based stream discharge. However, the change in evapo-transpiration would be very limited at the watershed scale. Reduced evapo-transpiration would be a temporary effect (less than 10 years) until crown expansion and ground vegetation response offsets the short-term reduction. Over time, the accelerated growth response of the residual trees as well as the development of understory vegetation will increase evapo-transpiration rates. Flow regimes at the local scale and within both watersheds would remain within the natural range of variability or would not further degrade conditions where stream flows are outside the natural range of variability.

ACS Objective 7: Maintain and restore timing, variability, and duration of flood plain inundation and water table elevation in meadows and wetlands.

Conditions of wetlands are discussed in Wetlands and Floodplains, page 464. Along the Deschutes River within the North Unit Diversion Dam- Deschutes River watershed, floodplain inundation is influenced by the altered flow regime and is outside the range of natural variability. Floodplains are inundated for weeks or months at a time. Outside of the Deschutes River, floodplain inundation and water tables in meadows and wetlands are likely within the range of natural variability. Within the Tumalo Creek watershed, floodplain inundation has been altered in some stream segments somewhat by diversions for irrigation and municipal water (See Objective 6 above), and may be outside the natural range of variability, especially Bridge Creek. Water table elevations in meadows and wetlands are within the natural range of variability. The action alternatives would maintain the current floodplain inundation and water table conditions at both the project and the watershed scales in the immediate short and long term in both watersheds due to the utilization of design of project design features including Best Management Practices near stream courses and wetlands, (including no-harvest buffers, no temporary road construction or log landings in Riparian Reserves, no stream crossings with skid trails). In addition, the highly permeable soils on the landscape minimize effects to changes in floodplain inundation and water table changes from implementing management actions. Changes in floodplain inundation and water table elevations in wetlands are largely determined by changes in stream flows and water yield. The proposed activities within the action alternatives would not affect flow regimes or water yield as described above under Objective 6 above and discussion under the Water Quantity section.

At the project scale, floodplains and wetlands are protected with riparian buffers, exclusion of road construction, exclusion of landings from Riparian Reserves, and other Best Management Practices.

ACS Objective 8: Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability.

Wetland and riparian plant communities along the stream courses are inhabited by a variety of species including several sedge and willow species, bog birch, quaking aspen, horsetail, serviceberry, and Douglas spirea. An overstory of mixed conifer is frequently associated with riparian areas near streams at the higher elevations and ponderosa pine at the lower elevations. The riparian area varies in width adjacent to the Deschutes River and Tumalo Creek, from approximately 10 feet to 200 feet or more. Smaller streams have a narrower riparian vegetation zone, often less than 10 feet. Although there are isolated occurrences of invasive plant species found along stream courses, species composition and structural diversity in riparian areas and wetlands are within the natural range of variability.

The three action alternatives of the West Bend project would meet Objective 8 at the project and watershed scale by maintaining the composition and structural diversity of riparian vegetation within the natural range of variability. The three action alternatives require no- treatment buffers along all riparian corridors and wetlands. The riparian buffers encompass diverse plant communities, protect current shading levels for thermal regulation, protect stream banks from operational disturbances and ensure that soil disturbance does not get routed to streams or wetlands. Designated no-treatment buffers along units in the planning area would also protect channel migration processes. No new roads or skid trails would cross streams.

In addition, thinning treatments to improve vigor and growth of residual trees in Riparian Reserves would improve long-term structural diversity, shading for thermal regulation, and coarse woody debris recruitment. Retention of snags would also provide coarse woody debris recruitment as they eventually

fall over time. By protecting riparian vegetation, nutrient filtering, surface erosion, bank erosion, and channel migration would remain within the natural range of variability.

All action alternatives promote the reduction of fuels across the landscape both outside and within Riparian Reserves. Treating heavy fuels accumulations would reduce the potential for wildfire to severely effect riparian vegetation and soils that could lead to adverse effects to the components of this objective. More information on potential adverse effects to riparian areas from severe wildfire is discussed previously under Water Quality, page 442.

Untreated stand conditions across the landscape and within Riparian Reserves would provide different stocking levels and species composition. These gaps in treatments also allow diversity in snag numbers and coarse woody debris loadings.

ACS Objective 9: Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

The action alternatives would meet Objective 9 at the local and watershed scale for both watersheds by maintaining riparian vegetation and wetlands through no-treatment buffers and prohibition of stream crossings. Ladder fuels reduction would maintain habitat and protect habitat in the case of wildfire by reduce the severity of effects.

Native vegetation, invertebrates, and vertebrate riparian-dependent species habitat would be maintained. Riparian vegetation and associated snags and downed wood would be protected, providing an important habitat component for invertebrates and riparian-dependent wildlife. As the snags fall over time, additional coarse woody debris would be available. Protection of riparian vegetation would maintain the existing microclimates which are especially important for species that are extremely sensitive to changes in temperature and humidity, such as amphibians and certain types of vegetation, as well as for those animals that use the riparian areas as travel corridors (some bird species), or young-rearing habitat (e.g. deer and elk). Gaps in the Riparian Reserve treatments would allow diversity in habitat.

All action alternatives prescribe green tree thinning, both inside and outside Riparian Reserves, while still protecting riparian vegetation. The treatments would reduce fuel loadings and promote vigor and growth in residual live trees, maintaining and helping to protect habitat for wildlife species that utilize riparian forested habitat.

All action alternatives provide increased future ability to suppress wildfire and help prevent the negative effects a high severity fire can have on the riparian habitat (loss of cover, nesting, foraging and calving habitat). Severely burned soils can result in delayed re-growth of some riparian vegetation species.

A specific Riparian Reserve issue for spotted owls is to provide dispersal habitat (ROD B-13). The Riparian Reserves affected by the proposed alternatives are used for spotted owl dispersal within the 10^{th} field watersheds. There are untreated areas both within Riparian Reserves and distributed between the proposed units. Dispersal habitat for northern spotted owls will not be limiting within this watershed.

Aquatic Conservation Strategy Summary

The West Bend Project action alternatives would help maintain and restore riparian vegetation and aquatic conditions within the North Unit Diversion Dam – Deschutes River and Tumalo Creek 10th field watersheds by reducing fuel loadings, prescribing silvicultural treatments including harvest and thinning. The treatments would help prevent negative effects to Aquatic Conservation Strategy objectives in the event of wildfire, and alternatives include project design features, including Best Management Practices, to limit any potential adverse effects to aquatic resources during implementation. Because terrestrial vegetation and aquatic components and processes are tightly inter-connected, meeting the Desired Future Condition for the terrestrial landscape would also contribute to abundant, well dispersed, high quality habitat for riparian-dependent species. Treatments within

Riparian Reserves are identical for all action alternatives. Alternatives 2-4 are consistent with the Aquatic Conservation Strategy Objectives.

Wetlands and Floodplains

Existing Condition

Floodplains and wetlands within the project area are rare in the project area due to the highly permeable soils across the landscape. Approximately 46 acres of wetlands are found within the project area. Most of the floodplains are associated with the Deschutes River and Tumalo Creek. Wetlands are primarily associated with the Tumalo Lake and Tumalo Lake Creek area. Wetland and riparian plant communities along the stream courses are inhabited by a variety of species including several sedge and willow species, bog birch, quaking aspen, horsetail, serviceberry, and Douglas spiraea. With the absence of fire, some wetland habitats have been encroached by conifers. Some floodplain habitat has been impacted by developed recreation sites, including two boat launch sites along the Deschutes River, and by the road network and stream crossings.

Floodplains: 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."

Wetlands: 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."

Alternative 1 (No Action)

Direct and Indirect Effects: There would be no direct effects to wetlands and floodplains. Stand replacing wildfire potential in floodplains and wetlands would increase and could result in short term effects to vegetation. Wildfires routinely enter wetlands and floodplains.

Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

Direct and Indirect Effects: There would be no direct or indirect effects. There would be no machinery operated in wetlands and floodplains. There would be no destruction, modification, or occupancy of wetlands and floodplains.

Cumulative Effects

There would be no cumulative effects to wetlands and floodplains as there were no direct or indirect effects.

Deschutes National Forest Land and Resource Management Plan Consistency

Alternatives 2-4 are consistent with Standards and Guides of the LRMP:

- RP 1-4 as riparian areas would be maintained, protected, and enhanced in the long term.
- RP 6,7 as no adverse effects to water temperature would occur and actions proposed would provide long term benefits to shade and thus water temperatures. Best Management Practices are being utilized.

- RP 8 as cumulative effects to water quantity, water quality, stream channel conditions, and fish habitat were evaluated. Measures to avoid adverse effects to these resources are included in the design.
- RP 10 as woody debris and riparian vegetation would be managed to maintain stream channel and bank structure and provide structural habitat for resident fish.
- RP 11-16 as there would be no scheduled timber harvest in riparian zones, within approximately 100 feet of streams, ground cover disturbance is minimized, channel conditions and water quality would be protected through project design criteria and mitigation measures, and future large woody debris inputs to streams, shade, and streambanks would be maintained. Scheduled timber harvest is described as what meets the criteria of allowable sale quantity (ASQ). ASQ was calculated for the Forest Plan over the entire forest but only certain management areas were considered for scheduled harvest. These calculations did not include timber within riparian zones or 100 feet of streams.
- RP-33-35 as only hand piling of burn piles of small size would occur near riparian areas, prescribed burning will be of low intensity, and adequate numbers of residual live trees larger than 5 inches would be left intact to provide for streambank stability, shading, and fish and wildlife habitat. No-cut stream buffers were included in the design. No machine firelines would be constructed in RHCAs or RRs.
- RP-47 as natural floodplain characteristics would be maintained.
- FI-5 as site-specific prescriptions are proposed within RHCAs and RRs that enhance the recruitment of large woody debris to streams and protects and improves shade to enhance water temperatures.
- WT-1,2 as Water Quality Best Management Practices would be implemented and monitored.

3.17 Economic Analysis

3.17.1 Introduction

Three aspects of economic and social impacts are analyzed: 1) financial feasibility of a potential timber sale, 2) cost efficiency of a timber sale and all other project activities, and 3) impacts to local employment. Financial feasibility is dependent on costs and revenues associated with a particular timber sale. Cost efficiency includes the costs and revenue associated with a timber sale, planning costs and related projects. Impacts to the local economy are a reflection of District and Forest harvest levels and associated employment. Timber sales, fuel treatments, and associated resource work can generate employment and stimulate the local economy.

3.17.2 Management Direction

Forest Service Handbooks 1909.17, 2409.18, and Forest Service Manual 2400-Timber Management, Chapter 2430 direct the evaluation of Economic Feasibility for timber sales and related costs and Cost Efficiency for proposed projects and all related costs.

3.17.3 Analysis Methods

The economic analysis compares present net revenues and present net costs. Present net value and present net cost were calculated using TEA.ECON (USDA Forest Service, 2009) which is an economic analysis tool. The program uses the most recent product log values and appraisal costs to evaluate timber sale and project economics. A 4% discount rate is used to value all costs and benefits to present value. The analysis can be used to compare alternatives, but not to give any absolute numbers for the outputs.

Revenue

Revenue is based on harvest volume and value. The harvest volumes and species mix are estimates from the silvicultural prescriptions. Volumes were estimated using stand exams and past volume yields from similar treatments in the project area. The stand exams were from the project area and modeled using the Forest Vegetation Simulator (FVS). Timber values from TEA.ECON from February 2011 were calculated using the current Product Quality Adjustment (PQA) for delivered logs, in eastern Oregon saw mills.

This analysis does not place a monetary value (revenue) on benefits which may occur from actions other than the timber sale. These benefits include but are not limited to increased future yields resulting from reduced stocking and reduced risk of a stand replacing wildfire. Benefits associated with other actions are described elsewhere in the FEIS.

Costs

The Forest Service Manual (2002) directs the timber sale financial feasibility to be conducted including costs only associated with the timber sale. Timber sale costs are a subset of the project cost efficiency costs. Timber sale costs include: stump to truck, haul costs, essential KV (Knutsen-Vandenberg Act 1930), road maintenance and brush disposal. Stump to truck logging costs were estimated by the Deschutes/Ochoco Timber Sale Zone Appraiser at $89.14 /ccf for ground based logging. Brush disposal and haul costs, were pulled from the most current Transaction Evidence Appraisal Cost File (Version 811 TEA 02-08 R6 TEA dated February 2011). Brush disposal costs were set at $6.64/ccf and haul costs were set at $25.50/ccf (Vickie Dunaway Zone Appraiser). Road maintenance and reconstruction costs were based on the logging systems analysis for the sale. Road maintenance costs were set at $2.51/ccf, and road reconstruction costs were set at $3.07/ccf. Reforestation costs were identified for each harvest type and averaged for all the volume from that harvest type.

The project cost efficiency includes all costs for the project. These costs include; timber sale financial feasibility, Forest Service planning (NEPA planning, Sale Preparation and Administrative costs), and related projects costs. The related projects are not part of the logging are therefore considered non-timber costs. Non-timber costs include:

- Natural Fuel Treatments which will reduce the fuels loadings
- Mechanical Shrub Treatment (MST) with mowing type machinery.
- Ladder Fuels Reduction (LFR)
- Underburning
- Subsoiling of landings, temporary roads, and main skid trails
- Treatment of weed populations
- Skid and Deck treatments not included in the timber sale accounting which include the precommercial part of the activity.
- Precommercial thinning of plantations and understory trees in harvest units.
- Slash treatment including pile burning, grapple and hand piling.

Table 209: Related Project Treatment Costs and Production Rates.

Activity	Cost Per Acre	Unit of Measurement	Typical Production Rate Ranges
Natural Fuels Treatments			
Mechanical Shrub Treatment (MST)	$65.^{00}$	Per acre	10-15 acre/person/day
Ladder Fuels Reduction (LFR)	$125.^{00}$	Per acre	2-3 acre/person/day
Underburning	$200.^{00}$	Per acre	20-30 acre/person/day
Subsoiling (actual acres)	$300.^{00}$	Per acre	8 acre/person/day
Precommercial thinning	$60.^{00}$	Per acre	2-3 acre/person/day
Precommercial thin mechanical			
Skid & Deck (excludes TS portion)	$622.^{00}$	Per acre	1-2 acre/person/day
Slash Treatment			
Hand piling	$379.^{00}$	Per acre	½-1 acre/person/day
Grapple piling	$200.^{00}$	Per acre	3-7 acre/person/day
Lop & Scatter	$90.^{00}$	Per acre	3-7 acre/person/day
Reforestation			
Reforestation surveys	$2.^{50}$	Each	150-200 acre/person/day
Whip Falling	$60.^{00}$	Per acre	3-4 acre/person/day
Reforestation Planting with site prep	$362.^{50}$	Per acre	5-7 acre/person/day
Weed Spraying	$125.^{00}$	Per acre	

Table 210: All Alternatives - Summary of Understory Activities and costs

	Alternative					
Activity Description	**2 Acres**	**2 Costs**	**3 Acres**	**3 Costs**	**4 Acres**	**4 Costs**
Ladder fuels reduction	1,514	$189,250	1,514	$189,250	1,514	$189,250
Precommercial thinning	6,466	$387,960	6,327	$379,620	5,216	$312,960
Precommercial thinning mechanically	235	$14,100	235	$14,100	235	$14,100
Non-commercial thinning with utilization	2,302	$1,431,844	2,302	$1,431,844	1,806	$1,123,332
Whip-falling	1,167	$70,020	1,167	$70,020	1,167	$70,020
Reforestation Surveys	1,494	$7,470	1,606	$8,030	1,606	$8,030
Reforestation planting	165	$59,812	265	$96,062	265	$96,062

Table 211: All Alternatives - Summary of Fuels Activities and costs

	Alternative					
Activity Description[1]	**2 Acres**	**2 Costs**	**3 Acres**	**3 Costs**	**4 Acres**	**4 Costs**
Piling of slash (thinning/harvest residue)	7,719	$1,543,800	7,587	$1,517,400	7,793	$1,558,600
Mechanical shrub treatment (MST)	18,790	$1,221,350	18,779	$1,220,635	18,550	$1,205,750
Prescribed underburning	17,402	$3,480,400	17,391	$3,478,200	17,162	$3,432,400
Cutting and scattering of slash	1,085	$97,650	1,085	$97,650	1,079	$97,110

1 More than one fuels activity may occur in an individual unit.

Table 212: All Alternatives - Summary of Other Activities and costs

	Alternative					
Activity Description	**2 Acres**	**2 Costs**	**3 Acres**	**3 Costs**	**4 Acres**	**4 Costs**
Spraying of Weeds	8.13	$1,016	8.13	$1,016	7.5	$937
Subsoil landings, temp roads	90	$27,000	90	$27,000	74	$22,200

Discounted Revenue and Costs

The benefits and costs specific to each analysis (timber sale financial feasibility and project cost efficiency) were entered into TEA.ECON which computed discounted benefits, discounted costs, and present net value for each alternative.

Local Employment

This analysis utilizes numerical values from the Deschutes National Forest Land and Resource Management Plan, which assumed 8.6 jobs created or maintained for each million board feet of ponderosa pine harvested and 2.5 jobs per million board feet for all other species (USDA Forest Service, 1990). The volume for lodgepole pine sawlog and fiber of all species was combined for the calculations, but the volume for ponderosa pine was not combined with any other. The estimated volume for each alternative was used to estimate how many timber industry jobs each of the alternatives could provide or maintain.

The projects associated with the West Bend project each will create short term jobs. These are captured with estimates of production rates of work and the acres of projects planned. The production estimates were supplied by Jim Summers and John Erwert on the Bend/Fort Rock Ranger District.

3.17.4 Timber Sale Financial Feasibility and Project Cost Efficiency

It is important to note that the economic analysis presented here is a best estimate of costs. Actual appraised value may change over time and depend on how one or more sales are packaged out of this project. It may be possible to produce one or more viable sales out of a project that appears as a whole, to be non-viable. Market conditions may fluctuate throughout the year, and depending on the season a sale is offered for auction, the current estimates may or may not be accurate. This could have an impact on the final sale values. Rising energy and fuel costs could create a substantial increase in sale operation and manufacturing costs.

Timber Sale Feasibility

Financial feasibility utilizes only a subset of the project discounted costs, as described under costs. Financial feasibility only includes revenue from timber products, which is the only revenue for this project. When the predicted high bid is greater than the minimum bid price the timber sale is considered feasible.

Project Cost Efficiency

Cost efficiency is the project as a whole and includes revenue from timber products and all project costs. Timber products are the only revenue for this project. All associated project costs include; timber sale financial feasibility, Forest Service planning (NEPA planning, Sale Preparation and Administrative costs), and planned projects costs.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: This alternative would not harvest any timber and therefore would not support employment, contributions to local economies or any other benefits from related projects. Current downward trends in timber harvesting from National Forests lands would continue into the future. Employment rates in the wood products sector of the local economy would remain unchanged.

Alternative 2

Direct and Indirect Effects: The timber sales and project costs for all alternatives are less than 10% difference. There are sensitivities in the analysis tied to the amount of volume which would be classified as saw timber or non-sawtimber. Changes of less than 10% in this ratio can determine a sale being able to return as much as the forest service costs are. In alternative 2 the timber sale is financially feasible with a positive net present value of $955,376. This value is approximately 3 percent ($29,461) greater than Alternative 3. Figure 82 compares the timber sales from each alternative.

The project costs associated with Alternative 2 are the highest of all the alternatives. When the entire project is considered, Alternative 2 is more costly due to the total level of treatments. The project net present value is negative, creating a deficit that is approximately 4 percent higher of discounted cost than Alternative 3 and 5 percent more than Alternative 4.

Figure 82: Alternative Timber Sale Feasibility Comparison

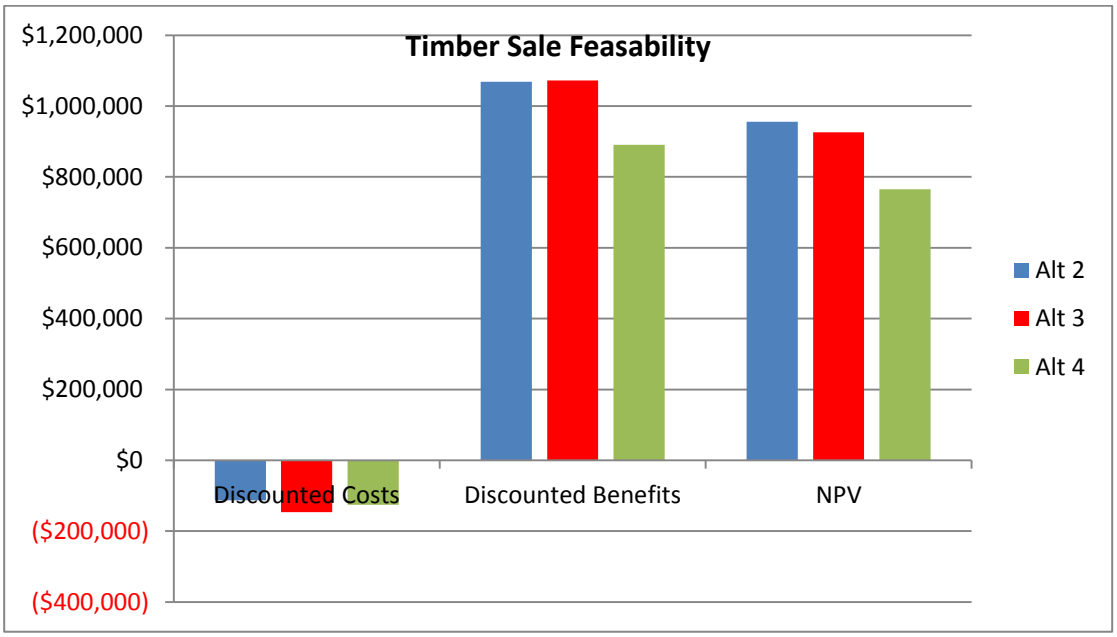


Table 213: Alternative 2 Economic Measures.

Project Type	Discounted Cost	Discounted Revenue	Net Present Value
Timber Sale Financial Feasibility	$112,831	$1,068,207	$955,376
Project Cost Efficiency (including Timber Sale)	$7,489,099	$1,068,207	$(-6,420,892)

Alternative 3

Direct and Indirect Effects: Similar to Alternative 2, the timber sale for Alternative 3 is financially feasible, with a positive net present value of $925,915. The net present value of the timber sale for Alternative 2 is higher, but at the project level Alternative 3 is less cost to the government. The cost efficiency project discounted cost is approximately 4 percent lower than Alternative 2. This cost reduction is mostly due to decreased acres of precommercial thinning and fuels piling. There is an increase in reforestation costs and an increase in some of the volume.

Table 214: Alternative 3 Economic Measures.

Project Type	Discounted Cost	Discounted Revenue	Net Present Value
Timber Sale Financial Feasibility	$146,715	$1,072,630	$925,915
Project Cost Efficiency (including Timber Sale)	$7,241,639	$1,072,630	$(-6,169,009)

Alternative 4

Direct and Indirect Effects: Similar to Alternative 2, the timber sale for Alternative 4 is financially feasible, with a positive net present value of $765,272. The net present value of the timber sale for Alternative 2 is higher, but at the project level Alternative 4 is less cost to the government. The cost efficiency project discounted cost is approximately 7 percent lower than Alternative 2. This cost

reduction is mostly due to decreased acres of precommercial thinning and fuels piling though there is also an increase in regeneration treatments.

Table 215: Alternative 4 Economic Measures

Project Type	Discounted Cost	Discounted Revenue	Net Present Value
Timber Sale Financial Feasibility	$125,455	$890,727	$765,272
Project Cost Efficiency (including Timber Sale)	$7,021,121	$890,727	$(-6,130,393)

Cumulative Effects

Other employment would continue to occur as a result of other timber sales in progress, recreation activities, and other special uses across the Forest. Commercial collection of non-timber forest products could continue to occur, although the quantity of harvest is unknown. Overall, none of the alternatives would result in economic-related cumulative effects.

3.17.5 Employment

Over the last 10 years, an annual average of approximately 68.2 million board feet of timber has been sold from the Deschutes National Forest (DNF). In the near future, the amount of timber offered for sale is expected to be close to this annual average. 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.

The Bend/Fort Rock Ranger District (BFR) provides timber and non-timber forest products to the local community and state. The Forest products include timber, firewood, vegetative material and more. The West Bend project plans to provide timber and possibly biomass. The timber offered from this project would be included in the Deschutes National Forest offer. Biomass produced from the tops and less than merchantable material could be removed by purchasers if a market exists. Biomass was not included as a commodity since it is considered slash and not a saleable product.

Although the past decade has seen 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. Wood products manufacturing is still the single largest industrial employer in Jefferson County and the second largest industry in Crook County. In Deschutes County, according to the 2005 Oregon Employment Department, 1,798 people were employed in the wood products manufacturing.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects: Alternative 1 would not contribute to the Deschutes National Forest timber sold. No maintenance or increase in employment is imputed with this alternative on the Bend/ Fort Rock district.

Alternative 2

Direct and Indirect Effects: Alternative 2 would produce approximately 31.4 million board feet of timber. This is estimated to be 18.1 million board feet of ponderosa pine sawlog, 2.9 million board feet lodgepole pine sawlog and 10.2 million board feet of fiber. Using the DNF LRMP method, Alternative 2 creates or maintains the largest amount of jobs, estimated to be 188 timber industry jobs.

Activities, other than the timber sales, would produce the equivalent of between 28 and 48 annual jobs. The amount of work is the same as Alternative 3 and about 9 percent more than Alternative 4. This

employment could be seasonal and spread out over seven years. This employment could be implemented through stewardship or service contracts or forest service employees.

Alternative 3

Direct and Indirect Effects: Alternative 3 would produce the greatest amount of volume, approximately 31.8 million board feet of timber, which is approximately 2 percent more volume than Alternative 2. With the slight increase in timber volume, Alternative 3 produces approximately 2 more jobs than Alternative 2.

The volume is estimated to be 18.2 million board feet of ponderosa pine sawlog, 3.1 million board feet lodgepole pine sawlog and 10.5 million board feet of fiber. Using the Deschutes National Forest LRMP method, Alternative 3 estimated to maintain or create 190 timber industry jobs.

The activities other than the timber sales associated with the West Bend project would produce the equivalent of between 28 and 48 annual jobs. This employment could be seasonal and spread out over seven years. This employment could be implemented through stewardship or service contracts or forest service employees.

Alternative 4

Direct and Indirect Effects: Alternative 4 would produce 26.5 million board feet of timber, which is approximately 15 percent less volume than Alternative 2. With the decrease in timber volume, Alternative 4 supplies approximately 35 fewer jobs or 19 percent less employment than alternatives 2 and 3.

The volume is estimated to be 14.7 million board feet of ponderosa pine sawlog, 3 million board feet lodgepole pine sawlog and 8.8 million board feet of fiber. Using the Deschutes National Forest LRMP method, Alternative 4 estimated to maintain or create 155 timber industry jobs.

The activities other than the timber sales associated with the West Bend project in Alternative 4 would produce the equivalent of between 26 and 44 annual jobs. This is a couple of jobs less than Alternatives 2 and 3 or a little less than a 10 percent reduction. This employment could be seasonal and spread out over seven years. This employment could be implemented through stewardship or service contracts or forest service employees.

Table 216: Estimated Volume by Alternative

Volume				
Volume Measure	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Ponderosa Pine Sawlog				
CCF	0	35,550.0	35,709.0	28,761.0
MBF	0	18,300.0	18,200.0	14,668.0
MMBF*	0	18.3	18.2	14.7
Lodgepole Pine Sawlog				
CCF	0	5,637.0	6,030.0	5,808.0
MBF	0	2,874.0	3,075.0	2,962.0
MMBF	0	2.8	3.1	3.0
Fiber				
CCF	0	20,034.0	20,545.0	17,261.0
MBF	0	10,220.0	10,477.0	8,803.0
MMBF	0	10.2	10.4	8.8
Total Volume				
Total MMBF	**0**	**31.4**	**31.8**	**26.5**

Table 217: Estimated Employment

Estimated Jobs Created				
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**
Forest Plan*	0	188	190	155

*Calculated using figures for the Deschutes National Forest Plan from Appendix B. Excluding firewood from the volume harvested on the Deschutes National Forest, an estimated 8.6 jobs per million board feet ponderosa pine and 2.5 jobs per million board feet for all other species were maintained or created.

3.18 Analysis of Forest Plan Amendments

3.18.1 Scenic Views Forest Plan Amendments

The description of the alternatives in Chapter 2 includes two Forest Plan Amendments being proposed in order to implement Alternatives 2 and 3. These amendments deal with standards and guidelines in the Scenic Views management area that restrict the use of prescribed fire. The use of fire in the ponderosa pine forest type is key to restoring the area to historic conditions, including the promotion of late and old structure.

Goals of Scenic Views MA: To provide Forest visitors with high quality scenery that represents the natural character of Central Oregon.

General Theme and Objectives of Scenic Views: Landscapes seen from selected travel routes and use areas will be managed to maintain or enhance their appearance. To the casual observer, results of activities either will not be evident or will be visually subordinate to the natural landscape.

Landscapes will be enhanced by opening views to distant peaks, unique rock forms, unusual vegetation, or other features of interest. Timber harvest is permitted, but only to protect and improve the visual quality of the stands both now and in the future. Timber stands, which have remained unmanaged in the past because of their visual sensitivity, will begin receiving treatment to avoid loss of the stand to natural causes. Landscapes containing negative visual elements, such as skid roads, activity residue, or cable corridors, will be rehabilitated.

The desired condition for ponderosa pine is to achieve and maintain visual diversity through variations of stand densities and size classes. Large, old-growth pine will remain an important constituent, with trees achieving 30 inches in diameter or larger and having deeply furrowed, yellowbark characteristics.

For other species, the desired condition requires obtaining visual variety through either spatial distribution of age classes and species mixes, through density manipulation, or through a mixture of age classes within a stand.

Standard & Guidelines and Reasons for Amending

M9-27 (LRMP 4-125) states: *In Retention Foregrounds, slash from a thinning or tree removal activity, or other visible results of management activities, will not be visible to the casual forest visitor for one year after the work has been completed. In Partial Retention foregrounds, logging residue or other results of management activities will not be obvious to the casual forest visitor two years following the activity.*

Although activity fuels would be treated as soon as possible, especially along travel corridors, the use of prescribed fire will create visible impacts (e.g. blackened, scorched vegetation and tree trunks) for approximately 5 years, which exceeds the amount of time management actions can be visible within retention and partial retention allocations. The District recommends amending this standard to allow visible effects of harvest cleanup and fuels reduction for approximately 5 years.

M9-90 (LRMP page 4-131) states: *Low intensity prescribed fires will be used to meet and promote the Desired Visual Condition within each stand type. Prescribed fire and other fuel management techniques will be used to minimize the hazard of a large high intensity fire. In foreground areas, prescribed fires will be small, normally less than 5 acres, and shaped to appear as natural occurrences. If burning conditions cannot be met such that scorching cannot be limited to the lower 1/3 of the forest canopy, then other fuel management techniques should be considered.*

Limiting acreage for the use of prescribed fire to 5 acres or less in foreground areas of Scenic Views would not meet the goal of reducing wildfire risk, providing safety corridors for the public, or creating a defensible fuel break for an advancing fire. It is necessary to amend the 5 acre limitation for fuels

treatments to meet stand and fire management objectives. These areas would remain at substantial risk to mortality from wildfire without a more comprehensive and intensive system of treatments, including prescribed fire.

The maximum acres proposed for treatment within foreground areas of Scenic Views MA is 1,937. To maintain scorching below 30% of the crown, treatments would be based on the following:

- If stand density is too dense to burn without substantial mortality, thinning with follow-up slash pile and burning.
- If shrubs are present and stand density is low, mowing would be followed with prescribed burning. Some mortality could occur.
- If stand density is low and no shrubs are present, the area would be assessed to determine if treatment is needed.
- To achieve under burning objectives, follow-up fuels treatments may be necessary.

Ecologically, the reintroduction of fire is consistent with the restoration concept of more frequent low intensity fire on the landscape. Historically, fire played the bigger role in influencing forest succession. Interfering with one disturbance agent (fire) has increased the influence of other disturbance agents (insect and disease) (Gara 2000). These agents now exhibit their influence over entire landscapes in episodes lasting decades, which is a result of replacing open stands of shade intolerant tree species with dense, closed stands of shade-tolerant species (Agee 1993).

Effects Common to Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

Direct and Indirect Effects: The objectives for providing high quality scenery (including open, park-like stands of ponderosa pine and enhancement of existing large pine trees) will be met in the long-term (longer than 5 years). Overall, reducing the fuels within foreground scenic views will help to feature the large ponderosa pine with old-growth characteristics. This will be consistent with the Goal, General Theme and Objectives, and the Standards and Guidelines of Scenic Views for Ponderosa Pine – Foregrounds (LRMP, pages 4 – 121-123). Scorching will, likely, remain below 30% crown scorch, meeting Standard and Guide M9-90, although some mortality could occur to smaller trees. Larger trees that might experience mortality from burning would remain to provide snag habitat. Prescribed burning would occur during periods of cooler burning periods to keep burn intensity and scorch heights down.

A proposed amendment to the Forest Plan is needed to amend M9-90 to allow prescribed fire to occur throughout Foreground viewing areas (0-300 feet) within the Scenic Views Foreground Management Areas, not limiting treatment to 5 acres of less and to allow clean-up of visual evidence of management activities to occur within 2 years instead of 1 year. The following treatment units are included in Scenic Views – Foreground Management Areas; Units 20-23, 26 36-39, 44-47, 51, 52, 54-57, 59, 61-66, 70-76, 86-88, 99, 101, 102, 136, 138-140, 142, 143, 148, 154, 156, 192-197, 200-202, 390, 402-407, 415, 416, 418-426, 428-432, 442, 444-452, 456, 499, 500, 502.

About 631 acres of stands along the Cascade Lakes Scenic Byway will be thinned to remove shade and allow sunlight to reach the highway and melt snow and ice. These would not negatively impact scenery because the whole stand will be thinned to levels similar to the surrounding stands of ponderosa pine and would showcase healthier ponderosa pine. This would help meet the standards and guidelines for Scenic Views Management Areas for the desired future condition of opening views and providing an environment that encourages large ponderosa pine visible from scenic travel corridors or through areas accessed by recreation trails.

Within the Scenic segment of the Wild and Scenic Deschutes River, the overstory thinning and pile/mow/burn treatments will meet standards and guidelines for Scenic Views – Foreground Management Areas classified as High Scenic Integrity (Retention-VMS) (units #91, #95, #401, #408, #409, #410, #411).

The desired visual condition in these foreground areas will maintain a visual mosaic of numerous, large diameter, yellow-barked trees with stands of younger trees, providing visual diversity and sense of depth, consistent with Standard and Guide M9-4.

This amendment will also be consistent with the Eastside Screens. This amendment will reduce ground and ladder fuels within the foreground scenic view to reduce the risk from wildfire to large (21 inches and greater dbh) ponderosa pine and those ponderosa pine less than 21 inches dbh with old growth characteristics. This will reduce the tendency for fires to burn through the crowns of trees that remain after treatment.

In accordance with FSM 1926.51, the following items describe non-significant amendments with a discussion of how the actions address these items:

1. *Actions that do not significantly alter the multiple-use goals and objectives for long-term land and resource management;*

   By reintroducing fire to this frequent fire regime, the consequence of the reduction of highly flammable shrubs and ladder fuels within Scenic Views will provide long-term protection and resiliency to ponderosa pine that are large and have old growth characteristics. This also will allow larger black bark to eventually grow and replace the existing old growth ponderosa pine. Providing and maintaining the natural character of Central Oregon is a central premise of and is consistent with the goals and objectives of Scenic Views.

2. *Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management;*

   Adjusting the Standard and Guideline M9-90 will allow for long-term land and resource management by reducing the risk of high intensity, stand replacement wildfire that would likely cause widespread tree mortality, including large, old growth ponderosa pine. Maintaining these large, old-growth ponderosa pine is essential to being consistent with the goals and objectives of Scenic Views.

3. *Minor changes in standards and guidelines; and/or*

   This is a minor change in two Standard and Guidelines. This change will contribute to the long-term protection, enhancement, and meeting the goals and objectives of Scenic Views.

4. *Opportunities for additional projects or activities that will contribute to achievement of the management prescriptions.*

   By reintroducing fire at this time, fire can be used periodically to maintain the Scenic View management area as needed.

3.18.2 Deer Habitat (MA-7) Thermal Cover Amendment

The current LRMP general themes and objectives for maintaining thermal cover restrict the activities that can be implemented within Deer Habitat (winter range). It is expected that activities proposed under this project may not meet these general themes and objectives; therefore, one site-specific, short-term amendment is proposed. Refer to Chapter 3, Wildlife, Big Game, Mule Deer Thermal Cover - Forest Plan Amendment, for an analysis of effects of the changes.

Goals: To manage vegetation to provide optimum habitat conditions on deer winter and transition ranges while providing some domestic livestock forage, wood products, visual quality and recreation opportunities.

General Theme and Objectives of Deer Habitat: Vegetation will be managed to provide optimum habitat considering the inherent productivity of the land. Herbaceous vegetation will be managed to provide a vigorous forage base with a variety of forage species available. Forage conditions may be improved where conditions are poor. Foraging areas will be created where forage is lacking, maintained when in proper balance, or reduced when overabundant and more foraging areas are needed.

Long-term tree or shrub cover to moderate cold weather conditions is equally important. Ideally, cover and forage areas should be in close proximity for optimum use by big game, with cover making up 40 percent of the land area. Approximately three-quarters of cover areas should be thermal cover with the remainder being in hiding areas. Some stand conditions may satisfy both kinds of cover.

Standards and Guidelines and Reasons for Amending

The General Theme and Objectives for thermal cover (LRMP page 4-113) state *"...with cover making up to 40 percent of the land area. Approximately three-quarters of cover areas should be thermal cover..."*

The West Bend project area landscape has several plant associations that vary on an east to west gradient. The Deer Habitat MA is located in the eastern one-third of the project area. Thermal cover has been assessed for the analysis area and the value of the habitat is marginalized because of high levels of recreation use. A strategy has been developed that will maintain important deer migration corridors where deer use the area to move south to north into the northern Tumalo Winter Range.

The objective for the management area is to provide approximately 30% of the area as thermal cover. The project area currently provides about 31% thermal cover. Any thinning within thermal cover areas will take the ratio below the "ideal" of approximately 30%. The alternatives would reduce it to about 11%. Alternative 4 responds to public comment by dropping thinning treatments on about 700 acres but the amendment is still necessary for that alternative due to 419 acres of small group opening units. See Figure 14 for units impacting MA-7.

Relatively low site productivity for tree-growth, coupled with recent cycles of drought, increase the risk of insect-pest epidemics killing or severely damaging tree-stands valuable for cover. Tree canopy-cover conditions for optimum thermal protection may need to be compromised somewhat in order to moderate the risk of future extensive pine beetle damage. Canopy cover should be managed at the highest percentage that will maintain healthy stand conditions with a low risk of extensive damage due to insects or disease. As a minimum, canopy cover must be 40%, but a greater canopy cover percentage is preferred.

Effects Common to all Action Alternative

Effects of the overall project to mule deer is disclosed in the EIS in section 3.6. Working with the Oregon Department of Fish and Wildlife, the ID Team identified an appropriate thinning strategy and group opening creation to develop high quality hiding cover. The development of high quality hiding cover is lacking in the winter range and it is necessary to develop because of the relative high levels of human disturbance. Alternative 4 thins 700 fewer acres than Alternatives 2 and 3, retaining 700 acres of thermal cover, but also provides for the small group opening treatments that will promote quality forage and cover.

In accordance with FSM 1926.51, the following items describe non-significant amendments with a discussion of how the actions address these items:

1. *Actions that do not significantly alter the multiple-use goals and objectives for long-term land and resource management;*

   Multiple-use goals and objectives for long-term land and resource management are not altered with this amendment. This project took a landscape approach to managing deer habitat by identifying the appropriate locations and relative importance of thermal and hiding cover.

2. *Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management;*

   As stated above, the multiple-use goals and objectives are not significantly changed with the amendment, which is a minor adjustment to a management prescription. The resulting modification of 1,124 acres of thermal cover stands leaves MA-7 at 11% thermal cover. The entire MA-7 has 24,705 acres of thermal cover present.

3. *Minor changes in standards and guidelines; and/or*

   The Forest Plan provides a general objective of 30% thermal cover, not a standard and guideline.

4. *Opportunities for additional projects or activities that will contribute to achievement of the management prescriptions.*

   The amendment will provide opportunities to address the specific needs of big game in and around the West Bend landscape. Limiting factors for mule deer are quality forage and cover; therefore, the amendment will improve the Forest's ability to meet the objectives of MA-7.

3.18.3 Eastside Screens Harvest within LOS Amendment

Late and old structure (LOS) is an important vegetative condition specifically identified in the Regional Forester's Forest Plan Amendment #2 (Eastside Screens, June 1995). The amendment defines LOS as those vegetative structures in which large trees are a common feature.[13] It goes on to identify two different structural conditions: multi-strata and single-strata. Lidar imagery is used as the landscape analysis tool to estimate the existing amount of LOS, which is displayed as Structures 4 and 5 for each type of biophysical environment in tables 32, 33, and 34 (Forested Vegetation section 3.3).

Reasons for Amending

Eastside Screens standards and guidelines Appendix B 6 (d) Scenario A states *"If either one or both late and old structural stages falls BELOW HRV in a particular biophysical environment within a watershed, then there should be NO NET LOSS from that biophysical environment. Do not allow timber harvest activities to occur within LOS stages that are BELOW HRV."*

In 2003, following nine years of review of Screens implementation the Regional Forester encouraged Forests to consider site-specific Forest plan amendments to the Screens direction when doing so would better meet LOS objectives by moving the landscape towards HRV, and providing LOS for the habitat needs of associated wildlife (Goodman 2003). In the West Bend project area, an amendment to the Scenario A direction is included to better meet LOS objectives by protecting and promoting large tree structure.

In the ponderosa pine-dominated biophysical environments, Structure stage 5 falls below the HRV (shown as "underrepresented" in Table 32 and Table 33 Chapter 3.3). Therefore, under Scenario A, a site-specific amendment would be required to conduct harvest activities within structure stage 5. All action alternatives propose thinning within ponderosa pine and mixed conifer dry structure stage 5 stands. Thinning within stands of ponderosa pine LOS stage 4 is consistent with the Screens and does not require an amendment.

Treatments are proposed in areas where the development of large trees is currently impeded, or existing large trees are at risk from fire or insects and disease. The objective of these treatments would be to

[13] The Forest defines "common" as > 13 trees per acre and a minimum patch size of 40 acres. See Chapter 3.3 for more details on the methods of classifying structural stages.

improve conditions for the development and/or maintenance of large trees, thus retaining or enhancing LOS acreage in the long-term. Alternatives 2, 3, and 4 would need to employ a commercial timber sale or some other mechanism where commercial size trees are removed in order to accomplish objectives. All treated areas would remain in an LOS condition because all trees > 21" dbh would be retained. There would be no net loss of LOS, but what is currently multi-stratum could become single-stratum.

As shown in Table 218, a reduction in ponderosa stage 4 (closed canopy) creates a corresponding increase in stage 5 (open canopy). The amendment applies to acres of stage 5 that will be thinned in ponderosa pine (125) and mixed conifer dry (595) because stage 5 is below HRV. A map is included in Chapter 3.3.

Table 218: Large tree structural stages in the ponderosa pine biophysical environment

Structure Stage	Existing Acres LOS	Acres Treated All Alternatives	Acres LOS following treatment
Late Succession Open Canopy	2,111 (below HRV)	683	4,553
Late Succession Closed Canopy	6,121 (above HRV)	2,350	2,679
Total	8,232	3,033	8,232

Effects Common to Alternatives 2, 3, and 4

The effects to structure stage classes is discusses in Chapter 3.3 Forested Vegetation. In summary, because late succession/closed canopy stands are thinned, the resulting amount of late succession open canopy increases. There is no net loss of LOS and stands with large trees have a reduced risk of mortality and therefore the large trees are maintained for a longer period of time.

In accordance with FSM 1926.51, the same four items used to describe non-significant amendments on the previous pages also applies to this amendment.

This amendment is a minor change in one standard and guide. The stands proposed for thinning are primarily black-bark ponderosa pine, meaning they are 60 to 80 years old. The stands have reached a density where they are at risk to beetle mortality and need to be thinned. There is little difference between the younger stands that have more than 13 trees > 21" dbh and the rest of the black bark ponderosa pine stands. The proposed thinning would not remove trees greater than 21" dbh and stands would still be considered LOS after treatment. Thinning follows the Eastside Screens standard to encourage the development and maintenance of large diameter, disease-free, open-canopy structure so will contribute to the achievement of management prescriptions in the long term.

3.19 Other Disclosures

3.19.1 Civil Rights and Environmental Justice

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, elderly and low-income groups. 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 project area 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 most likely reside in the rural communities adjacent to National Forest Lands, such as La Pine, Crescent, and Gilchrist, Oregon.

The no action alternative would continue the local economic situation as described in the section titled Economics. Opportunities for employment of minority and low income workers may arise through contract activities for various forest work, such as thinning, hand piling, and various small business contracts related to work outside the project area, but there are no known disproportionately high effects to any ethnic minorities, people with disabilities, and low-income groups.

Under both action alternatives there would be no known adverse effects that would be disproportionately high to any ethnic minorities, people with disabilities, and low-income groups as a result of implementation of either action alternative in the West Bend project. Within the social context presented, the action alternatives developed for this project have the potential to bring in workers from the outside to perform logging and post-harvest activities such as small tree thinning and hand piling. While the outside workforce is more likely to be racially diverse than the local resident population, the residents have worked effectively with and supported anticipated fluctuations in the workforce expected with the implementation of an action-based alternative. The primary services needed by the 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. Since these businesses have supported similar workforces in the past, capitol expansion would probably not be required.

3.19.2 Human Health and Safety

Under each action alternative, danger trees would be removed from along all haul routes. The signing of project activity areas in addition to notification of additional project-related traffic would promote a safe environment for forest visitors during project implementation. Implementation of action alternatives would increase the potential for encounters on roadways between forest visitors and equipment associated with harvest. This elevated level of risk would be present for the short-term (approximately 5 years). Safety measures such as informational signing, flaggers, and road maintenance activities, such as brushing roads for increased visibility, would be enforced in the timber sale contract.

The work environment during all phases of logging operations would be physically demanding and potentially hazardous; effects to worker health and safety would be possible. Activities with the highest potential for serious injury would include tree felling and helicopter operations (helicopter may be used for prescribed fire ignition). All project activities carried out by Forest Service and Forest Service contract employees would comply with State and Federal Occupational Safety and Health Administration (OSHA) standards. All Forest Service project operations would be consistent with Forest Service Handbook 6709.11 (Health and Safety Code).

The Clean Air Act lists 189 hazardous air pollutants to be regulated. Some components of smoke, such as polycyclic aromic hydrocarbons (PAH) are known to be carcinogenic. Probably the most carcinogenic component is benzo-a-pyrene (BaP). Other components, such as aldehydes, are acute irritants. In 1994 and 1997[14], air toxins were assessed relative to the exposure of humans to smoke from prescribed and wildfires. The five toxins most commonly found in prescribed fire smoke were:

Particulate matter - Particulates are the most prevalent air pollutant from fires, and are of the most concern to regulators. Research indicates a correlation between hospitalizations for respiratory problems and high concentrations of fine particulates (PM2.5, fine particles that are 2.5 microns in diameter or less). Particulates can carry carcinogens and other toxic compounds. Overexposure to

[14] Results of an April 1997 conference to review the results of health studies and develop a risk management plan for the protection of fire crews were published by Missoula Technology Development Center in Health Hazards of Smoke, Technical Report 9751-2836-MTDC.

particulates can cause irritation of mucous membranes, decreased lung capacity, and impaired lung function. Particulate matter is analyzed for each alternative in Chapter 3.3.2.

Acrolein - An aldehyde with a piercing, choking odor. Exposure severely irritates the eyes and upper respiratory tract.

Formaldehyde - Low-level exposure can cause irritation of the eyes, nose and throat. Long-term exposure is associated with nasal cancer.

Carbon Monoxide - CO reduces the oxygen carrying capacity of the blood, a reversible effect. Low exposures can cause loss of time awareness, motor skills, and mental acuity. Also, exposure can lead to heart attack, especially for persons with heart disease. High exposures can lead to death due to lack of oxygen.

Benzene - Benzene causes headache, dizziness, nausea and breathing difficulties, as well as being a potent carcinogen. Long-term exposure can cause anemia, liver and kidney damage, and cancer. The closest Designated Area to the analysis area is the city of Bend, Oregon; the communities of Sunriver, and La Pine are closer to the analysis area but are not as highly populated.

The greatest risk of exposure to airborne toxins from prescribed fires or wildfires would be to firefighters and forest workers implementing the prescribed burning. It is unlikely the general public would be exposed to toxic levels adverse to human health during implementation of prescribed burning operations in the West Bend analysis area because of the distance from populated areas and the application of prescriptions designed to lessen the release of particulate matter. People who suffer from breathing ailments may experience some difficulty during periods of prescribed burning, especially during atmospheric conditions that do not favor dispersion of smoke. The Forest Service voluntarily follows the guidelines assigned by Oregon Smoke Management to limit state-wide exposure on a cumulative basis, in compliance with the Clean Air Act.

Forest workers and firefighters can face unhealthy levels of smoke when patrolling or holding fire lines on the downward edge of a wildfire or prescribed fire, or while mopping intense hot spots. In most cases, measures such as education on the effects of short and long term exposure, rotation out of the smoke, and the use of respirators can reduce exposure levels. OSHA regulates exposure to hazardous materials in the workplace. All project activities carried out by Forest Service and Forest Service contract employees would comply with State and Federal OSHA standards.

3.19.3 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line right-of-way or road.

The action alternatives are not expected to create any impacts that would cause irreversible damage to soil productivity. 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 a productive capacity. Both action alternatives include soil restoration activities that would improve the hydrologic function and productivity on detrimentally disturbed soils. There would be no irretrievable losses of soil productivity associated with these reclamation treatments.

3.19.4 Prime Farmland, Rangeland, and Forestland

All Alternatives were consistent with the Secretary of Agriculture memorandum 1827 for the management of prime farmland. The West Bend Project area does not contain any prime farm land or rangelands. Prime Forest Land, as defined in the memorandum, is not applicable to lands within the National Forest System.

3.19.5 Energy Requirements of the Alternatives

Under the action Alternatives, additional consumption of fossil fuels and human labor would be expended for the use of vehicles transporting Forest workers, chainsaws, heavy equipment and trucks. Fossil fuel would not be a retrievable resource. There are no irregular energy requirements involved in implementing any of the action alternatives.

3.19.6 Climate Change

Introduction

The impacts on forests from climate change and the effects on climate change from forest management are complex and sometimes negated by the different factors involved. The most expected condition in Central Oregon is a warming time and potentially less snowfall. The best comparison to the average condition is the drought cycles experienced in this area due to the pacific decadal oscillation (also known as El Nino and La Nina) (Hessl et al. 2004).

According to the Climate Impacts Group[15], based out of the University of Washington, climate modeling for the Pacific Northwest predicts a future rate of warming of approximately 0.5 degrees Fahrenheit per decade for the Pacific Northwest through at least 2050, relative to the 1970-1999 average temperature. Temperatures are projected to increase across all seasons, although most models project the largest temperature increases in summer (June – August), and the average temperature s could increase beyond the year-to-year variability observed in the Pacific Northwest during the 20th century as early as the 2020s.

With climate change, increases in drought, fires, and greater vulnerability to insects and diseases can be expected (Brown 2008). Thinning of stands to reduce competition for resources and favoring drought-tolerant species (such as ponderosa pine) will reduce the impacts of drought cycles on tree mortality, and increase resistance to insect and fire mortality (Ritchie 2008).

Regulatory Framework

The Forest Service does not have a national policy or guidance for managing carbon, and the tools for estimating carbon and sequestration are not fully developed. Current direction for addressing climate change issues in project planning and the NEPA process is provided in the document *Climate Change Considerations in Project Level NEPA Analysis* (USFS 2009). This document outlines the basic considerations for assessing climate change in relation to project-level planning.

Forest Service Strategic Framework for Responding to Climate Change

The Forest Service mission is to sustain the health, diversity, and productivity of the National's forests and grasslands to meet the needs of present and future generations. The agency has developed the *Strategic Framework for Responding to Climate Change*[16] because climate change threatens our ability to fulfill that mission (USFS 2008). The *Strategic Framework* describes several inter-related programs of the agency to help forests, grasslands and humans mitigate and adapt to global climate change.

[15] Intergovernmental Panel on Climate Change (IPCC). Their reports (2007) provide the authoritative scientific basis for subsequent Forest Service analysis of this phenomenon. Information specific to the Forest Service can be found in the latest Synthesis and Assessment Product 4.4.24.

[16] To see the complete strategic framework, go to http://www.fs.fed.us/climatechange/documents/strategic-framework-climate-change-1-0.pdf.

Table 219. The Strategic Framework has seven goals to address climate change:

Foundational	**Science** - Advance our understanding of the environmental, economic, and social implications of climate change and related adaptation and mitigation activities on forests and grasslands.
	Education - Advance awareness and understanding regarding principles and methods for sustaining forests and grasslands, and sustainable resource consumption, in a changing climate.
Structural	**Alliances** - Establish, enhance, and retain strong alliances and partnerships with federal agencies, State and local governments, Tribes, private landowners, non-governmental organizations, and international partners to provide sustainable forests and grasslands for present and future generations.
	Policy - Integrate climate change, as appropriate, into Forest Service policies, program guidance, and communications and put in place effective mechanisms to coordinate across and within Deputy Areas.
Action	**Sustainable Operations** - Reduce the environmental footprint of Forest Service operations and be a leading example of a green organization.
	Adaptation - Enhance the capacity of forests and grasslands to adapt to the environmental stresses of climate change and maintain ecosystem services.
	Mitigation - Promote the management of forests and grasslands to reduce the buildup of greenhouse gases, while sustaining the multiple benefits and services of these ecosystems.

Existing Condition

The existing vegetation conditions are described throughout Chapter 3. There is uncertainty about how the climate will change within the project area in the future. This portion of central Oregon has gone through at least five distinct periods of warming climate over the past 110 years (NASA Global Climate Change Website http://climate.jpl.nasa.gov). In the Western United States and at the continental scale (1 km), long-term satellite data show consistently earlier onsets of spring greening and corresponding increases in length of growing season (Forest Service Climate Change Resource Center: http://www.fs.fed.us/ccrc).

Lengthening of the fire season due to early snow melt and warmer summers appears to be causing a trend of larger and more frequent fires in the western US; and increased winds may make the fires more severe (Westerling et al. 2006 in Brown).

Alternative 1 (No Action)

Direct and Indirect Effects: Although there is uncertainty about what the climate future may be, the predicted climate change scenario for this area would exacerbate the conditions for the forests in the project area. Under the warmer/drier scenario of future climate, ponderosa pine will be the most impacted because of its sensitivity to density. Under the No Action alternative, there would be no direct changes to the forested vegetation, and no releases of greenhouse gasses would occur.

Alternative 2 (Proposed Action), Alternative 3, and Alternative 4

Direct, Indirect, and Cumulative Effects: The trajectory of these stands should lead to more resilience should the climate become warmer and drier as predicted. Thinning of stands under both alternatives will reduce competition for resources (FEIS, Forest Vegetation, section 3.3). And favoring drought-

tolerant species such as ponderosa pine would reduce the impacts of future drought cycles on tree mortality, and increase resistance to insect and fire mortality (Ritchie 2008). Also, if a crown fire burns through a forest that was thinned to a low density, the fire may change from a crown fire to a surface fire, where many trees can often survive. In contrast, many or all of the trees in an unthinned stand would be killed by a crown fire.

The scope and degree of change from either action alternative is minor relative to the amount of forested land available as a whole. A project of this magnitude (about 12% of watershed) would have such minimal contributions of greenhouse gasses that its impact on global climate change would be infinitesimal. Therefore, at the global scale, the proposed action's direct and indirect contribution to greenhouse gasses and climate change would be negligible, and therefore the project's cumulative effects on greenhouse gasses and climate change would also be negligible.

The Intergovernmental Panel on Climate Change has summarized the contributions to climate change of global human activity sectors in its Fourth Assessment Report (IPCC 2007). The top three anthropogenic (human-caused) contributors to greenhouse gas emissions (from 1970-2004) are: fossil fuel combustion (56.6% of global total), deforestation (17.3%), and agriculture/waste/energy (14.3%). IPCC subdivides the deforestation category into land use conversions, and large scale deforestation. Deforestation is defined as removal of all trees, most notably the conversion of forest and grassland into agricultural land or developed landscapes (IPCC 2000).

This vegetation management project does not fall within any of these main contributors of greenhouse gas emissions. Forested land will not be converted into a developed or agricultural condition. In fact, forest stands are being retained and thinned to maintain a vigorous forested condition that can continue to support trees and sequester carbon long-term.

The net carbon balance is extremely difficult to quantify for a forest project. Adaptation and Mitigation can have positive and negative influences on each other's effectiveness (Klein et. al. 2007 in Joyce et. al. 2008). This project is also consistent with IPCC recommendations for land use to help mitigate climate change. The 2007 IPCC report summarizes sector-specific key mitigation "technologies." For the forestry sector, the report recommends forest management including management to "improve tree species" and increase biomass. The two action alternatives are consistent with these recommendations.

Timber management projects can influence carbon dioxide sequestration in three main ways: (1) by increasing new forests (afforestation), (2) by avoiding their damage or destruction (avoided deforestation), and (3) by manipulating existing forest cover (managed forests). Land-use changes, specifically deforestation and regrowth, are by far the biggest factors on a global scale in forests' role as sources or sinks of carbon dioxide, respectively (IPCC, Intergovernmental Panel on Climate Change, 2000). Projects that create forests or improve forest conditions and capacity to grow trees are positive factors in carbon sequestration. The action alternatives fall into this category.

CHAPTER 4
CONSULTATION AND COORDINATION

Chapter 4: Public Notification & Participation

4.1 Consultation with Other Agencies and Governments

U.S. Environmental Protection Agency

The initial response from the Environmental Protection Agency (EPA) dated December 22, 2010, during the scoping phase included a list of recommendations for analysis and project design. The Draft EIS was filed with the Environmental Protection Agency (EPA) for review pursuant to 40 CFR 1506.9. They provided a Lack of Objections rating (FEIS p.). The EPA's reviewing official wrote on June 3, 2013:

> "The EPA is supportive of the overarching goals and objectives of the proposed project, and we find the DEIS to be clear, well organized, and robust. We also appreciate the Forest's responsiveness to issues raised during the scoping process through the development and adoption of Alternative 3 as the preferred alternative. We support the increases in diversity and variability across the landscape proposed under Alternative 3."

Per Forest Service regulations, this FEIS will be filed with the EPA's Office of Federal Activities in Washington, DC, who will publish a notice of availability in the *Federal Register*.

Oregon State Historic Preservation Office

The Forest has completed necessary reporting for the State Historic Preservation Office (SHPO) following guidelines in the Regional Programmatic Agreement among USDA-Forest Service, the Advisory Council on Historic Preservation, and the Oregon SHPO. On June 13, 2013 the Oregon SHPO concurred with the Forest Service finding of "No Adverse Effect (No Historic Properties Affected)."

U.S. Fish and Wildlife Service

The Forest Service consulted informally with the U.S. Fish and Wildlife Service on effects of the project to northern spotted owl critical habitat. Level 1 review and informal consultation was initiated on January 10, 2013. A Biological Assessment was completed on July 15, 2013 with a conclusion that the project "May Affect But is Not Likely to Adversely Affect" the northern spotted owl and its habitat.

Tribal Governments

The Klamath Tribes

Will Hatcher, Director, Natural Resources
Gary Frost, Chairman
Perry Chocktoot, Director, Cultural and Heritage

Confederated Tribes of the Warm Springs

Stanley Smith, Council Chairman
Bobby Brunoe, General Manager, Natural Resources
Clay Penhollow, Natural Resource Planner
Sally Bird, Cultural Resources

Burns Paiute Tribe

Charisse Soucie, Chairperson
Anna Deboard, General Manager
Teresa Peck, Cultural Resources
Jason Kesling, Natural Resources

4.2 Public Participation

During the initial scoping (FEIS page8), a number of comments and questions were received. Responses varied from those who wanted more clarification to specific suggestions for project implementation. Comments from scoping were used to help develop the planning issues and alternatives (FEIS page 9 and page24).

The scoping letter resulted in six responses from individuals, organizations, and agencies. Following development of the alternatives, a letter was sent August 17, 2010 updating the public and other agencies on the issues, alternatives, and timeline, and asking people to notify the Forest Service if they wanted, and in what format, to receive the Draft EIS. All correspondence is part of the Project Record, located at the Bend/Ft. Rock Ranger District office.

4.3 Public Comment Period

A 45-day public comment period was offered on the DEIS per NEPA regulations (40 CFR 1503; 1506.10). The previously mentioned agencies and governments and the following individuals, agencies, and organizations were either notified of the availability of the Draft EIS, or sent a copy of the document. Comments were reviewed and substantive comments responded to. Appendix G of this FEIS includes the comment responses.

Individuals

Senator Jeff Merkley
Senator Ron Wyden
Congressman Greg Walden
Larry Ulrich
Billy Toman
Jim Anderson
David Pitts
Scott Walley
Vic Russell
Robert Speik
Patricia Moore
David Tjomsland
Scott O'Neill
Wade N. Foss
Fred Tanis
Scott Odgers
Daryle Sharkey
Robert Mullong
Stu Garrett
Marilyn Miller
Susan Jane Brown
Peter Geiser
C Norman Winningstad
Ruth Williamson
Bill Houck
Robert Madden
Kreg Lindberg
Robert Ross
Mike Halsey
Daniel Walker
Diana Short
Paul Krahn
Mark Porter
Daren Staab
Maria Farinacci
Larry and Vera Riser
Linda Frost
Linda Danforth
Bob Crain
George Chesley
William Mueters
Mark Schulz
James T. Mills
Scott Harper
John Davidson
Richard Ridnour
Mary E. Quackenbush
Lynne E. Swift
Anne Marie Leonard
Dan Walker
Douglas L. Treadwell
John Simonson
Robert H. Hamilton
Cynthia J. Bowker
Barbara VanHolde
Su Lukinbeal
Richard A. Whipple
Virginia M. Neff
Corrinne Brawner
Tracey L. Whitaker
Susan Mondry
Claudine Skjersaa
Harold O. Cecil
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Timothy H. Peacock
Kelly S. Esterbrook
Greg Teraar
Gerald Patterson
Eric M. Anderson
Don Skjersaa
Christoher M. Morrison
Tad Hodgert
Marce Monte
Steve Edwards
Gary W. Zimmerman
Roger Roper
Al Urich
Keenan Howard
Mike Morris
Paul MacMillan
Paul Dewey
Jim Allen
Woody Starr
Mike Kern

Organizations

Visit Bend
Central Oregon Visitors Association
Konnie Handschuch, Central Oregon Community College
Jim Jorgensen, Broken Top Community Association
Inn of the Seventh Mountain
Entrada Lodge
Widgi Creek Golf Club
Tetherow Golf Club
Katie Lighthall, Project Wildfire
Brad Chalfant, Deschutes Basin Land Trust
Don Mercer, Upper Deschutes River Natural Resources Coalition
Ryan Houston, Upper Deschutes Watershed Council
Scott McCaulou, Deschutes River Conservancy
Jim Larsen, Upper Deschutes River Coalition
Garth Fuller, The Nature Conservancy
Brian Pasko, Oregon Chapter Sierra Club
Larry Pennington, Oregon Chapter Sierra Club
Northwest Environmental Defense Center
Doug Heiken, Oregon Wild
Chandra LaGue, Oregon Wild
Tim Lillebo, Oregon Wild
Karen Coulter, Blue Mountains Biodiversity Project
Francis Eatherington, Cascadia Wildlands Project
Bill Richardson, Rocky Mountain Elk Foundation
Chris Smith, INNspired, LLC
Dennis Oliphant, Sun Country Tours
Central Oregon Trail Alliance (COTA)
Ben Husaby, Bend Endurance Academy
Pat Schatz, Mickey Finn Guide Service
Craig Vaage, Bigfoot Guide Service
David Nissen, Wanderlust Tours
Bruce Cunningham, Moon CountrySnowmobilers
Rick Bozarth, Bozarth's Offroad Service Specialties
Ed Duffy, Deschutes County 4-Wheelers
Lev Stryker and Melanie Fisher, Cog Wild
John Morgan, Ochoco Lumber
Chuck Burley, Interfor
Greer Kelly, Interfor
Chris Johnson Interfor
Bodie Dowding, Interfor
Darin Stringer, IRM Forestry
Ms. Lynne Breese, Eastern Oregon Forest Protection Association
Darwin Thurston, Midstate Electric Cooperative
Dylan Darling, The Bulletin
KTVZ
Steve Fitzgerald, Oregon State University Extension Service
Mark Dunaway, Pine Mountain Observatory, University of Oregon
Shawn Gerdes, Arnold Irrigation District
Kelly Cannon-Miller, Deschutes County Historical Society
Jim Wilson, JTS Animal Bedding
Spatial Interest, LLC
Patti Gentiluomo, Sunriver Environmental Manager
Sunriver Owners Association (SROA) Public Affairs Committee Chair
John McKenzie, SROA, Public Works

Bend and Deschutes County Agencies

Eric King, City Manager
Eric Denzler, Bend Metro Parks and Recreation District
Bend Fire and Rescue Department
Bend Public Works Department
Dan Sherwin, Deschutes County Road Department
Ed Keith, Forester, Deschutes County
Sally Russell, Deschutes County Committee on Recreation Assets

State and Federal Agencies

Libby Johnson, Bonneville Power Administration
Glen Ardt, Oregon Department of Fish and Wildlife
Stuart Otto, Oregon Department of Forestry
Rick Williams, Oregon Department of Transportation
Nancy Gilbert, USDI Fish & Wildlife Service
Advisory Council on Historic Preservation
Environmental Protection Agency, Region 10
Federal Aviation Administration, NW Mountain Region
Federal Highway Administration National

Marine Fisheries Service Natural
Resources Conservation Service Northwest
Power Planning Council
U.S. Army of Engineers
U.S. Dept. of Energy
U.S. Dept. of the Interior, Office of Environmental Policy
USDA APHIS PPD/EAD
USDA National Agricultural Library

4.4 Preparers of the EIS

The following people were members of the Interdisciplinary Team:

Beth Peer

Position:	USDA, Forest Service, Deschutes National Forest, Bend/Ft. Rock Ranger District, Environmental Coordinator
Education:	BS, Anthropology, University of Oregon (1990)
Experience:	22 years professional experience
Contribution:	Interdisciplinary Team Leader

Pete Powers

Position:	USDA, Forest Service, Deschutes National Forest, Bend/Ft. Rock Ranger District, Silviculturist
Education:	BS, Forestry, Washington State University (1979)
Experience:	26 years professional experience
Contribution:	Forest Vegetation Analysis

Deana Wall

Position:	USDA, Forest Service, Deschutes National Forest, Bend/Ft. Rock Ranger District, Fuels Specialist
Education:	BA, Biology, minor Chemistry, Lewis and Clark College (1997)
Experience:	14 years professional experience
Contribution:	Fire and Fuels Analysis

Monty Gregg

Position:	USDA, Forest Service, Deschutes National Forest, Sisters RD, District Wildlife Biologist
Education:	BS, Wildlife Biology, Oregon State University (1995)
Experience	17 years professional experience
Contribution:	Wildlife Analysis

Todd Reinwald

Position:	USDA, Forest Service, Deschutes National Forest, Bend/Ft. Rock Ranger District, Soils Scientist
Education:	AS, Forestry, Central Oregon Community College (1997); BS, Agronomy and Soils, Oregon State University (1992)
Experience	26 years professional experience
Contribution:	Soils Analysis

Tom Walker

Position:	USDA, Forest Service, Deschutes National Forest, Bend/Ft. Rock Ranger District, Fisheries Biologist
Education:	BS, Fisheries Science, Oregon State University (1983)
Experience	26 years professional experience
Contribution:	Fisheries and Hydrology Analysis

Robin Gyorgyfalvy

Position:	USDA, Forest Service, Deschutes National Forest, Bend/Ft. Rock Ranger District, Landscape Architect
Education:	BA, Sculpture, Mt. Holyoke College (1973); BLA/MLA, Landscape Architecture, University of Oregon (1978)
Experience:	32 years professional experience
Contribution:	Scenery Resources

Charmane Powers

Position:	USDA, Forest Service, Deschutes National Forest, Bend/Ft. Rock Ranger District, District Botanist
Education:	Bachelor of Science from The Evergreen State College (1984)
Experience:	23 years botany, 5 years wildlife (birds)
Contribution:	TES Plant Biological Evaluation, Weed Risk Analysis, Survey and Manage plants evaluation

Steve Bigby

Position:	USDA, Forest Service, Deschutes National Forest, Bend/Ft. Rock Ranger District, District Roads Manager
Education:	Oregon Institute of Technology
Experience:	24 years professional experience
Contribution:	Transportation System Analysis

Amy Tinderholt

Position:	USDA, Forest Service, Deschutes National Forest, Bend/Ft. Rock Ranger District, Recreation Program Manager
Education:	BS, Natural Resources, University of Arizona (2001)
Experience:	12 years professional experience
Contribution:	Recreation and Undeveloped Lands

Maureen Durrant

Position:	USDA, Forest Service, Deschutes National Forest, Bend/Ft. Rock Ranger District, District GIS Specialist
Education:	BS, Environmental Science, University of Redlands (2002); Post-Baccalaureate Certificate, GIS, Central Oregon Community College, (2007)
Experience:	10 years professional experience
Contribution:	Geographical Information Services

Dorothy Thomas

Position:	USDA, Forest Service, Region 6, Data Resource Management, Deschutes National Forest, Forest Supervisors Office, GIS Analyst
Education:	BS, Environmental Science, Oregon State University (2000); Associates of Applied Science, Geographic Information Systems, Central Oregon Community College, (1995); Associates of Applied Science, Computer Aided Drafting, Central Oregon Community College, (1994)
Experience:	17 years professional experience
Contribution:	Geographical Information Systems (GIS) analysis for Management Indicator Species (MIS), DeCAID, and Potential Wilderness Area Inventory

David Frantz

Position:	USDA, Forest Service, Deschutes National Forest, Bend/Ft. Rock Ranger District, Environmental Specialist
Education:	BS, Forest Management, Northern Arizona University (1974); MS, Forest Entomology, Northern Arizona University (1988)
Experience:	22 years professional experience
Contribution:	Writer/Editor

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Glossary of Terms

- A -

ACCESS – Usually refers to a road or trail route over which a public agency claims a right-of-way for public use; a way of approach.

ACTIVITY – An action, measure or treatment undertaken that directly or indirectly produces, enhances, or maintains forest and rangeland outputs, or achieves administrative or environmental quality objectives. An activity can generate multiple outputs.

ACTIVITY FUELS – Fuels generated or altered by a management activity.

ADMINISTRATIVE UNIT – An area under the administration of one line officer, such as a District Ranger, Forest Supervisor, or Regional Forester.

ADMINISTRATIVE RECORD – The official project record file.

ADVANCED REGENERATION - Small trees, usually less than 1 inch in diameter, which are growing under mature trees prior to planned harvest activities.

AFFECTED ENVIRONMENT – The natural and physical environment and the relationship of people to that environment that will or may be changed by proposed actions.

AGE CLASS -An interval, usually 10 to 20 years, into which the age ranges of vegetation are divided for classification or use.

AIRSHED - A geographic area that, because of topography, meteorology, and climate, shares the same air.

ALLOCATION - See Land Use allocation or Resource allocation.

ALLOTMENT - See Range allotment.

ALL TERRAIN VEHICLE (ATV) – A vehicle characterized by its ability to negotiate most kinds of terrain, by virtue of traction devices such as wide tracks, large, low-pressure rubber tires and/or four-wheel drive.

ALTERNATIVE – One of several policies, plans, or projects proposed for decision-making.

AMENITY – An object, feature, quality, or experience that gives pleasure or is pleasing to the mind or senses. The terms “amenity values” or “amenity resources” are typically used in land management planning to describe those resources for which monetary values are not or cannot be established (such as clean air and water, or scenic quality).

ANALYSIS AREA – The basic land unit of analysis that is used to allocate and schedule management prescriptions.

ARTERIAL ROAD - Primary traffic route serving a large area and providing travel efficiency for many activities. Arterial roads are non-project roads, usually built with Agency funds.

ARTIFACT - An object made or modified by humans.

- B -

BARK BEETLE – An insect that bores through the bark of forest trees to eat the inner bark and lay its eggs.

BASAL AREA - The area of the cross-section of a tree stem near the base, generally at breast height and inclusive of bark.

BENEFIT - The value of the expected outputs.

BEST MANAGEMENT PRACTICES (BMP) - A practice or combination of practices that is the most effective and practical means (including technological, economic, and institutional considerations) of preventing or reducing negative environmental impacts that may result from resource management activities. For example, Best Management Practices are used to reduce the amount of pollution generated by non-point sources to a level compatible with water quality goals.

BIG GAME - Large mammals hunted for sport. On the Deschutes National Forest these include animals such as deer and elk.

BIG GAME SUMMER RANGE - A range, usually at higher elevation, used by deer and elk during the summer. Summer ranges are usually much more extensive than winter ranges.

BIG GAME WINTER RANGE - A range, usually at lower elevation, used by migratory deer and elk during the winter months; usually more clearly defined and smaller than summer ranges.

BIOLOGICAL DIVERSITY – The number and abundance of species found within a common environment. This includes the variety of genes, species, ecosystems, and the ecological processes that connect everything in a common environment. The variety of life and its processes within communities and ecosystems.

BIOLOGICAL EVALUATION (BE) – Describes and displays the effects to Proposed, Endangered, Threatened, and Sensitive (PETS) flora and fauna species.

BOARD FOOT (BF) - The amount of wood equivalent to a piece of wood one foot by one foot by one inch thick.

BROWSE - Twigs, leaves, and young shoots of trees and shrubs on which animals feed; in particular, those shrubs that are used by big game animals for food.

BUREAU OF LAND MANAGEMENT (BLM) - An agency within the Department of the Interior, with land management responsibility for the Public Domain lands.

- C -

CABLE LOGGING – Refers to methods used to skid or pull logs to a central landing or collection area by a cable connected to a remote power source.

CANOPY – The more-or-less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth.

CANOPY BASE HEIGHT – The height above the ground of the first canopy layer where the density of the crown mass within the layer is high enough to support vertical movement of a fire. Low canopy base heights have been shown to initiate crown fire behavior.

CANOPY BULK DENSITY - Canopy bulk density (CBD) describes the density of available canopy fuel in a stand. It is defined as the mass of available canopy fuel per canopy volume unit.

CANOPY CLOSURE – The progressive reduction of space between crowns as they spread laterally, increasing canopy cover.

CANOPY COVER – The percentage of a fixed area covered by crowns of plants delimited by a vertical projection of the outermost perimeter of the spread of the foliage.

CAVITY - The hollow excavated in trees by birds or other natural phenomena, used for roosting and reproduction by many birds and mammals.

CHARACTERISTIC LANDSCAPE - In reference to the U.S.D.A. Forest Service visual management system; the overall impression created by a landscape's unique combination of visual features (land, vegetation, water, structures), as seen in terms of form, line, color, and texture; synonymous with “visual landscape character.”

CLOSURE - An administrative order restricting either location, timing, or type of use in a specific area.

COARSE WOODY MATERIAL (CWM) – Dead and down material greater than 10 inches DBH at the small end.

CODE OF FEDERAL REGULATIONS (CFR) - A codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the federal government.

COLLECTOR ROADS - Roads constructed to serve two or more elements but which do not fit into the other two categories (arterial or local). These roads serve smaller land areas, are usually connected to a Forest arterial or public highway, and are operated for constant service. They collect traffic from Forest roads or terminal facilities.

COMMERCIAL HARVEST – The removal of commercial wood fiber through commercial thinning and regeneration cuts (small clearcuts that leave all trees greater than or equal to 21 inches dbh).

COMMERCIAL THINNING - Any type of tree thinning that produces merchantable material at least equal in value to the direct costs of harvesting.

COMMODITIES – Transportable resources with commercial value; all resource products that are articles of commerce.

COMMUNITY STABILITY - A community's capacity to handle change without major hardships or disruptions to component groups or institutions. Measurement of community stability requires identification of the type and rate of proposed change and an assessment of the community's capacity to accommodate that level of change.

COMPACTION – The packing together of soil particles by forces exerted at the soil surface, resulting in increased soil density.

COMPETING VEGETATION – Vegetation that seeks and uses the limited common resources (space, light, water, and nutrients) of a forest site needed by preferred trees for survival and growth.

CONDITION CLASS - 1) Timber: a grouping of timber strata into size-age-stocking classes for Forest planning. **2)** Range: one of a series of arbitrary categories used to classify range conditions, usually expressed as excellent, good, fair, or poor.

CORRIDOR - A linear strip of land identified for the present or future location of transportation or utility rights-of-way within its boundaries.

COST EFFECTIVENESS - Achieving specified outputs or objectives under given conditions for the least cost.

COUNCIL ON ENVIRONMENTAL QUALITY (CEQ) - An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

COVER/FORAGE RATIO - The mixture of cover and forage areas on a unit of land, expressed as a ratio. The optimum cover/forage mix for deer on summer range is 60:40.

CRITICAL HABITAT – That portion of a wild animal's habitat that is critical for the continued survival of the species. Areas designated for the survival and recovery of federally listed threatened or endangered species.

CROP TREES -Trees which are considered suitable to meet long term management objectives for an analysis area. These may also be referred to as healthy or manageable trees. This may include both the physical make-up of the tree as well as the species.

CROWN – The part of a tree, or other woody plant, bearing live branches and foliage.

CROWN HEIGHT - In a standing tree, the vertical distance from ground level to the base of the crown, measured either to the lowest live branch whorl, or to the lowest live branch (excluding shoots arising spontaneously from buds on the stem of a woody plant), or to a point halfway between.

CRYIC - Soils in this temperature regime have a mean annual temperature higher than 0°C but lower than 8°C.

CUBIC FOOT (CF) - The amount of timber equivalent to a piece of wood one foot by one foot by one foot.

CULTURAL RESOURCE - The remains of sites, structures, or objects used by humans in the past-historic or prehistoric.

CUMULATIVE EFFECTS OR IMPACTS - Cumulative effect or impact is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

CUMULATIVE EFFECTS AREA (CEA) – The portion of a study area on which the effects from implementing project activities are expected to occur (and may occur outside the project analysis area).

CYCLE - As applied to uneven-aged management, it is the time interval between harvest entries. It should be noted that harvest entries in uneven-aged management are to leave residual levels of growing stock which should not need treatment for at least one cycle length.

- D -

DATA – Any recorded measurements, facts, evidence, or observations reduced to written, graphical, tabular, or computer form. The term implies reliability, and therefore provides an explanation of source, type, precision and accuracy.

DecAID – An advisory tool that has been developed to replace the biological potential models for species that utilize dead and partially dead trees and down wood. It is an internet-based summary, synthesis, and integration of published scientific literature, research data, wildlife databases, forest inventory databases, and expert judgment and experience. It offers a way of estimating or evaluating levels of dead wood habitat that provide for a wide array of species and ecological processes. The DecAID Repository is located on the Internet at http://www.fs.fed.us/wildecology/decaid/decaid_background/decaid_home.htm.

DECOMMISSION – Activity that results in the stabilization and restoration of unneeded roads to a more natural state.

DEER WINTER RANGE – See BIG GAME WINTER RANGE.

DEPENDENT COMMUNITIES – Communities where social, economic, or political life would change in important respects if market or non-market outputs from the National Forests were substantially decreased.

DESIRABLE SPECIES – Any species of plant or animal which is considered to be compatible with meeting management goals and objectives.

DESIRED CONDITION – A description of the desired human dimension, production, and physical/biological characteristics to be achieved on an area.

DEVELOPED RECREATION – Recreation that requires facilities that, in turn, result in concentrated use of an area. Examples of developed recreation areas are campgrounds and ski areas; facilities in these areas might include roads, parking lots, picnic tables, toilets, drinking water, ski lifts, and buildings.

DEVELOPED RECREATION SITE – Relatively small, distinctly defined areas where facilities are provided for concentrated public use; e.g. campgrounds, picnic areas, swimming areas, and downhill ski areas.

DIAMETER AT BREAST HEIGHT (dbh) – The diameter of a tree measured 4 feet 6 inches above the ground.

DISPERSED RECREATION – A general term referring to recreation use outside developed recreation sites; this includes activities such as scenic driving, hiking, backpacking, hunting, fishing, snowmobiling, horseback riding, cross-country skiing, and recreation in primitive environments.

DISTANCE ZONE – One of three categories used in the Visual Management System to divide a view into near and far components. The three categories are: **(1)** foreground, **(2)** middleground, and **(3)** background.

DISTURBANCE (Ecosystem) – Refers to events (either natural or human caused) that alter the structure, composition, or function of terrestrial or aquatic habitants.

DIVERSITY – The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

DIURNAL - Active during the daytime, resting during the night.

DOMINANT – Trees with crowns extending above the general level of the canopy and receiving full light from above and partly from the side; taller than the average trees in the stand with crowns well developed.

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) – The draft statement of environmental effects that is required for major federal actions under Section 102 of the National Environmental Policy Act, and released to the public and other agencies for comment and review.

DUFF – Organic matter in various stages of decomposition on the floor of the forest.

- E -

EARLY FOREST SUCCESSION - The early stage or condition of a plant community that occurs during its development from bare ground to climax.

EARLY SERAL - Plants which inhabit a disturbed site within the first few years subsequent to the disturbance.

ECONOMIC EFFICIENCY ANALYSIS - An analytical method in which discounted benefits are compared with discounted costs.

ECOSYSTEM - An interacting system of organisms considered together with their environment; for example, marsh, watershed, and lake ecosystems.

ECO-TYPE – Groupings of soil and potential vegetation. Areas that have similar site potentials and are expected to have similar responses to treatments.

EFFECTS - Environmental changes resulting from a proposed action. Included are direct effects, which are caused by the action and occur at the same time and place, and indirect effects, which are caused by the action and are later in time or further removed in distance, but which are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Effects and impacts as used in this EIS are synonymous. Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic quality, historic, cultural, economic, social, or healthy effects, whether direct, indirect, or cumulative. Effects may also include those resulting from actions that may have both beneficial and detrimental effects, even if on balance the agency believes that the effects will be beneficial.

ENDANGERED SPECIES - Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act.

ENHANCEMENT - See VISUAL QUALITY OBJECTIVE.

ENVIRONMENTAL ASSESSMENT (EA) - The concise public document required by the regulations for implementing the procedural requirements of the National Environmental Policy Act.

ENVIRONMENTAL IMPACT STATEMENT (EIS) - A statement of the environmental effects of a proposed action and alternatives to it**.** It is required for major federal actions under Section 102 of the National Environmental Policy Act (NEPA), and released to the public and other agencies for comment and review. It is a formal document that must follow the requirements of NEPA, the Council on Environmental Quality (CEQ) guidelines, and directives of the agency responsible for the project proposal.

ENVIRONMENTAL JUSTICE - The pursuit of equal justice and equal protection under the law for all environmental statutes and regulations, without discrimination based on race, ethnicity, or socioeconomic status.

ENVIRONMENTAL PROTECTION AGENCY (EPA) - An agency of the Executive Branch of the Federal Government which has the responsibility for environmental matters of national concern.

EPHEMERAL DRAW - A drainage-way that conveys surface water for short periods of time in direct response to snowmelt or rainfall runoff.

EQUIVALENT CLEARCUT AREA - Watershed index of snowmelt and evapotranspiration rates relative to baseline condition where tree stands are considered fully canopied.

EROSION - **(1)** The wearing away of the land surface by running water, wind, ice, or other geologic agents, including such processes as gravitation creep; or **(2)** detachment and movement of soil or rock fragments by water, wind, ice, or gravity. The following terms are used to describe different types of erosion:

Accelerated erosion - Erosion which is much more rapid than natural erosion, with the increase in erosion rate resulting primarily from the influence of human activities, or, in some cases, of other events that expose mineral soil surfaces, such as wildfire.

Gully erosion - The erosion process whereby water accumulates in narrow channels, and, over short periods, removes the soil from this narrow area to considerable depths, ranging from 4 inches to as much as 75 to 100 feet.

Rill erosion - An erosion process in which numerous small channels less than 4 inches deep and 6 inches wide are formed.

Sheet erosion - The removal of a fairly uniform layer of soil from the land surface by runoff water.

EXCESS TREES - Trees which are considered not needed in the stand in order to meet management objectives.

EXISTING CONDITION – A description of present-day human dimensions, production, physical/biological characteristics of an area.

EXTENDED ATTACK - When a fire has not been contained by the initial attack resources dispatched to the fire, will not have been contained within the management objectives that are established for that zone or area, and has not been contained within the first operational period.

EXTIRPATED - Local extinction.

EXTREME FIRE BEHAVIOR – "Extreme" implies a level of fire behavior characteristics that ordinarily precludes methods of direct control action. One or more of the following is usually involved: high rate of spread, prolific crowning and/or spotting, presence of fire whirls, strong convection column. Predictability is difficult because such fire often exercise some degree of influence on their environment and behave erratically, sometimes dangerously.

- F -

FINAL ENVIRONMENTAL IMPACT STATEMENT - The final version of the statement of environmental effects required for major federal actions under section 102 of the National Environmental Policy Act. It is a revision of the draft environmental impact statement to include public and agency responses to the draft.

FIRE INTENSITY – The nature of a fire in terms of its rate of energy release. These are physical descriptions of the fires, rather than ecological effects. "Fire intensity is a term that is used to describe the rate at which a fire produces thermal energy. Fire intensity is influenced by the amount of fuel available for burning, local weather conditions before and at the time of the fire, and the topography of the burning site. The limiting factor in fire intensity is the amount of energy stored in the fuel. As a consequence, the greater the fuel loading, the more intensely a fire is likely to burn" (DeBano et al 1998 p. 56-57.).

FIRE MANAGEMENT - All activities required for protection of resources from fire and for the use of fire to meet land management goals and objectives.

FIRE FREQUENCY - Refers to the number of fires in a specified time an area.

FIRE REGIME - A function of the historical frequency of fire and the degree of severity of those fires.

FIRE SEVERITY or BURN SEVERITY - Refers to the degree which a site has been altered or the successional process disrupted by fire. Fire severity is a product of fire time and intensity (DeBano et al., 1998).

Severity also describes the fire-caused damage to the soil. The severity ratings are based on the following standards (BAER Handbook, FSH 2509.13):

High severity – More than 40 percent of the area exhibits soil features likely to significantly increase runoff and erosion (such as., absence of duff layer, hydrophobic soils, soil discoloration).
Moderate severity – Less than 40 percent of the area exhibits high severity indicators. Duff layers may be absent or mostly absent.
Low severity – Duff layers are burned but intact. Unburned areas are intermingled with lightly burned areas.

FIXED COSTS - Costs incurred that are not expected to change significantly with the production of outputs, or over the range of alternatives. They are not tied to specific management activities and are usually a small component of the overall budget.

FORAGE - All browse and non-woody plants that are available to livestock or game animals and used for grazing or harvested for feeding.

FORB - Any herb other than grass.

FOREGROUND - A term used in visual management to describe the portions of a view between the observer and up to 1/4 to 1/2 mile distant.

FOREST HEALTH – A measure of the robustness of forest ecosystems. Aspects of forest health include biological diversity; soil, air, and water productivity; natural disturbances; and the capacity of the forest to provide a sustaining flow of goods and services for people.

FOREST LAND - Land at least 10 percent occupied by forest trees or formerly having had such tree cover and not currently developed for non-forest use. Lands developed for non-forest use include areas for crops, improved pasture, residential, or administrative areas, improved roads of any width, and adjoining road clearings and powerline clearings of any width.

FOREST SERVICE HANDBOOK (FSH) - For Forest Service use, directives that provide detailed instructions on how to proceed with a specialized phase of a program or activity.

FOREST SERVICE MANUAL (FSM) - A system of manuals that provides direction for Forest Service activities.

FOREST SYSTEM ROADS - Roads that are part of the Forest development transportation system, which includes all existing and planned roads as well as other special and terminal facilities designated as Forest development transportation facilities. See ARTERIAL ROADS, COLLECTOR ROADS, and LOCAL ROADS.

FRAGMENTATION – Breaking up of a continuous area into progressively smaller patches of increasing degrees of isolation.

FUEL BREAK - A zone in which fuel quantity has been reduced or altered to provide a position for suppression forces to make a stand against wildfire. Fuel breaks are designated or constructed before the outbreak of a fire. Fuel breaks may consist of one or a combination of the following: natural barriers, constructed fuel breaks, constructed barriers.

FUEL MANAGEMENT - The practice of planning and executing the treatment or control of living or dead vegetative material in accordance with fire management direction.

FUEL MODELS - Fuel models are a tool used to standardize discussion of fuel conditions on a landscape.

FUEL TREATMENT - The rearrangement or disposal of natural or activity fuels (generated by management activity, such as slash left from logging) to reduce fire hazard. Fuels are defined as both living and dead vegetative materials consumable by fire (See Fire and Fuels, Chapter 3, for a definition of various fuel treatment methods).

FUELS - Combustible wildland vegetative materials. While usually applied to above-ground living and dead surface vegetation, this definition also includes roots and organic soils such as peat.

- G -

GEOGRAPHIC INFORMATION SYSTEMS (GIS) – Computer software that provides database and spatial analytic capabilities.

GEOMORPHOLOGY - The science that deals with land and submarine relief features of the earth's surface and seeks a genetic interpretation of them, using the principles of physiography in its descriptive aspects and dynamic and structural geology in its explanatory phases.

GOAL - A concise statement that describes a desired condition to be achieved sometime in the future. It is normally expressed in broad, general terms and is timeless in that it has no specific date by which it is to be completed. Goal statements form the principal basis from which objectives are developed.

GOODS AND SERVICES - The various outputs, including on-site uses, produced from forest and rangeland resources.

GOSHAWK FORAGING AREA – Areas where prey are searched for and captured by goshawks. Desired size of foraging areas is approximately 5400 acres (not including nest stand and post fledgling area).

GOSHAWK NEST AREA – The nest tree and stand surrounding the nest that contains prey handling areas, perches and roosts. Often referred to as the nest stand, usually approximately 30 acres in area.

GRASS/FORB - An early forest successional stage where grasses and forbs are the dominant vegetation.

GREEN TREE REPLACEMENT (GTR) – Trees retained, or managed through time, to provide snags or CWM habitat at some point in the future.

GROUND FUELS – All combustible materials below the surface litter layer. These fuels may be partially decomposed, such as forest soil organic layers (duff), dead mosses and lichen layers, punky wood, and deep

organic layers (peat), or may be living plant material, such as tree and shrub roots.

GROUND-BASED HARVESTING SYSTEMS – Logging systems that employ ground-based equipment such as feller-bunchers, skidders, and forwarders.

GROUP SELECTION CUTTING - See UNEVEN-AGED SILVICULTURAL SYSTEMS.

GROWING SEASON - That part of the year when temperature and moisture are favorable for vegetation growth.

GUIDELINE - An indication or outline of policy or conduct; i.e. any issuance that assists in determining the course of direction to be taken in any planned action to accomplish a specific objective.

GUZZLER - A device for collecting and storing precipitation for use by wildlife or livestock. Consists of an impenetrable water collection area, a storage facility, and a trough from which animals may drink.

- H -

HABITAT - The place where a plant or animal naturally or normally lives or grows.

HABITAT DIVERSITY - The distribution and abundance of different plant and animal communities and species within a specific area.

HABITAT TYPE – An aggregation of all land areas potentially capable of producing similar climax plant communities.

HAND PILING – The use of personnel to manually gather accumulated fuels (usually smaller fuels such as woodcutting slash or small thinning slash) and place it in a pile to be burned or retained for wildlife.

HAZARD – Any real or potential condition that can cause injury, illness, or death of personnel, or damage to or loss of equipment or property.

HIDING COVER - Vegetation that will hide 90 percent of a deer from the view of a human at a distance of 200 feet or less. The distance at which the animal is essentially hidden is called a "sight distance."

HISTORIC RANGE OF VARIABILITY (HRV) – The historical pattern and abundance of structural stages within watersheds, using pre-settlement (1800-1900) conditions as a reference point.

HISTORIC SITE - Site associated with the history, tradition, or cultural heritage of national, state, or local interest, and of enough significance to merit preservation or restoration.

- I -

ID TEAM - See INTERDISCIPLINARY TEAM.

IMPACTS - See EFFECTS**.**

INCREMENT – The increase in diameter, basal area, height, volume, quality or value of individual trees or stands during a given period.

INDICATOR SPECIES - See MANAGEMENT INDICATOR SPECIES**.**

INDIRECT OUTPUTS -Outputs caused by an action, but which are later in time or farther removed in distance, although still reasonably foreseeable. See EFFECTS.

INDIVIDUAL TREE SELECTION - A stand management method in which silviculturists identify individual trees that need to be removed from a stand of trees. In this method specific types, sizes, or qualities of trees are identified for either removing from the stand or remaining in the stand.

INITIAL ATTACK – The fire suppression effort that takes place as soon as possible following a wildland fire report.

INTEGRATED PEST MANAGEMENT - A process for selecting strategies to regulate forest pests in which all aspects of a pest-host system are studied and weighed. The information considered in selecting appropriate strategies includes the impact of the unregulated population on various resource values, alternative regulation tactics and strategies, and benefit/cost estimates of those alternative strategies. Regulatory strategies are based on sound silvicultural practices and ecology of the pest-host system, and consist of a combination of tactics such as timber stand improvement plus selective use of pesticides.

INTENSIVE MANAGEMENT (INTENSIVE FOREST MANAGEMENT) - A high investment level of timber management that includes use of precommercial thinnings, commercial thinnings, genetically improved stock, and control of competing vegetation.

INTERDISCIPLINARY TEAM (ID TEAM) - A group of individuals with different training assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad to adequately solve the problem.

INTERMEDIATE CUTTING - Any removal of trees from a stand between the time of its formation and the regeneration cut. Most commonly applied intermediate cuttings are release, thinning, improvement, and salvage.

INTERMITTENT STREAMS - A stream which flows only at certain times of the year when it receives water from some surface source, such as melting snow in mountainous areas.

INVENTORY DATA AND INFORMATION COLLECTION - The process of obtaining, storing, and using current inventory data appropriate for planning and managing the Forest.

IRRETRIEVABLE - Applies to losses of production, harvest, or commitment of renewable natural resources. For example, some or all of the timber production from an area is irretrievably lost during the time an area is used as a winter sports site. If the use is changed, timber production can be resumed. The production lost is irretrievable, but the action is not irreversible.

IRREVERSIBLE - Applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or to those factors that are renewable only over long time spans, such as soil productivity. Irreversible also includes loss of future options.

ISSUE - A point, matter, or question of public discussion or interest to be addressed or decided through the planning process. See also PUBLIC ISSUE.

- L -

LADDER FUELS – Fuels that provide vertical continuity between the surface fuels and crown fuels in a forest stand, thus contributing to the ease of torching and crowning.

LAND MANAGEMENT - The intentional process of planning, organizing, programming, coordinating, directing, and controlling land use actions.

LANDING - Any place where round timber is assembled for further transport, commonly with a change of method.

LANDSCAPE LEVEL – A watershed, or series of interacting watersheds or other natural biophysical (ecological) units, within the larger Land and Resource Management Planning areas. This term is used for conservation planning and is not associated with visual landscape management and viewscape management.

LAND USE ALLOCATION - The commitment of a given area of land or a resource to one or more specific uses, for example, to campgrounds or wilderness.

LATE FOREST SUCCESSION – A stage of forest succession where the majority of trees are mature or over-mature.

LEAVE-TOP-ATTACHED-YARDING (LTA) – All trees meeting Utilization Standards which are 60 feet in length or longer are required to have tops (and limbs) attached to the last log while being yarded to the landing. Portions of live trees which break during felling or yarding, and are greater than 8 feet in length shall be yarded to the landing.

LOGGING RESIDUES - See SLASH.

LOPPING AND SCATTERING – Lopping the slash created after felling and spreading it more or less evenly over the ground.

LATE AND OLD STRUCTURE (LOS) – Late and old structural stages are defined by the Eastside Screens as multi-strata stands with large trees and single strata stands with large trees.

- M -

MANAGEMENT AREA - Tracts of land grouped into one category having a particular management emphasis.

MANAGEMENT CONCERN - An issue, problem, or condition that influences the range of management practices identified by the Forest Service in the planning process.

MANAGEMENT DIRECTION - A statement of multiple use and other goals and objectives, and the associated management prescriptions, and standards and guidelines for attaining them.

MANAGEMENT EMPHASIS - That portion of a management scheme that receives the most stress or is of the greatest significance or importance. It may be the resources being produced, or it may be the way in which they are produced.

MANAGEMENT INDICATOR SPECIES – A species selected because its welfare is presumed to be an indicator of the welfare of other species using the same habitat. A species whose condition can be used to assess the impacts of management actions on a particular area.

MANAGEMENT PRACTICE – A specific activity, measure, course of action, or treatment.

MANAGEMENT PRESCRIPTION – The management practices and intensity selected and scheduled for application on a specific area to attain multiple use and other goals and objectives.

MANAGEMENT REQUIREMENT (MR) – Minimum standards for resource protection, vegetation manipulation, silvicultural practices, even-aged management, riparian areas, soil and water diversity that are to be met to accomplish National Forest System goals and objectives.

MASS MOVEMENT – A general term for any of the variety of processes by which large masses of earth material are moved downslope by gravitational forces - either slowly or quickly.

MATURE TIMBER – Trees that have attained full development, particularly height, and are in full seed production.

MEAN ANNUAL INCREMENT OF GROWTH – The total volume of a tree or stand of trees up to a given age divided by that age.

MECHANICAL PILING – The use of mechanized equipment to gather accumulated fuels, usually activity fuels created by thinning, harvest or woodcutting and places it in a pile configuration to be either utilized, burned or left for wildlife habitat.

MECHANICAL SHRUB TREATMENT (MST) – Use of mechanized equipment to mow, cut, chop, grind or otherwise reduce shrub or ground fuel vertical structure. Equipment and attachments would be chosen based on soils (compaction and displacement potential), terrain, other resource concerns, cost and availability.

MECHANICAL THINNING - Reducing the number of trees in a stand.

MIDDLEGROUND – A term used in visual management to describe the portions of a view extending from the foreground zone out to 3 to 5 miles from the observer.

MINERAL MATERLALS - Deposits such as sand, stone, gravel, and clay.

MINERAL SOIL - Weathered rock materials, usually containing less than 20 percent organic matter.

MITIGATION MEASURES - Actions to avoid, minimize, reduce, eliminate, or rectify adverse impacts of management practices.

MODEL - A representation of reality used to describe, analyze, or understand a particular concept. A "model" may be a relatively simple qualitative description of a system or organization, or a highly abstract set of mathematical equations.

MODIFICATION - See VISUAL QUALITY OBJECTIVE**.**

MONITORING AND EVALUATION - The periodic evaluation of LRMP management practices on a sample basis to determine how well objectives have been met.

MORTALITY - In wildlife management, the loss in a population from any cause, including hunter kill, poaching, predation, accident, and disease. In forestry, trees in a stand that die of natural causes.

MOUNTAIN PINE BEETLE - A tiny black insect, ranging in size from 1/8 to 3/4 inch, which bores its way into a tree's cambium and cuts off its supply of nutrients, thus killing the tree.

MULTI-COHORT – a stand with two or more age classes or cohorts.

MULTIPLE USE - The management of all the various renewable surface resources of the National Forest System so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some lands will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land and with consideration being given to the relative values of the various resources; and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.

- N -

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) OF 1969 - An Act to declare a National policy that will encourage productive and enjoyable harmony between humankind and the environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, to enrich the understanding of the ecological systems and natural resources important to the nation, and to establish a Council on Environmental Quality.

NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN - A Plan which "…shall provide for multiple use and sustained yield of goods and services from the National Forest System in a way that maximizes long-term net public benefits in an environmentally sound manner."

NATIONAL FOREST MANAGEMENT ACT (NFMA) - A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring the preparation of Regional Guides and Forest Plans and the preparation of regulations to guide that development.

NATIONAL FOREST SYSTEM (NFS) - A nationally significant system of federally owned units of forest, range, and related land consisting of National Forest, Purchase Units, National Grasslands, and other lands, waters, and interest in lands which are administered by the Forest Service or designated for administration through the Forest Service.

NATIONAL FOREST SYSTEM (NFS) LANDS – National Forests, National Grasslands, or Purchase Units and other federal lands, that have been designated by Executive Order or statute as lands under the management of the Forest Service, including experimental areas and Bankhead-Jones Title 111 lands.

NATIONAL REGISTER OF HISTORIC PLACES - A listing (maintained by the U.S. National Park Service) of areas that have been designated as being of historical significance. The Register includes places of local and state significance as well as those of value to the Nation.

NATURAL BARRIER - A natural feature that restricts livestock or wildlife movements, such as a dense stand of trees or a cliff.

NATURAL DISTURBANCE REGIMES – The historic patterns (frequency and extent) of fire, insects, wind, landslides and other natural processes in an area.

NATURAL REGENERATION - Reforestation of a site by natural seeding from the surrounding trees. Natural regeneration may or may not be preceded by site preparation.

NET PUBLIC BENEFITS - An expression used to signify the overall long-term value to the nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs), whether they can be quantitatively valued or not. Net public benefits are measured by both quantitative and qualitative criteria rather than a single measure or index. The maximization of net public benefits to be derived from management of units of the National Forest System is consistent with the principles of multiple use and sustained yield.

NON-FOREST LAND - Lands that never have had or that are incapable of having 10 percent or more of the area occupied by forest trees; or lands previously having such cover and currently developed for non-forest use.

NON-GAME SPECIES – Animal species that are not hunted, fished, or trapped.

NOXIOUS WEEDS – Undesirable plant species that are unwholesome to the range or to animals. The Forest Service Manual describes a noxious weed as a plant that is aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier of host of serious insects or disease, and being native or new to, or not common to the United States or parts thereof (USDA, Forest Service, 1995c).

- O -

OBJECTIVE – A concise, time-specific statement of measurable planned results that respond to pre-established goals. An objective forms the basis for further planning to define the precise steps to be taken and the resources to be used in achieving identified goals.

OFF-HIGHWAY VEHICLE (OHV) – Vehicle such as motorcycles, all-terrain vehicles, four-wheel drive vehicles, and snowmobiles, synonymous with Off-road vehicle (ORV).

OLD-GROWTH ATTRIBUTES – Structural features and other characteristics of old-growth forests, including: large trees for the species and site; wide variation in tree sizes and spacing; accumulations of large dead standing and fallen trees; multiple canopy layers; canopy gaps and understory patchiness; elements of decay such as broken or deformed tops or trunks and root decay; and the presence of species characteristic of old growth.
OLD-GROWTH HABITAT – Habitat for certain wildlife that is characterized by over-mature coniferous forest stands with large snags and decaying logs.

OPPORTUNITY – A statement of general actions, measure, or treatments that addresses a public issue or management concern in a favorable way.

OUTPUTS – The goods, services, products, and concerns that are measurable and capable of being used to determine the effectiveness of programs and activities in meeting objectives. Goods, end products, or services that are purchased, consumed, or utilized directly by people. A broad term for describing any result, product, or service that a process or activity actually produces.

OVERSTORY – That portion of the trees, in a forest or in a stand of more than one story, forming the upper or uppermost canopy.

- P -

PARTIAL RETENTION – See VISUAL QUALITY OBJECTIVE.

PARTICULATES – Small particles suspended in the air and generally considered pollutants. See TOTAL SUSPENDED PARTICULATES.

PERCENTILE WEATHER - The weather conditions that can be expected of X% of the days during a fire season. The standard percents are Low (0%-15%), Moderate (16%-89%), High (90%-96%) and Extreme (97% and higher). Low percentile weather is the average suite of weather conditions that would occur less than 15% of the time.

PERENNIAL STREAM – A stream that flows year round.

PERMITTEE – Any person or business formally allowed to graze livestock on the land of another person or business (e.g.; on state or federal land).

PERSONAL USE – Normally used to describe the type of permit issued for removal of wood products (firewood, post, poles, and Christmas trees) from National Forest Land when the product is for home use and not to be resold for profit.

PLANNED IGNITION - A fire started deliberately, and controlled to accomplish a resource management objective

PLANNING AREA - The contiguous area within defined boundaries that is determined to be logical for analysis of the existing condition and proposed activities.

PLANNING CRITERIA - Criteria prepared to guide the planning process. Criteria applied to collection and use of inventory data and information, analysis of the management situation, and the design, formulation, and evaluation of alternatives.

PLANNING RECORDS - The body of information documenting the decisions and activities that result from the

process of developing an EIS, Forest Plan, or significant amendment (also referred to as the Project Record).

PLANT ASSOCIATION GROUP (PAG) – Combine plant associations by climax species, site potential, and temperature and moisture similarities.

POLE/SAPLING – A Forest successional stage in which trees between five and nine inches in diameter are the dominant vegetation. See also SIZE CLASS.

POLE TIMBER - Trees of at least five inches in diameter at breast height, but smaller than the minimum utilization standard for sawtimber. See also SIZE CLASS.

POLICY - A definite course or method of action selected by a governmental agency, institution, group, or individual from among alternatives and, in the light of given conditions, to guide and usually determine present and future decisions. A specified decision or set of decisions designed to carry out such a chosen course of action.

POST-FLEDGLING AREA (PFA) – The area of concentrated use by the goshawk family after the young leave their nest. The desired area is approximately 420 acres.

PRACTICES - Those management activities that are proposed or expected to occur.

PRECOMMERCIAL THINNING - The practice of removing some of the trees less than marketable size from a stand so that the remaining trees will grow faster.

PREHISTORIC SITE - An area that contains important evidence and remains of the life and activities of early societies that did not record their history.

PRESCRIBED FIRE - A fire burning under specified conditions that will accomplish certain planned objectives.

PRESCRIPTION - A written direction for various Forest management activities, such as tree harvest and fuels reduction activities.

PRESERVATION - A visual quality objective that allows only for ecological changes.

PROGRAM - When spelled with a capital, the Renewable Resource Program required by the RPA. In the general sense, sets of activities or projects with specific objectives, defined in terms of specific results and responsibilities for accomplishment.

PROGRAMMATIC MEMORANDUM OF AGREEMENT - An agreement between the U.S.D.A. Forest Service, Pacific Northwest Region, the Oregon State Historic Preservation Office (SHPO), and the Advisory Council on Historic Preservation on the management of two types of cultural resource sites found on the Forest: Depression-era administrative structures and prehistoric lithic scatters.

PROJECT RECORD - The body of information documenting the decisions and activities that result from the process of developing an EIS, Forest Plan, or significant amendment (also referred to as the Planning Record).

PROJECTS - Work schedules prescribed for a project area to accomplish management prescriptions. Projects can be for operation, maintenance, and protection (OMP), or for investment purposes. OMP projects are for ongoing work and are generally considered one year at a time. Investments can be of multi-year duration. A project is organized for managerial convenience, and is described by location, activities, outputs, effects, work force, dollars, time, and responsibility for execution.

PUBLIC ACCESS – Refer to Access

PUBLIC ISSUE - A subject or question of widespread public interest relating to management of the National Forest System.

PUBLIC PARTICIPATION - Meetings, conferences, seminars, workshops, tours, written comments, responses to survey questionnaires, and similar activities designed and held to obtain comments from the public about Forest Service planning.

- R -

RAPTORS – Predatory birds such as falcons, hawks, eagles, and owls.

RANGER DISTRICT – A sub-unit of a National Forest for management and administration purposes.

RECORD OF DECISION - A document separate from but associated with an Environmental Impact Statement which states the decision, identifies all alternatives, specifying which were environmentally preferable, and states whether all practicable means to avoid environmental harm from the alternative have been adopted, and if not, why not.

REGENERATION - The renewal of a tree crop, whether by natural or artificial means. Also, the young crop itself**,** which is commonly referred to as reproduction.

REGULATIONS - Generally refers to the Code of Federal Regulations, Title 36, Chapter II, which covers management of the Forest Service.

REHABILITATION - Action taken to restore, protect, or enhance site productivity, water quality, or other resource values over a period of time.

RELEASE CUTTING – Removal of competing vegetation to allow a desired tree species to grow.

RESIDUAL STAND - The trees remaining standing after some activity such as selection cutting.

RESOURCE - Anything which is beneficial or useful, be it animal, vegetable, mineral, a location, a labor force, a view, an experience, etc. Resources, in the context of land use planning, thus vary from such commodities as timber and minerals to such amenities as scenery, scenic viewpoints, or recreation opportunities.

RESOURCE MANAGEMENT PLAN - A Plan developed prior to the LRMP that outlined the activities and projects for a particular resource element independently of considerations for other resources. Such Plans are superseded by the LRMP.

RESOURCE PLANNLNG ACT (RPA) - The Forest and Rangeland Renewable Resources Planning Act of 1974**.** Also refers to the National Assessment and Recommended Program developed to fulfill the requirements of the act.

RESPONSIBLE OFFICIAL - The Forest Service employee who has been delegated the authority to carry out a specific planning action.

RETENTION - See VISUAL QUALITY OBJECTIVE.

RIPARIAN - Pertaining to areas of land directly influenced by water. Riparian areas usually have visible vegetative or physical characteristics reflecting this water influence. Stream sides, lake borders, or marshes are typical riparian areas.

RIPARIAN AREA - Geographically delineated areas, with distinctive resource values and characteristics that are comprised of aquatic and riparian ecosystems.

ROADED NATURAL (RN) - A classification of the Recreation Opportunity Spectrum that characterizes a predominately natural environment with evidence of moderate permanent alterations and resource utilization. Evidence of the sights and sounds of people is moderate, but in harmony with the natural environment. Opportunities exist for both social interaction and moderate isolation from the sights and sounds of people.

ROTATION - A pre-determined time frame in which an even-aged forest stand will reach maturity and be harvested.

RURAL - A Recreation Opportunity Spectrum classification for areas characterized by a substantially modified natural environment. Sights and sounds of people are evident. Renewable resource modification and utilization practices enhance specific recreation activities or provide soil and vegetative cover protection.

- S -

SALE PREPARATION COSTS - Costs associated with preparing a timber harvest on Forest Service lands for sale to the public; usually include all administrative costs for developing sale layout, writing an Environmental Assessment and selling the timber sale.

SALVAGE - Activity, usually removal or chipping, of material killed by a disturbance event such as insects, fire, wind, etc. Where possible, this material is used as some form of forest product of commercial value, such as firewood, pulp, and/or chips.

SCARIFIED - Land in which the topsoil has been broken up or loosened in preparation for regenerating by direct

seeding or natural seedfall. Also refers to ripping or loosening road surfaces to a specified depth for obliteration or "putting a road to bed."

SCOPING PROCESS -A part of the National Environmental Policy Act (NEPA) process; early and open activities used to determine the scope and significance of the issues, and the range of actions, alternatives, and impacts to be considered in an Environmental Impact Statement.

SECOND GROWTH – Forest growth that has become established following some interference, such as cutting, serious fire, or insect attack, with the previous Forest crop.

SEDIMENT – Earth material transported, suspended, or deposited by water.

SEEDLINGS AND SAPLINGS – Live trees less than five inches in diameter at breast height. See also SIZE CLASS.

SENSITIVE SPECIES – Plant or animal species that are susceptible or vulnerable to activity impacts or habitat alterations. Those species that have appeared in the Federal Register as proposed for classification or are under consideration for official listing as endangered or threatened species, that are on an official State list, or that are recognized by the Regional Forester as needing special management to prevent placement on Federal or State lists.

SERAL – A biotic community which is a developmental, transitory stage in an ecological succession.

SERAL STAGES - Seral stage describes the phase of development of a plant community. Early seral species are those species you would expect to find on a site soon after a major disturbance, like fire.

SILVICULTURAL EXAMINATION – The process used to gather the detailed in-place field data needed to determine management opportunities and direction for the forest resource within a small subdivision of a Forest area, such as a stand. Also, Stand Exam.

SIVICULTURAL SYSTEM – A management process whereby Forests are tended, harvested, and replaced, resulting in a Forest of distinctive form. Systems are classified according to: 1) the method of carrying out tree falling that remove the mature crop and provide for regeneration, and 2) the type of forest thereby produced.

SILVICULTURE – The art and science of controlling the established, composition, and growth of forests.

SITE - A specific location where management activity is considered, planned, or operating.

SITE INDEX – A numerical evaluation of the quality of land for plant productivity, based on the height of dominant trees in a stand at an arbitrarily chosen age.

SITE POTENTIAL - The specific ability of a site to grow vegetation. It includes the soil, topographic, and climatic conditions that determine the resources available for growing vegetation.

SITE PREPARATION – An activity (such as prescribed burning, disking, and tilling) performed on a reforestation area, before introduction of reforestation, to ensure adequate survival and growth of the future crop.

SITE PRODUCTIVITY – Production capability of specific areas of land.

SIZE CLASS – For the purposes of Forest planning, size class refers to the intervals of tree stem diameter used for classification of timber in the LRMP database.

Seedling/sapling = less than five-inch diameter
Pole/sapling or pole timber = five-inch to nine-inch diameter
Sawtimber = greater than nine-inch diameter

SKIDDING – A general term for hauling loads by sliding, not on wheels, as developed originally from stump to roadside, deck, skidway, or other landing.

SLASH – The residue left on the ground after tree felling and tending, and/or accumulating there as a result of storm, fire, girdling, or poisoning. It includes unutilized logs, uprooted stumps, broken or uprooted stems, the heavier branchwood, etc.

SMALL GAME – Birds and small mammals normally hunted or trapped.

SNAG – A standing dead tree.

SOCIO-ECONOMIC – Pertaining to, or signifying the combination or interaction of social and economic factors.

SOIL – The portion of the earth's surface consisting of disintegrated rock and humus.

SOIL PRODUCTIVITY – The capacity of a soil to produce a specific crop such as fiber or forage under defined levels of management. Productivity is generally dependent on available soil moisture and nutrients, and length of growing season.

SOIL RESOURCE INVENTORY - See SOIL SURVEYS**.**

SOIL SURVEYS - Systematic examinations of soils in the field and in laboratories, their description and classification; the mapping of kinds of soil; the interpretation according to their adaptability for various crops, grasses, and trees, their behavior under use or treatment for plant production or for other purposes, and their productivity under different management systems.

SOIL TEXTURE - The relative proportions of the various soil separates in a soil, described by the classes of soil texture. Twelve basic soil texture classes are recognized, such as "loam." The textural classes may be modified by the addition of suitable adjectives when coarse fragments are present in substantial amounts; for example, "stony loam."

STAND (TREE STAND, TIMBER STAND) - An aggregation of trees or other vegetation occupying a specific area and sufficiently uniform in species composition, age arrangement, and condition as to be distinguishable from the forest or other vegetation or land cover on adjoining areas.

STAND COMPOSITION – The proportion of each tree species in a stand expressed as a percentage of either the total number, basal area or volume of all tree species in the stand.

STAND DENSITY – A relative measure of the amount of stocking on a forest area. Often described in terms of stems per acre, basal area, or stand density index.

STAND DENSITY INDEX (SDI) – The number of trees per acre that a stand would have at a quadratic mean diameter of 10 inches. SDI=(trees/acre)*$(Dq/10)^{1.66}$ where Dq is the quadratic mean diameter for the stand or portion thereof. (See SDImax)

STAND DIVERSITY - Any attribute that makes one timber stand biologically or physically different from other stands. This difference can be measured by, but not limited to: different age classes; species; densities; or non-tree floristic composition.

STAND DYNAMICS - The changes in forest stand structure with time, including stand behavior during and after disturbances (Oliver, 1996).

STAND EXAMINATION SURVEYS - Procedures to collect data on Forest stands.

STAND STRUCTURE – The distribution of trees in a stand, which can be described by species, vertical or horizontal spatial patterns, size of trees or tree parts, age, or a combination of these.

STANDARD - A statement that describes a condition when a job is done properly. Standards show how well something should be done, rather than what should be done.

STANDARDS AND GUIDELINES - Principles specifying conditions or levels of environmental quality to be achieved.

STRATUM – A distinct layer of vegetation within a forest community; canopy layer.

SUITABILITY - The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone. A unit of land may be suitable for a variety of individual or combined management practices.

SUITABLE FOREST LAND - Land to be managed for timber production on a regulated basis.

SUPPRESSED VEGETATION – Trees or shrubs with crowns receiving no direct light either from above or from the sides, and that will not respond to release. Usually crowns are entirely below the general level of the canopy.

SUPPRESSION - The process of extinguishing or confining fire.

SURFACE FUELS - Loose surface litter on the soil surface, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches that have not yet decayed enough to lose their identity; also grasses, forbs, low and medium shrubs, tree seedlings, heavier branchwood, downed logs, and stumps interspersed with or partially replacing the litter.

SUSTAINABILTY - The ability of forested systems to withstand or resist rapid and widespread structural change due to fire, insects, and disease.

- T -

TEMPORARY ROAD - Roads authorized by contract, permit, lease, other written authorization, or emergency operation not intended to be a part of the forest transportation system and not necessary for long term resource management (36CFR 212.1).

THERMAL COVER - Cover used by animals to ameliorate effects of weather; for deer, a stand of coniferous trees 5 feet or taller with an average crown closure of 75 percent or more, or a pole-size or larger stand with 60 percent or more closure.

THINNING - A felling made in an immature stand primarily to maintain or accelerate diameter increment and also to improve the average form of the remaining trees without permanently breaking the canopy. An intermediate cutting.

THREATENED AND ENDANGERED (T&E) SPECIES - See THREATENED; see ENDANGERED

THREATENED SPECIES - Those plant or animal species likely to become endangered species throughout all or a significant portion of their range within the foreseeable future. See also ENDANGERED SPECIES.

THRIFTY TREES - Trees which have at least a 40% live crown ratio and with little or no evidence of disease or insects are called thrifty. They should also show evidence of good growth with long leaders and a good color, usually dark green.

TIERING - Refers to the coverage of general matters in broader environmental impact statements (such as national program or policy statements) with subsequent narrower statements or environmental analyses (such as Regional or Forest program statements, or ultimately, site-specific statements) incorporating, by reference, the general discussions and concentrating solely on the issues specific to the statement subsequently prepared.

TIMBER PRODUCTION - The purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use. For purposes of Forest planning, the term "timber production" does not include production of fuelwood or harvest of unsuitable lands.

TIMBER STAND IMPROVEMENT (TSI) - Measures such as thinning, pruning, release cutting, prescribed fire, girdling, weeding, or poisoning of unwanted trees aimed at improving the growing condition of the remaining trees.

TOPOGRAPHY - The configuration of a surface including its relief, elevation, and the position of its natural and human-created features

TOTAL SUSPENDED PARTICULATES (TSP) - Any finely divided material (solid or liquid) that is airborne with an aerodynamic diameter smaller than a few hundred micrometers.

TRACTOR LOGGING - Any logging method that uses a tractor as the motive power for transporting logs from the stumps to a collecting point, whether by dragging or carrying the logs.

TRADE-OFF -The combination of benefits and costs that are gained and lost in switching between alternative courses of action. Trade-offs include only those portions of benefits and costs that are not common to all alternative courses of action under consideration.

TREATMENTS – Any planned manipulation of plant materials. Prescribed burning, thinning, logging, lopping are all examples of vegetation treatments.

TREES PER ACRE – The number of trees of a specific diameter on an acre of land.

- U -

UNCLASSIFIED ROAD - Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and off road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization (36 CFR 212.1).

UNDERBURNING (UB) – Use of prescribed fire under a stand of trees to decrease or remove accumulated ground fuels during periods of spring like moisture to reduce risk of wildfire

UNDERSTORY - The trees and other woody species growing under a more-or-less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth.

UNDESIRABLE SPECIES - Any species of plant or animal which is NOT considered to be compatible with meeting management goals and objectives.

UNPLANNED IGNITION - A fire started at random by either natural or human causes, or a deliberate incendiary fire.

UNROADED AREA - Any area, without the presence of a classified road, of a size and configuration sufficient to protect the inherent characteristics associated with its roadless condition. Unroaded areas do not overlap with inventoried roadless areas.

UPPER DENSITY LIMIT - The density level at which a suppressed class of trees begins to develop.

UPPER MANAGEMENT ZONE – Refer to Upper Density Limits

UPPER MANAGEMENT ZONE – UMZ –The level of stocking or relative density beyond which there is imminent risk of loss of overstory trees to bark beetles.

USTIC - A soil moisture regime in which moisture is limited but is present at a time when conditions are suitable for plant

- V -

VARIABLE COSTS - Costs that vary according to the activity or output level. They may be expressed as a cost per acre or cost per unit of output.

VEGETATIVE MANAGEMENT - Activities designed primarily to promote the health of the crop forest cover for multiple-use purposes.

VIABLE POPULATIONS - That number of individuals of a species sufficient to ensure the long-term existence of the species in natural self-sustaining populations adequately distributed throughout the planning area.

VISUAL RESOURCE - The composite of basic terrain, geologic features, water features, vegetative patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for visitors.

- W -

WATERSHED - The entire land area that contributes water to a drainage system or stream.

WETLANDS - Areas that are inundated by surface or ground water often enough to support, and usually do support, primarily plants and animals that require saturated or seasonally saturated soil conditions for growth and reproduction.

WHOLE-TREE-YARD (WTY) – All trees meeting utilization standards less than 60 feet in length are required to be whole tree yarded to the landing. Portions of live trees which break during felling or yarding, and are greater than 8 feet in length shall be yarded to the landing.

WILDERNESS - Areas designated by congressional action under the 1964 Wilderness Act. Wilderness is defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation. Wildernesses are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or a primitive and unconfined type of recreation; are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition, and may contain features of scientific, educational, scenic, or historical value as well as ecologic and geologic interest.

WILDFIRE - Any wildland fire that is not a prescribed fire. See also PRESCRIBED FIRE.

WILDLIFE – All non-domesticated mammals, birds, reptiles, and amphibians living within a natural environment, and include both game species and non-game species. Animals, or their progeny, which one were domesticated but escaped captivity and are running wild (i.e., feral animals), such as horses, burros, and hogs, are not considered wildlife.

WILDLIFE HABITAT DIVERSITY – The distribution and abundance of different plant and animal communities and species within a specified area.

WINTER RANGE HABITAT UNIT (WRHU) – Areas in the biological winter range of mule deer ranging from 15,000 to 20,000 acres.

WOOD FIBER PRODUCTION - The growing, tending, harvesting, and regeneration of harvestable trees.

WOODY DEBRIS - Dead pieces of woody vegetation such as stems, limbs, or leaves which are on a site.

- X, Y, Z -

XERIC - A soil moisture regime in which soil is dry for 45 or more consecutive days in the 4 months following the summer solstice, and moist for 45 or more consecutive days in the 4 months following the winter solstice.

YARDING - Hauling timber from the stump to a collection point.

YARDING TOPS ATTACHED – This refers to hauling the tops and limbs left attached to the last log of each tree as it is yarded to the landing for processing and is done to reduce accumulations of logging fuels within the harvest unit.

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Appendices

Appendix A – Landscape Design

Landscape Design Process for the West Bend Project

A landscape design process similar to the methodology devised by Diaz and Apostle (USDA 1992) was conducted to provide a means for tailoring how broad-based goals and objectives should translate into rationale for stand-level treatments across the planning area. The process entailed a top-down look, from agency direction, to local uses, to current conditions for helping to determine what kinds of treatments should be proposed, where they should occur, and why. The goal was to discover what kind of general pattern should emerge, as a result of prescribed treatments that would capitalize on the intrinsic diversity of the landscape and help restore or improve ecosystem function, structure, resilience, and services.

In the West Bend planning area, intrinsic factors that were taken into account were the strong ecologic gradients, which are paramount to the landscape's capability, resilience, and sensitivity. These are profound and compressed in the planning area, and are indicative of the east slope of the Cascades. In the ten miles from east-to-west across the planning area:

- elevation rises from 3,652 feet to 6,628 feet
- average annual precipitation ranges from 12 inches to 51 inches
- average maximum July temperatures range from 82 to 70 (degrees F)
- average minimum January temperatures range from 22 to 17
- average snowpack accumulation deepens from less than 6 inches to over 60 inches
- soils change from gentle to moderate slopes of ash covered lava/tuff or pumice that exhibit low relative productivity to moderate or steep slopes of ash covered glacial deposits that exhibit high productivity
- plant associations transition from dry Ponderosa pine types to wet mixed conifer types
- the fire regime transitions from a high frequency, low severity type to a mixed frequency and severity regime.

This level of variability in such a compact distance generates strong ecotones where plant associations and habitats transition into one another in a short distance. In the midst of this variability there has been a high to moderate degree of disturbance, principally as a result of past forest management, fire exclusion, and insect infestation; also due to both prescribed and wildfire. This has resulted in a landscape where horizontal and vertical differentiation has been altered from inherent pathways of development so that patch sizes and structure types are somewhat more homogeneous and fragmented than the historic range of variability.

The east-west ecological gradients also give rise to another phenomenon; a wide range of human uses and ecosystem services. This is apparent in the scope of recreation where winter, summer, and year-round activities, both motorized and non-motorized, are spatially focused and dependent on the location of streams, roads, and snow persistence. The relationship is also influenced by extractible resources; for example the number and type of developed rock sources across the planning area range from pumice, to alluvial gravel, to cinders. Maybe more apparent was the degree of timber harvest that occurred, particularly in the early 20th century when the growth of Bend was largely supported by a mill economy reliant on stands of large Ponderosa pine. This is very noticeable in the eastern half of the planning area.

These variations in landscape elements and human uses are reflected in the Deschutes National Forest's Land and Resource Management Plan (LRMP). Within the planning area there are more than a half-dozen Management Area land allocations where emphasis on a particular resource objective is defined.

They range from wildlife focused management to intensive recreation to general forest that emphasizes timber production. In places, there are overlapping objectives; for example the Scenic Byway and deer winter range. There are also other management considerations, such as the presence of threatened, endangered, or sensitive (TES) species. Other considerations are based more on existing use rather than agency directive, such as stakeholder focused partnerships, like mountain biking with an extensive trail network.

These factors are not exclusive to the West Bend planning area. Rather they transcend it, both east to west and north to south. It is important to consider how this landscape is related to or associated with those landscapes adjacent to it. How are and do the structures, function, and flows of the West Bend planning landscape and the landscapes around affect each other? Notable examples include:

- the Bend Municipal Watershed which is adjacent to the northwest
- the Deschutes Wild and Scenic River that borders the southeast portion of the planning area and extends north, south, and across from it
- scenic views from the Newberry National Volcanic Monument (NNVM) into the planning area
- views from the planning area out into the NNVM
- Tumalo Creek canyon along the north
- a National Scenic Byway that bisects through
- the wildland urban interface of Bend to the east and developments along Skyline Road to the north and west
- important deer and elk habitat that extend to the north and south
- the privately owned Skyline Forest that connects the west Bend area with the Sisters area

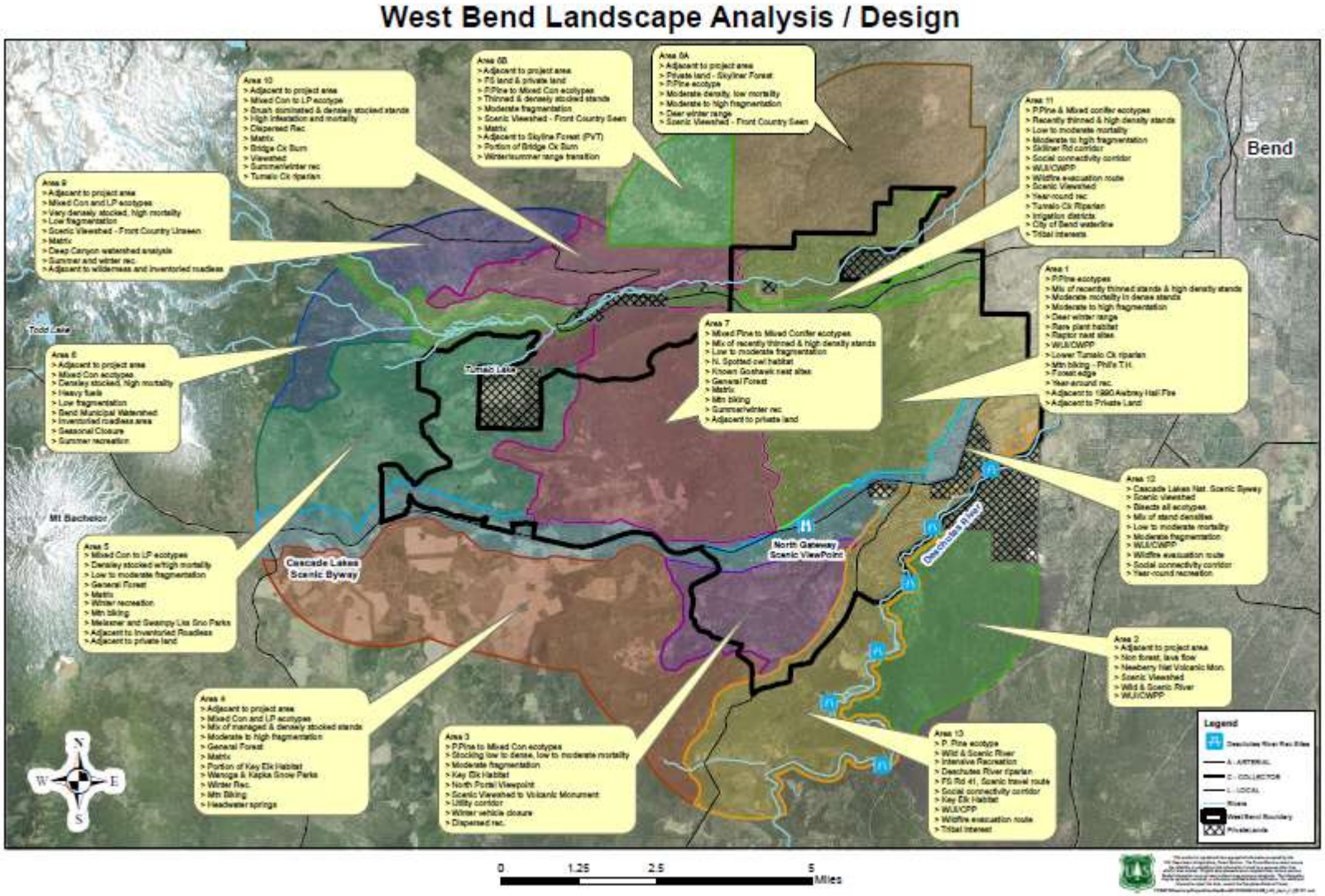
How do these considerations translate into stand-level treatments that can address multiple objectives while restoring habitats and ecosystem functions? For the West Bend planning area, the landscape design process focused on eleven basic strategies from which stand-level treatments could be formulated. They include:

- Restoring forest health and reducing fuels
- Hastening the development of older forest structure
- Regenerating lodgepole stands
- Retention of previously thinned stands
- Enhancing riparian habitat
- Areas of retention for wildlife
- Restoring wildlife connectivity
- Enhancing deer winter range
- Enhancing raptor habitat
- Enhancing rare and sensitive plant habitat
- Restoring aspen stands
- Enhancing scenic viewsheds

These general strategies provide the foundation for formulating stand-level treatments. These treatments can be categorized as overstory, understory, or a combination of both treatments. The former will be mostly variable thinning (i.e. light, moderate, or heavy) across the planning area, and some regeneration treatments in lodgepole pine. Understory treatments will include mostly young-stand management (pre-commercial thinning) or fuels reduction (mowing and/or underburning).

West Bend Landscape Design Process Map

Figure 83: West Bend Landscape Analysis/Design



Appendix B – Alternative Units, Prescriptions and Acres

Stand Management Descriptions

The following describes the stand-level objectives for overstory tree treatments that will address landscape level objectives identified in Table 1, page 7 of the FEIS. The prescription code (e.g. 60 BA thin) is used in the unit prescription tables (tables 161, 162, and 163) to identify which stand management technique will be used.

Most stands in ponderosa pine (Prescription code: 60 BA thin)

This is managing ponderosa pine (PP) stands for restoration towards historic range of variability (HRV). The typical stands of PP were established in the last century and are mostly uniform, dense stands. Many stands have been thinned at least once but are now stocked at a level which is susceptible to bark beetle mortality and lack the vigor which may not withstand fire. This prescription would thin trees to about 60 square feet of basal area leaving the healthiest and largest dominant and codominant ponderosa pine, focusing on:

- Addressing the objectives for wildlife focal species listed in Table 1;
- Promoting large diameter trees and open stands that dominate the landscape;
- Maintaining the health and improve the vigor of the trees, allowing the reintroduction of fire;
- Thinning to allow the development of larger diameter trees and an open stand condition similar to the historic condition;
- Increasing resistance to mortality due to fire and bark beetles; and
- Decreasing fire hazard.

Lodgepole with dead component (prescription code: Seed tree)

In the last decade, in the watersheds surrounding the west Bend Project area, lodgepole pine (LP) has undergone a change in structure. Heavily stocked stands of similar diameters and ages are now dominated by bark beetle killed dead LP, with some larger trees and many smaller diameter trees that escaped mortality. These stands are primarily in the LRMP Winter Recreation designation which prefers single storied healthy stands. To promote single storied LP and promote healthy, scenic stands the dead and most of the overstory would be removed, except for adequate seed trees to regenerate the stands. Leave tees would have a 60’ spacing or 10 trees per acre (tpa).

Lodgepole pine regeneration with overstory seed trees (prescription code: HOR)

In past LP regeneration stands seed trees were left to provide for the regeneration seed source. In most of these stands the overstory trees contain mistletoe and provide a multi-storied LP stand. To allow the stands to develop healthily, without overstory mistletoe infection, and as single storied stands, the overstory seed trees would be removed, leaving 15% retention areas.

Lodgepole pine seed tree no harvest (prescription code: Girdle OS)

These stands have overstory seed trees remaining over LP regeneration. Most of the overstory is infected with dwarf mistletoe and is infecting the regeneration. Instead of harvesting the overstory trees to manage the stands as single story LP, the overstory will be killed through girdling. This will leave some overstory structure as snags for wildlife use. This will not occur adjacent to paved roads or recreation areas.

Mixed conifer (white fir and lodgepole) in the wildland urban interface (prescription code: WUI Cut)

Adjacent to some WUI areas there are mixed conifer stands dominated by white fir (WF) and lodgepole pine (LP). These stands have a heavy percentage of dead LP, heavy understory stocking of LP and WF, and an inconsistent overstory density of fir. These stands have many components of stands where wildfire would be difficult to control. Being adjacent to WUI the volatility of these stands is not acceptable. To reduce the resistance to control of fire, the understory ladder and surface fuels would be managed along with the live and dead LP component. This prescription would cut all LP greater than 7" dbh and salvage dead standing and down LP, in order to remove fuels and soon to be fuels. PP would be released by cutting WF and smaller LP. Understory treatment of ladder fuels is important with heavy thinning of less than 7" dbh WF and LP.

Stands managed in the mixed conifer zone

Mixed conifer stand management is focused on the dry mixed conifer stands that have generally lost the dominance of large PP. Historically these stands had fluxes of species mixes, with PP being dominant during dry periods and WF becoming a component during moister cycles or fire free periods. It is the intent of management to keep heterogeneity and reduce the threats to PP resiliency. The mixed conifer dry stands will be managed to meet three foci: 1) PP dominated stands; 2) PP dominated stands with a WF component; and 3) future northern spotted owl connectivity or nesting.

1) Mixed conifer dry (prescription code: 60 BA thin)

Mixed conifer stands which are mostly PP would maintain PP in an open condition and promote returning fire to the ecosystem. Treatments in these stands would cut white fir and LP and thin the remaining PP. This may leave some small openings from the removal of all LP and WF.

2) Mixed conifer moist (prescription code: Thin MC & gaps)

Mixed conifer stands with a mix of PP and WF would be made more resilient through opening the stands around ponderosa pine and leaving pockets of WF. This would involve thinning PP, removing WF close to PP and cutting LP. Fire would be reintroduced into these stands. No lighting of fire would occur in pockets of WF.

3) Future spotted owl connectivity (prescription code: Connect thin)

Spotted owl connectivity is an attempt to provide stands which will enhance movement of spotted owls, which may be traversing the area, from south to north. Providing nesting, roosting and foraging habitat is not sustainable in this area due to the low precipitation and species mix of stands in this area.

Future Connectivity should be managed to provide large long lasting trees, which would be comprised of PP, and a multi-layer denser lower canopy, which would be comprised primarily of WF with some PP. PP is the longest lasting trees in the plant associations where the WF and densities can be managed for a bit of time (from observations in the area). These stands are on the ecotone from PP into the wetter plant associations. PP in this area is about the only species which provides large structure, and it is not very tolerant of heavy competition. Treatments in this type would cut WF and LP around the PP. Through the stands lodgepole pine removal would reduce some of the future fire hazard and release white fir. PP would be thinned where it was dominant in the stands to provide large tree structure.

Stands managed for *Castilleja chlorotica* (prescription code: CACH15)

Castilleja chlorotica (CACH15) *management* will provide openings and generally light tree stocking for CACH15 development. It is severely set back or eliminated when it is mowed or burned. In the West Bend project area, CACH15 appears to use bitterbrush as its primary host (it is a hemiparasitic plant) and prefers thin soil conditions. Generally, CACH15 is most vigorous when the brush component is vigorous. Open stands promote more brush development. Areas without overstory PP and associated needle cast after initial fire entry carry fire less. With open stands and openings of 2-6 acres, more

brush will develop and less area should burn a second time where needle cast does not accumulate. Existing populations of CACH15 will not be burned through.

Figure 84: Typical suitable *Castilleja chlorotica* (CACH15) site near the West Bend area; few trees, vigorous brush, ample sunlight. *Castilleja chlorotica* plant in the left foreground, near rock

Stands will be thinned in an uneven-aged group selection pattern with average stocking at 40-50 square feet (ft^2) basal area (BA), with openings of 2-6 acres concentrated around thin soil areas. Thin soil areas can usually be identified through exposed rock areas, short trees, or heavy dwarf mistletoe. Edges of openings should be lower stocking than the average stand, with BAs around 30-40 ft^2. Following thinning, in areas where the CACH15 does not currently exist, stands should be mowed and burned (to eliminate the needle cast) to reduce the chance of stand replacement wildfire. It will be 20-30 years before it becomes potentially suitable CACH15 habitat. Prescribed fire and mowing will not occur within known CACH15 populations. Subsequent future prescribed burning will focus on burning where needle cast has accumulated, which is expected to be predominately under PP trees.

The lower stocked edges will reduce the amount of needle cast expected to accumulate on the edge or drift into the openings. This reduction in needle cast will potentially reduce the amount of brush burnt in subsequent prescribed fire events.

Stands managed for deer winter range (MA-7); future forage and screening (prescription code: Deer WR Thin)

The area of the West Bend project identified in the forest plan as Deer winter is dominated by single cohort 50-90 year old stands of PP. The mostly continuous crown canopy of these stands has reduced the forage and hiding cover component of the area. This prescription is designed to initiate some growth of both forage and hiding cover or young stands of PP. Forage and screening will be developed through opening stands and making open areas for brush forage and eventually new seedling and saplings to develop into screening or hiding cover. The areas desired for increased forage and screening should be selected away from potential disturbances from trails and roads. Desired forage is developed as bitterbrush or ceanothus tall enough to be above the snow. Brush develops well in open stands and open areas. Vegetation response (including brush) is different for different management activities. It has been observed in the project area that where overstory trees are denser than about 130 ft^2 BA understory vegetation is typically in decline or absent. Where stands are opened there are increases the understory vegetation. Where overstory is opened only a response of the bitterbrush in the area is common. If Ceanothus or manzanita is the successional species, these may increase also. Open areas mowed to a low height will favor forbs and ceanothus or manzanita. Mowing at a higher level will allow all brush species to resprout and typically grow to the same levels as before treatment within 5-10 years. Burning once following opening of a stand typically favors Ceanothus and manzanita, and kills

bitterbrush. Burning twice within a decade following opening of a stand favors forbs and grasses. Openings will be planted with ponderosa pine. Competing vegetation control may be necessary.

Stands will be thinned in an uneven-aged group selection pattern. Stand average stocking will have a BA of 50-70 ft^2 with group selection openings of 2-7 acres concentrated around areas well distanced from roads and trails. Edges of openings should be higher stocking, than the average stand, with BAs around 70-80 ft^2. Following thinning the stands should be mowed and burnt to reduce the chance of stand replacement wildfire. Subsequent future prescribed burning will focus on burning where needle cast has accumulated, which is expected to be predominately under PP trees.

Stands managed for road sun (prescription code: Road sun)

The Cascades Lakes Scenic Byway and Skyliners roads are paved roads heavily traveled in the winter. Trees along these roads shade the roads so that snow and ice are retained longer than more open areas. Thinning trees to reduce canopy shading of the roads will reduce the amount of time snow and ice remains on the roads. The target of stands thinned to reduce winter tree shading of road will reduce crown canopy to less than 10% with patches of trees removed adjacent to corners. The whole stand will be thinned the same way. The target stocking level outside of the area influencing the road sun would be 40-60 ft^2 BA leaving the healthiest dominant PP.

Larger diameter plantation thinning (prescription code: Skid & Deck)

Following logging in the 1920s a large area of West Bend experienced wildfire. Fires removed the regeneration which was common in the area. The land was acquired by the USFS from Shevlin-Hixon Company in the 1940s. Reforestation efforts in the 1950s and 1960s established over 2,000 acres of the stands in the West Bend Project area. Currently these stands are overstocked with PP from the regeneration efforts. This overstocking is making the stands susceptible to bark beetle mortality and the vigor of the stands is low. The trees in the stands are too large to precommercial thin and pile and burn, but are of a size where only a small component of the trees which need to be removed are merchantable in a timber sale. The prescription for these stands would thin to a more sustainable stocking level using machinery and hand thinning. This prescription would thin to 80 trees per acre (tpa) with machinery, whole tree yard to landings, and process on or off site. Smaller diameter material will be hand thinned, piled, and burned. Much of these areas will be mowed and underburned. If utilization removes enough material to keep fuel levels at acceptable levels, the slash would be lopped and scattered. This would typically be followed with mowing and underburning as well.

Alternatives 3 and 4 - future goshawk habitat management

Alternatives 3 and 4 propose to manage a northern goshawk post fledgling area (PFAs) around historical nest areas in a manner similar to that described in the latest paper by Yountz et al Implementing Northern Goshawk Habitat Management in Southwestern Forests: A Template for Restoring Fire-Adapted forest Ecosystems. This activity responds to Key Issue number four described in Chapter 1, Key Issues beginning on page 9

Variability within and between stands is the main objective found in the recommendations. Part of the variation within stands starts with leaving at least 15% of some stands untreated in the current condition. Leaving untreated areas is matched with identifying two possible goshawk nest stands larger than 30 acres where no treatment would occur. These prescriptions intend to thin the stands to levels where bark beetle mortality would not develop as a common problem for more than 10 years, while still maintaining suitable goshawk habitat.

1) 80 Basal area with gap (prescription code: PFA80)

This prescription will create desired variation with planned openings interspersed with heavier crown canopy than generally desired in the planning area. Thinning from below will occur, leaving the largest dominant and codominant PP trees at stocking levels of 80 ft^2 BA. By focusing on the largest

trees and the higher stocking levels, a clumpy appearance to stocking can be expected and be accentuated by gaps within the stand up to 2 acres in size. These stands were selected where this can occur and in close proximity to the nest stands. Fire will be reintroduced into, and maintained within these stands to help maintain varying stocking of understory brush, which is one of the desired characteristics. Reduction in fuels characteristics near nest stands will reduce the opportunity for stand replacing fire to affect stands adjacent to nest stands.

2) 60 basal area (prescription code: PFA60)

This prescription is similar to most of the PP stocking prescriptions in the planning area. The variation within the PFA is important to maintain crown canopy levels and open stands that will not be susceptible to bark beetle mortality for at least 20 years. This would be thinning from below leaving the largest dominant and codominant PP trees at stocking levels of 55-65 ft^2 BA, while cutting all lodgepole pine in the stand. By focusing on the largest trees, a clumpy appearance to stocking can be expected, though there will be few if any openings or gaps except where LP once dominated the overstory. Fire will be reintroduced and maintained in these stands to help maintain varying stocking of understory brush which is one of the desired characteristics.

3) 60 basal area retain white fir and lodgepole pine (prescription code: PFA60)

This prescription is similar to most of the PP stocking prescriptions in the planning area. Leaving LP within the stand understory, seedlings and saplings can be expected to develop within 10–20 years. The variation within the PFA is important to maintain crown canopy levels and open stands that will not be susceptible to bark beetle mortality, although this can be expected due to leaving larger lodgepole pine in the stand. This prescription is led by thinning from below leaving the largest dominant and codominant trees at stocking levels of 55-65 ft^2 BA. By focusing on the largest trees and recruitment of LP in the understory, a multi-canopy appearance to stocking can be expected to develop, providing tree species diversity for goshawk prey base. Fire will be reintroduced and maintained in these stands but would focus on ponderosa pine-dominated areas.

4) 40 basal area (prescription code: PFA40)

This prescription is not similar to most of the ponderosa stocking prescriptions in the planning area. The variation within the goshawk habitat is in currently open stands which will be slightly above the minimum stocking levels desired in the Forest plan and wide open stands in an area which has plenty of consistent crown canopy blackbark ponderosa pine. These open stands will be developed by thinning from below leaving the largest dominant and codominant trees at stocking levels of 35-45 ft^2 BA. By focusing on the largest trees, a wide open stand with scattered denser trees will be seen. The open understory will be maintained with periodic underburning.

Nest stands for goshawk and cooper's hawk (prescription code: Hawk Nest)

Stands where hawk nests were historically or currently found are being managed as nest stands. It is assumed that the historical nest stands have the structural components for the birds and will be retained. In these stands there will be no active management.

Goshawk habitat areas retention blocks (prescription code: PFA retention)

PFA retention stand and blocks were identified as dense stands with multiple canopy characteristics to promote northern goshawk prey development stands. Within the PFA retention stands no treatments to modify the canopy structure are proposed, though fir will be introduced in order to reduce the risk of loss to wildfire.

Alternative 2

Table 220: Appendix B – West Bend - Alternative 2 - Units, Prescriptions, and Acres

Alternative 2						
Unit[17]	**Overstory Rx**	**Activity Code**	**Understory Rx**	**Fuels Rx**	**Salvage**	**Acres**
1.0				Mow/Burn		39
2.0	60 BA thin	HTH		Mow/Burn		27
3.0	60 BA thin	HTH		Mow/Burn		26
4.0	60 BA thin	HTH		Mow/Burn		17
5.0	60 BA thin	HTH		Mow/Burn		31
6.0	60 BA thin	HTH		Mow/Burn		27
7.0				Mow/Burn		137
8.0	60 BA thin	HTH	LFR	Lop & Scat/Mow/Burn		41
10.0				Mow/Burn		38
11.0				Mow/Burn		6
12.0				Mow/Burn		9
13.0			PCT	Pile/Mow/Burn		6
14.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		53
15.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		234
16.0	60 BA thin	HTH	PCT	Lop & Scat/Mow/Burn		37
17.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		109
18.0	60 BA thin	HTH	PCT	Mow/Burn		214
20.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		72
21.0				Mow/Burn		18
22.0	60 BA thin	HTH		Mow/Burn		43
24.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		10
25.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		32
26.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		79
27.0	60 BA thin	HTH		Mow/Burn		69
27.1 (1)				Mow/Burn		4
28.0			LFR	Mow/Burn		3
29.0	60 BA thin	HTH		Mow/Burn		72
29.1 (7)				Mow/Burn		1
30.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		203
31.0	60 BA thin	HTH		Mow/Burn		103
32.0				Mow/Burn		49
33.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		14
34.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		166
35.0	60 BA thin	HTH		Mow/Burn		132
36.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		30
37.0	60 BA thin	HTH		Mow/Burn		100
38.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		200
39.0	60 BA thin	HTH		Mow/Burn		35
40.0	60 BA thin	HTH		Mow/Burn		77
41.0	Skid & deck		Skid & deck	Mow/Burn		52
42.0	Skid & deck		Skid & deck	Mow/Burn		20
43.0	Skid & deck		Skid & deck	Mow/Burn		42

[17] Units that have a .1 (i.e. 27.1) indicates retention areas within units (27.0). When retention areas are indicated, more than one retention area within a unit may exist. Mowing and/or burning will occur within retention areas. Numbers in parenthesis (i.e. 29.1 (7)) indicate the number of retention areas within a unit, in this example 7 within unit 29, also have the same treatments.

Alternative 2						
Unit[17]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	Salvage	Acres
44.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		123
45.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		12
46.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		33
47.0	60 BA thin	HTH		Mow/Burn		108
48.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		20
49.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		41
50.0	60 BA thin	HTH		Mow/Burn		34
51.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		43
52.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		41
53.0	60 BA thin	HTH		Mow/Burn		18
54.0	Skid & deck		Skid & deck	Mow/Burn		9
55.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		18
56.0	Skid & deck		Skid & deck	Mow/Burn		142
57.0	Skid & deck		Skid & deck	Mow/Burn		191
58.0				Mow/Burn		114
58.1 (4)				Mow/Burn		20
59.0				Mow/Burn		56
59.1 (3)				Mow/Burn		11
60.0	Skid & deck		Skid & deck	Mow/Burn		29
61.0				Mow/Burn		77
61.1 (2)				Mow/Burn		4
62.0	Skid & deck		Skid & deck	Mow/Burn		13
63.0				Mow/Burn		10
64.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		12
65.0				Mow/Burn		13
66.0			PCT	Pile/Mow/Burn		13
67.0				Mow/Burn		9
68.0	Skid & deck		Skid & deck	Mow/Burn		16
69.0	60 BA thin	HTH		Mow/Burn		6
70.0				Mow/Burn		34
70.1 (1)				Mow/Burn		6
71.0				Mow/Burn		37
72.0				Mow/Burn		32
73.0				Mow/Burn		32
74.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		43
75.0	Skid & deck		Skid & deck	Mow/Burn		11
77.0				Mow/Burn		41
78.0				Mow/Burn		10
78.1 (1)				Mow/Burn		2
79.0				Mow/Burn		9
80.0				Mow/Burn		35
80.1 (2)				Mow/Burn		7
81.0				Mow/Burn		71
81.1 (1)				Mow/Burn		11
82.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		44
83.0				Mow/Burn		21
84.0				Mow/Burn		89
85.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		7
86.0	Skid & deck		Skid & deck	Mow/Burn		77
87.0				Mow/Burn		143
87.1 (1)				Mow/Burn		11

Alternative 2						
Unit[17]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	Salvage	Acres
88.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		33
89.0				Mow		36
90.0				Mow		105
91.0				Mow		71
92.0				Mow/Burn		50
94.0			PCT	Pile/Mow/Burn		94
95.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		53
96.0	Skid & deck		Skid & deck	Mow/Burn		49
97.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		46
98.0	Skid & deck		Skid & deck	Mow/Burn		13
99.0				Mow/Burn		9
100.0				Mow/Burn		22
101.0				Mow/Burn		4
102.0				Mow/Burn		127
103.0				Mow/Burn		8
104.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		65
105.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		11
106.0				Mow/Burn		164
106.1 (2)				Mow/Burn		8
107.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		25
108.0	60 BA thin	HTH		Mow/Burn		8
109.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		38
110.0	Skid & deck		Skid & deck			84
111.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		13
112.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		67
113.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		62
114.0	Skid & deck		Skid & deck			63
115.0				Mow/Burn		44
116.0	60 BA thin	HTH		Mow/Burn		74
117.0	60 BA thin	HTH		Mow/Burn		25
118.0				Mow/Burn		23
119.0	60 BA thin	HTH		Burn		10
120.0	60 BA thin	HTH		Mow/Burn		30
121.0	60 BA thin	HTH		Mow/Burn		63
122.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		26
123.0				Mow		199
124.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		18
125.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		143
126.0	60 BA thin	HTH		Mow/Burn		18
127.0				Mow/Burn		55
128.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		26
129.0	60 BA thin	HTH		Mow/Burn		165
130.0	Skid & deck		Skid & deck	Mow/Burn		38
131.0	Skid & deck		Skid & deck	Mow/Burn		23
132.0	60 BA thin	HTH		Mow/Burn		18
133.0	60 BA thin	HTH		Mow/Burn		51
134.0				Mow/Burn		45
135.0				Mow/Burn		82
136.0				Mow/Burn		211
136.1 (4)				Mow/Burn		46
137.0				Mow		75

Alternative 2						
Unit[17]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	Salvage	Acres
138.0	Skid & deck		Skid & deck	Mow/Burn		18
139.0				Mow/Burn		12
140.0	60 BA thin	HTH		Mow/Burn		118
141.0				Mow/Burn		5
142.0				Mow/Burn		12
143.0				Mow/Burn		20
144.0				Mow/Burn		12
145.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		19
146.0				Mow/Burn		15
147.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		194
148.0				Mow/Burn		179
148.1 (1)				Mow/Burn		3
149.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		23
150.0	60 BA thin	HTH		Mow/Burn		136
151.0	Skid & deck		Skid & deck	Mow/Burn		10
152.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		97
153.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		34
154.0	60 BA thin	HTH		Mow/Burn		112
154.1 (7)				Mow/Burn		4
155.0	60 BA thin	HTH		Mow/Burn		93
155.1 (1)				Mow/Burn		4
156.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		22
157.0	60 BA thin	HTH		Mow/Burn		172
157.1 (1)				Mow/Burn		9
158.0	60 BA thin	HTH		Mow/Burn		60
158.1 (4)				Mow/Burn		10
159.0				Mow/Burn		80
160.0				Mow/Burn		15
161.0	60 BA thin	HTH		Mow/Burn		13
162.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		153
162.1 (1)				Mow/Burn		4
163.0	60 BA thin	HTH		Mow/Burn		89
164.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		102
165.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		11
166.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		8
167.0	60 BA thin	HTH		Mow/Burn		5
168.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		22
171.0	60 BA thin	HTH		Mow/Burn		115
172.0	60 BA thin	HTH		Mow/Burn		15
176.0	60 BA thin	HTH		Mow/Burn		15
176.1 (1)				Mow/Burn		2
177.0	60 BA thin	HTH		Mow/Burn		40
178.0	60 BA thin	HTH	PCT	Pile/Mow/Burn	y	103
179.0	60 BA thin	HTH	PCT	Mow/Burn		7
181.0	60 BA thin	HTH		Mow/Burn		97
181.1 (2)				Mow/Burn		8
182.0	60 BA thin	HTH		Mow/Burn		106
182.1(13)				Mow/Burn		4
183.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		17
184.0	60 BA thin	HTH		Mow/Burn		335
185.0	60 BA thin	HTH		Mow/Burn		76

Alternative 2						
Unit[17]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	Salvage	Acres
185.1 (1)				Mow/Burn		1
186.0	60 BA thin	HTH		Mow/Burn		55
187.0	60 BA thin	HTH		Mow/Burn		46
188.0	Thin MC & gaps	HTH		Mow/Burn		9
189.0	60 BA thin	HTH		Mow/Burn		61
190.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		50
191.0	60 BA thin	HTH		Mow/Burn		236
192.0	60 BA thin	HTH		Mow/Burn		157
192.1 (3)				Mow/Burn		14
193.0	60 BA thin	HTH		Mow/Burn		8
194.0	60 BA thin	HTH		Mow/Burn		22
195.0	60 BA thin	HTH		Mow/Burn		34
196.0	60 BA thin	HTH		Mow/Burn		9
197.0	60 BA thin	HTH	LFR	Mow/Burn		24
200.0	Thin MC & gaps	HIM	PCT	Pile/Mow/Burn		48
201.0	60 BA thin	HTH	LFR	Mow/Burn		121
202.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		47
203.0	60 BA thin	HTH		Mow/Burn		126
203.3 (1)				Mow/Burn		1
204.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		31
204.1 (1)				Mow/Burn		8
205.0				Mow		76
206.0				Mow/Burn		29
208.0	Seed tree	HCR	PCT	Pile	y	36
209.0	HOR	HOR				40
210.0	Seed tree	HCR	whip	Pile/Mow/Burn	y	18
211.0	Seed tree	HCR	whip	Pile/Mow/Burn	y	43
212.0	60 BA thin	HTH		Mow/Burn	y	14
213.0	60 BA thin	HTH		Mow/Burn	y	25
214.0	HOR	HOR	PCT	Lop & Scat/Mow	y	20
215.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		9
216.0	Seed tree	HCR	whip	Pile	y	80
217.0	60 BA thin	HTH		Mow/Burn		40
218.0	60 BA thin	HTH		Mow/Burn		8
219.0	60 BA thin	HTH		Mow/Burn		50
220.0	60 BA thin	HTH		Mow/Burn		24
220.1 (2)				Mow/Burn		6
221.0	60 BA thin	HTH		Mow/Burn		53
222.0	60 BA thin	HTH		Mow/Burn		94
223.0	60 BA thin	HTH	PCT	Mow/Burn	y	11
224.0	60 BA thin	HTH	PCT	Lop & Scat/Mow/Burn		196
225.0	Skid & deck		Skid & deck	Mow/Burn		55
225.1 (1)				Mow/Burn		7
226.0	60 BA thin	HTH	LFR	Mow/Burn	y	195
226.1 (3)				Mow/Burn		30
227.0	60 BA thin	HTH		Mow/Burn		45
227.1 (5)				Mow/Burn		4
228.0	60 BA thin	HTH		Mow/Burn		76
228.1 (1)				Mow/Burn		6
229.0	60 BA thin	HTH	PCT	Pile/Burn	y	8

Alternative 2						
Unit[17]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	Salvage	Acres
230.0	60 BA thin	HTH		Mow/Burn		28
230.1 (4)				Mow/Burn		1
231.0	60 BA thin	HTH		Mow/Burn		32
231.1 (2)				Mow/Burn		14
233.0	60 BA thin	HTH		Mow/Burn		73
233.1 (1)				Mow/Burn		4
234.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		20
234.1 (1)				Mow/Burn		3
235.0	60 BA thin	HTH		Mow/Burn		40
235.1 (2)				Mow/Burn		5
236.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		8
237.0			LFR	Pile/Mow/Burn		15
238.0	60 BA thin	HTH		Mow/Burn		27
239.0	Skid & deck		Skid & deck	Mow/Burn		222
240.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		33
241.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		7
242.0	Skid & deck		Skid & deck	Mow/Burn		39
243.0	Skid & deck		Skid & deck	Mow/Burn		33
243.1 (1)				Mow/Burn		2
244.0	Skid & deck		Skid & deck	Mow/Burn		12
245.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		22
246.0	Skid & deck		Skid & deck	Mow/Burn		20
247.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		34
248.0	Skid & deck		Skid & deck	Pile/Mow/Burn		9
249.0	Skid & deck		Skid & deck	Pile/Mow/Burn		8
250.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		240
250.1 (3)				Mow/Burn		18
251.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		26
251.1 (1)				Mow/Burn		2
252.0	60 BA thin	HTH		Mow/Burn		44
253.0	60 BA thin	HTH		Mow/Burn		32
253.1 (1)				Mow/Burn		3
254.0	60 BA thin	HTH		Mow/Burn		60
255.0	60 BA thin	HTH	LFR	Pile/Mow/Burn	y	106
255.1 (1)				Mow/Burn		7
256.0	60 BA thin	HTH		Mow		115
258.0				Mow		11
259.0	WUI Cut	HIM	LFR	Pile/Mow	y	38
260.0			LFR	Pile/Mow		13
261.0	WUI Cut	HIM	LFR	Pile	y	17
262.0	HOR	HOR	PCT	Pile	y	30
263.0	Seed tree	HCR	PCT	Pile	y	17
264.0			PCT	Pile/Mow		29
265.0	Seed tree	HCR	whip	Pile	y	14
266.0	HOR	HOR	LFR	Lop & Scat/Mow		23
267.0	Seed tree	HCR	whip		y	88
268.0	HOR	HOR	PCT Mech			8
269.0	Seed tree	HCR			y	9
270.0	Seed tree	HCR	whip	Pile	y	43
271.0	Seed tree	HCR		Pile	y	116
272.0	Seed tree	HCR	whip	Pile	y	69

Alternative 2						
Unit[17]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	Salvage	Acres
273.0	HOR	HOR	PCT	Pile		9
274.0	Seed tree	HCR		Pile	y	32
275.0			PCT	Pile		8
276.0	Thin MC & gaps	HIM	LFR	Pile	y	10
277.0	HOR	HOR	PCT	Lop & Scat/Mow		18
278.0	60 BA thin	HTH		Mow/Burn		132
279.0	HOR	HOR	PCT	Lop & Scat/Mow		21
280.0	60 BA thin	HTH	PCT	Mow/Burn	y	149
281.0	60 BA thin	HTH		Mow		59
282.0	HOR	HOR	PCT	Pile		127
283.0	Seed tree	HCR			y	18
284.0				Mow/Burn		19
285.0	HOR	HOR	PCT	Lop & Scat		82
285.1 (1)	NSO Connect					1
286.0	HOR	HOR	PCT	Lop & Scat		4
289.0	Seed tree	HCR	whip		y	29
290.0	60 BA thin	HTH	PCT	Pile/Mow	y	41
291.0	Seed tree	HCR		Mow	y	25
292.0	Seed tree	HCR		Mow	y	6
293.0	Skid & deck		Skid & deck	Burn		21
294.0				Mow/Burn		12
294.1 (1)				Mow/Burn		2
295.0			PCT	Lop & Scat/Mow		31
296.0	Seed tree	HCR	whip	Pile	y	26
297.0				Pile/Mow		34
298.0	Skid & deck		Skid & deck	Mow/Burn	y	49
299.0	Seed tree	HCR	whip	Lop & Scat	y	117
300.0	HOR	HOR	PCT	Lop & Scat		23
301.0	Seed tree	HCR	whip	Pile	y	65
301.2 (1)	NSO Connect					15
304.0	Seed tree	HCR	whip	Pile	y	33
305.0	HOR	HOR	PCT	Lop & Scat		14
307.0	Seed tree	HCR	whip	Pile	y	25
308.0	Seed tree	HCR	whip	Lop & Scat	y	87
310.0	HOR	HOR	PCT	Lop & Scat		13
311.0	Seed tree	HCR	whip	Pile/Burn	y	7
312.0	Seed tree	HCR	whip	Pile		8
315.0	Seed tree	HCR	whip	Lop & Scat	y	26
316.0	Seed tree	HCR	whip	Lop & Scat	y	18
319.0	HOR	HOR				63
320.0	HOR	HOR				41
321.0	HOR	HOR	PCT	Lop & Scat		53
323.0	HOR	HOR				13
324.0	Seed tree	HCR	whip	Pile	y	47
325.0	60 BA thin	HTH	PCT	Lop & Scat		38
326.0	Seed tree	HCR	whip	Pile	y	57
327.0	Seed tree	HCR	whip	Pile		45
328.0	HOR	HOR	PCT	Pile		47
331.0	HOR	HOR	PCT	Pile		30
333.0	HOR	HOR	PCT	Pile		22
334.0	HOR	HOR	PCT	Lop & Scat		12

Alternative 2						
Unit[17]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	Salvage	Acres
336.0	Seed tree	HCR	whip	Pile	y	25
337.0	HOR	HOR	PCT	Lop & Scat		15
338.0	Seed tree	HCR	PCT	Pile	y	14
340.0	60 BA thin	HTH	PCT	Pile	y	34
341.0	60 BA thin	HTH	PCT	Pile	y	111
342.0	Seed tree	HCR	PCT	Lop & Scat	y	132
343.0	Seed tree	HCR	PCT	Pile	y	10
344.0	HOR	HOR	PCT	Lop & Scat		9
347.0			PCT	Lop & Scat		16
350.0	HOR	HOR				37
353.0	Seed tree	HCR	PCT	Pile	y	17
354.0			PCT	Lop & Scat/Mow		27
355.0	Seed tree	HCR	PCT	Pile	y	145
357.0	WUI Cut	HIM		Pile	y	30
359.0	Seed tree	HCR	PCT	Lop & Scat		7
360.0	Skid & deck		Skid & deck			28
361.0	Skid & deck		Skid & deck			18
362.0	Seed tree	HCR	whip	Pile	y standing	80
363.0			LFR	Pile		5
364.0	HOR	HOR	PCT	Pile		10
365.0			LFR	Pile		5
366.0			PCT	Pile/Mow		12
367.0			PCT	Pile/Mow		14
368.0			PCT	Pile		12
369.0			PCT	Pile		22
370.0	WUI Cut	HIM	PCT	Pile/Mow		16
371.0	HOR	HOR	PCT	Pile/Mow		8
372.0			PCT Mech	Pile/Mow		64
373.0			PCT Mech	Pile		9
374.0				Mow		20
375.0			PCT Mech	Pile/Mow		14
376.0			PCT Mech	Pile/Mow		92
377.0			PCT Mech	Pile/Mow		48
380.0	60 BA thin	HTH		Mow/Burn		87
382.0				Mow/Burn		75
383.0				Mow/Burn		44
384.0				Mow/Burn		42
385.0				Mow/Burn		24
386.0				Mow/Burn		36
387.0				Mow/Burn		4
389.0	Seed tree	HCR	whip	Pile	y	31
390.0				Mow/Burn		108
391.0			PCT	Lop & Scat		5
401.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		151
402.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		29
403.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		35
404.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		14
405.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		14
406.0	60 BA thin	HTH		Mow/Burn		75
407.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		31
408.0				Mow/Burn		304

Alternative 2						
Unit[17]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	Salvage	Acres
408.1 (6)				Mow/Burn		82
409.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		40
410.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		95
411.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		47
411.1 (1)				Mow/Burn		25
412.0	Skid & deck		Skid & deck	Mow/Burn		13
413.0	Skid & deck		Skid & deck	Mow/Burn		76
414.0	Skid & deck		Skid & deck	Mow/Burn		83
414.1 (1)				Mow/Burn		9
415.0	60 BA thin	HTH		Mow/Burn		79
415.1 (1)				Mow/Burn		16
416.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		96
418.0	60 BA thin	HTH		Mow/Burn		16
419.0				Mow/Burn		7
420.0	60 BA thin	HTH		Mow/Burn		26
421.0	60 BA thin	HTH		Mow/Burn		33
422.0	60 BA thin	HTH	PCT	Mow/Burn		53
423.0	60 BA thin	HTH		Mow/Burn		12
424.0	60 BA thin	HTH		Mow/Burn		32
425.0				Mow/Burn		15
426.0	60 BA thin	HTH		Mow/Burn		58
427.0			PCT	Pile		21
428.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		43
429.0	Skid & deck		Skid & deck	Pile/Mow/Burn		14
430.0	Skid & deck		Skid & deck	Pile/Mow/Burn		7
431.0	Skid & deck		Skid & deck	Pile/Burn		58
432.0	Skid & deck		Skid & deck	Pile/Mow/Burn		53
433.0	Skid & deck		Skid & deck	Pile/Burn		5
434.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		51
435.0	60 BA thin	HTH		Mow/Burn		29
436.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		6
437.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		8
438.0	Skid & deck		Skid & deck	Mow/Burn		25
439.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		37
440.0	60 BA thin	HTH		Pile/Mow/Burn		12
440.1 (1)				Mow/Burn		2
441.0	60 BA thin	HTH		Mow/Burn		9
442.0	Skid & deck		Skid & deck	Mow/Burn		6
444.0	60 BA thin	HTH		Mow/Burn		28
445.0				Mow/Burn		13
446.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		19
448.0	60 BA thin	HTH	PCT	Mow/Burn		15
449.0	60 BA thin	HTH		Mow/Burn		10
450.0	60 BA thin	HTH		Mow/Burn		13
451.0	60 BA thin	HTH	LFR	Pile/Burn		61
452.0	60 BA thin	HTH		Mow/Burn		25
453.0	Skid & deck		Skid & deck	Mow/Burn		7
454.0	60 BA thin	HTH		Mow/Burn		6
455.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		6
456.0	Seed tree	HCR	whip	Mow/Burn	y	72
457.0	Skid & deck		Skid & deck	Mow		59

Alternative 2						
Unit[17]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	Salvage	Acres
458.0	Skid & deck		Skid & deck	Mow/Burn		42
460.0	60 BA thin	HTH		Mow/Burn		15
461.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		11
462.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		95
463.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		11
464.0	60 BA thin	HTH	PCT	Mow/Burn		64
465.0	60 BA thin	HTH		Mow/Burn		14
466.0	60 BA thin	HTH		Mow/Burn		31
467.0	Skid & deck		Skid & deck	Mow/Burn		83
468.0	60 BA thin	HTH		Mow/Burn		15
469.0	60 BA thin	HTH		Mow/Burn		30
470.0	60 BA thin	HTH		Mow/Burn		6
471.0	Skid & deck		Skid & deck	Mow/Burn		45
472.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		10
473.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		18
474.0	Skid & deck		Skid & deck	Mow/Burn		68
475.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		23
476.0			LFR	Pile/Mow/Burn		10
477.0	Skid & deck		Skid & deck	Mow/Burn		44
478.0	Skid & deck		Skid & deck	Mow/Burn		32
479.0	60 BA thin	HTH		Mow/Burn		29
480.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		10
481.0				Mow/Burn		6
482.0	Skid & deck		Skid & deck	Mow/Burn		35
483.0			PCT	Pile		18
484.0	Skid & deck		Skid & deck	Mow/Burn		12
485.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		26
486.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		71
487.0	60 BA thin	HTH	PCT	Pile/Mow		64
488.0	60 BA thin	HTH		Mow/Burn		16
489.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		70
490.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		6
491.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		30
492.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		26
493.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		12
494.0	60 BA thin	HTH		Mow/Burn	y	11
495.0	60 BA thin	HTH	LFR	Mow		30
496.0	60 BA thin	HTH	PCT	Pile/Mow/Burn	y	42
497.0				Mow		12
498.0	Aspen	HIM	LFR			22
499.0	60 BA thin	HTH		Mow/Burn		26
500.0	60 BA thin	HTH		Mow/Burn		6
502.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		46
503.0	HOR	HOR	LFR	Pile/Mow		32
504.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		51
505.0	Seed tree	HCR	Whip	Pile/Mow/Burn	y	6
506.0	Seed tree	HCR	whip	Pile/Mow/Burn	y	8
509.0	Skid & deck		Skid & deck	Mow/Burn		6
510.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		14
511.0	60 BA thin	HTH		Mow/Burn		9
512.0	Skid & deck		Skid & deck	Mow/Burn		92

Alternative 2						
Unit[17]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	Salvage	Acres
513.0	Skid & deck		Skid & deck	Mow/Burn		23
514.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		42
515.0	60 BA thin	HTH		Mow/Burn		38

Alternative 3

Table 221: Appendix B – West Bend – Alternative 3 – Units, Prescriptions, and Acres

Alternative 3						
Unit[18]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
1.0				Mow/Burn		39
2.0	60 BA thin	HTH		Mow/Burn		27
3.0	60 BA thin	HTH		Mow/Burn		26
4.0	60 BA thin	HTH		Mow/Burn		17
5.0	60 BA thin	HTH		Mow/Burn		31
6.0	60 BA thin	HTH		Mow/Burn		27
7.0				Mow/Burn		137
8.0	60 BA thin	HTH	LFR	Lop & Scat/Mow/Burn		41
10.0				Mow/Burn		38
11.0				Mow/Burn		6
12.0				Mow/Burn		9
13.0			PCT	Pile/Mow/Burn		6
14.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		53
15.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		234
16.0	60 BA thin	HTH	PCT	Lop & Scat/Mow/Burn		37
17.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		109
18.0	Deer WR Thin	HTH	PCT	Mow/Burn		214
20.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		72
21.0				Mow/Burn		18
22.0	Road Sun	HTH		Mow/Burn		43
24.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		10
25.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		32
26.0	Road Sun	HTH	PCT	Pile/Mow/Burn		79
27.0	60 BA thin	HTH		Mow/Burn		69
27.1 (1)				Mow/Burn		4
28.0			LFR	Mow/Burn		3
29.0	60 BA thin	HTH		Mow/Burn		72
29.1 (7)				Mow/Burn		1
30.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		203
31.0	60 BA thin	HTH		Mow/Burn		103
32.0				Mow/Burn		49
33.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		14
34.0	CACH15	HTH	PCT	Pile/Mow/Burn		166
35.0	60 BA thin	HTH		Mow/Burn		132
36.0	Road Sun	HTH	PCT	Pile/Mow/Burn		30
37.0	CACH15	HTH		Mow/Burn		100

[18] Units that have a .1 (i.e. 27.1) indicates retention areas within units (27.0). When retention areas are indicated, more than one retention area within a unit may exist. Mowing and/or burning will occur within retention areas. Numbers in parenthesis (i.e. 29.1 (7)) indicate the number of retention areas within a unit, in this example 7 within unit 29 also have t the same treatments.

Alternative 3						
Unit[18]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
38.0	Deer WR Thin	HTH	PCT	Pile/Mow/Burn		200
39.0	Road Sun	HTH		Mow/Burn		35
40.0	60 BA thin	HTH		Mow/Burn		77
41.0	Skid & deck		Skid & deck	Mow/Burn		52
42.0	Skid & deck		Skid & deck	Mow/Burn		20
43.0	Skid & deck		Skid & deck	Mow/Burn		42
44.0	Road Sun	HTH		Mow/Burn		123
45.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		12
46.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		33
47.0	60 BA thin	HTH		Mow/Burn		108
48.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		20
49.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		41
50.0	60 BA thin	HTH		Mow/Burn		34
51.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		43
52.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		41
53.0	60 BA thin	HTH		Mow/Burn		18
53.1 (1)	Hawk Nest					39
54.0	Skid & deck		Skid & deck	Mow/Burn		9
55.0	Road Sun	HTH	PCT	Pile/Mow/Burn		18
56.0	Skid & deck		Skid & deck	Mow/Burn		142
57.0	Skid & deck		Skid & deck	Mow/Burn		191
58.0				Mow/Burn		114
58.1 (4)				Mow/Burn		20
59.0				Mow/Burn		56
59.1 (3)				Mow/Burn		11
60.0	Skid & deck		Skid & deck	Mow/Burn		29
61.0				Mow/Burn		77
61.1 (2)				Mow/Burn		4
62.0	Skid & deck		Skid & deck	Mow/Burn		13
63.0				Mow/Burn		10
64.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		12
65.0				Mow/Burn		13
66.0			PCT	Pile/Mow/Burn		13
67.0				Mow/Burn		9
68.0	Skid & deck		Skid & deck	Mow/Burn		16
69.0	60 BA thin	HTH		Mow/Burn		6
70.0				Mow/Burn		34
70.1 (1)				Mow/Burn		6
71.0				Mow/Burn		37
72.0				Mow/Burn		32
73.0				Mow/Burn		32
74.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		43
75.0	Skid & deck		Skid & deck	Mow/Burn		11
77.0				Mow/Burn		41
78.0				Mow/Burn		10
78.1 (1)				Mow/Burn		2
79.0				Mow/Burn		9
80.0				Mow/Burn		35
80.1 (2)				Mow/Burn		7
81.0				Mow/Burn		71
81.1 (1)				Mow/Burn		11

Alternative 3						
Unit[18]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
82.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		44
83.0				Mow/Burn		21
84.0				Mow/Burn		89
85.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		7
86.0	Skid & deck		Skid & deck	Mow/Burn		77
87.0				Mow/Burn		143
87.1 (1)				Mow/Burn		11
88.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		33
89.0				Mow		36
90.0				Mow		105
91.0				Mow		71
92.0				Mow/Burn		50
94.0			PCT	Pile/Mow/Burn		94
95.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		53
96.0	Skid & deck		Skid & deck	Mow/Burn		49
97.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		46
98.0	Skid & deck		Skid & deck	Mow/Burn		13
99.0				Mow/Burn		9
100.0				Mow/Burn		22
101.0				Mow/Burn		4
102.0				Mow/Burn		127
103.0				Mow/Burn		8
104.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		65
105.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		11
106.0				Mow/Burn		164
106.1 (2)				Mow/Burn		8
107.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		25
108.0	60 BA thin	HTH		Mow/Burn		8
109.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		38
110.0	Skid & deck		Skid & deck			84
111.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		13
112.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		67
113.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		62
114.0	Skid & deck		Skid & deck			63
115.0				Mow/Burn		44
116.0	60 BA thin	HTH		Mow/Burn		74
117.0	60 BA thin	HTH		Mow/Burn		25
118.0				Mow/Burn		23
119.0	60 BA thin	HTH		Burn		10
120.0	60 BA thin	HTH		Mow/Burn		30
121.0	CACH15	HTH		Mow/Burn		63
122.0	CACH15	HTH	PCT	Pile/Mow/Burn		26
123.0				Mow		199
124.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		18
125.0	CACH15	HTH	PCT	Pile/Mow/Burn		143
126.0	60 BA thin	HTH		Mow/Burn		18
127.0				Mow/Burn		55
128.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		26
129.0	CACH15	HTH		Mow/Burn		165
130.0	Skid & deck		Skid & deck	Mow/Burn		38
131.0	Skid & deck		Skid & deck	Mow/Burn		23

Alternative 3						
Unit[18]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
132.0	60 BA thin	HTH		Mow/Burn		18
133.0	Deer WR Thin	HTH		Mow/Burn		51
134.0				Mow/Burn		45
135.0				Mow/Burn		82
136.0				Mow/Burn		211
136.1 (4)				Mow/Burn		46
137.0				Mow		75
138.0	Skid & deck		Skid & deck	Mow/Burn		18
139.0				Mow/Burn		12
140.0	60 BA thin	HTH		Mow/Burn		118
141.0				Mow/Burn		5
142.0				Mow/Burn		12
143.0				Mow/Burn		20
144.0				Mow/Burn		12
145.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		19
146.0				Mow/Burn		15
147.0	Deer WR Thin	HTH	PCT	Pile/Mow/Burn		194
148.0				Mow/Burn		179
148.1 (1)				Mow/Burn		3
149.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		23
150.0	Deer WR Thin	HTH		Mow/Burn		136
151.0	Skid & deck		Skid & deck	Mow/Burn		10
152.0	Deer WR Thin	HTH	PCT	Pile/Mow/Burn		97
153.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		34
154.0	60 BA thin	HTH		Mow/Burn		112
154.1 (7)				Mow/Burn		4
155.0	60 BA thin	HTH		Mow/Burn		93
155.1 (1)				Mow/Burn		4
156.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		22
157.0	Deer WR Thin	HTH		Mow/Burn		172
157.1 (1)				Mow/Burn		9
158.0	Deer WR Thin	HTH		Mow/Burn		60
158.1 (4)				Mow/Burn		10
159.0				Mow/Burn		80
160.0				Mow/Burn		15
161.0	60 BA thin	HTH		Mow/Burn		13
162.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		153
162.1 (1)				Mow/Burn		4
163.0	60 BA thin	HTH		Mow/Burn		89
164.0	CACH15	HTH	PCT	Pile/Mow/Burn		102
165.0	CACH15	HTH	PCT	Pile/Mow/Burn		11
166.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		8
167.0	60 BA thin	HTH		Mow/Burn		5
168.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		22
171.0	60 BA thin	HTH		Mow/Burn		115
172.0	60 BA thin	HTH		Mow/Burn		15

Alternative 3						
Unit[18]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
176.0	60 BA thin	HTH		Mow/Burn		15
176.1 (1)				Mow/Burn		2
177.0	60 BA thin	HTH		Mow/Burn		40
178.0	PFA 60	HTH	PCT	Pile/Mow/Burn	y	103
179.0	PFA retention			Mow/Burn		7
181.0	PFA 80	HTH		Mow/Burn		97
181.1 (2)	PFA retention			Mow/Burn		8
182.0	PFA 80	HTH		Mow/Burn		106
182.1(13)	PFA retention			Mow/Burn		4
183.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		17
184.0	CACH15	HTH		Mow/Burn		335
185.0	60 BA thin	HTH		Mow/Burn		76
185.1 (1)	PFA retention			Mow/Burn		1
186.0	PFA 80	HTH		Mow/Burn		55
187.0	60 BA thin	HTH		Mow/Burn		46
188.0	PFA 80	HTH		Mow/Burn		9
189.0	PFA 60	HTH		Mow/Burn		61
190.0	PFA 60	HTH	PCT	Pile/Mow/Burn		50
191.0	60 BA thin	HTH		Mow/Burn		236
192.0	CACH15	HTH		Mow/Burn		157
192.1 (3)				Mow/Burn		14
193.0	60 BA thin	HTH		Mow/Burn		8
194.0	60 BA thin	HTH		Mow/Burn		22
195.0	60 BA thin	HTH		Mow/Burn		34
196.0	60 BA thin	HTH		Mow/Burn		9
197.0	60 BA thin	HTH	LFR	Mow/Burn		24
200.0	Thin MC & gaps	HIM	PCT	Pile/Mow/Burn		48
201.0	PFA 60	HTH	LFR	Mow/Burn		121
202.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		47
203.0	PFA 60	HTH		Mow/Burn		126
203.3 (1)	PFA retention			Mow/Burn		1
204.0	PFA 80 mix	HSV	PCT	Pile		31
204.1 (1)	PFA retention			Mow/Burn		8
205.0				Mow		76
206.0				Mow/Burn		29
208.0	Seed tree	HCR	PCT	Pile	y	36
209.0	Girdle OS					40
210.0	Seed tree	HCR	whip	Pile/Mow/Burn	y	18
211.0	Seed tree	HCR	whip	Pile/Mow/Burn	y	43
212.0	60 BA thin	HTH		Mow/Burn	y	14
213.0	60 BA thin	HTH		Mow/Burn	y	25
214.0	HOR	HOR	PCT	Lop & Scat/Mow	y	20
216.0	Seed tree	HCR	whip	Pile	y	80
217.0	PFA 80	HTH		Mow/Burn		40
218.0	PFA retention			Mow/Burn		8
219.0	PFA 80	HTH		Mow/Burn		50
220.0	PFA 80	HTH		Mow/Burn		24
220.1 (2)	PFA retention			Mow/Burn		6
221.0	60 BA thin	HTH		Mow/Burn		53
222.0	60 BA thin	HTH		Mow/Burn		94
223.0	60 BA thin	HTH	PCT	Mow/Burn	y	11

Alternative 3						
Unit[18]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
224.0	60 BA thin	HTH	PCT	Lop & Scat/Mow/Burn		196
225.0	Skid & deck		Skid & deck	Mow/Burn		55
225.1 (1)	PFA retention			Mow/Burn		7
226.0	PFA 60	HTH	LFR	Mow/Burn	y	195
226.1 (2)	PFA retention			Mow/Burn		24
226.5 (1)	PFA retention	HTH		Mow/Burn		6
227.0	PFA 80			Mow/Burn		45
227.1 (5)	PFA retention			Mow/Burn		4
228.0	PFA 60	HTH		Mow/Burn		76
228.1 (1)	PFA retention			Mow/Burn		6
229.0	PFA Cut LP	HTH	PCT	Pile/Burn	y	8
230.0	PFA 80	HTH		Mow/Burn		28
230.1 (4)	PFA retention			Mow/Burn		1
231.0	PFA 80	HTH		Mow/Burn		32
231.1 (2)	PFA retention			Mow/Burn		14
233.0	PFA 60	HTH		Mow/Burn		73
233.1 (1)				Mow/Burn		4
234.0	PFA 40	HTH	PCT	Pile/Mow/Burn		20
234.1 (1)				Mow/Burn		3
235.0	60 BA thin	HTH		Mow/Burn		40
235.1 (2)				Mow/Burn		5
236.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		8
237.0			LFR	Pile/Mow/Burn		15
238.0	60 BA thin	HTH		Mow/Burn		27
239.0	Skid & deck		Skid & deck	Mow/Burn		222
240.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		33
241.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		7
242.0	Skid & deck		Skid & deck	Mow/Burn		39
243.0	Skid & deck		Skid & deck	Mow/Burn		33
243.1 (1)				Mow/Burn		2
244.0	Skid & deck		Skid & deck	Mow/Burn		12
245.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		22
246.0	Skid & deck		Skid & deck	Mow/Burn		20
247.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		34
248.0	Skid & deck		Skid & deck	Pile/Mow/Burn		9
249.0	Skid & deck		Skid & deck	Pile/Mow/Burn		8
250.0	PFA 60	HTH	PCT	Pile/Mow/Burn		240
250.1 (3)	PFA retention			Mow/Burn		18
251.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		26
251.1 (1)				Mow/Burn		2
252.0	60 BA thin	HTH		Mow/Burn		44
253.0	60 BA thin	HTH		Mow/Burn		32
253.1 (1)				Mow/Burn		3
254.0	60 BA thin	HTH		Mow/Burn		60
255.0	60 BA thin	HTH	LFR	Pile/Mow/Burn	y	106
255.1 (1)				Mow/Burn		7
256.0	60 BA thin	HTH		Mow		115
257.1 (1)	NSO Connect					38
258.0				Mow		11
259.0	Connect thin	HTH	LFR	Pile/Mow	y	38
260.0			LFR	Pile/Mow		13

Alternative 3						
Unit[18]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
261.0	Connect thin	HTH	LFR	Pile	y	17
262.0	HOR	HOR	PCT	Pile	y	30
263.0	Seed tree	HCR	PCT	Pile	y	17
264.0			PCT	Pile/Mow		29
265.0	Seed tree	HCR	whip	Pile	y	14
266.0	Girdle OS		LFR	Lop & Scat/Mow		23
267.0	Seed tree	HCR	whip		y	88
268.0	HOR	HOR	PCT Mech			8
269.0	Seed tree	HCR			y	9
270.0	Seed tree	HCR	whip	Pile	y	43
271.0	Seed tree	HCR		Pile	y	116
272.0	Seed tree	HCR	whip	Pile	y	69
273.0	Girdle OS		PCT	Pile		9
274.0	Seed tree	HCR		Pile	y	32
275.0			PCT	Pile		8
276.0	Thin MC & gaps	HIM	LFR	Pile	y	10
277.0	Girdle OS		PCT	Lop & Scat/Mow		18
278.0	60 BA thin	HTH		Mow/Burn		132
279.0	HOR	HOR	PCT	Lop & Scat/Mow		21
280.0	60 BA thin	HTH	PCT	Mow/Burn	y	149
281.0	60 BA thin	HTH		Mow		59
282.0	HOR	HOR	PCT	Pile		127
283.0	Seed tree	HCR			y	18
284.0				Mow/Burn		19
285.0	HOR	HOR	PCT	Lop & Scat		82
286.0	Girdle OS		PCT	Lop & Scat		4
289.0	Seed tree	HCR	whip		y	29
290.0	60 BA thin	HTH	PCT	Pile/Mow	y	41
291.0	Seed tree	HCR		Mow	y	25
292.0	Seed tree	HCR		Mow	y	6
293.0	Skid & deck		Skid & deck	Burn		21
294.0				Mow/Burn		12
294.1 (1)				Mow/Burn		2
295.0			PCT	Lop & Scat/Mow		31
296.0	Seed tree	HCR	whip	Pile	y	26
297.0				Pile/Mow		34
298.0	Skid & deck		Skid & deck	Mow/Burn	y	49
299.0	Seed tree	HCR	whip	Lop & Scat	y	117
300.0	Girdle OS		PCT	Lop & Scat		23
301.0	Seed tree	HCR	whip	Pile	y	65
304.0	Seed tree	HCR	whip	Pile	y	33
305.0	HOR	HOR	PCT	Lop & Scat		14
307.0	Seed tree	HCR	whip	Pile	y	25
308.0	Seed tree	HCR	whip	Lop & Scat	y	87
310.0	Girdle OS		PCT	Lop & Scat		13
311.0	Seed tree	HCR	whip	Pile/Burn	y	7
312.0	Seed tree	HCR	whip	Pile		8
315.0	Seed tree	HCR	whip	Lop & Scat	y	26
316.0	Seed tree	HCR	whip	Lop & Scat	y	18
319.0	HOR	HOR				63
320.0	HOR	HOR				41

Alternative 3						
Unit[18]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
321.0	Girdle OS		PCT	Lop & Scat		53
324.0	Seed tree	HCR	whip	Pile	y	47
325.0	60 BA thin	HTH	PCT	Lop & Scat		38
326.0	Seed tree	HCR	whip	Pile	y	57
327.0	Seed tree	HCR	whip	Pile		45
328.0	HOR	HOR	PCT	Pile		47
331.0	HOR	HOR	PCT	Pile		30
333.0	Girdle OS		PCT	Pile		22
334.0	Girdle OS		PCT	Lop & Scat		12
336.0	Seed tree	HCR	whip	Pile	y	25
337.0	HOR	HOR	PCT	Lop & Scat		15
338.0	Seed tree	HCR	PCT	Pile	y	14
340.0	60 BA thin	HTH	PCT	Pile	y	34
341.0	60 BA thin	HTH	PCT	Pile	y	111
342.0	Seed tree	HCR	PCT	Lop & Scat	y	132
343.0	Seed tree	HCR	PCT	Pile	y	10
344.0	HOR	HOR	PCT	Lop & Scat		9
347.0			PCT	Lop & Scat		16
350.0	HOR	HOR				37
353.0	Seed tree	HCR	PCT	Pile	y	17
354.0			PCT	Lop & Scat/Mow		27
355.0	Seed tree	HCR	PCT	Pile	y	145
357.0	WUI Cut	HIM		Pile	y	30
359.0	Seed tree	HCR	PCT	Lop & Scat		7
360.0	Skid & deck		Skid & deck			28
361.0	Skid & deck		Skid & deck			18
362.0	Seed tree	HCR	whip	Pile	y standing	80
363.0			LFR	Pile		5
364.0	HOR	HOR	PCT	Pile		10
365.0			LFR	Pile		5
366.0			PCT	Pile/Mow		12
367.0			PCT	Pile/Mow		14
368.0			PCT	Pile		12
369.0			PCT	Pile		22
370.0	WUI Cut	HIM	PCT	Pile/Mow		16
371.0	Girdle OS		PCT	Pile/Mow		8
372.0			PCT Mech	Pile/Mow		64
373.0			PCT Mech	Pile		9
374.0				Mow		20
375.0			PCT Mech	Pile/Mow		14
376.0			PCT Mech	Pile/Mow		92
377.0			PCT Mech	Pile/Mow		48
380.0	60 BA thin	HTH		Mow/Burn		87
382.0				Mow/Burn		75
383.0				Mow/Burn		44
384.0				Mow/Burn		42
385.0				Mow/Burn		24
386.0				Mow/Burn		36
387.0				Mow/Burn		4
389.0	Seed tree	HCR	whip	Pile	y	31
390.0				Mow/Burn		108

Alternative 3						
Unit[18]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
391.0			PCT	Lop & Scat		5
401.0	Road Sun	HTH	LFR	Pile/Mow/Burn		151
402.0	Road Sun	HTH	LFR	Pile/Mow/Burn		29
403.0	Road Sun	HTH	PCT	Pile/Mow/Burn		35
404.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		14
405.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		14
406.0	60 BA thin	HTH		Mow/Burn		75
407.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		31
408.0				Mow/Burn		304
408.1 (6)				Mow/Burn		82
409.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		40
410.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		95
411.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		47
411.1 (1)				Mow/Burn		25
412.0	Skid & deck		Skid & deck	Mow/Burn		13
413.0	Skid & deck		Skid & deck	Mow/Burn		76
414.0	Skid & deck		Skid & deck	Mow/Burn		83
414.1 (1)				Mow/Burn		9
415.0	60 BA thin	HTH		Mow/Burn		79
415.1 (1)				Mow/Burn		16
416.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		96
418.0	60 BA thin	HTH		Mow/Burn		16
419.0				Mow/Burn		7
420.0	Road Sun	HTH		Mow/Burn		26
421.0	Road Sun	HTH		Mow/Burn		33
422.0	60 BA thin	HTH	PCT	Mow/Burn		53
423.0	60 BA thin	HTH		Mow/Burn		12
424.0	60 BA thin	HTH		Mow/Burn		32
425.0				Mow/Burn		15
426.0	60 BA thin	HTH		Mow/Burn		58
427.0			PCT	Pile		21
428.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		43
429.0	Skid & deck		Skid & deck	Pile/Mow/Burn		14
430.0	Skid & deck		Skid & deck	Pile/Mow/Burn		7
431.0	Skid & deck		Skid & deck	Pile/Burn		58
432.0	Skid & deck		Skid & deck	Pile/Mow/Burn		53
433.0	Skid & deck		Skid & deck	Pile/Burn		5
434.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		51
435.0	60 BA thin	HTH		Mow/Burn		29
436.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		6
437.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		8
438.0	Skid & deck		Skid & deck	Mow/Burn		25
439.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		37
440.0	60 BA thin	HTH		Pile/Mow/Burn		12
440.1 (1)				Mow/Burn		2
441.0	60 BA thin	HTH		Mow/Burn		9
442.0	Skid & deck		Skid & deck	Mow/Burn		6
444.0	60 BA thin	HTH		Mow/Burn		28
445.0				Mow/Burn		13
446.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		19
448.0	60 BA thin	HTH	PCT	Mow/Burn		15

Alternative 3						
Unit[18]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
449.0	Road Sun	HTH		Mow/Burn		10
450.0	Road Sun	HTH		Mow/Burn		13
451.0	60 BA thin	HTH	LFR	Pile/Burn		61
452.0	60 BA thin	HTH		Mow/Burn		25
453.0	Skid & deck		Skid & deck	Mow/Burn		7
454.0	60 BA thin	HTH		Mow/Burn		6
455.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		6
456.0	Seed tree	HCR	whip	Mow/Burn	y	72
457.0	Skid & deck		Skid & deck	Mow		59
458.0	Skid & deck		Skid & deck	Mow/Burn		42
460.0	60 BA thin	HTH		Mow/Burn		15
461.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		11
462.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		95
463.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		11
464.0	60 BA thin	HTH	PCT	Mow/Burn		64
465.0	60 BA thin	HTH		Mow/Burn		14
466.0	60 BA thin	HTH		Mow/Burn		31
467.0	Skid & deck		Skid & deck	Mow/Burn		83
468.0	60 BA thin	HTH		Mow/Burn		15
469.0	60 BA thin	HTH		Mow/Burn		30
470.0	60 BA thin	HTH		Mow/Burn		6
471.0	Skid & deck		Skid & deck	Mow/Burn		45
472.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		10
473.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		18
474.0	Skid & deck		Skid & deck	Mow/Burn		68
475.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		23
476.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		10
477.0	Skid & deck		Skid & deck	Mow/Burn		44
478.0	Skid & deck		Skid & deck	Mow/Burn		32
479.0	60 BA thin	HTH		Mow/Burn		29
480.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		10
481.0				Mow/Burn		6
482.0	Skid & deck		Skid & deck	Mow/Burn		35
483.0			PCT	Pile		18
484.0	Skid & deck		Skid & deck	Mow/Burn		12
485.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		26
486.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		71
487.0	60 BA thin	HTH	PCT	Pile/Mow		64
488.0	60 BA thin	HTH		Mow/Burn		16
489.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		70
490.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		6
491.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		30
492.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		26
493.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		12
494.0	60 BA thin	HTH		Mow/Burn	y	11
495.0	60 BA thin	HTH	LFR	Mow		30
496.0	60 BA thin	HTH	PCT	Pile/Mow/Burn	y	42
497.0				Mow		12
498.0	Aspen	HIM	LFR			22
499.0	60 BA thin	HTH		Mow/Burn		26
500.0	Road Sun	HTH		Mow/Burn		6

Alternative 3						
Unit[18]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
502.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		46
503.0	HOR	HOR	LFR	Pile/Mow		32
504.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		51
505.0	Seed tree	HCR	whip	Pile/Mow/Burn	y	6
506.0	Seed tree	HCR	whip	Pile/Mow/Burn	y	8
509.0	Skid & deck		Skid & deck	Mow/Burn		6
510.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		14
511.0	60 BA thin	HTH		Mow/Burn		9
512.0	Skid & deck		Skid & deck	Mow/Burn		92
513.0	Skid & deck		Skid & deck	Mow/Burn		23
514.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		42
515.0	60 BA thin	HTH		Mow/Burn		38

Alternative 4

Table 222: Appendix B – West Bend – Alternative 4 – Units, Prescriptions, and Acres

Alternative 4						
Unit[19]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
1.0				Mow/Burn		39
2.0	60 BA thin	HTH		Mow/Burn		9
2.1 (1)				Mow/Burn		18
3.0				Mow/Burn		26
4.0	60 BA thin	HTH		Mow/Burn		17
5.0	60 BA thin	HTH		Mow/Burn		31
6.0				Mow/Burn		27
7.0				Mow/Burn		137
8.0	60 BA thin	HTH	LFR	Lop & Scat/Mow/Burn		28
8.1 (1)			LFR	Lop & Scat/Mow/Burn		13
10.0				Mow/Burn		38
11.0				Mow/Burn		6
12.0				Mow/Burn		9
13.0			PCT	Pile/Mow/Burn		6
14.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		53
15.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		232
15.1 (1)				Mow/Burn		2
16.0	60 BA thin	HTH	PCT	Lop & Scat/Mow/Burn		31
16.1 (1)	60 BA thin			Mow/Burn		6
17.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		99
17.1 (1)				Mow/Burn		10
18.0				Mow/Burn		214
20.0				Mow/Burn		72
21.0				Mow/Burn		18
22.0	Road Sun	HTH		Mow/Burn		43
24.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		10
25.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		32
26.0	Road Sun	HTH	PCT	Pile/Mow/Burn		72

[19] Units that have a .1 (i.e. 27.1) indicates retention areas within units (27.0). When retention areas are indicated, more than one retention area within a unit may exist. Mowing and/or burning will occur within retention areas. Numbers in parenthesis (i.e. 29.1 (7)) indicate the number of retention areas within a unit, in this example 7 within unit 29 also have the same treatments.

Alternative 4						
Unit[19]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
26.1 (1)				Mow/Burn		7
27.0	60 BA thin	HTH		Mow/Burn		69
27.1 (1)				Mow/Burn		4
28.0			LFR	Mow/Burn		3
29.0	60 BA thin	HTH		Mow/Burn		72
31.0	60 BA thin	HTH		Mow/Burn		87
31.1 (2)				Mow/Burn		16
32.0				Mow/Burn		49
33.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		14
34.0	CACH15	HTH	PCT	Pile/Mow/Burn		161
34.1 (1)				Mow/Burn		5
35.0	60 BA thin	HTH		Mow/Burn		77
35.1 (1)				Mow/Burn		55
36.0	Road Sun	HTH	PCT	Pile/Mow/Burn		30
37.0	CACH15	HTH		Mow/Burn		100
38.0	Deer WR Thin	HTH	PCT	Pile/Mow/Burn		178
38.1 (1)				Mow/Burn		22
39.0	Road Sun	HTH		Mow/Burn		35
40.0	60 BA thin	HTH		Mow/Burn		61
40.1 (1)				Mow/Burn		16
41.0				Mow/Burn		52
42.0	Skid & deck		Skid & deck	Mow/Burn		20
43.0	Skid & deck		Skid & deck	Mow/Burn		33
43.1 (1)				Mow/Burn		10
44.0	Road Sun	HTH		Mow/Burn		123
45.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		12
46.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		33
47.0	60 BA thin	HTH		Mow/Burn		108
48.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		20
49.0				Mow/Burn		41
50.0	60 BA thin	HTH		Mow/Burn		34
51.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		43
52.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		41
53.0	60 BA thin	HTH		Mow/Burn		18
54.0	Skid & deck		Skid & deck	Mow/Burn		9
55.0	Road Sun	HTH	PCT	Pile/Mow/Burn		18
56.0	Skid & deck		Skid & deck	Mow/Burn		132
56.1 (1)				Mow/Burn		6
56.1 (1)	Skid & deck		Skid & deck	Mow/Burn		4
57.0				Mow/Burn		191
58.0				Mow/Burn		114
58.1 (4)				Mow/Burn		20
59.0				Mow/Burn		56
59.1 (3)				Mow/Burn		11
60.0	Skid & deck		Skid & deck	Mow/Burn		27
60.1 (1)				Mow/Burn		1
61.0				Mow/Burn		77
61.1 (2)				Mow/Burn		4
62.0	Skid & deck		Skid & deck	Mow/Burn		13
63.0				Mow/Burn		10
64.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		8

Alternative 4						
Unit[19]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
64.1 (1)				Mow/Burn		4
65.0				Mow/Burn		13
66.0			PCT	Pile/Mow/Burn		13
67.0				Mow/Burn		9
68.0				Mow/Burn		16
69.0				Mow/Burn		6
70.0				Mow/Burn		34
70.1 (1)				Mow/Burn		6
71.0				Mow/Burn		37
72.0				Mow/Burn		32
73.0				Mow/Burn		32
74.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		43
75.0	Skid & deck		Skid & deck	Mow/Burn		11
77.0				Mow/Burn		41
78.0				Mow/Burn		10
78.1 (1)				Mow/Burn		2
79.0				Mow/Burn		9
80.0				Mow/Burn		35
80.1 (2)				Mow/Burn		7
81.0				Mow/Burn		71
81.1 (1)				Mow/Burn		11
82.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		16
82.1 (1)				Mow/Burn		28
83.0				Mow/Burn		21
84.0				Mow/Burn		89
85.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		7
86.0				Mow/Burn		77
87.0				Mow/Burn		143
87.1 (1)				Mow/Burn		11
88.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		22
88.1 (2)				Mow/Burn		10
89.0				Mow		36
90.0				Mow		105
91.0				Mow		71
92.0				Mow/Burn		50
94.0			PCT	Pile/Mow/Burn		94
95.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		53
96.0	Skid & deck		Skid & deck	Mow/Burn		49
97.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		46
98.0	Skid & deck		Skid & deck	Mow/Burn		13
99.0				Mow/Burn		9
100.0				Mow/Burn		22
101.0				Mow/Burn		4
102.0				Mow/Burn		127
103.0				Mow/Burn		8
104.0			LFR	Pile/Mow/Burn		65
105.0			LFR	Pile/Mow/Burn		11
106.0				Mow/Burn		164
106.1 (2)				Mow/Burn		8
107.0			LFR	Pile/Mow/Burn		25
108.0				Mow/Burn		8

Alternative 4						
Unit[19]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
109.0			LFR	Pile/Mow/Burn		38
111.0			LFR	Pile/Mow/Burn		13
112.0			LFR	Pile/Mow/Burn		67
113.0			LFR	Pile/Mow/Burn		62
114.0	Skid & deck		Skid & deck			45
115.0				Mow/Burn		44
116.0	60 BA thin	HTH		Mow/Burn		48
116.1 (1)				Mow/Burn		27
117.0	60 BA thin	HTH		Mow/Burn		18
117.1 (1)				Mow/Burn		7
118.0				Mow/Burn		23
119.0	60 BA thin	HTH		Burn		10
120.0	60 BA thin	HTH		Mow/Burn		30
121.0	CACH15	HTH		Mow/Burn		63
122.0	CACH15	HTH	PCT	Pile/Mow/Burn		26
123.0				Mow		199
124.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		18
125.0	CACH15	HTH	PCT	Pile/Mow/Burn		139
125.1 (1)				Mow/Burn		3
126.0	60 BA thin	HTH		Mow/Burn		11
126.1 (1)				Mow/Burn		7
127.0				Mow/Burn		55
128.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		26
129.0	CACH15	HTH		Mow/Burn		127
129.1 (1)				Mow/Burn		38
130.0	Skid & deck		Skid & deck	Mow/Burn		25
130.1 (1)				Mow/Burn		13
131.0				Mow/Burn		23
132.0	60 BA thin	HTH		Mow/Burn		18
133.0				Mow/Burn		51
134.0				Mow/Burn		45
135.0				Mow/Burn		82
136.0				Mow/Burn		211
136.1 (4)				Mow/Burn		46
137.0				Mow		75
138.0	Skid & deck		Skid & deck	Mow/Burn		18
139.0				Mow/Burn		12
140.0				Mow/Burn		118
141.0				Mow/Burn		5
142.0				Mow/Burn		12
143.0				Mow/Burn		20
144.0				Mow/Burn		12
145.0				Mow/Burn		19
146.0				Mow/Burn		15
147.0				Mow/Burn		194
148.0				Mow/Burn		179
148.1 (1)				Mow/Burn		3
149.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		9
149.1 (1)				Mow/Burn		14
150.0	Deer WR Thin	HTH		Mow/Burn		136
151.0	Skid & deck		Skid & deck	Mow/Burn		10

Alternative 4						
Unit[19]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
152.0	Deer WR Thin	HTH	PCT	Pile/Mow/Burn		61
152.1 (2)				Mow/Burn		36
153.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		21
153.1 (1)				Mow/Burn		13
154.0	60 BA thin	HTH		Mow/Burn		112
154.1 (3)				Mow/Burn		3
155.0	60 BA thin	HTH		Mow/Burn		68
155.1 (2)				Mow/Burn		29
156.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		19
156.1 (1)	60 BA thin	HTH	PCT	Pile/Mow/Burn		3
157.0				Mow/Burn		172
157.1 (1)				Mow/Burn		9
158.0	Deer WR Thin	HTH		Mow/Burn		44
158.1 (5)				Mow/Burn		26
159.0				Mow/Burn		80
160.0				Mow/Burn		15
161.0	60 BA thin	HTH		Mow/Burn		13
162.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		153
162.1 (1)				Mow/Burn		4
163.0	60 BA thin	HTH		Mow/Burn		70
163.1 (1)				Mow/Burn		19
164.0	CACH15	HTH	PCT	Pile/Mow/Burn		93
164.2				Mow/Burn		4
164.3				Pile/Mow/Burn		5
165.0	CACH15	HTH	PCT	Pile/Mow/Burn		11
166.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		8
167.0	60 BA thin	HTH		Mow/Burn		5
168.0				Mow/Burn		22
171.0	60 BA thin	HTH		Mow/Burn		70
171.1 (1)				Mow/Burn		45
172.0	60 BA thin	HTH		Mow/Burn		15
176.0	60 BA thin	HTH		Mow/Burn		15
176.1 (1)				Mow/Burn		2
177.0	60 BA thin	HTH		Mow/Burn		40
178.0	PFA 60	HTH	PCT	Pile/Mow/Burn	y	100
178.1 (1)				Mow/Burn	y	3
179.0	PFA retention			Mow/Burn		7
181.0	PFA 80	HTH		Mow/Burn		97
181.1 (2)	PFA retention			Mow/Burn		8
182.0	PFA 80	HTH		Mow/Burn		106
182.1 (3)	PFA retention			Mow/Burn		4
183.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		17
184.0	CACH15	HTH		Mow/Burn		224
184.1 (4)				Mow/Burn		112
185.0	60 BA thin	HTH		Mow/Burn		76
185.1 (1)	PFA retention			Mow/Burn		1
186.0	PFA 80	HTH		Mow/Burn		55
187.0	60 BA thin	HTH		Mow/Burn		46
188.0	PFA 80	HTH		Mow/Burn		9
189.0	PFA 60	HTH		Mow/Burn		61
190.0	PFA 60	HTH	PCT	Pile/Mow/Burn		50

Alternative 4						
Unit[19]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
191.0	60 BA thin	HTH		Mow/Burn		236
192.0	CACH15	HTH		Mow/Burn		150
192.1 (5)				Mow/Burn		21
193.0	60 BA thin	HTH		Mow/Burn		4
193.1 (1)				Mow/Burn		4
194.0	60 BA thin	HTH		Mow/Burn		22
195.0	60 BA thin	HTH		Mow/Burn		34
196.0	60 BA thin	HTH		Mow/Burn		9
197.0	60 BA thin	HTH	LFR	Mow/Burn		24
200.0	Thin MC & gaps	HIM	PCT	Pile/Mow/Burn		48
201.0	PFA 60	HTH	LFR	Mow/Burn		121
202.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		47
203.0	PFA 60	HTH		Mow/Burn		126
203.3	PFA retention			Mow/Burn		1
204.0	PFA 80 Mix	HSV	PCT	Pile		31
204.1 (1)	PFA retention			Mow/Burn		8
205.0				Mow		76
206.0				Mow/Burn		29
208.0	Seed tree	HCR	PCT	Pile	y	36
209.0	Girdle OS					40
210.0	Seed tree	HCR	whip	Pile/Mow/Burn	y	18
211.0	Seed tree	HCR	whip	Pile/Mow/Burn	y	43
212.0	60 BA thin	HTH		Mow/Burn	y	14
213.0	60 BA thin	HTH		Mow/Burn	y	25
214.0	HOR	HOR	PCT	Lop & Scat/Mow	y	20
216.0	Seed tree	HCR	whip	Pile	y	80
217.0	PFA 80	HTH		Mow/Burn		40
218.0	PFA retention			Mow/Burn		8
219.0	PFA 80	HTH		Mow/Burn		50
220.0	PFA 80	HTH		Mow/Burn		24
220.1 (2)	PFA retention			Mow/Burn		6
221.0	60 BA thin	HTH		Mow/Burn		53
222.0	60 BA thin	HTH		Mow/Burn		94
223.0	60 BA thin	HTH	PCT	Mow/Burn	y	11
224.0	60 BA thin	HTH	PCT	Lop & Scat/Mow/Burn		196
225.0	Skid & deck		Skid & deck	Mow/Burn		55
225.1 (1)	PFA retention			Mow/Burn		7
226.0	PFA 60	HTH	LFR	Mow/Burn	y	195
226.1 (3)	PFA retention			Mow/Burn		30
227.0	PFA 80	HTH		Mow/Burn		45
227.1 (5)	PFA retention			Mow/Burn		4
228.0	PFA 60	HTH		Mow/Burn		76
228.1 (1)	PFA retention			Mow/Burn		6
229.0	PFA Cut LP	HTH	PCT	Pile/Burn	y	8
230.0	PFA 80	HTH		Mow/Burn		28
230.1 (4)	PFA retention			Mow/Burn		1
231.0	PFA 80	HTH		Mow/Burn		32
231.1 (2)	PFA retention			Mow/Burn		14
233.0	PFA 60	HTH		Mow/Burn		73
233.1 (1)				Mow/Burn		4
234.0	PFA 40	HTH	PCT	Pile/Mow/Burn		20

Alternative 4						
Unit[19]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
234.1 (1)				Mow/Burn		3
235.0	60 BA thin	HTH		Mow/Burn		40
235.1 (2)				Mow/Burn		5
236.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		8
237.0			LFR	Pile/Mow/Burn		15
238.0	60 BA thin	HTH		Mow/Burn		27
239.0	Skid & deck		Skid & deck	Mow/Burn		222
240.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		33
241.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		7
242.0	Skid & deck		Skid & deck	Mow/Burn		39
243.0	Skid & deck		Skid & deck	Mow/Burn		33
243.1 (1)				Mow/Burn		2
244.0	Skid & deck		Skid & deck	Mow/Burn		12
245.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		22
246.0	Skid & deck		Skid & deck	Mow/Burn		20
247.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		34
248.0	Skid & deck		Skid & deck	Pile/Mow/Burn		9
249.0	Skid & deck		Skid & deck	Pile/Mow/Burn		8
250.0	PFA 60	HTH	PCT	Pile/Mow/Burn		240
250.1 (3)	PFA retention			Mow/Burn		18
251.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		26
251.1 (1)				Mow/Burn		2
252.0	60 BA thin	HTH		Mow/Burn		44
253.0	60 BA thin	HTH		Mow/Burn		32
253.1 (1)				Mow/Burn		3
254.0	60 BA thin	HTH		Mow/Burn		60
255.0	60 BA thin	HTH	LFR	Pile/Mow/Burn	y	106
255.1 (1)				Mow/Burn		7
256.0	60 BA thin	HTH		Mow		115
258.0				Mow		11
259.0	Connect thin	HIM	LFR	Pile/Mow	y	38
260.0			LFR	Pile/Mow		13
261.0	Connect thin	HIM	LFR	Pile	y	17
262.0	HOR	HOR	PCT	Pile	y	30
263.0	Seed tree	HCR	PCT	Pile	y	17
264.0			PCT	Pile/Mow		29
265.0	Seed tree	HCR	whip	Pile	y	14
266.0	Girdle OS		LFR	Lop & Scat/Mow		23
267.0	Seed tree	HCR	whip		y	88
268.0	HOR	HOR	PCT Mech			8
269.0	Seed tree	HCR			y	9
270.0	Seed tree	HCR	whip	Pile	y	43
271.0	Seed tree	HCR		Pile	y	116
272.0	Seed tree	HCR	whip	Pile	y	69
273.0	Girdle OS		PCT	Pile		9
274.0	Seed tree	HCR		Pile	y	32
275.0			PCT	Pile		8
276.0	Thin MC & gaps	HIM	LFR	Pile	y	10
277.0	Girdle OS		PCT	Lop & Scat/Mow		18
278.0	60 BA thin	HTH		Mow/Burn		132
279.0	HOR	HOR	PCT	Lop & Scat/Mow		21

Alternative 4						
Unit[19]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
280.0	60 BA thin	HTH	PCT	Mow/Burn	y	149
281.0	60 BA thin	HTH		Mow		59
282.0	HOR	HOR	PCT	Pile		127
283.0	Seed tree	HCR			y	18
284.0				Mow/Burn		19
285.0	HOR	HOR	PCT	Lop & Scat		82
286.0	Girdle OS		PCT	Lop & Scat		4
289.0	Seed tree	HCR	whip		y	29
290.0	60 BA thin	HTH	PCT	Pile/Mow	y	41
291.0	Seed tree	HCR		Mow	y	25
292.0	Seed tree	HCR		Mow	y	6
293.0	Skid & deck		Skid & deck	Burn		21
294.0				Mow/Burn		12
294.1 (1)				Mow/Burn		2
295.0			PCT	Lop & Scat/Mow		31
296.0	Seed tree	HCR	whip	Pile	y	26
297.0				Pile/Mow		34
298.0	Skid & deck		Skid & deck	Mow/Burn	y	49
299.0	Seed tree	HCR	whip	Lop & Scat	y	117
300.0	Girdle OS		PCT	Lop & Scat		23
301.0	Seed tree	HCR	whip	Pile	y	65
304.0	Seed tree	HCR	whip	Pile	y	33
305.0	HOR	HOR	PCT	Lop & Scat		14
307.0	Seed tree	HCR	whip	Pile	y	25
308.0	Seed tree	HCR	whip	Lop & Scat	y	87
310.0	Girdle OS		PCT	Lop & Scat		13
311.0	Seed tree	HCR	whip	Pile/Burn	y	7
312.0	Seed tree	HCR	whip	Pile		8
315.0	Seed tree	HCR	whip	Lop & Scat	y	26
316.0	Seed tree	HCR	whip	Lop & Scat	y	18
319.0	HOR	HOR				63
320.0	HOR	HOR				41
321.0	Girdle OS		PCT	Lop & Scat		53
324.0	Seed tree	HCR	whip	Pile	y	47
325.0	60 BA thin	HTH	PCT	Lop & Scat		38
326.0	Seed tree	HCR	whip	Pile	y	57
327.0	Seed tree	HCR	whip	Pile		45
328.0	HOR	HOR	PCT	Pile		47
331.0	HOR	HOR	PCT	Pile		30
333.0	Girdle OS		PCT	Pile		22
334.0	Girdle OS		PCT	Lop & Scat		12
336.0	Seed tree	HCR	whip	Pile	y	25
337.0	HOR	HOR	PCT	Lop & Scat		15
338.0	Seed tree	HCR	PCT	Pile	y	14
340.0	60 BA thin	HTH	PCT	Pile	y	34
341.0	60 BA thin	HTH	PCT	Pile	y	111
342.0	Seed tree	HCR	PCT	Lop & Scat	y	132
343.0	Seed tree	HCR	PCT	Pile	y	10
344.0	HOR	HOR	PCT	Lop & Scat		9
347.0			PCT	Lop & Scat		16
350.0	HOR	HOR				37

Alternative 4						
Unit[19]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
353.0	Seed tree	HCR	PCT	Pile	y	17
354.0			PCT	Lop & Scat/Mow		27
355.0	Seed tree	HCR	PCT	Pile	y	145
357.0	WUI Cut	HIM		Pile	y	30
359.0	Seed tree	HCR	PCT	Lop & Scat		7
360.0	Skid & deck		Skid & deck			28
361.0	Skid & deck		Skid & deck			18
362.0	Seed tree	HCR	whip	Pile	y standing	80
363.0			LFR	Pile		5
364.0	HOR	HOR	PCT	Pile		10
365.0			LFR	Pile		5
366.0			PCT	Pile/Mow		12
367.0			PCT	Pile/Mow		14
368.0			PCT	Pile		12
369.0			PCT	Pile		22
370.0	WUI Cut	HIM	PCT	Pile/Mow		16
371.0	Girdle OS		PCT	Pile/Mow		8
372.0			PCT Mech	Pile/Mow		64
373.0			PCT Mech	Pile		9
374.0				Mow		20
375.0			PCT Mech	Pile/Mow		14
376.0			PCT Mech	Pile/Mow		92
377.0			PCT Mech	Pile/Mow		48
380.0	60 BA thin	HTH		Mow/Burn		54
380.1 (1)				Mow/Burn		34
382.0				Mow/Burn		75
383.0				Mow/Burn		44
384.0				Mow/Burn		42
385.0				Mow/Burn		24
386.0				Mow/Burn		36
387.0				Mow/Burn		4
389.0	Seed tree	HCR	whip	Pile	y	31
390.0				Mow/Burn		108
391.0			PCT	Lop & Scat		5
401.0	Road Sun	HTH	LFR	Pile/Mow/Burn		142
401.1 (1)			LFR	Pile/Mow/Burn		9
402.0	Road Sun	HTH	LFR	Pile/Mow/Burn		29
403.0	Road Sun	HTH	PCT	Pile/Mow/Burn		35
404.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		8
404.1 (1)			LFR	Pile/Mow/Burn		6
405.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		10
405.1 (1)			LFR	Pile/Mow/Burn		3
406.0	60 BA thin	HTH		Mow/Burn		62
406.1				Mow/Burn		5
406.2	60 BA thin	HTH		Mow/Burn		9
407.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		31
408.0				Mow/Burn		304
408.1 (6)				Mow/Burn		82
409.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		37
409.1 (1)				Mow/Burn		3
410.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		95

Alternative 4						
Unit[19]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
411.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		47
411.1 (1)				Mow/Burn		25
412.0	Skid & deck		Skid & deck	Mow/Burn		13
413.0	Skid & deck		Skid & deck	Mow/Burn		76
414.0	Skid & deck		Skid & deck	Mow/Burn		83
414.1 (1)				Mow/Burn		9
415.0	60 BA thin	HTH		Mow/Burn		79
415.1 (1)				Mow/Burn		16
416.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		96
418.0	60 BA thin	HTH		Mow/Burn		16
419.0				Mow/Burn		7
420.0	Road Sun	HTH		Mow/Burn		26
421.0	Road Sun	HTH		Mow/Burn		33
422.0	60 BA thin	HTH	PCT	Mow/Burn		53
423.0	60 BA thin	HTH		Mow/Burn		12
424.0	60 BA thin	HTH		Mow/Burn		32
425.0				Mow/Burn		15
426.0	60 BA thin	HTH		Mow/Burn		58
427.0			PCT	Pile		21
428.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		43
429.0	Skid & deck		Skid & deck	Pile/Mow/Burn		14
430.0	Skid & deck		Skid & deck	Pile/Mow/Burn		7
431.0	Skid & deck		Skid & deck	Pile/Burn		58
432.0	Skid & deck		Skid & deck	Pile/Mow/Burn		53
433.0	Skid & deck		Skid & deck	Pile/Burn		5
434.0				Mow/Burn		5
434.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		43
434.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		3
435.0	60 BA thin	HTH				17
435.2 (1)	60 BA thin	HTH				6
436.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		6
437.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		8
438.0	Skid & deck		Skid & deck	Mow/Burn		25
439.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		37
440.0	60 BA thin	HTH		Pile/Mow/Burn		12
440.1 (1)				Mow/Burn		2
441.0	60 BA thin	HTH		Mow/Burn		9
442.0	Skid & deck		Skid & deck	Mow/Burn		6
444.0	60 BA thin	HTH		Mow/Burn		28
445.0				Mow/Burn		13
446.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		19
448.0	60 BA thin	HTH	PCT	Mow/Burn		15
449.0	Road Sun	HTH		Mow/Burn		10
450.0	Road Sun	HTH		Mow/Burn		13
451.0	60 BA thin	HTH	LFR	Pile/Burn		61
452.0	60 BA thin	HTH		Mow/Burn		25
453.0	Skid & deck		Skid & deck	Mow/Burn		7
454.0	60 BA thin	HTH		Mow/Burn		6
455.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		6
456.0	Seed tree	HCR	whip	Mow/Burn	y	72
457.0	Skid & deck		Skid & deck	Mow		59

Alternative 4						
Unit[19]	Overstory Rx	Activity Code	Understory Rx	Fuels Rx	HSV	Acres
458.0	Skid & deck		Skid & deck	Mow/Burn		42
460.0	60 BA thin	HTH		Mow/Burn		15
461.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		11
462.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		95
463.0				Mow/Burn		11
464.0	60 BA thin	HTH	PCT	Mow/Burn		57
464.1 (1)				Mow/Burn		7
465.0				Mow/Burn		14
466.0				Mow/Burn		31
467.0	Skid & deck		Skid & deck	Mow/Burn		78
467.1 (2)				Mow/Burn		6
468.0				Mow/Burn		15
469.0	60 BA thin	HTH		Mow/Burn		23
469.1 (1)				Mow/Burn		7
470.0	60 BA thin	HTH		Mow/Burn		6
471.0	Skid & deck		Skid & deck	Mow/Burn		45
472.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		10
473.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		18
474.0	Skid & deck		Skid & deck	Mow/Burn		68
475.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		23
476.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		10
477.0	Skid & deck		Skid & deck	Mow/Burn		44
478.0	Skid & deck		Skid & deck	Mow/Burn		32
479.0	60 BA thin	HTH		Mow/Burn		29
480.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		10
481.0				Mow/Burn		6
482.0	Skid & deck		Skid & deck	Mow/Burn		35
483.0			PCT	Pile		18
484.0	Skid & deck		Skid & deck	Mow/Burn		12
485.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		14
485.1 (1)				Mow/Burn		12
486.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		68
486.1 (1)			LFR	Pile/Mow/Burn		4
487.0				Mow		64
488.0	60 BA thin	HTH		Mow/Burn		16
489.0				Mow/Burn		70
490.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		6
491.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		30
492.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		26
493.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		12
494.0	60 BA thin	HTH		Mow/Burn	y	11
495.0	60 BA thin	HTH	LFR	Mow		30
496.0	60 BA thin	HTH	PCT	Pile/Mow/Burn	y	42
497.0				Mow		12
498.0	Aspen	HIM	LFR			22
499.0	60 BA thin	HTH		Mow/Burn		26
500.0	Road Sun	HTH		Mow/Burn		6
502.0	60 BA thin	HTH	LFR	Pile/Mow/Burn		46
503.0	HOR	HOR	LFR	Pile/Mow		32
504.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		51
505.0	Seed tree	HCR	whip	Pile/Mow/Burn	y	6

Alternative 4						
Unit[19]	**Overstory Rx**	**Activity Code**	**Understory Rx**	**Fuels Rx**	**HSV**	**Acres**
506.0	Seed tree	HCR	whip	Pile/Mow/Burn	y	8
509.0	Skid & deck		Skid & deck	Mow/Burn		6
510.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		14
511.0	60 BA thin	HTH		Mow/Burn		9
512.0	Skid & deck		Skid & deck	Mow/Burn		92
513.0	Skid & deck		Skid & deck	Mow/Burn		23
514.0	60 BA thin	HTH	PCT	Pile/Mow/Burn		42
515.0	60 BA thin	HTH		Mow/Burn		38

Appendix C – Fire and Fuels

Section 1: Critical Transportation Routes

Critical Transportation Routes do not have a standard definition in Deschutes County. For purposes of the E/W Deschutes County CWPP, the Steering Committees define Critical Transportation Routes as:
• all routes necessary for the support of routine flow of commerce to and/or through the greater planning areas,
• all routes that could be used for potential evacuation of citizens and/or visitors from a wildland fire threat to public safety,
• routes needed for emergency ingress and egress to a wildland fire incident, not including unimproved or "two-track" roads,
• and, all routes needed to protect and support critical infrastructure (power substations, communication transmission lines, water and fuel storage, public service facilities, recreation facilities, etc).

Section 2: Definition/Description of Fire Regime/Condition Class

Fire Regime Condition Class is an ecological index that measures the departure of current stand structure, fire return intervals and fire severity from historic stand structure, fire return intervals and fire severity. The most recent analysis for the Tumalo Creek and North Unit Diversion Dam Deschutes River watersheds was conducted in 2007, as part of a larger assessment of 2.4 million acres that included the entire of the Upper Deschutes Basin, by the Upper Deschutes Basin Fire Learning Network (UDBFLN), a collaborative group of federal and state agencies, local government and community groups and conservation organizations (USDA 2007). This coarse scale analysis identifies changes to key ecosystem components such as species composition, structural stage, tree, stand age, and canopy closure. It characterizes the landscape by five "Fire Regime Groups" and three "Fire Condition Classes." A fire regime is a generalized classification of the role fire would play across a landscape – characterized by fire frequency, predictability, seasonality, intensity, duration and scale (USDA and USDI 2002).

The five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency), combined with the severity (amount of replacement) of fire on the dominant overstory vegetation (Hann and Bunnell 2001). These five regimes include:

Fire Regime I: 0-35 years, Low severity
Typical climax plant communities include ponderosa pine, eastside/dry Douglas-fir; where surface fires are most common. Large stand-replacing fire can occur under certain weather conditions, but are rare events (i.e. every 200+ years).

Fire Regime II: 0-35 years, Stand-replacing, non-forest
Includes true grasslands and savannahs with typical return intervals of less than 10 years; mesic sagebrush communities with typical return intervals 25-35 years and occasionally up to 50 years and mountain shrub communities (bitterbrush, snowberry, ninebark, ceanothus, Oregon chaparral; etc.), with typical return intervals of 10-25 years. Fire severity is generally high to moderate. Grasslands and mountain shrub communities are not completely killed, but usually only top-killed and re-sprout.

Fire Regime III: 35-100 years, Mixed severity
This regime usually results in heterogeneous landscapes. Large, stand replacing fires may occur but are usually rare events. Such stand-replacing fire may "reset" large areas (10,000-100,000 acres) but subsequent mixed intensity fires are important for creating landscapes' heterogeneity. Within these landscapes a mix of stand ages and size classes are important characteristics; generally the landscape is not dominated by one or two age classes.

Fire Regime IV: 35-100+ years Stand-replacing
Seral communities that arise from or are maintained by stand-replacement fire, such as lodgepole pine, aspen, western larch, and western white pine, often are important components in this fire regime. Dry sagebrush communities also fall within this fire regime. Natural ignitions within this regime that results in large fires may be relatively rare, particularly in the Cascades north of 45 degrees latitude.

Fire Regime V: >200 years, Stand-replacing
This fire regime occurs at the environmental extremes where natural ignitions are very rare or virtually non existent or environmental conditions rarely result in large fires. Sites tend to be very cold, very hot, very wet, very dry or some combination of these conditions.

For each of the fire regimes present, the UDBFLN assessment also identified that there is also a certain amount of departure from the natural fire regime that has occurred possibly due to the following; fire exclusion, timber harvesting, introduction and establishment of exotic plant species, insects or disease (introduced or native), or other past management activities. This departure has resulted in alterations of key ecosystem components such as species composition, structural stage and canopy closure. This departure from the natural fire regime has been classified into condition classes. Condition classes are assessed looking at the estimated departure on vegetation, fire frequency and fire severity. Refer to the following table, for the descriptions of each of these condition classes.

Table 223: Appendix C – Condition Class Description

Condition Class	Attributes	Example Management Options
Condition Class 1	▪ Fire regimes are within or near an historical range. ▪ The risk of losing key ecosystem components is low. ▪ Fire frequencies have departed from historical frequencies (either increased or decreased) by no more than one return interval. ▪ Vegetation attributes (species composition and structure) are intact and functioning within an historical range.	Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.
Condition Class 2	▪ Fire regimes have been moderately altered from their historical range. ▪ The risk of losing key ecosystem components has increased to moderate. ▪ Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. This change results in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. ▪ Vegetation attributes have been moderately altered from their historical ranges.	Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
Condition Class 3	▪ Fire regimes have been significantly altered from their historical range. ▪ The risk of losing key ecosystem components is high. ▪ Fire frequencies have departed (either increased or decreased) by multiple return intervals. This change results in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. ▪ Vegetation attributes have been significantly altered from their historical ranges.	Where appropriate, these areas need high levels of restoration treatments, such as hand or mechanical treatments. These treatments may be necessary before fire is used to restore the historical fire regime.

Section 3: Description of fire behavior expected by fuel model

Fuel Model 1: Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present. (Anderson, 1982)

Fuel Model 2: Fire spread is primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material, in addition to litter and dead-down stemwood from the open shrub or timber overstory, contributes to the fire intensity. (Anderson, 1982)

Fuel Model 6: Fire carries through the shrub layer and can produce high flame lengths. Moderate winds are usually required to carry the fire. Shrubs are older than other shrub fuel models, but average only about two and a half feet. (Anderson, 1982)

Fuel Model 8: Slow burning surface fires with low flame lengths are expected. This model represents closed canopy stands of short needle conifers and results in desired fire behavior. Fire tends to travel through the needle layer, because little other undergrowth is present. (Anderson, 1982)

Fuel Model 9: Fires run through the surface little faster than fuel model 8 and have longer flame lengths. This model represents closed stands of ponderosa pine. (Anderson, 1982)

Fuel Model 10: Fires burn in surface and ground fuels with greater fire intensities than models 8 and 9. There are heavier accumulations of large dead and down woody material. Crowning, spotting and torching is more frequent leading to potential fire control difficulties. (Anderson, 1982)

Fuel Model 141: The primary carrier of the fire in fuel model 141 is woody shrubs and shrub litter. Low shrub fuel load, fuelbed depth about 1 foot; some grass may be present. The spread rate is very low and flame lengths are very low. (Scott & Burgan, 2005)

Fuel Model 161: The primary carrier of the fire in fuel model 161 is a low load of grass and/or shrub with litter. The spread rate is low, and flame lengths are low. (Scott & Burgan, 2005)

Fuel Model 202: The primary carrier of the fire in fuel model 202 is moderate dead and down activity fuel or light blowdown. Fine fuel load is 7 to 12 t/ac, evenly distributed across fuel size classes, depth is about 1 foot. The spread rate is moderate, and flame lengths are moderate. (Scott & Burgan, 2005)

Section 4: 97th Percentile fuel moisture and wind conditions used for data input into FlamMap for both Existing Condition/No Action and Action Alternative discussions:

Table 224: Appendix C - Lava Butte 97th Percentile Fuel Moistures

1 hour fuel moisture	2
10 hour fuel moisture	3
100 hour fuel moisture	7
Herbaceous material fuel moisture	33
Woody material fuel moisture	70

Winds:

- windspeed of 11 miles per hour (average gust at Bend Watershed)
- azimuth of 290 degrees (most common azimuth of winds for Round Mountain RAWS station)
- Foliar moisture content: 90 percent

Files used for 97th Percentile Fuel Moisture Conditioning:

Weather (.wtr) file from Lava Butte RAWS (see FlamMap for meaning to the file)

Month	Day	Precip	Hour 1	Hour 2	Temp 1	Temp 2	Humid 1	Humid 2	Elevation	rt 1	rt2
8	9	0	500	1500	58	87	53	19	4655		
8	10	0	500	1400	54	87	77	21	4655		
8	11	0	300	1400	56	86	62	21	4655		
8	12	0	200	1400	56	90	52	19	4655		
8	13	0	500	1400	61	97	48	16	4655		
8	14	0	2300	1400	59	92	61	18	4655		

Appendix D – Soils

Soil and Water Related Concerns

Table 225: List of Units Where there are Soil and Water Related Concerns[1]

Soil or Water Related Concern	EIS Units
Perennial/Seasonal Streams	299, 355
Sensitive Soils	
Steep Slopes	8,15,18,127,148,152,155,157,159,181-189,211-213,216,218,219, 242,243,246, 247,249,289,291,293,300,302,303,305,306,309,310, 351,352,355,358,370,372-379,381,390,401-404,406,408,410,411, 415,416,418-420,422-426,428,431,434, 435,437-440,443-446,451-453,456,480-483,487
Wet Soils	346,355,451,452,455,464,490,498
Swales w/steep sideslopes and/or moist draw bottoms	15,17,115,127,148,152,155,157,159,181,183-185,212,213,216,218,219,401-403, 407,408,410,411,415,428,431,434,435,437-440, 50-455,458,459,464,480-483, 487
Frost pockets with low productivity	191,341,355
Shallow soils or lava ridges	8, 18, 38, 47, 50, 51, 52, 67, 68, 82, 84, 85, 86, 89, 91, 94, 102, 106, 109, 123, 127, 137, 138, 140, 143-147, 181-183, 212, 213, 221, 222, 226-228, 382, 401, 408, 474
High Proportion of Existing Detrimental Soil Impacts (≥10% of unit area, soil condition class 3-5)	2,4,5,8,13-17,22,24-27,29,31,33,36-40,43-48,50-52,54-56,62,75,94-98,109,112, 114,116,117,121,125,126,130,150,152-156,158,162-167,171,172,176-178,181-186,188-192,194,196,197,202,203,212-214,216,219-222,224,225,227-229,231, 233-250,252,253,256,259,261-263,265,268,274,276,278,279,281,282,289,290, 292,293,298,305,312,328,331,333,337,338,341,342,344,350,360,368,371,372, 376,401-407,409-416,418,420-424,426,429-434,436-439,441,442,444,446,450-452,454,457,458,460-462,467,469-472,474,477-480,482-484,491-493,496,499, 503,504,509,510,512,514,515
Rocky Soils – non sensitive	161-167, 171, 176, 177, 188, 200, 201, 203-211, 213, 214, 216, 217, 219-241, 244-254, 256, 259-291, 293-355, 357-379, 413, 416, 434-440, 450, 456-477, 479-499, 502-512,
High displacement potential on slopes	300,303,305,306,310,372,373,377-379,381,445,446
Previously Machine Scarified Plantations on Slopes	62,114,213,224,226,227,237,243,246,248,249,293,414,420,426,431,432,436, 442,453,458,462,464,469-471,478,480-484,512,515

[1] The extent of the soil type of concern is substantial enough to warrant a modification to SOP

Other unit-specific concerns: (implement specialized PDC/BMP/Mitigation for each)

- Potential retention/leave areas: Steep slopes, rock outcrops, frost pockets, wet soils
- Other rocky soils can inhibit restoration of roads, landings, and skid trails (subsoiling may only be partially, other non-traditional de-compaction methods could be needed, or other offsetting mitigation, try and place temporary roads elsewhere as is feasible).
- In the western portion of unit 355, avoid wet meadows on south side of ephemeral channel (below unit 354), also avoid large poorly stocked frost with bare soils on the flats in the far western margin.
- Avoid mechanical operations that would impact soils in aspen units (units 464, 498), high water tables – unmapped wet soil inclusion in unit 498.
- Avoid mechanical operations that would impact soils in bottom of draw between units 452 and 455 were moist 4" below the surface and wet @ 8" below surface (Sept 2011), also in unit 451.

- Avoid small ponded wetland and adjacent moist sites on western third of Vista Butte (unit 346)
- Avoid forested wetland and histisol (organic soil) on western edge of Tumalo Lake in glacial trough (no units are being proposed).
- Avoid or minimize mechanical operations on the steepest slopes in the Kiwa Spring draw (units 480, 481, 482, 482, 483, 487).
- Avoid or minimize mechanical operations on slopes subject to dry ravel that have a high displacement hazard, and minimize disturbance from underburning operations (units 300, 303, 305, 306, 310, 372, 373, 377, 378, 379, 381, 445, 446).
- A moderate to high windthrow hazard can be associated with steep slopes, ridge tops, shallow soils, and aspects exposed to west and southwest winds, minimize edge effect (units 260, 277, 276, 300, 305, 309, 310, 371, 372, 374, 376, 377, 390, 416, 445, 446).

Table 226: Acres of Subsoiling of Temporary Roads, Landings, and Primary Skid Trails

Unit[1]	Alternative 2[2]		Alternative 3[2]		Alternative 4[2]	
	Acres	Subsoil Acres	Acres	Subsoil Acres	Acres	Subsoil Acres
2	27	2	27	2	9	1
3	26	2	26	2	26	0
4	17	1	17	1	17	1
5	31	2	31	2	31	2
6	27	2	27	2	27	0
8	41	3	41	3	28	2
14	53	4	53	4	53	4
15	234	18	234	18	232	17
16	37	3	37	3	31	2
17	109	8	109	8	99	7
18	214	16	214	16	214	0
20	72	5	72	5	72	0
22	43	3	43	3	43	3
24	10	1	10	1	10	1
25	32	2	32	2	32	2
26	79	6	79	6	72	5
27	69	5	69	5	69	5
29	72	5	72	5	72	5
30	203	15	203	15	203	0
31	103	8	103	8	87	7
33	14	1	14	1	14	1
36	30	2	30	2	30	2
37	100	8	100	8	100	8
38	200	15	200	15	178	13
39	35	3	35	3	35	3
40	77	6	77	6	61	5
41	52	4	52	4	52	0
43	42	3	42	3	33	2
44	123	9	123	9	123	9
45	12	1	12	1	12	1
46	33	2	33	2	33	2
47	108	8	108	8	108	8
48	20	2	20	2	20	2
49	41	3	41	3	41	0
50	34	3	34	3	34	3
51	43	3	43	3	43	3

Unit[1]	Alternative 2[2]		Alternative 3[2]		Alternative 4[2]	
	Acres	Subsoil Acres	Acres	Subsoil Acres	Acres	Subsoil Acres
52	41	3	41	3	41	3
54	9	1	9	1	9	1
55	18	1	18	1	18	1
56	142	11	142	11	132	10
62	13	1	13	1	13	1
68	16	1	16	1	16	0
69*	6	1	6	1	6	0
75	11	1	11	1	11	1
86		6		6		0
95	53	4	53	4	53	4
96	49	4	49	4	49	4
97	46	3	46	3	46	3
98	13	1	13	1	13	1
109	38	3	38	3	38	0
110	84	6	84	6	84	0
112	67	5	67	5	67	0
114	63	5	63	5	45	3
116	74	6	74	6	48	4
117	25	2	25	2	18	1
121	63	5	63	5	63	5
125	143	11	143	11	139	10
126	18	1	18	1	11	1
130	38	3	38	3	25	2
131	23	2	23	2	23	0
140	118	9	118	9	118	0
145	19	1	19	1	19	0
147	194	15	194	15	194	0
150	136	10	136	10	136	10
152	97	7	97	7	61	5
153	34	3	34	3	21	2
154	112	8	112	8	112	8
155	93	7	93	7	68	5
156	22	2	22	2	19	1
157	172	13	172	13	172	0
158	60	5	60	5	44	3
162	153	11	153	11	153	11
163	89	7	89	7	70	5
164	102	8	102	8	93	7
165	11	1	11	1	11	1
166	8	1	8	1	8	1
167*	5	1	5	1	5	1
168	22	2	22	2	22	0
171	115	9	115	9	70	5
172	15	1	15	1	15	1
176	15	1	15	1	15	1
177	40	3	40	3	40	3
178	103	8	103	8	100	8
179	7	1	7	0	7	0
181	97	7	97	7	97	7
182	106	8	106	8	106	8
183	17	1	17	1	17	1

Unit[1]	Alternative 2[2]		Alternative 3[2]		Alternative 4[2]	
	Acres	Subsoil Acres	Acres	Subsoil Acres	Acres	Subsoil Acres
184	335	25	335	25	224	17
185	76	6	76	6	76	6
186	55	4	55	4	55	4
188	9	1	9	1	9	1
189	61	5	61	5	61	5
190	50	4	50	4	50	4
191	236	18	236	18	236	18
192	157	12	157	12	150	11
194	22	2	22	2	22	2
196	9	1	9	1	9	1
197	24	2	24	2	24	2
202	47	4	47	4	47	4
203	126	9	126	9	126	9
212	14	1	14	1	14	1
213	25	2	25	2	25	2
214	20	2	20	2	20	2
216	80	6	80	0	80	0
217	40	0	40	3	40	3
218	8	1	8	0	8	0
219	50	4	50	4	50	4
220	24	2	24	2	24	2
221	53	4	53	4	53	4
222	94	7	94	7	94	7
223	11	0	11	1	11	1
224	196	15	196	0	196	0
225	55	4	55	4	55	4
227	45	3	45	3	45	3
228	76	6	76	6	76	6
229	8	1	8	1	8	1
230	28	0	28	2	28	0
231	32	2	32	0	32	2
233	73	5	73	5	73	5
234	20	2	20	2	20	2
235	40	3	40	3	40	3
236	8	1	8	1	8	1
238	27	2	27	2	27	2
239	222	17	222	17	222	17
240	33	2	33	2	33	2
241	7	1	7	1	7	1
242	39	3	39	3	39	3
243	33	2	33	2	33	2
244	12	1	12	1	12	1
245	22	2	22	2	22	2
246	20	2	20	2	20	2
247	34	3	34	3	34	3
248	9	1	9	1	9	1
249	8	1	8	1	8	1
250	240	18	240	18	240	18
252	44	3	44	0	44	3
253	32	2	32	2	32	2
254	60	0	60	5	60	0

Unit[1]	Alternative 2[2]		Alternative 3[2]		Alternative 4[2]	
	Acres	Subsoil Acres	Acres	Subsoil Acres	Acres	Subsoil Acres
256	115	9	115	9	115	9
259	38	3	38	3	38	3
261	17	1	17	1	17	1
262	30	2	30	2	30	2
263	17	1	17	1	17	1
265	14	1	14	1	14	1
266	23	2	23	0	23	0
268	8	1	8	1	8	1
274	32	6	32	6	32	6
276	10	1	10	1	10	1
277	18	1	18	0	18	0
278	132	10	132	10	132	10
279	21	2	21	2	21	2
281	59	4	59	4	59	4
282	127	10	127	10	127	10
289	29	2	29	2	29	2
290	41	3	41	3	41	3
292*	6	1	6	1	6	1
293	21	2	21	2	21	2
298	49	4	49	4	49	4
300	23	2	23	0	23	0
305	14	1	14	1	14	1
310	13	1	13	0	13	0
312	8	1	8	1	8	1
328	47	4	47	4	47	4
331	30	2	30	2	30	2
333	22	2	22	0	22	0
334	12	1	12	0	12	0
337	15	1	15	1	15	1
338	14	1	14	1	14	1
341	111	8	111	8	111	8
342	132	10	132	10	132	10
344	9	1	9	1	9	1
350	37	3	37	3	37	3
360	28	2	28	2	28	2
371	8	1	8	0	8	0
401	151	11	151	11	142	11
402	29	2	29	2	29	2
403	35	3	35	3	35	3
404	14	1	14	1	8	1
405	14	1	14	1	10	1
406	75	6	75	6	62	5
407	31	2	31	2	31	2
409	40	3	40	3	37	3
410	95	7	95	7	95	7
411	47	4	47	4	47	4
412	13	1	13	1	13	1
413	76	6	76	6	76	6
414	83	6	83	6	83	6
415	79	6	79	6	79	6
416	96	7	96	7	96	7

Unit[1]	Alternative 2[2]		Alternative 3[2]		Alternative 4[2]	
	Acres	Subsoil Acres	Acres	Subsoil Acres	Acres	Subsoil Acres
418	16	1	16	1	16	1
420	26	2	26	2	26	2
421	33	2	33	2	33	2
422	53	4	53	4	53	4
423	12	1	12	1	12	1
424	32	2	32	2	32	2
426	58	4	58	4	58	4
429	14	1	14	1	14	1
430	7	1	7	1	7	1
431	58	4	58	4	58	4
432	53	4	53	4	53	4
433*	5	1	5	1	5	1
434	51	4	51	4	51	4
435	29	2	29	2	17	1
436*	6	1	6	1	6	1
437	8	1	8	1	8	1
438	25	2	25	2	25	2
440	12	1	12	1	12	1
441	9	1	9	1	9	1
442*	6	1	6	1	6	1
444	28	2	28	2	28	2
446	19	1	19	1	19	1
450	13	1	13	1	13	1
451	61	5	61	5	61	5
452	25	2	25	2	25	2
453	7	1	7	1	7	1
454*	6	1	6	1	6	1
457	59	4	59	4	59	4
458	42	3	42	3	42	3
460	15	1	15	1	15	1
461	11	1	11	1	11	1
462	95	7	95	7	95	7
463	11	1	11	1	11	0
466	31	2	31	2	31	0
467	83	6	83	6	78	6
468	15	1	15	1	15	0
469	30	2	30	2	23	2
470*	6	1	6	1	6	1
471	45	3	45	3	45	3
472	10	1	10	1	10	1
474	68	5	68	5	68	5
477	44	3	44	3	44	3
478	32	2	32	2	32	2
479	29	2	29	2	29	2
480	10	1	10	1	10	1
482	35	3	35	3	35	3
484	12	1	12	1	12	1
487	64	5	64	5	64	0
491	30	2	30	2	30	2
492	26	2	26	2	26	2
493	12	1	12	1	12	1

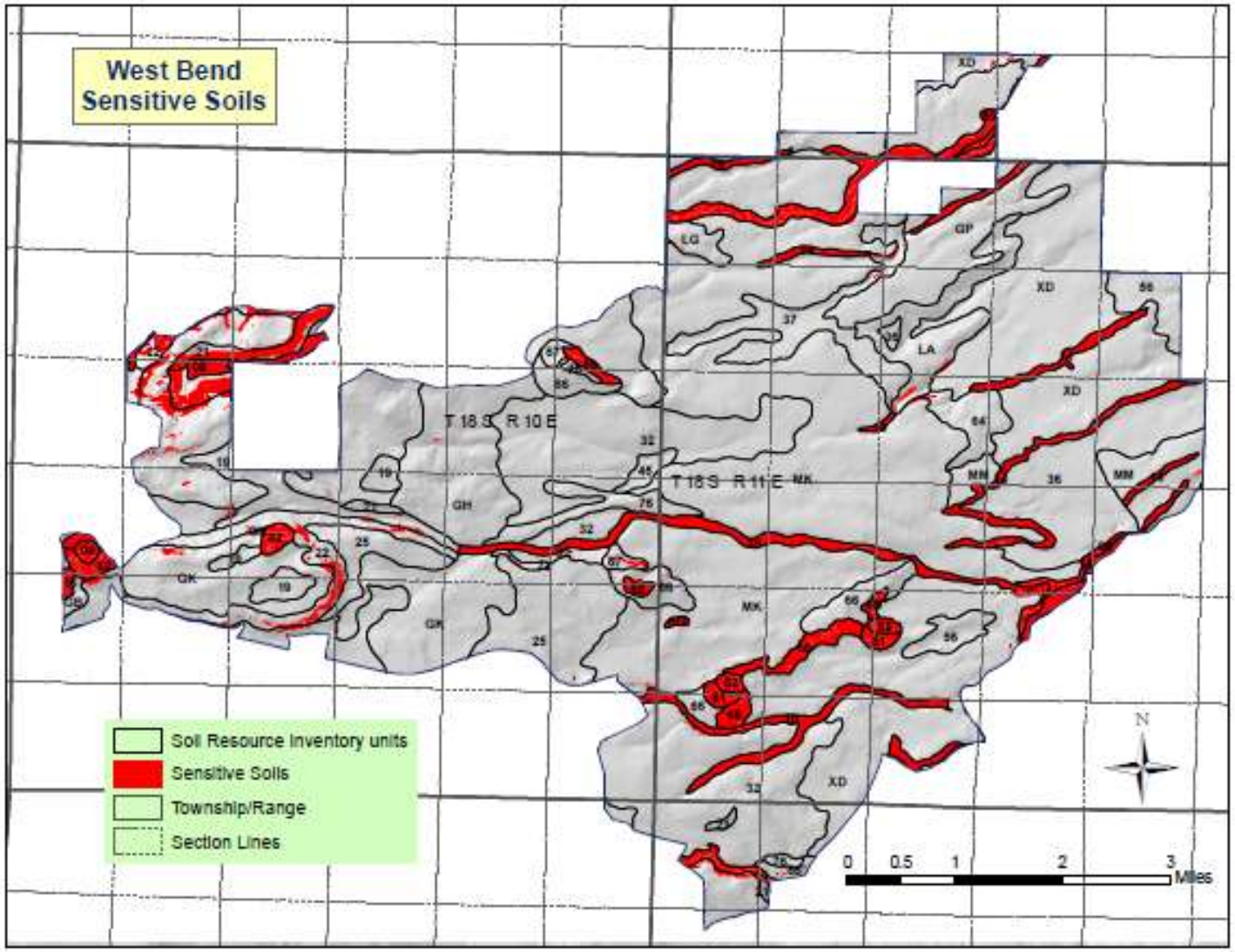
Unit[1]	Alternative 2[2]		Alternative 3[2]		Alternative 4[2]	
	Acres	Subsoil Acres	Acres	Subsoil Acres	Acres	Subsoil Acres
496	42	3	42	3	42	3
499	26	2	26	2	26	2
503	32	2	32	2	32	2
504	51	4	51	4	51	4
509*	6	1	6	1	6	1
510	14	1	14	1	14	1
512	92	7	92	7	92	7
514	42	3	42	3	42	3
515	38	3	38	3	38	3
Total Acres	**9846**	**957**	**9846**	**930**	**9425**	**763**

1 – Asterisks = units have less than 1 acre of subsoiling. Less than 1 acre was rounded up to 1.

2 – A zero indicates that the unit has no treatment, has a different prescription, or the unit was dropped and subsoiling will not be necessary.

Sensitive Soils Map

Figure 85: West Bend Sensitive Soils Map



Appendix E – Addressing Road Closure Effectiveness and Eliminating User-Created Roads

System Road Closures

All action alternatives will address ineffective road closures. These are roads that were put into maintenance category 1 in years past and are usually called "closed roads" but the closures have failed, meaning that people are driving their vehicles on them. The project will also implement road closures that were identified in previous NEPA decisions (East Tumbull, Katalo, Katalo East) but have not been implemented on the ground.

Within the West Bend project area, approximately 30 miles of roads are in maintenance category 1 (see Figure G-1). Closed roads remain on the transportation system but have the following attributes:

- Vehicular traffic is eliminated, including administrative traffic.
- Physically blocked or entrance is disguised.
- Not subject to the requirements of the Highway Safety Act.
- Maintenance is done only to minimize resource impacts.
- No maintenance other than a condition survey may be required so long as no potential exists for resource damage.

Many of the closures have failed and the roads are being used for vehicular traffic. Closure failures are generally the result of poorly executed closure strategies. Most common failures are a result of poor closure device selection for the site; failure to include multiple device strategies; not informing the historical user group of the proposed action; or no management signing on the ground (Deschutes National Forest Closure Guide 1997).

Road closures are important because the amount of open road density in an area is tied to wildlife habitat effectiveness. The Forest Plan specifies objectives for open road density for Key Elk Areas and for deer summer range. Roads were closed under previous NEPA decisions to move areas towards those objectives, but where closures fail, habitat effectiveness is reduced.

In order to address this problem, a systematic approach to road closures will be taken during implementation of any of the action alternatives of the West Bend project. The strategy relies on the Deschutes National Forest Road Closure Guide (1997) states "Ways to assure closure success include: site visitation to determine which closure device fits strategy; using multiple closure devices...; informing historical user groups of reason for closure; and proper signing." The Forest Service 2005 Guidelines for Road Maintenance Levels will also be referenced. As implementation begins in each sale or stewardship area, the roads will be reviewed for closure failures. The public will be notified of upcoming operations as part of a larger public communication plan for the project. Included in that notification will be information on what roads are maintenance category 1 so that the public understands that following activities, these roads will have an effective closure in place and they cannot be used for vehicle travel. Possible means of communication are red carsonite signs at road entrances.

Road Closure Methods for Maintenance Category 1 Roads

The Forest Plan states "Roads will be closed through the most economical method that is effective in meeting the management objectives for the area. These include seasonal administrative closures, sign restrictions, barriers, gates, and road obliteration. The preferred method of closing roads will be by obscuring the road entrance to discourage vehicle access." (TS-8).

Figure 86: This photo of a maintenance category 1 road in the project area shows an ineffective road closure – obviously used by motor vehicles.

Figure 87: This photo shows a more effective road closure where the entrance has been obliterated and disguised; there is no evidence of vehicle use.

User-Created Roads and Trails

Driving vehicles off of roads eventually can create tracks that appear to be an official road. User-created roads reduce habitat effectiveness and increase harassment of wildlife. Motor vehicle traffic as well as non-motorized use is expanding due to urbanization of the area. The effects of these disturbances overlap and make habitat enhancements and treatments ineffective.

Vehicles traveling off of designated roads and trails are also not complying with federal regulations that prohibit motor vehicles on lands other than those designated on the Motor Vehicle Use Map (36 CFR 212, 36 CFR 261.13) other than as specifically exempted by the rule.

As with maintenance category 1 roads, user-created roads will be dealt with as implementation progresses through a variety of methods to ensure that vehicle use does not continue. Unlike maintenance category 1 roads, however, user-created roads are to be permanently removed. The Deschutes National Forest Road Closure Guide (1997) provides details on appropriate methods.

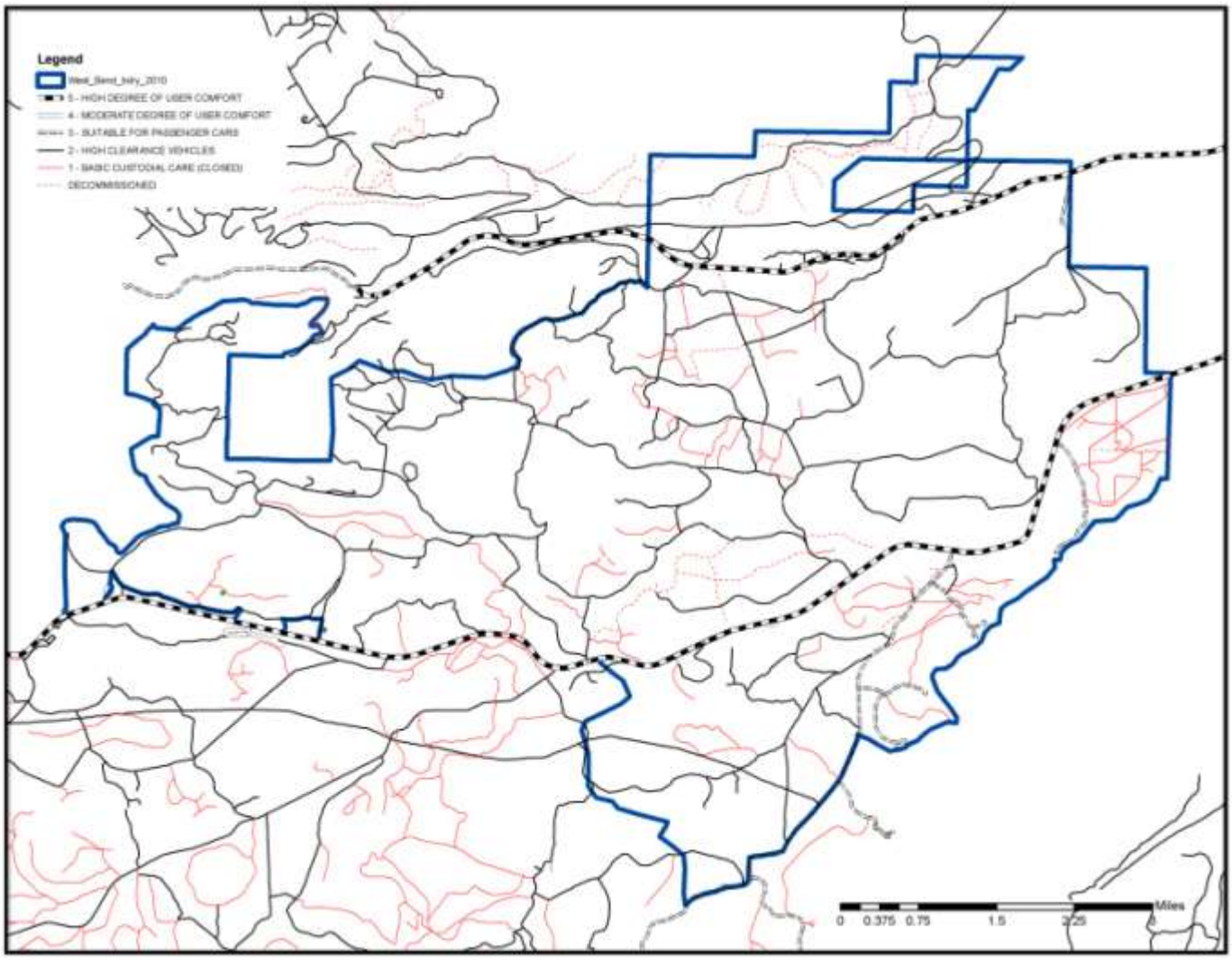


Figure G-1. Maintenance Level Categories for Roads in West Bend Project Area.

Appendix F - Snags, Down Wood, and Green Tree Replacements

Deschutes National Forest LRMP S&Gs

Standards and guidelines in the Deschutes National Forest LRMP which apply to species associated with snags and down wood include WL-37 and WL-38:

WL-37: In coniferous forest, sufficient snags will be maintained to provide 40 percent of potential population levels of cavity nesting species within even-aged harvest units of the General Forest, visual areas (retention, partial retention, and middle ground), and Deer Management Area allocations. In uneven-aged harvest units, within the management areas noted above, live replacement trees will be left during any harvest to assure 60 percent of cavity nesting potential through the rotation, except where natural deficits occur in diameter classes. In both even and uneven-aged management, groupings of green replacements will be the preferred implementation technique. Compliance will be based on the harvest unit area rather than an individual acre evaluation. In all other management areas, at least 60 percent of cavity nesting species potential population needs will be provided.

WL-38: Specific guidance will be provided by the Deschutes National Forest Wildlife Tree Implementation Plan.

Eastside Screens

The Decision Notice for the Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales (known as the *Eastside Screens*) addresses the need for project design to include the principles of landscape ecology and conservation biology (USDA FS 1994a and 1995). Screen 3, the Wildlife Screen, represents direction and parameters based on general scientific principles and concepts. The purpose of the Wildlife Screen is to maintain options in the short-term for the conservation of wildlife species associated with late and old structural stages in eastern Oregon and Washington. This direction generally equates to approximately 2.25 snags per acre for the ponderosa pine and mixed conifer and 1.8 snags per acre in lodgepole pine.

Specifically the direction for snags and down woody material are: 1) maintaining snags and green tree replacements (GTRs) of ≥15 inches dbh at 100% maximum potential population (MPP) for all vegetation types except lodgepole pine; 2) for lodgepole pine, maintain snags and green tree replacements of >10 inches dbh at 100% MPP; and 3) down logs ranging between 3 and 20 pieces per acre depending upon vegetative series (Table 2). The down log criteria are not intended to preclude the use of prescribed fire as an activity fuels modification treatment. Fire prescription parameters will ensure that consumption will not exceed 3 inches total (1/1/2 inches per side) of diameter reduction in the featured large log sizes below.

Table 2. LRMP Down Wood Requirements.

Timber Sale Activities				
Tree Species	**Pieces per acre**	**Diameter Small End**	**Piece Length**	**Total Lineal Length**
Ponderosa pine	3-6	13 inches	>6 feet	20-40 feet
Mixed conifer	15-20	13 inches	>6 feet	100-140 feet
Lodgepole pine	15-20	8 inches	>8 feet	120-160 feet
Prescribed Fire Parameter				
Consumption will not exceed 3 inches total (1 ½ inches per side) of diameter reduction in the featured large log sizes above.				

The estimated number of trees per acre (tpa) required to meet best available science for Green Tree Replacements (GTRs) is as follows.

	Habitat Type		
	Ponderosa Pine	**Mixed Conifer**	**Lodgepole Pine**
100% MPP based on best available science	4 snags per acre	4 snags per acre	6 snags per acre
GTRs @ 13-19 inches residual stand*	8 trees per acre	8 trees per acre	6 trees per acre

*This concurs with the 10 to 19 inches average dbh for the small/medium structure stage defined in DecAID.

Wildlife Tree and Log Implementation Strategy

The Deschutes National Forest Wildlife Tree and Log Implementation Strategy (WLTL) provides guidance and options for meeting the snag, green tree replacements (GTRs), and down log objectives on the forest, regardless of management direction (USFS 1994b). This strategy focuses on the treatment unit as the area of accountability for meeting WLTL objectives. It states that "Snags, GTRs, and down logs will not be provided on every acre in the forested ecosystem. A mosaic distribution of WLTL resources on the landscape maintaining viable populations and ecological functions is the desired condition." Current literature and research at the time, as well as incorporating the NWFP and Eastside Screen requirements were used to develop the number of hard snags (recent dead standing snag) needed by each species to support various percentages of their population. These were developed for each vegetative series and for areas west and east of the Northwest Forest Plan line.

Biological Potential

Habitat requirements, including snag and down woody material levels, were described in the LRMP and amended Eastside Screens for a variety of wildlife species using information known at the time in Thomas (1979) and Brown (1985). However, more recent empirical studies indicate that snag numbers and sizes selected by some wildlife species are far higher than those calculated using the maximum potential population method (Bull et al. 1997, Rose et al. 2001).

This suggests that the LRMP direction of managing for 100 percent population levels (WL-37 S&G) of primary excavators may not represent the most current knowledge of managing for cavity nesters and that these snag levels, under certain conditions, may not be adequate for some species, particularly for secondary cavity nesters. In addition, the current direction provides recommendations for green stands only when studies show that cavity-nesting birds require higher snag densities in post-fire conditions versus green stands for nesting and productivity (Bull et al. 1997, Rose et al. 2001). This is likely because cavity-nesting birds require more snags for foraging, cover, and protection from predators in post-fire environments.

Northwest Forest Plan (NWFP)

The NWFP provided standards and guidelines for snags and logs by allocation. There is no management within congressionally reserved lands; therefore, there are no standards and guidelines for snags and down wood. Harvest is limited in riparian reserves and late-successional reserves. Any treatment must meet the attainment of the Aquatic Conservation Strategy Objectives and follow guidance in Late-Successional Reserve (LSR) Assessments respectively. Snags and down wood likely to persist through time are highlighted to be retained for LSRs. Standards and guidelines for the matrix allocation also apply to Administratively Withdrawn allocation.

Matrix S&Gs speak to the retention of GTRs and snags both in patches and singly. For treatments such as clearcuts with reserves and shelterwood harvests, 15% of the area associated with each cutting unit is

to be retained. However, this S&G does not apply to intermediate harvests (i.e. thinning). At a minimum, snags are to be retained within the harvest unit at levels to sufficient to support species of cavity nesting birds at 40% potential population levels based on published guidelines and models.

Matrix S&Gs for down woody material in eastern Oregon apply primarily to regeneration harvest but state that the same guidelines apply to partial harvest but should be modified to reflect the timing of stand development cycles. A minimum of 120 lineal feet per acre greater than or equal to 16 inches in diameter and 16 feet long should be retained. Decay class 1 and 2 logs count towards these totals and down woody material already on the ground should be retained and protected to the greatest extent possible during activities.

DecAID Advisor

The DecAID Advisor (Mellen-McLean et al. 2009) is used as the best available science for the West Bend snag analysis. DecAID is a web-based advisory tool that helps managers evaluate effects of forest conditions and existing or proposed management activities on organisms that use snags and down wood. It is a summary, synthesis, and integration of published scientific literature, research data, wildlife databases, forest inventory databases, and expert judgment and experience. DecAID is used to estimate sizes and densities of dead wood that provide habitat for many species and ecological processes. It presents information on the range of *natural conditions* (as represented by unharvested plots within the plots sampled), *current conditions* (all plots sampled, including both unharvested and harvested plots), and *wildlife use*.

Historical Range of Variability

The terms Historical Range of Variability (HRV), Natural Conditions, and Historical Conditions in DecAID are sometimes used interchangeably to indicate conditions which occurred on the landscape prior to the influence of humans (particularly Europeans). Because it is difficult to determine the actual snag and down wood levels prior to the influence of humans, the term Reference Condition is used in DecAID when referring to the use of vegetation inventory data reported in DecAID based on data from unharvested plots. When using the *natural condition* of snag and down wood distribution represented by the summary of forest inventory data from unharvested inventory data in DecAID, caution should be used due to years of fire exclusion. The vegetation data can help determine the *natural range of variability* for dead wood, which can be used as a proxy for HRV. It is assumed that adequate habitat will be provided because species which survived those levels of habitat in the past are present today. The more that current conditions deviate from HRV, the less likely it is that adequate habitat occurs on the landscape to sustain those species. Although existing snag and down wood levels and composition in DecAID may not accurately reflect pre-European natural or historical conditions, they are still within reason when comparing them to other recent research.

Comparison of DecAID with other research

Harrod et al. (1998) estimated snag densities in ponderosa pine dominated dry forests for snag densities (> 6 inches dbh) at 6 to 14 snags per acre (4.5-7.0 tons per acre) in pre-European settlement landscapes. These estimates were derived by calculating the basal area of snags from pre-1930 growth rates, holding forest stand structure relatively constant (i.e., as a new live tree is recruited another one becomes a mortality) and applying published snag fall rates (Bull et al. 1980, Keen 1929, Raphael and Morrison 1987, and Schmid et al. 1985). It was assumed that historical frequent, low intensity fires did not accelerate snag fall rates.

Agee (2002) estimated lower snag densities (2 snags per acre) than Harrod et al. (1998) for the ponderosa pine/Douglas-fir forest series by estimating the number of trees in 0.25 acre clumps of 16 age classes and assuming that the oldest patch was killed by insects every 25 years. He assumed fire helped to decompose snag patches and after 5 fires at 10 year intervals, snags would be completely consumed. Agee (2002) compared his estimates to Harrod et al. (1998) but assumed an average snag diameter of 30 inches dbh when calculating biomass, whereas Harrod et al. (1998) estimated densities for size classes as

small as 6 inches dbh. Results from regional studies in Eastern Washington and Oregon (across all land ownerships) by Ohmann and Waddell (2002) suggest there are currently 2.03 total snags per acre >10 inches dbh, of which 0.41 snags are >20 inches dbh.

Snag densities reported by Harrod et al. (1998), Agee (2002), and Ohmann and Waddell (2002) are within the range (50% tolerance level) of those reported in DecAID (Mellen-McLean et al. 2009) for ponderosa pine/Douglas-fir and eastside mixed conifer habitat types for small and medium trees.

How DecAID Was Reviewed for the West Bend Project Analysis

Analysis areas should be sufficiently large to encompass the range of variation in wildlife habitat types and structural conditions that occur in the area (Mellen-McLean et al. 2009). In general, at least 20 square miles (12,800 acres) in each habitat type is suggested as a minimum size for an analysis. The Tumalo Creek and North Unit Diversion Dam-Deschutes River watersheds (HUC 10) were used for an appropriate comparison to the vegetation inventory data in DecAID for the West Bend project area. In cases where the habitat type for the watershed did not meet the minimum 12,800 acre analysis size, adjoining watersheds were combined.

The PAGs in the West Bend project area were compared to habitat types in DecAID. These are: (1) ponderosa pine/Douglas-fir (PP/DF) which best represents the ponderosa pine dry (PPD) and ponderosa pine wet (PPW) PAGs; (2) eastside mixed conifer (EMC) which best represents the mixed conifer wet (MCW) and MCD mixed conifer dry (MCD) PAGs; and (3) lodgepole pine (LP) (Table 3).

Table 3. Plant association groups and corresponding habitat types in DecAID.

Plant Association Group in West Bend Project Area	DecAID Habitat Type	Number of Acres
Ponderosa pine (wet and dry)	ponderosa pine/douglas fir	19,808
Mixed conifer (wet and dry)	eastside mixed conifer	4,088
Lodgepole Pine (wet and dry)	lodgepole pine	1,391

An HRV analysis of existing snag density and down wood on the Deschutes National Forest and at the 5th field watershed (HUC 10) level using information reported in DecAID and the Ochoco and Deschutes Viable/Wildhab Ecosystems Management Guide (*Viable*, USDA FS 1994c). The Viable model was developed to classify vegetation on a landscape basis and compares existing vegetation with site potential. Viable stratifies the environment along a gradient of size, structure, species composition, and relative tree density. The various classifications are then linked to wildlife habitat requirements. The 2004 Deschutes National Forest satellite imagery layer was used to develop the Viable map. Data is mapped on a 25 meter pixel grid and assigned a value relating to size, structure, tree species, and tree density for the animal species. The resulting layer was then updated by removing stand replacement and mixed mortality fires and forest management activities within the last five years.

The percentage of the landscape in each snag category was then weighted to match the HRV ranges from the Viable analysis. The snags per acre categories were summarized to get a historical range of snag densities that would be expected to occur in the West Bend analysis area.

Wildlife Data Tolerance Levels

In DecAID, a tolerance level as it relates to wildlife data is defined as follows: "Tolerance levels are estimates of the percent of all individuals in the population that are within some specified range of values" (Mellen-McLean et al. 2009). DecAID is not a viability model and tolerance levels should not be interpreted as population viability thresholds. DecAID tolerance levels may be interpreted as three levels of *assurance*: low (30% tolerance level), moderate (50% tolerance level), and high (80% tolerance level) (Mellen-McLean et al. 2009). The higher the tolerance level, the higher the assurance that snag habitat is being provided. For example, using data from the wildlife species curves for white-headed woodpeckers in small and medium sized trees in the ponderosa pine/ Douglas-fir habitat type, the snag density (≥10 inches dbh) for white-headed woodpeckers is as follows:

Tolerance Level	Snags Per Acre	Explanation

30% tolerance level	0.3	Areas with < 0.3 snags per acre would be expected to be used for nesting by only 30% of the individuals within the population of white headed woodpeckers, and conversely 70% of the population would be expected to nest in areas with > 0.3 snags per acre.
50% tolerance level	1.7	Half the individuals within the population would be expected to nest in areas with <1.7 snags per acre and the other half would be expected to nest in areas with >1.7 snags per acre.
80% tolerance level	3.7	80% of the individuals within the population of white headed woodpeckers would be expected to nest in areas with <3.7 snags per acre and conversely 20% of the population would be expected to nest in areas with >3.7 snags per acre.

Existing Condition — Snags

Forestwide Snag Density Existing Conditions and HRV

Tables 4 and 5 show the forest-wide number of acres with snags ≥10 and ≥20 inches dbh in the PP/DF, EMC, LP, and MMC habitat types categorized by snag densities (i.e., number of snags per acre). The PP/DF is the dominant habitat type, followed by LP, EMC, and MMC. The MMC does not occur in the West Bend project area and will not be further addressed.

Table 4. Forestwide acres with snags ≥10 inches dbh by habitat type.

Forestwide acres with snags ≥10 inches dbh snag density (snags per acre)							
Habitat Type	**0**	**>0 to 6**	**>6 to 12**	**>12 to 24**	**>24 to 36**	**>36**	**Total Acres**
PP/DF	258,587	167,405	46,295	10,894	2,052	914	486,148
EMC	50,293	100,335	79,614	53,685	27,688	25,418	337,034
LP	157,253	117,618	39,977	15,652	6,807	5,063	342,370
MMC	6,502	12,931	41,507	64,192	30,033	21,268	176,434
Total							**1,341,986**

Table 5. Forestwide acres with snags ≥20 inches dbh by habitat type.

Forestwide acres with snags ≥20 inches dbh by snag densities (snags per acre)							
Habitat Type	**0**	**>0 to 4**	**>4 to 8**	**>8 to 12**	**>12 to 16**	**>16**	**Total Acres**
PPDF	373,171	109,068	3,870	31	5	2	486,148
EMC	126,158	162,298	36,404	9,054	2,539	581	337,034
LP	278,128	58,236	4,893	686	99	328	342,370
MMC	36,954	57,678	51,872	19,090	6,778	4,062	176,434
Total							**1,341,986**

An historical range of variability (HRV) analysis for snag densities was also completed at the forestwide scale using information reported in DecAID and the Viable Ecosystems model. The HRV was based on the existing condition for snag densities and not the reference conditions. As shown in Table 6, for snags ≥10 inches dbh in the PP/DF habitat type, only the >0 to 4 snags per acre category is above HRV, while the remaining categories are within or slightly below HRV. Approximately 15% of the existing landscape in the EMC type has zero snags per acre which is within HRV (8 to 25%). The EMC is within HRV for the >0 to 6 snag density category, above HRV in the >6 to 12 and >36 categories, and within or slightly above HRV for the higher snag density categories. For the LP habitat type, 46% of the landscape has zero snags per acre which is above HRV (23 to 32%), well above (34%) the HRV for the >0 to 6 (12 to 17%), at the lower end (12%) of the HRV for >6 to 12 (12-20%) and below HRV in the remaining higher snag density categories.

Table 6. Forestwide percent of the Landscape with snags ≥10 inches dbh compared to HRV.

Forestwide Percent (%) of Landscape with snags ≥10 inches dbh								
Habitat Type	**Snag Density**	**0**	**>0 to 4**	**>4 to 12**	**>12 to 24**	**>24 to 36**	**>36**	**Total%**
PP/DF (486,148 acres)	HRV	55-61	19-27	13-15	3-5	0-1	0-1	100%
	Existing	53	34	10	2	0	0	100%
Habitat Type	**Snag Density**	**0**	**>0 to 6**	**>6 to 12**	**>12 to 24**	**>24 to 36**	**>36**	**Total%**
EMC (337,034 acres)	HRV	8-25	28-31	15-16	16-22	6-10	5-7	100%
	Existing	15	30	24	16	8	8	100%
LP (342,370 acres)	HRV	23-32	12-17	12-20	11-15	5-11	5-9	100%
	Existing	46	34	12	5	2	1	100%
Information reported in DecAID tables (unharvested plots for snags ≥10 inches (24.5cm) dbh) PP/DF_O.Inv-14, PP/DF_S.Inv-14, PP/DF_L.Inv-14, EMC_ECB_O.Inv-14., EMC_ECB_S.Inv-14, EMC_ECB_L.Inv-14, LP_O.Inv-14, LP_S.Inv-14, MMC_O.Inv-14, MMC_S.Inv-14, MMC_L.Inv-14 and modified with HRV information from Viable								

As shown in Table 7, for snags ≥20 inches dbh in the PP/DF habitat type, 77% of the landscape has no snags which is slightly above the HRV of 66-75%, while all the remaining categories are below HRV. Approximately 37% of the existing landscape in the EMC habitat type has no snags which is above HRV (32 to 44%), while the >0 to 4 category is above (48%) the HRV (29 to 35%), but below HRV in the remaining categories. For the LP habitat type, 81% of the landscape has no snags, which is within the HRV (72 to 83%), and 17% is within HRV (15-20%) for the >0 to 4 category. The main deviations in snag densities on the landscape are a result of historical clearcut timber harvesting (resulting in an excess of land area without snags) and fire exclusion in the stem exclusion and late successional forests (resulting in a lack of patches with high snag densities). Other factors include thinning, prescribed fire, firewood collection, illegal cutting of large snags, and loss of snags in green forests due to wildfire.

Table 7. Forestwide percent of the Landscape with snags ≥20 inches dbh compared to HRV.

Forestwide Percent (%) of Landscape with snags ≥20 inches dbh								
Habitat Type	**Snag Density**	**0**	**>0 to 4**	**>4 to 8**	**>8 to 12**	**>12 to 16**	**>16**	**Total%**
PP/DF (486,148 acres)	HRV	66-75	23-30	2-3	0-1	0-1	0	100%
	Existing	77	22	1.0	0.0	0.0%	0.0	100%
EMC (337,034 acres)	HRV	32-44	29-35	14-22	7-10	2-3	1-2	100%
	Existing	37	48	11	3	1.0	0.2	100%
LP (342,370 acres)	HRV	72-83	15-20	1-7	0-2	0	0	100%
	Existing	81	17	1.0	0.2	0.0	0.1	100%
Information reported in DecAID tables (unharvested plots for snags ≥20 inches (50cm) dbh) PP/DF_O.Inv-15, PP/DF_S.Inv-15, PP/DF_L.Inv-15, EMC_ECB_O.Inv-15., EMC_ECB_S.Inv-15, EMC_ECB_L.Inv-15, LP_O.Inv-15, LP_S.Inv-15, MMC_O.Inv-15, MMC_S.Inv-15, MMC_L.Inv-15, and modified with HRV information from Viable								

Snag Density Existing Conditions and HRV in the Watersheds

The West Bend project area occurs within two 5th field (HUC 10) watersheds: North Unit Diversion Dam – Deschutes River and Tumalo Creek. Table 8 displays the percent of the North Unit Diversion Dam – Deschutes River watershed for snags ≥10 and ≥20 inches dbh. Table 9 displays the percent of the Tumalo Creek watershed for snags ≥10 and ≥20 inches dbh. As displayed in Table 8, for the North Unit Diversion Dam-Deschutes River watershed in the PP/DF habitat type, for snags ≥10 inches, approximately 63% of the watershed has no snags and for snags ≥20 inches dbh, 84% of the watershed has no snags. In the EMC habitat type, for snags ≥10 inches, approximately 44% of the watershed has no snags ≥10 inches dbh and for snags ≥20 inches dbh, 70% of the watershed has no snags. In the LP habitat type for snags ≥10 inches dbh, approximately 39% of the watershed has no snags per acre and for snags ≥20 inches dbh, 83% of the watershed has no snags.

Table 8. Percent of North Unit Diversion Dam-Deschutes River Watershed for snags ≥10 and ≥20 inches dbh.

North Unit Diversion Dam-Deschutes River Watershed							
Percent (%) of Landscape for Snags ≥ 10 inches dbh							
Snags per acre	**0**	**>0 to 6**	**>6 to 12**	**>12 to 24**	**>24 to 36**	**>36**	**Total%**
PP/DF (41,884 acres)	63	29	3	4	1	0	100%
EMC (19,563 acres)	44	24	17	7	6	1	100%
LP (25,961 acres)	39	43	10	7	1	0	100%
Percent (%) of Landscape for Snags ≥ 20 inches dbh							
Snags per acre	**0**	**>0 to 4**	**>4 to 8**	**>8 to 12**	**>12 to 16**	**>16**	**Total%**
PP/DF (41,884 acres)	84	16	0	0	0	0	100%
EMC (19,563 acres)	70	27	3	0	0	0	100%
LP (25,961 acres)	83	16	1	0	0	0	100%

Table 9 displays the percent of the Tumalo Creek watershed for snags ≥10 and ≥20 inches dbh. In the PP/DF habitat type, for snags ≥10 inches dbh, approximately 58% of the watershed has no snags per acre and for snags ≥20 inches dbh, 80% of the watershed has no snags per acre. In the EMC habitat type, for snags ≥10 inches dbh, approximately 17% of the watershed has no snags per acre and for snags ≥20 inches dbh, approximately 57% of the watershed has no snags per acre. In the LP habitat type,

approximately 17% of the watershed has no snags per acre and for snags ≥20 inches dbh, approximately 65% of the watershed has no snags per acre.

Table 9. Percent of Tumalo Creek watershed for snags ≥10 and ≥20 inches dbh.

Tumalo Creek Watershed							
Percent (%) of Landscape for Snags ≥10 inches dbh							
Snags per acre:	**0**	**>0 to 6**	**>6 to 12**	**>12 to 24**	**>24 to 36**	**>36**	**Total%**
PP/DF (27,025 acres)	58	24	10	7	1	0	100%
EMC (26,098 acres)	17	17	25	25	13	2	100%
LP (28,489 acres)	17	25	21	20	10	7	100%
Percent (%) of Landscape for Snags ≥20 inches dbh							
Snags per acre:	**0**	**>0 to 4**	**>4 to 8**	**>8 to 12**	**>12 to 16**	**>16**	**Total%**
PP/DF (27,025 acres)	80	18	3	0	0	0	100%
EMC (26,098 acres)	57	32	10	1	0	0	100%
LP (28,489 acres)	65	24	7	2	0	1	100%

Data for the HRV for each watershed is not available. Tables 10 and 11 compare the existing conditions in the North Unit Diversion Dam – Deschutes River watershed with the forestwide HRV for snags ≥10 and ≥20 inches dbh. For snags ≥10 inches dbh, there is a higher percent of the watershed with no snags per acre and in the >0 to 6/>0 to 4 snags per acre category compared with the forestwide HRV for all three habitat types. The percent of the watershed for the remaining snag density categories (medium and higher snag densities) is mostly below HRV for all three habitat types.

Table 10. Percent of the North Unit Diversion Dam – Deschutes River Watershed compared with the forestwide HRV for snags ≥10 inches dbh.

Percent (%) of North Unit Diversion Dam – Deschutes River Watershed with snags ≥10 inches dbh								
Habitat Type	**Snag Density**	**0**	**>0 to 4**	**>4 to 12**	**>12 to 24**	**>24 to 36**	**>36**	**Total%**
PP/DF	Forestwide HRV	55-61	19-27	13-15	3-5	0-1	0-1	100%
	Existing	63	29	3	4	1	0	100%
Habitat Type	**Snag Density**	**0**	**>0 to 6**	**>6 to 12**	**>12 to 24**	**>24 to 36**	**>36**	**Total %**
EMC	Forestwide HRV	18-25	28-31	15-16	16-22	6-10	5-7	100%
	Existing	40	32	15	7	4	2	100%
LP	Forestwide HRV	23-32	12-17	12-20	11-15	5-11	5-9	100%
	Existing	39	43	10	7	1	0	100%
Information reported in DecAID tables (unharvested plots for snags ≥10 inches (24.5cm) dbh) PP/DF_O.Inv-14, PP/DF_S.Inv-14, PP/DF_L.Inv-14, EMC_ECB_O.Inv-14., EMC_ECB_S.Inv-14, EMC_ECB_L.Inv-14, LP_O.Inv-14, LP_S.Inv-14, and modified with HRV information from Viable.								

For snags ≥20 inches dbh in the North Unit Diversion Dam – Deschutes River watershed, the percent of the watershed with no snags per acre is higher than the HRV for the EMC and PP/DF habitat types and at the upper end of HRV for LP (Table 11). In the PP/DF, the percent of the landscape with >0 to 4 snags per acre is lower than HRV with the remaining snag density categories below or within HRV. In the EMC and LP habitat types, the remaining snag density categories are within or below HRV (Table 11).

Table 11. Percent of the North Unit Diversion Dam – Deschutes River watershed compared with the forestwide HRV for snags ≥20 inches dbh.

Percent (%) of North Unit Diversion Dam – Deschutes River Watershed with snags ≥20 inches dbh								
Habitat Type	**Snag Density**	**0**	**>0 to 4**	**>4 to 8**	**>8 to 12**	**>12 to 16**	**>16**	**Total%**
PP/DF	Forestwide HRV	66-75	23-30	2-3	0-1	0-1	0	100%
	Existing	84	16	0	0	0	0	100%
EMC	Forestwide HRV	32-44	29-35	14-22	7-10	2-3	1-2	100%
	Existing	65	32	3	0	0	0	100%
LP	Forestwide HRV	72-83	15-20	1-7	0-2	0	0	100%
	Existing	83	16	1	0	0	0	100%
Information reported in DecAID tables (unharvested plots for snags ≥20 inches (50cm) dbh) PP/DF_O.Inv-15, PP/DF_S.Inv-15, PP/DF_L.Inv-15, EMC_ECB_O.Inv-15., EMC_ECB_S.Inv-15, EMC_ECB_L.Inv-15, LP_O.Inv-15, LP_S.Inv-15, and modified with HRV information from Viable.								

Tables 12 and 13 compare the existing conditions in the Tumalo Creek watershed with the forestwide HRV for snags ≥10 and ≥20 inches dbh. As displayed in Table 12, for snags ≥10 inches dbh in the Tumalo Creek watershed, the percent of the PP/DF habitat type with no snags per acre, >0 to 4, and >4 to 12 are within HRV, the >12 to 24 is above HRV, and the >24 to 36, and >36 snag densities are within HRV. For the EMC habitat type, the existing percent of acres with zero snags per acre and >0 to 6 are lower than HRV, higher for the >6 to 12, >12 to 24, and >24 to 36, and within HRV for >36. For the LP habitat type, the existing condition in the zero snags per acre is lower than HRV, and higher than HRV in the >0 to 6, >6 to 12, and >12 to 24 densities, and within HRV for the >24 to 36 and >36 densities.

Table 12. Percent of the Tumalo Creek Watershed compared with the forestwide HRV for snags ≥10 inches dbh.

Percent (%) of Tumalo Creek Watershed with snags ≥10 inches dbh								
Habitat Type	**Snag Density**	**0**	**>0 to 4**	**>4 to 12**	**>12 to 24**	**>24 to 36**	**>36**	**Total%**
PP/DF	Forestwide HRV	55-61	19-27	13-15	3-5	0-1	0-1	100%
	Existing	58	24	10	7	1	0	100%
Habitat Type	**Snag Density**	**0**	**>0 to 6**	**>6 to 12**	**>12 to 24**	**>24 to 36**	**>36**	**Total %**
EMC	Forestwide HRV	18-25	28-31	15-16	16-22	6-10	5-7	100%
	Existing	17	7	25	25	13	2	100%
LP	Forestwide HRV	23-32	12-17	12-20	11-15	5-11	5-9	100%
	Existing	17	25	21	20	10	7	100%
Information reported in DecAID tables (unharvested plots for snags ≥10 inches (24.5cm) dbh) PP/DF_O.Inv-14, PP/DF_S.Inv-14, PP/DF_L.Inv-14, EMC_ECB_O.Inv-14., EMC_ECB_S.Inv-14, EMC_ECB_L.Inv-14, LP_O.Inv-14, LP_S.Inv-14, and modified with HRV information from Viable.								

As shown in Table 13, for the snags ≥20 inches dbh in the Tumalo Creek watershed, the existing condition for the PP/DF habitat type is above HRV for the zero snags per acre, below HRV for the >0 to 4 snag density, and within HRV for remaining snag densities. In the EMC habitat type, the existing condition is above HRV for zero snags per acre, within HRV for the >0 to 4 snag density, and below HRV for the remaining higher snag densities. In the LP habitat type, the existing condition for the zero snags per acre is below HRV, higher for the >0 to 4, and within HRV for the remaining snag densities.

Table 13. Percent of the Tumalo Creek Watershed compared with the forestwide HRV for snags ≥20 inches dbh.

Percent (%) of Tumalo Creek Watershed with snags ≥20 inches dbh								
Habitat Type	**Snag Density**	**0**	**>0 to 4**	**>4 to 8**	**>8 to 12**	**>12 to 16**	**>16**	**Total%**
PP/DF	Forestwide HRV	66-75	23-30	2-3	0-1	0-1	0	100%
	Existing	80	18	3	0	0	0	100%
EMC	Forestwide HRV	32-44	29-35	14-22	7-10	2-3	1-2	100%
	Existing	57	32	10	1	0	0	100%
LP	Forestwide HRV	72-83	15-20	1-7	0-2	0	0	100%
	Existing	65	24	7	2	0	1	100%
Information reported in DecAID tables (unharvested plots for snags ≥20 inches (50cm) dbh) PP/DF_O.Inv-15, PP/DF_S.Inv-15, PP/DF_L.Inv-15, EMC_ECB_O.Inv-15., EMC_ECB_S.Inv-15, EMC_ECB_L.Inv-15, LP_O.Inv-15, LP_S.Inv-15, and modified with HRV information from Viable.								

Existing Conditions – Down Wood

Forestwide Down Wood Existing Conditions and HRV

Tables 14 and 15 show the acres on the Deschutes National Forest with down wood cover ≥5 inches dbh and ≥20 inches dbh. The PP/DF is the predominant habitat type followed by LP, EMC and MMC. There is no MMC in the West Bend project area.

Table 14. Forestwide acres with down wood ≥5 inches dbh by habitat type.

Forestwide acres with down wood ≥5 inches dbh in percent (%) down wood cover							
Habitat Type	**0**	**>0 to 4**	**>4 to 8**	**>8 to 10**	**>10 to 16**	**>16**	**Total Acres**
PP/DF	132,295	311,206	34,935	3,728	3,622	362	486,148
EMC	8,532	191,592	102,178	18,714	14,640	1,378	337,034
LP	31,308	216,185	62,713	13,243	17,355	1,565	342,370
MMC	10,199	99,061	46,646	11,402	8,507	620	176,434
						Total	**1,341,986**

Table 15. Forestwide acres with down wood ≥20 inches dbh by habitat type.

Forestwide acres with down wood ≥ 20 inches dbh in percent (%) down wood cover					
Habitat Type	**0**	**>0 to 4**	**>4 to 10**	**>10**	**Total Acres**
PP/DF	359,324	126,204	614	6	486,148

EMC	183,705	143,188	8,431	1,710	337,034
LP	274,256	67,555	465	94	342,370
MMC	89,960	76,313	10,129	32	176,434
				Total	**1,341,986**

Tables 16 displays the percent of the forestwide landscape with down wood compared with the forestwide HRV for the down wood categories for down wood ≥5 inches dbh. In the PP/DF habitat type, 27% of the landscape has no down wood and is below HRV (37-46%), and all the remaining categories are above HRV except for >16 which is 0. In the EMC habitat type, only 3% of the existing forestwide landscape has no down wood, and all the remaining categories are above HRV except for >16 which is 0. In the LP habitat type, approximately 9% of the forestwide landscape has no down wood which is within HRV (5-16%), 63% is in the >0 to 4 category which is above HRV (46-59%), 18% is in the >4 to 8% category which is within HRV (17-23%), 4% is in the >8-10% category which is below HRV, and >10 to 16 is within HRV (5%) and within >16 (0%).

Table 16. Percent of the Deschutes National Forest with down wood ≥5 inches dbh compared to HRV.

Percent (%) of Forest with down wood cover ≥5 inches dbh								
Habitat Type	**% Down Wood Cover**	**0**	**>0 to 4**	**>4 to 8**	**>8 to 10**	**>10 to 16**	**>16**	**Total%**
PP/DF (486,148 acres)	HRV	37-46	51-60	2-3	0	0	0	100%
	Existing	27	64	7	1	1	0	100%
EMC (337,034 acres)	HRV	22-30	53-54	13-19	2-3	1-3	0	100%
	Existing	3	57	30	6	4	0	100%
LP (342,370 acres)	HRV	5-16	46-59	17-23	5-7	4-8	0	100%
	Existing	9	63	18	4	5	0	100%
Information reported in DecAID tables (unharvested plots for down wood ≥5 inches (12.5cm) dbh) PP/DF_O.Inv-16, PP/DF_S.Inv-16, PP/DF_L.Inv-16, EMC_ECB_O.Inv-16., EMC_ECB_S.Inv-16, EMC_ECB_L.Inv-16, LP_O.Inv-16, LP_S.Inv-16, MMC_O.Inv-16, MMC_S.Inv-16, MMC_L.Inv-16 and weighted by structure and HRV information from Viable								

Tables 17 displays the percent of the forestwide landscape with down wood compared with the forestwide HRV for the down wood categories for down wood ≥20 inches dbh. In the PP/DF habitat type, 74% of the landscape has no down wood but is within HRV while all the remaining categories are also within HRV. In the EMC habitat type, 55% of the existing landscape has no down wood which is below HRV, the >0 to 4 and >10% categories are above HRV, and at the upper end in the >4 to 10 category. In the LP habitat type, 80% of the landscape has no down wood which is within HRV, the >0 to 4% category is above HRV, while the >4 to 10 and >10 categories are below HRV. Down wood reductions have likely occurred due to previous timber vegetation management, prescribed fire, wildlife, and firewood collection.

Table 17. Forestwide percent of the Landscape with down wood ≥20 inches dbh compared to HRV.

Percent (%) of Forest with down wood cover ≥20 inches dbh						
Habitat Type	**% Down Wood Cover**	**0**	**>0 to 4**	**>4 to 10**	**>10**	**Total%**
PP/DF (486,148 acres)	HRV	70-79	21-31	0-1	0	100%
	Existing	74	26	0	0	100%

EMC (337,034 acres)	HRV	61-72	27-36	1-3	0	100%
	Existing	55	42	3	1	100%
LP (342,370 acres)	HRV	63-84	10-16	1-2	0	100%
	Existing	80	20	0	0	100%
Information reported in DecAID tables (unharvested plots for down wood ≥20 inches (50cm) dbh) PP/DF_O.Inv-17, PP/DF_S.Inv-17, PP/DF_L.Inv-17, EMC_ECB_O.Inv-17, EMC_ECB_S.Inv-17, EMC_ECB_L.Inv-17, LP_O.Inv-17, LP_S.Inv-17, MMC_O.Inv-17, MMC_S.Inv-17, MMC_L.Inv-17 and weighted by structure and HRV information from Viable.						

Down Wood Existing Conditions in the Watersheds

Tables 18 and 19 show the existing conditions for down wood in both watersheds: North Unit Diversion Dam – Deschutes River and Tumalo Creek. For the North Unit Diversion Dam – Deschutes River watershed in the PP/DF habitat type, approximately 40% of the watershed and has no down wood ≥5 inches dbh and 88% has no down wood ≥20 inches dbh. In the EMC habitat type, approximately 4% has no down wood ≥5 inches dbh and 69% has no down wood ≥20 inches dbh. In the LP habitat type, approximately 7% has no down wood ≥5 inches dbh and 86% has no down wood ≥20 inches dbh.

Table 18. Existing conditions for down wood in the watersheds in the North Unit Diversion Dam-Deschutes River watershed.

North Unit Diversion Dam - Deschutes River Watershed							
Percent (%) of watershed with down wood cover ≥5 inches dbh							
% Down Wood	**0**	**>0 to 4**	**>4 to 8**	**>8 to 10**	**>10 to 16**	**>16**	**Total %**
PPDF (41,884 acres)	40	56	3	1	0	0	100%
EMC (28,200 acres)	4	65	22	6	3	0	100%
LP (25,961 acres)	7	55	26	9	2	0	100%
Percent (%) of watershed with down wood cover ≥20 inches dbh							
% Down Wood	**0**	**>0 to 4**		**>4 to 10**	**>10**		**Total %**
PPDF (41,884 acres)	88	12		0	0		100%
EMC (28,200 acres)	69	28		0	2		100%
LP (25,961 acres)	86	14		0	0		100%

For down wood in the Tumalo Creek watershed, approximately 31% in PP/DF habitat type does not have down wood ≥5 inches dbh and 79% does not have down wood ≥20 inches dbh. Most of the down wood percent in the EMC and LP habitat types is between 0 and 8% of the watershed. There is no down wood cover ≥20 inches dbh in 79% of the PP/DF, 63% of the EMC, and 69% of the LP.

Table 19. Existing conditions for down wood in the watersheds in the Tumalo Creek watershed.

Tumalo Creek Watershed							
Percent (%) of watershed with down wood cover ≥ 5 inches dbh							
	0	**>0 to 4**	**>4 to 8**	**>8 to 10**	**>10 to 16**	**>16**	**Total %**
PPDF (27,025 acres)	31	59	8	0	2	0	100%
EMC (26,098 acres)	1	61	22	10	5	0	100%
LP (28,489 acres)	2	59	29	4	5	1	100%

Percent (%) of watershed with down wood cover ≥ 20 inches dbh					
	0	>0 to 4	>4 to 10	>10	Total %
PPDF (27,025 acres)	79	21	0	0	100%
EMC (26,098 acres)	63	36	0	1	100%
LP (28,489 acres)	69	30	0	0	100%

Data for HRV by each watershed for down wood cover is not available. Tables 20 and 21 show the existing percent of down wood ≥5 inches dbh and ≥20 inches dbh in the North Unit Diversion Dam – Deschutes River watershed compared to the forestwide HRV. For the down wood ≥5 inches dbh in the EMC and LP habitat types, there are fewer acres with no down wood than compared with the forestwide HRV. For the down wood ≥5 inches dbh in the PP/DF, 40% of the acres in the watershed do not have down wood cover and 56% of the acres in the watershed have less than 4% down wood but this is within the forestwide HRV.

Table 20. Percent of North Unit Diversion Dam – Deschutes River Watershed with down wood ≥5 inches dbh compared to the forestwide HRV.

Percent (%) of North Unit Diversion Dam – Deschutes River Watershed with down wood ≥5 inches dbh								
Habitat Type	% Down Wood Cover	0	>0 to 4	>4 to 8	>8 to 10	>10 to 16	>16	Total%
PP/DF	Forestwide HRV	37-46	51-60	2-3	0	0	0	100%
	Existing	40	56	3	0	0	0	100%
EMC	Forestwide HRV	22-30	53-54	13-19	2-3	1-3	0	100%
	Existing	4	65	22	6	3	0	100%
LP	Forestwide HRV	5-16	46-59	17-23	5-7	4-8	0	100%
	Existing	7	55	25	9	2	0	100%
Information reported in DecAID tables (unharvested plots for down wood ≥5 inches dbh) PP/DF_O.Inv-16, PP/DF_S.Inv-16, PP/DF_L.Inv-16, EMC_ECB_O.Inv-16., EMC_ECB_S.Inv-16, EMC_ECB_L.Inv-16, LP_O.Inv-16, LP_S.Inv-16, and weighted by structure and HRV information from Viable.								

As displayed in Table 21 for the down wood ≥20 inches dbh, the levels and distribution in the North Unit Diversion Dam – Deschutes River watershed are within the forestwide HRV for all three habitat types for the 0%, and >0 to 4% categories, with the exception of LP, which has slightly more acres with no down wood than the forestwide HRV. For all three habitat types, there are fewer acres in the watershed that have down wood in the >4 to 10% and >10% categories.

Table 21. Percent of North Unit Diversion Dam – Deschutes River Watershed with down wood ≥20 inches dbh compared to forestwide HRV.

Percent (%) of North Unit Diversion Dam – Deschutes River Watershed with down wood ≥20 inches dbh						
Habitat Type	% Down Wood Cover	0	>0 to 4	>4 to 10	>10	Total%
PP/DF	Forestwide HRV	70-79	21-31	0-1	0	100%
	Existing	75	24	0	0	100%
EMC	Forestwide HRV	61-72	27-36	1-3	0	100%

	Existing	69	28	0	2	100%
LP	Forestwide HRV	63-84	10-16	1-2	8	100%
	Existing	86	14	0	0	100%
Information reported in DecAID tables (unharvested plots for down wood ≥5 inches dbh) PP/DF_O.Inv-16, PP/DF_S.Inv-16, PP/DF_L.Inv-16, EMC_ECB_O.Inv-16., EMC_ECB_S.Inv-16, EMC_ECB_L.Inv-16, LP_O.Inv-16, LP_S.Inv-16, and weighted by structure and HRV from Viable.						

As shown in Table 22, for down wood ≥5 inches dbh, there are fewer acres with no down wood for all three habitat types (lower than HRV) and down wood cover ≥20 inches dbh is within HRV for all three habitat types for no snags per acre (Table 23). The percent of down wood cover ≥20 inches dbh with no down wood in the watershed is within the forestwide HRV for all three habitat types.

Table 22. Percent of Tumalo Creek watershed with down wood ≥5 inches dbh compared to forestwide HRV.

Percent (%) of Tumalo Creek Watershed with down wood ≥5 inches dbh								
Habitat Type	**% Down Wood Cover**	**0**	**>0 to 4**	**>4 to 8**	**>8 to 10**	**>10 to 16**	**>16**	**Total%**
PP/DF	Forestwide HRV	37-46	51-60	2-3	0	0	0	100%
	Existing	31	59	8	0	2	0	100%
EMC	Forestwide HRV	22-30	53-54	13-19	2-3	1-3	0	100%
	Existing	1	61	22	10	5	0	100%
LP	Forestwide HRV	5-16	46-59	17-23	5-7	4-8	0	100%
	Existing	2	59	29	4	5	0	100%
Information reported in DecAID tables (unharvested plots for down wood ≥5 inches (12.5cm) dbh) PP/DF_O.Inv-16, PP/DF_S.Inv-16, PP/DF_L.Inv-16, EMC_ECB_O.Inv-16., EMC_ECB_S.Inv-16, EMC_ECB_L.Inv-16, LP_O.Inv-16, LP_S.Inv-16, and weighted by structure and HRV information from Viable.								

Table 23. Percent of Tumalo Creek watershed with down wood ≥20 inches dbh compared to forestwide HRV.

Percent (%) of Tumalo Creek Watershed with down wood ≥20 inches dbh						
Habitat Type	**% Down Wood Cover**	**0**	**>0 to 4**	**>4 to 10**	**>10**	**Total%**
PP/DF	Forestwide HRV	70-79	21-31	0-1	0	100%
	Existing	79	21	0	0	100%
EMC	Forestwide HRV	61-72	27-36	1-3	0	100%
	Existing	63	36	0	1	100%
LP	Forestwide HRV	63-84	10-16	1-2	0	100%
	Existing	69	30	0	0	100%
Information reported in DecAID tables (unharvested plots for down wood ≥5 inches (12.5cm) dbh) PP/DF_O.Inv-16, PP/DF_S.Inv-16, PP/DF_L.Inv-16, EMC_ECB_O.Inv-16., EMC_ECB_S.Inv-16, EMC_ECB_L.Inv-16, LP_O.Inv-16, LP_S.Inv-16, and weighted by structure and HRV from Viable.						

Existing Conditions — Species Associated with Snags, Down Wood, and Green Tree Replacements

American Marten

American (pine) martens are closely associated with forested habitats that have complex physical structure near the ground (Buskirk and Powell 1994, Bull et al. 2005, Slauson et al. 2007). Open areas, such as regeneration logging units, recent severely burned areas, and natural openings are avoided, especially during the winter. Martens recross their own tracks often to investigate microhabitat features, such as stumps, logs, and brush piles that might contain food. They often use fallen logs as runways (Clark et al. 1987). Stands used by martens have higher densities of large snags (≥20 inches dbh) and trees ≥10 inches dbh (Bull et al. 2005). Raphael and Jones (1997) found that down wood and slash piles were important resting and denning structures in the eastern Cascades of central Oregon. Forests in their study area were dominated by lodgepole pine. Based on DecAid, Table 24 shows the relative range of snag and tree sizes used by martens in the Blue Mountains and Washington Cascades for denning and resting. Table 25 shows the relative snag densities at American marten occupied sites in the Blue Mountains within vegetation condition classes in the eastside mixed conifer, montane mixed conifer (large trees), and lodgepole pine habitat types (small and medium trees). The montane mixed conifer habitat type does not occur in the West Bend project area.

Table 24. Range of snag and tree sizes used by American marten in the Blue Mountains and Washington Cascades for denning and resting.

American marten: Snag size (inches dbh)			
Type of Use	**Range**	**mean**	
Montane Mixed Conifer			
Denning	27.3 to 53.8	38.2	DecAID Tables MMC_L.sp-18 (Mellen-McLean et al. 2009)
Resting	20.9 to 46.8	31.2	
Eastside mixed conifer			
Denning and resting	23.9 to 40.5	30.6	DecAID Tables EMC_L.sp-18 (Mellen-McLean et al. 2009)
Lodgepole Pine			

Denning	20.8 to 46.6	31.6	DecAID Tables LP_S.sp-17 & 18 (Mellen-McLean et al. 2009)
Resting	3.8 to 57.1[1]	25.7	

[1] The 30% and 80% tolerance level are likely a result of high variance in the sample. It is not physically possible for a marten to rest inside a 3.8 inch dbh snag.

Table 25. Snag densities at American marten occupied sites in the Blue Mountains, eastside mixed conifer, montane mixed conifer (large trees), and lodgepole pine (small/medium trees).

American marten: Snag density (snags per acre)			
Snag Size	**30% tolerance level**	**mean**	
≥10 inches dbh	11.8 to 14.4	12.8	DecAID Table EMC_S/L.sp-22, MMC_S/L.sp-22, and LP_S.sp-22 (Mellen-McLean et al. 2009)
≥20 inches dbh	3.7 to 4.5	4.0	

Snag Distribution in American Marten Denning Habitat on the Deschutes National Forest

There are approximately 433,973 acres of potential marten denning habitat on the Deschutes National Forest. Table 26 shows the existing snag distribution on the Forest for marten denning habitat by tolerance level. The acres of modeled denning habitat used only green tree data. The Sisters Ranger District on the northern end of the Forest has been heavily impacted by beetle outbreaks in the 1980s followed by wildfires between 2000 and 2009. The B&B, GW, and Eyerly fires resulted in reduced marten habitat, including connectivity to the National Forest lands to the south as well as northward onto the Warm Springs Tribal Lands. Habitat connectivity is fairly well connected on the Crescent and Bend/Ft. Rock Ranger Districts. Approximately 22% of the marten denning habitat forestwide does not have any snags, making it unlikely to provide suitable denning habitat. Only 1% of the denning habitat provides for the majority of individuals at the tolerance levels preferred by marten (>80% tolerance level). The remaining 77% of the habitat with snags ≥20 inches dbh provides varying levels of habitat for individuals.

Table 26. Existing snag distribution >20 inches dbh in American marten denning habitat on the Deschutes National Forest.

American Marten: Snags ≥20 inches dbh			
Tolerance Level	**Snags per acre**	**Forestwide Denning Acres**	**% of Habitat**
0	0	93,951	22
>0-30%	>0 to 3.7	28,514	7
>30-50%	>3.7 to 4.0	75,437	17
>50-80%	>4.0 to 4.5	231,980	53
>80%	>4.5	4,092	1
	Total	**433,973 acres**	**100%**
Based on DecAID Version 2.1: Tables EMC_S/L.sp-22, MMC_S/L.sp-22, and LP_S.sp-22.			

Snag Distribution in American Marten Denning Habitat in the Watersheds

Table 27 shows the existing snag distribution for snags ≥20 inches dbh in marten denning habitat in both watersheds. There are 7,063 acres of marten denning habitat in the North Unit Diversion Dam – Deschutes River watershed which comprises 1.6% of the habitat available forestwide. The majority of marten habitat in this watershed (72%) does not have snags and therefore may be less likely used for denning. No habitat is provided for the majority of individuals at the snag density tolerance level preferred by marten (>80%). The remaining 28% of the denning habitat provides varying levels of habitat for individuals.

There are 8,376 acres of marten denning habitat in the Tumalo Creek watershed which comprises 1.9% of the habitat available forestwide. Approximately 18% of the habitat does not have snags and therefore

may be less likely used for denning. No habitat is provided for the majority of individuals at the snag density preferred by marten (>80%). The remaining 82% of the denning habitat provides varying levels of habitat for individuals.

Table 27. Existing snag distribution ≥20 inches dbh in marten denning habitat in the watersheds.

American marten: Snags ≥20 inches dbh			
Tolerance Level	**Snags per acre**	**Acres of Denning Habitat in the Watershed**	**% of Habitat**
North Unit Diversion Dam – Deschutes River Watershed			
0	0	5,074	72
>0-30%	>0 to 2.8	1,660	24
>30-50%	>2.8 to 7.7	327	4
>50-80%	>7.7 to 15.2	2	0
≥80%	>15.2	0	0
	Total	**7,063**	**100%**
Tumalo Creek Watershed			
0	0	1,517	18
>0-30%	>0 to 2.8	1,409	17
>30-50%	>2.8 to 7.7	3,989	48
>50-80%	>7.7 to 15.2	1,461	17
≥80%	>15.2	0	0
	Total	**8,376**	**100%**
Based on DecAID Version 2.1: Tables EMC_S/L.sp-22, MMC_S/L.sp-22 and LP_S.sp-22.			

Down Wood for American Marten Denning Habitat on the Deschutes National Forest

Table 28 shows the size of hollow down logs by tolerance level for marten denning and resting in the eastside mixed conifer and Montana mixed conifer as reported in DecAID. No data for down wood size associated with marten use are available for the Westside-Lowland Conifer-Hardwood Forest or lodgepole pine wildlife habitat types in DecAID.

Specific down wood tolerance levels for marten forestwide are not available. However, the presence of down wood was modeled forestwide for the eastside mixed conifer and lodgepole pine habitat types and discussed earlier in this report on pages 13 and 14 (see Tables 16 and 17). Analysis shows that for down wood ≥5 inches dbh, both habitat types are generally at or above HRV for the 0 to 16% down wood cover level. For down wood ≥20 inches dbh, analysis shows >0 to 4% down wood cover is above HRV in both habitat types but below HRV in the >4 to 10% range for lodgepole pine.

Table 28. Size of hollow down logs, by tolerance level used by American marten for denning and resting in the Blue Mountains, eastside mixed conifer Forest and montane mixed conifer Forest, Larger Trees vegetation condition class (DecAID Table EMC_L.sp-21 and MMC_L.sp-21 (Mellen-McLean et al. 2009).

	American marten: Down wood diameter (inches dbh)				
Type of Use	**30% tolerance level**	**50% tolerance level**	**80% tolerance level**	**30 & 80% tolerance levels**	**50% tolerance level**
Denning and resting	20.7	26.1	33.2	67	77

Down Wood for American Marten Denning Habitat in the Watersheds

Specific down wood tolerance levels for marten in the watersheds are not available. However, the presence of down wood was modeled for the watersheds and discussed earlier in this report on pages 14 and 15 (see Tables 18 and 19). For down wood ≥5 inches dbh in the North Unit Diversion Dam – Deschutes River watershed, approximately 96% of the PP/DF habitat type has no down wood (40%) or less than 4% (56%) down wood on 41,884 acres. For the EMC and LP, the percent of down wood is highest in the >0 to 4 and >4 to 8 categories. There is no down wood cover ≥20 inches dbh in 88% of PP/DF, 69% of EMC, and 85% of the LP habitat types.

For down wood ≥5 inches dbh in the Tumalo Creek watershed, approximately 31% of the PP/DF does not have down wood with 59% of the watershed has less than 4% in PP/DF. Most of the down wood percent in the EMC and LP habitat types is between 0 and 8% of the watershed. There is no down wood cover ≥20 inches dbh in 79% of the PP/DF, 63% of the EMC, and 69% of the LP.

Snag and Down Wood Distribution for American Marten Denning Habitat in the West Bend Project Area

There are 630 acres of marten denning habitat in the West Bend project area which is 0.15% of the habitat available forestwide, approximately 1% of the habitat available in the North Unit Diversion Dam– Deschutes River watershed and less than 1% of the habitat available in the Tumalo Creek watershed.

Table 29 shows the snag distribution for snags ≥20 inches dbh in the project area. Approximately 40% of potential nesting habitat does not contain any snag habitat making it unlikely to be suitable denning habitat. No habitat is provided at the tolerance level preferred by more than half of the individuals (>50 to 80% and >80% tolerance levels). Specific down wood tolerance levels for marten in the West Bend project area are not available.

Table 29. Existing snag distribution ≥20 inches dbh in American marten denning habitat in the West Bend project area.

American marten			
Tolerance Level	**Snags per acre**	**Denning Acres in Project Area**	**% of Habitat**
0	0	258	41
>0-30%	>0 to 3.7	262	42
>30-50%	>3.7 to 4.0	110	17
>50-80%	>4.0 to 4.5	0	0
>80%	>4.5	0	0
	Total	**630**	**100%**
Based on DecAID Version 2.1: Tables EMC_S/L.sp-22, MMC_S/L.sp-22, and LP_S.sp-22.			

Williamson's sapsucker

Williamson's sapsuckers, a summer resident, prefer large decadent snags in mixed conifer or ponderosa pine forests. They feed mostly on sap from wells they drill in ponderosa pine or Douglas-fir trees, phloem fibers, cambium, and insects. They are not strong cavity excavators and select soft decayed wood in almost any tree species for nesting (Marshall et al. 2003 pp. 355-356). They favor larger trees, generally averaging 27 inches dbh but have been shown to utilize snags ranging from 21 to 37 inches dbh as evidenced by the 30 and 80 percent tolerance levels for nest snag diameter in DecAID (Mellen-McLean et al. 2009). Tables 30, 31, and 32 show the snag diameters and densities needed for Williamson's sapsucker for areas east and west of the Northwest Forest Plan.

This sapsucker is identified in the Conservation Strategy for Landbirds of the East-Slope of the Cascades Mountains in Oregon and Washington as a focal species for mixed conifer late-successional forests with large snags (Altman 2000). The biological objectives for habitat where ecologically appropriate are to initiate actions in mixed conifer late-successional forests to maintain or provide greater than 1 snag/acre >12 inches dbh except for ponderosa pine snags which should be >18 inches dbh and a mean canopy cover of 25 to 70% (Altman 2000).

Table 30. Snag numbers for Williamson's sapsucker by vegetative series and snag size for areas west of the NWFP line on the Deschutes National Forest (WLTL).

Williamson's sapsucker					
Vegetative Series	**Minimum Snag Diameter (inches dbh)**	**Snags per 100 acres to support various % woodpecker population levels**			
		100%	**80%**	**60%**	**40%**
Ponderosa Pine	>12 inches dbh	33	26	20	13
Mixed Conifer	>12 inches dbh	33	26	20	13
White Fir	>12 inches dbh	33	26	20	13

Table 31. Snag numbers for Williamson's sapsucker by vegetative series and snag size for areas east of the NWFP line on the Deschutes National Forest (WLTL).

Williamson's sapsucker		
Vegetative Series	**Minimum Snag Diameter (inches dbh)**	**Snags per 100 acres to support 100% maximum potential population**
Ponderosa Pine	>20 inches dbh	14
	>15 inches dbh	211
Total		**225**
Mixed Conifer	>20 inches dbh	14
	>15 inches dbh	211
Total		**225**

Table 32. Snag requirements for the Williamson's sapsucker regarding potential population levels.

Williamson's sapsucker					
	Veg Type/Series	**Target % Potential Population Level**	**Minimum Snag Size (inches dbh)**	**Snags per acre Required**	**Comments**
Des WLTL and	Ponderosa Pine	100%	>20	0.60	Retain all

NWFP	and Mixed Conifer				possible
	Ponderosa Pine and Mixed Conifer	40%	>10	0.24	
Eastside Screens	Ponderosa Pine	100%	>15	2.25	
	Mixed Conifer	100%	>15	2.25	

Snag Distribution in Williamson's Sapsucker Nesting Habitat on the Deschutes National Forest

Table 33 shows the existing snag distribution ≥10 inches dbh and ≥20 inches dbh in Williamson's sapsucker nesting habitat on the Deschutes National Forest. Approximately 34% of the nesting habitat with snags ≥10 inches dbh and 53% of the nesting habitat with snags ≥20 inches dbh do not contain any snag habitat, making it unlikely to be suitable nesting habitat. There is no nesting habitat for snags ≥20 inches dbh that provide for the majority of individuals (at the >80% tolerance level). The remaining 69% of the habitat with snags ≥10 inches dbh and 47% of the habitat with snags ≥20 inches dbh provide varying levels of habitat for individuals.

Table 33. Existing snag distribution ≥10 and ≥20 inches dbh in Williamson's sapsucker nesting habitat on the Deschutes National Forest.

Williamson's sapsucker			
Tolerance Intervals	**Snags per acre**	**Nesting Habitat Acres**	**% of Habitat**
Snags ≥10 inches dbh			
0	0	82,713	34
>0-30%	>0 to 14.0	126,319	52
>30-50%	>14.0 to 28.4	23,263	10
>50-80%	>28.4 to 49.7	8,284	3
>80%	>49.7	2,785	1
	Total	**243,364**	**100%**
Snags ≥20 inches dbh			
0	0	128,190	53
>0-30%	>0 to 3.3	83,437	34
>30-50%	>3.3 to 8.6	24,788	10
>50-80%	>8.6 to 16.6	6,552	3
>80%	>16.6	397	0
	Total	**243,364**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Snag Distribution in Williamson's Sapsucker Nesting Habitat in the Watersheds

There are 14,805 acres of nesting habitat in the North Unit Diversion Dam – Deschutes River watershed which is 6% of the habitat available forestwide. Table 34 shows the existing snag distribution ≥10 and ≥20 inches dbh in the watershed. Approximately 62% of the nesting habitat with snags ≥10 inches dbh and 81% of the nesting habitat with snags ≥20 inches dbh do not contain any snag habitat, making it unlikely to be suitable nesting habitat. There is no nesting habitat with snags ≥10 or ≥20 inches dbh that provide for more than half of the individuals at the >50 to 80% and >80% tolerance levels. The remaining 38% of the habitat with snags ≥10 inches dbh and 20% of the habitat with snags ≥20 inches dbh provide varying levels of habitat for individuals.

Table 34. Existing snag distribution ≥10 and ≥20 inches dbh in Williamson's sapsucker nesting habitat in the North Unit Diversion Dam – Deschutes River Watershed by tolerance level.

Williamson's sapsucker nesting habitat: North Unit Diversion Dam – Deschutes River Watershed			
Tolerance Intervals	**Snags per acre**	**Nesting Habitat Acres**	**% of Habitat**
Snags ≥10 inches dbh			
0	0	9,161	62
>0-30%	>0 to 14.0	5,025	34
>30-50%	>14.0 to 28.4	593	4
>50-80%	>28.4 to 49.7	13	0
>80%	>49.7	14	0
	Total	**14,805**	**100%**
Snags ≥20 inches dbh			
0	0	11,939	81
>0-30%	>0 to 3.3	2,469	17
>30-50%	>3.3 to 8.6	395	3
>50-80%	>8.6 to 16.6	2	0
>80%	>16.6	0	0
	Total	**14,805**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

There are 4,647 acres of nesting habitat for the Williamson's sapsucker in the Tumalo Creek watershed, which is 2% of the forestwide habitat. Table 35 show the existing snag distribution ≥10 and ≥20 inches dbh. Approximately 44% of the nesting habitat with snags ≥10 inches dbh and 57% of the nesting habitat with snags ≥20 inches dbh do not contain any snag habitat, making it unlikely to be suitable nesting habitat. There is no nesting habitat with snags ≥10 or ≥20 inches dbh that provide for a majority of individuals at the >80% tolerance level. The remaining 55% of the habitat with snags ≥10 inches dbh and 42% of the habitat with snags ≥20 inches dbh provide varying levels of habitat for individuals.

Table 35. Existing snag distribution ≥10 and ≥20 inches dbh in Williamson's sapsucker nesting habitat in the Tumalo Creek Watershed by tolerance level.

Williamson's sapsucker nesting habitat: Tumalo Creek Watershed			
Tolerance Intervals	**Snags per acre**	**Nesting Habitat Acres**	**% of Habitat**
Snags ≥10 inches dbh			
0	0	2,045	44
>0-30%	>0 to 14.0	1,692	36
>30-50%	>14.0 to 28.4	821	18
>50-80%	>28.4 to 49.7	66	1
>80%	>49.7	22	0
	Total	**4,647**	**100%**
Snags ≥20 inches dbh			
0	0	2,636	57
>0-30%	>0 to 3.3	1,090	23
>30-50%	>3.3 to 8.6	903	19
>50-80%	>8.6 to 16.6	18	0
>80%	>16.6	0	0
	Total	**4,647**	**100%**

Based on DecAID Version 2.1: Table EMC_S/L.sp-22

Snag Distribution in Potential Williamson's Sapsucker Nesting Habitat in the West Bend Project Area

There are 7,938 acres of Williamson's sapsucker nesting habitat in the West Bend project area which is 3% of the habitat available forestwide. Table 36 shows the existing snag distribution ≥10 and ≥20 inches dbh in Williamson's sapsucker nesting habitat in the West Bend Project Area. Approximately 72% of the nesting habitat with snags ≥10 inches dbh and 90% of the nesting habitat with snags ≥20 inches dbh do not contain any snag habitat, making it unlikely to be suitable nesting habitat. There is no nesting habitat with snags ≥10 or ≥20 inches dbh that provide for more than half of the individuals at the >50 to 80% and a majority of the individuals at the >80% tolerance levels. The remaining 28% of the habitat with snags ≥10 inches dbh and 10% of the habitat with snags ≥20 inches dbh provide varying levels of habitat for individuals.

Table 36. Existing snag distribution ≥10 and ≥20 inches dbh in Williamson's sapsucker nesting habitat in the West Bend Project Area.

Williamson's sapsucker nesting habitat: West Bend project area			
Tolerance Intervals	**Snags per acre**	**Project Area Nesting Acres**	**% of Habitat**
Snags ≥10 inches dbh			
0	0	6075	72
>0-30%	>0 to 14.0	1746	26
>30-50%	>14.0 to 28.4	113	2
>50-80%	>28.4 to 49.7	2	0
>80%	>49.7	2	0
	Total	**7,938 acres**	**100%**
Snags ≥20 inches dbh			
0	0	7,110	90
>0-30%	>0 to 3.3	762	10
>30-50%	>3.3 to 8.6	66	0
>50-80%	>8.6 to 16.6	0	0
>80%	>16.6	0	0
	Total	**7,938 acres**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Pileated Woodpecker

The pileated woodpecker needs large snags for nesting, generally averaging 25 to 35 inches dbh in green forests and slightly larger snags in open habitats (24-45 inches dbh) (Mellen-McLean et al. 2009). Bull and Holthausen (1993) found that pileateds selected stands for nesting with old growth, grand fir, no logging, and ≥ 60% canopy closure. They are rarely found in pure ponderosa pine forests. Snags, live trees, and down logs (at least 15 inches dbh) are needed for foraging (Bull and Holthausen 1993). A major food source for the pileated woodpecker includes carpenter ants found in decaying snags and logs (Bull et al. 1997). Pileated woodpeckers also utilize roosts, primarily at night, that tend to be cavities in dead or hollow trees (preferred) (Bull et al.1990). Tables 37, 38, and 39 show the snag diameters and densities needed for pileated woodpeckers for areas east and west of the Northwest Forest Plan.

Table 37. Snag numbers for pileated woodpeckers by vegetative series and snag size for areas west of the NWFP line on the Deschutes National Forest (WLTL).

Pileated woodpecker					
Vegetative Series	**Minimum Snag Diameter (inches dbh)**	**Snags per 100 acres to support various % woodpecker population levels**			
		100%	**80%**	**60%**	**40%**
Ponderosa Pine	>20 inches dbh	6	5	4	2
Mixed Conifer	>20 inches dbh	6	5	4	2
White(Grand) Fir	>20 inches dbh	6	5	4	2

Table 38. Snag numbers for pileated woodpeckers by vegetative series and snag size for areas east of the NWFP line on the Deschutes National Forest (WLTL).

Pileated woodpecker		
Vegetative Series	**Minimum Snag Diameter (inches dbh)**	**Snags per 100 acres to support 100% maximum potential population**
Ponderosa Pine	>20 inches dbh	14
	>15 inches dbh	211
	Total	**225**
Mixed Conifer	>20 inches dbh	14
	>15 inches dbh	211
	Total	**225**

Table 39. Snag requirements for the pileated woodpecker regarding potential population levels.

Pileated woodpecker				
	Veg Type/Series	**Target Percent (%) Potential Population Level**	**Minimum Snag Size (inches dbh)**	**Snags Per Acre Required**
Deschutes WLTL	Ponderosa Pine, White Fir and Mixed Conifer	60%	>20	0.04
Deschutes WLTL and NWFP	Ponderosa Pine, White Fir and Mixed Conifer	40%	>20	0.02
Eastside Screens	Ponderosa Pine	100%	>15	2.25
	Mixed Conifer	100%	>15	2.25

Snag Distribution in Pileated Woodpecker Nesting Habitat on the Deschutes National Forest

There are approximately 178,480 acres of pileated woodpecker nesting habitat on the Forest. Table 40 shows the existing snag distribution ≥10 and ≥20 inches dbh in nesting habitat on the Forest by tolerance level. Approximately 3% of the nesting habitat with snags ≥10 inches dbh and 16% of the nesting habitat with snags ≥20 inches dbh do not contain any snag habitat, making it unlikely to be suitable nesting habitat. Approximately 2% of the nesting habitat provides for the majority of individuals as this habitat contains snags ≥20 inches dbh which are preferred for nesting (at the >80% tolerance level). The remaining 92% of the habitat with snags ≥10 inches dbh and 82% of the habitat with snags ≥20 inches dbh provide varying levels of habitat for individuals.

Table 40. Existing snag distribution ≥10 and ≥20 inches dbh in pileated woodpecker nesting habitat on the Deschutes National Forest by tolerance level.

Pileated woodpecker: Snags ≥10 inches dbh			
Tolerance Level	**% Cover**	**Forestwide Nesting Acres**	**% of Habitat**
0	0	6,136	3
>0-30%	>0 to 14.9	85,881	48
>30-50%	>14.9 to 30.1	66,372	37
>50-80%	>30.1 to 49.3	13,007	7
>80%	>49.3	7,084	4
	Total	**178,480 acres**	**100%**
Snags ≥20 inches dbh			
Tolerance Level	**% Cover**	**Forestwide Nesting Acres**	**% of Habitat**
0	0	29,405	16
>0-30%	>0 to 3.5	63,658	36
>30-50%	>3.5 to 7.8	53,580	30
>50-80%	>7.8 to 18.4	28,676	16
>80%	>18.4	3,161	2
	Total	**178,480 acres**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-24 and LP_S/L.sp-24			

Snag Distribution in Pileated Woodpecker Nesting Habitat in the Watersheds

There are 743 acres of potential pileated woodpecker nesting habitat in the North Unit Diversion Dam – Deschutes River watershed, which is 0.4% of the habitat available forestwide. Table 41 shows the existing snag distribution ≥10 and ≥20 inches dbh in the watershed. Approximately 2% of the nesting habitat with snags ≥10 inches dbh and 27% of the nesting habitat with snags ≥20 inches dbh do not contain any snag habitat, making it unlikely to be suitable nesting habitat. There is no nesting habitat that provides for a majority of the individuals as this habitat contains snags ≥20 inches dbh (>80% tolerance level) which are preferred by this species for nesting. The remaining 98% of the habitat with snags ≥10 inches dbh and 74% of the habitat with snags ≥20 inches dbh provide varying levels of habitat for individuals.

Table 41. Existing snag distribution ≥10 and ≥20 inches dbh in pileated woodpecker nesting habitat in the North Unit Diversion Dam – Deschutes River watershed by tolerance level.

Pileated woodpecker			
Tolerance Level	**% Cover**	**Watershed Nesting Acres**	**% of Habitat**
Snags ≥10 inches dbh			
0	0	30	2
>0-30%	>0 to 14.9	630	84
>30-50%	>14.9 to 30.1	81	13
>50-80%	>30.1 to 49.3	1	1
>80%	>49.3	1	0
	Total	**743**	**100%**
Snags ≥20 inches dbh			
0	0	198	27
>0-30%	>0 to 3.5	376	51

>30-50%	>3.5 to 7.8	169	23
>50-80%	>7.8 to 18.4	0	0
>80%	>18.4	0	0
	Total	**743**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-24 and LP_S/L.sp-24			

There are and 7,585 acres of potential pileated woodpecker nesting habitat in the Tumalo Creek watershed, which is 4% of the habitat available forestwide. Table 42 shows the existing snag distribution ≥10 and ≥20 inches dbh in the watershed. Approximately 3% of the nesting habitat with snags ≥10 inches dbh and 16% of the nesting habitat with snags ≥20 inches dbh do not contain any snag habitat, making it unlikely to be suitable nesting habitat. There is no nesting habitat that provides for a majority of the individuals as this habitat contains snags ≥20 inches dbh (>80% tolerance level) which are preferred by this species for nesting. The remaining 97% of the habitat with snags ≥10 inches dbh and 84% of the habitat with snags ≥20 inches dbh provide varying levels of habitat for individuals.

Table 42. Existing snag distribution ≥10 and ≥20 inches dbh in pileated woodpecker nesting habitat in the Tumalo Creek Watershed by tolerance level.

Pileated woodpecker			
Tolerance Level	**% Down Wood Cover**	**Watershed Nesting Acres**	**% of Habitat**
Snags ≥10 inches dbh			
0	0	206	3
>0-30%	>0 to 14.9	3,718	49
>30-50%	>14.9 to 30.1	2,922	39
>50-80%	>30.1 to 49.3	631	8
>80%	>49.3	107	1
	Total	**7,585**	**100%**
Snags ≥20 inches dbh			
0	0	1,249	16
>0-30%	>0 to 3.5	1,359	18
>30-50%	>3.5 to 7.8	3,597	47
>50-80%	>7.8 to 18.4	1,380	18
>80%	>18.4	0	0
	Total	**7,585**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-24 and LP_S/L.sp-24			

Snag Distribution in Pileated Woodpecker Nesting Habitat in the West Bend Project Area

There are 184 acres of potential pileated woodpecker nesting acres in the West Bend project area which is 0.1% of the habitat available forestwide. Table 43 shows the existing snag distribution ≥10 and ≥20 inches dbh in the nesting habitat in the project area by tolerance level. Approximately 2% of the nesting habitat with snags ≥10 inches dbh and 14% of the nesting habitat with snags ≥20 inches dbh do not contain any snag habitat, making it unlikely to be suitable nesting habitat. There is no nesting habitat that provides for a majority of the individuals as this habitat contains snags ≥20 inches dbh (>80% tolerance level) which are preferred by this species for nesting. The remaining 98% of the habitat with snags ≥10 inches dbh and 86% of the habitat with snags ≥20 inches dbh provide varying levels of habitat for individuals.

Table 43. Existing snag distribution ≥10 and ≥20 inches dbh in pileated woodpecker nesting habitat in the West Bend Project Area by tolerance level.

Pileated woodpecker: Snags ≥10 inches dbh			
Tolerance Level	**% Down Wood Cover**	**Nesting Acres in Project Area**	**% of Habitat**
0	0	4	2
>0-30%	>0 to 14.9	177	96
>30-50%	>14.9 to 30.1	3	2
>50-80%	>30.1 to 49.3	0	0
>80%	>49.3	0	0
	Total	**184**	**100%**
Snag distribution ≥20 inches dbh			
Tolerance Level	**% Down Wood Cover**	**Nesting Acres in Project Area**	**% of Habitat**
0	0	25	14
>0-30%	>0 to 3.5	146	79
>30-50%	>3.5 to 7.8	13	7
>50-80%	>7.8 to 18.4	0	0
>80%	>18.4	0	0
	Total	**184**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-24 and LP_S/L.sp-24			

Down Wood for Pileated Woodpecker on the Deschutes National Forest

Downed wood distribution was analyzed on 178,480 acres of potential pileated woodpecker nesting habitat on the Forest (Table 44). Currently 6% of nesting habitat with down wood ≥5 inches dbh does not contain any down wood habitat making it unlikely to be suitable nesting habitat. The remaining 94% of the habitat with down wood ≥5 inches dbh provide varying levels of habitat for individuals.

Table 44. Existing down wood distribution ≥5 inches dbh in pileated woodpecker nesting habitat on the Deschutes National Forest by tolerance level.

Pileated woodpecker			
Tolerance Level	**% Down Wood Cover**	**Forestwide Nesting Acres**	**% of Habitat**
0	0	11,302	6
>0-30%	>0 to 4.0	93,567	52
>30-50%	>4.0 to 4.5	11,339	6
>50-80%	>4.5 to 5.1	12,529	7
>80%	>5.1	49,743	28
	Total	**178,480**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-24 and LP_S/L.sp-24			

Down Wood for Pileated Woodpecker in the Watersheds

There are 743 acres of nesting habitat in the North Unit Diversion Dam – Deschutes River watershed (0.4% of habitat forestwide) and 7,585 acres (4% of habitat forestwide) in the Tumalo Creek watershed. Table 45 shows the existing down wood distribution ≥5 inches dbh in pileated woodpecker nesting habitat in the watersheds by tolerance level. Currently 1% of nesting habitat with down wood ≥5 inches dbh in the North Unit Diversion Dam – Deschutes River watershed and 23% of the habitat in the Tumalo Creek watershed do not contain any down wood habitat making it unlikely to be suitable nesting habitat. The

remaining 99% of the habitat with down wood ≥5 inches dbh in the North Unit Diversion Dam – Deschutes River and 77% of the habitat in the Tumalo Creek watershed provide varying levels of habitat for individuals.

Table 45. Existing down wood distribution ≥5 inches dbh in pileated woodpecker nesting habitat in the watersheds by tolerance level.

Pileated woodpecker: Down wood ≥5 inches dbh			
North Unit Diversion Dam – Deschutes River Watershed			
Tolerance Levels	**% Down Wood Cover**	**Watershed Nesting Habitat Acres**	**% of Habitat**
0	0	7	1
>0-30%	>0 to 4.0	212	28
>30-50%	>4.0 to 4.5	15	2
>50-80%	>4.5 to 5.1	107	14
>80%	>5.1	402	65
	Total	**743**	**100%**
Tumalo Creek Watershed			
Tolerance Level	**% Down Wood Cover**	**Watershed Nesting Habitat Acres**	**% of Habitat**
0	0	1,770	**23**
>0-30%	>0 to 4.0	2,831	**37**
>30-50%	>4.0 to 4.5	384	**5**
>50-80%	>4.5 to 5.1	242	**3**
>80%	>5.1	2,358	**31**
	Total	**7,585**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Down Wood for Pileated Woodpecker in the West Bend Project Area

There are 184 acres of potential pileated woodpecker nesting acres in the West Bend project area which is 0.1% of the habitat available forestwide. Table 46 shows the existing down wood distribution ≥5 inches dbh in the nesting habitat by tolerance level. Currently 100% of nesting habitat has down wood ≥5 inches dbh, with 87% providing down wood ≥5 inches dbh at the level preferred by majority of the individuals.

Table 46. Existing down wood distribution ≥5 inches dbh in pileated woodpecker nesting habitat in the West Bend Project Area by tolerance level.

Pileated woodpecker			
Tolerance Level	**% Down Wood Cover**	**Nesting Acres in Project Area**	**% of Habitat**
0	0	0	0
0-30%	>0 to 4.0	17	9
>30-50%	>4.0 to 4.5	6	3
>50-80%	>4.5 to 5.1	2	1
>80%	>5.1	159	87

Total		**184**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-24 and LP_S/L.sp-24			

Lewis' woodpecker

Habitat for the Lewis' woodpecker, a migrant in this part of its range, includes old-forest, single-storied ponderosa pine. Burned ponderosa pine forests created by stand-replacing fires provide highly productive habitats as compared to unburned pine (Wisdom et al. 2000). Lewis' woodpeckers are not strong cavity excavators; they require large snags in an advanced state of decay that are easy to excavate or they use old cavities created by other woodpeckers. They are aerial insectivores during the breeding season, select for more open stands and use lower densities of smaller snags but rely more heavily on large snags ≥20 inches dbh for nest sites (Saab and Dudley 1998). Nest trees generally range from 17 to 44 inches dbh (Saab and Dudley 1998, Wisdom et al. 2000). Saab et al. (2002) found a negative relation to burned ponderosa pine/Douglas-fir stands with high crown closure (>70%) but was positively associated with low snag densities overall. Saab and Dudley (1998), Haggard and Gaines (2001), and Saab et al. (2002) found that Lewis' woodpeckers selected nest sites with low to moderate snag densities (3-14 snags per acre) but used areas with higher densities of larger snags (average is 17 inches dbh). They also noted that this species was rarely found in unlogged areas or high density snag patches (>15-37 snags per acre). Tables 47, 48, and 49 show the snag diameters and densities needed for Lewis' woodpeckers for areas east and west of the Northwest Forest Plan.

The Lewis' woodpecker is identified in the Conservation Strategy for Landbirds of the East-Slope of the Cascades Mountains in Oregon and Washington as a focal species for ponderosa pine forests with patches of burned old forest (Altman 2000). The biological objectives for habitat where ecologically and socially appropriate, through natural events or management, are to maintain >1% of the landscape as post-fire old ponderosa pine forest habitat or >50% of the post-fire landscape as unsalvaged. Where salvage logging is occurring in post-fire old ponderosa pine forests, maintain or provide in burns greater than 100 acres, greater than 50% of the standing and down wood, and in all burns, retain all snags greater than 20 and >50% of those be 12-20 inches dbh. In addition, snags should be clumped rather than evenly spaced with both hard and soft decay classes to lengthen the period stands are considered suitable nesting habitat (Altman 2000). Where ecologically appropriate, actions should be initiated in old forest habitat to maintain or provide approximately 24 snags per acre > 9 inches dbh and of these, approximately 6 snags per acre should be ≥20 inches dbh. In addition, actions should be initiated to provide recruitment of snags, particularly in areas with high risk of stand replacement fires, and to provide shrub understory with >13% cover (Altman 2000). There is no data in DecAID on snag density in green stands for the Lewis' woodpecker due to this species being highly reliant on post-fire habitats.

Table 47. Snag numbers for Lewis' woodpeckers by vegetative series and snag size for areas west of the NWFP line on the Deschutes National Forest (WLTL).

Lewis' woodpecker					
Vegetative Series	**Minimum Snag Diameter (inches dbh)**	**Snags per 100 acres to support various % woodpecker population levels**			
		100%	**80%**	**60%**	**40%**
Ponderosa Pine	>12 inches dbh	48	38	29	19
Mixed Conifer	>12 inches dbh	48	38	29	19

Table 48. Snag numbers for Lewis' woodpeckers by vegetative series and snag size for areas east of the NWFP line on the Deschutes National Forest (WLTL).

Lewis' woodpecker		
Vegetative Series	**Minimum Snag Diameter (inches dbh)**	**Snags per 100 acres to support 100% maximum potential population**
Ponderosa Pine	>20	14

	>15	211
	Total	**225**
Mixed Conifer	>20	14
	>15	211
	Total	**225**

Table 49. Snag requirements for the Lewis' woodpecker regarding potential population levels.

Lewis' woodpecker				
	Veg Type/Series	**Target Percent (%) Potential Population Level**	**Minimum Snag Size (inches dbh)**	**Snags Per Acre Required**
Deschutes WLTL	Ponderosa Pine and Mixed Conifer	60%	>12	0.29
Deschutes WLTL and NWFP	Ponderosa Pine and Mixed Conifer	40%	>12	0.19
Eastside Screens	Ponderosa Pine	100%	>15	2.25
	Mixed Conifer	100%	>15	2.25

DecAID Snag Density for Lewis' Woodpecker

There is no data on snag density in green stands for the Lewis' woodpecker due to this species being highly reliant on post-fire habitats. Table 50 displays tolerance level information for snag density relative to the Lewis' woodpecker for snags ≥10 inches dbh and snags ≥20 inches dbh in post-fire Eastside Mixed Conifer (EMC_PF) and post-fire Ponderosa Pine/Douglas-fir (PPDF_PF).

Table 50. Tolerance levels for the Lewis' woodpecker as reported in DecAID for post-fire habitats.

Lewis' woodpecker			
Snag Size	**30% tolerance level Snag Density (#/acre)**	**50% tolerance level Snag Density (#/acre)**	**80% tolerance level Snag Density (#/acre)**
>10 inches dbh EMC	24.8	43.0	71.0
>10 inches dbh PPDF	24.7	42.7	70.6
>20 inches dbh PPDF	0	6.2	16.1

Post-fire wildlife data use on snags is summarized from studies across the interior northwest, not just Oregon and Washington. This data suggests managing for a variety of snag densities and snag sizes across burned areas to provide habitat for many species. Table 51 displays tolerance level information for snag size relative to the Lewis' woodpecker use for nesting in Eastside Mixed Conifer, Post-fire (EMC_PF) and Ponderosa Pine/Douglas-fir, Post-fire (PPDF_PF) as cited in DecAID (Mellen McLean et al. 2009).

Table 51. Tolerance levels for snag size used by Lewis' woodpeckers for nesting by habitat type.

Habitat Type Size Use	**Tolerance Levels**			**Sample Size**
	30% Snag Size (inches dbh)	**50% Snag Size (inches dbh)**	**80% Snag Size (inches dbh)**	

Eastside Mixed Conifer Post-fire Nesting	15.4	19.8	26.2	353-355
Ponderosa Pine/Douglas-fir Post-fire Nesting	15.6	19.8	26.1	400

Snag Distribution in Lewis' Woodpecker Nesting Habitat on the Deschutes National Forest

Based on Viable modeling there are 84,978 acres of Lewis' woodpecker nesting habitat on the Deschutes National Forest. There is no information available on DecAID tolerance levels for this species for the Forest.

Snag Distribution in Lewis' Woodpecker Nesting Habitat in the Watersheds

Based on Viable modeling there are 3,495 acres of Lewis' woodpecker nesting habitat in the North Unit Diversion Dam – Deschutes River (4% of the watershed) and 1,131 acres of Lewis' woodpecker nesting habitat in the Tumalo Creek watershed (1% of the watershed). There is no information available on DecAID tolerance levels for this species for the watersheds.

Snag Distribution in Lewis' Woodpecker Nesting Habitat in the West Bend Project Area

Based on Viable modeling there are 3,535 acres of Lewis' woodpecker nesting habitat in the West Bend project area. There is no information available on DecAID tolerance levels for this species for the project area.

White-headed Woodpecker

The white-headed woodpecker is a primary cavity excavator of soft snags and the only woodpecker species to rely heavily on seeds of ponderosa pine for food (Marshall et al. 2003 p. 364). The white-headed woodpecker was identified as a species that was not sufficiently aided by the application of mitigation measures for riparian reserves as it occurs on the periphery of the range of the northern spotted owl on the east slope of the Cascade Range (USDA and USDI 2001). Therefore, additional standards and guidelines as well as management recommendations were written for this species. These apply to the forest matrix outside spotted owl habitat and riparian reserves.

Specifically, snags ≥ 20 inches dbh are particularly valuable for these species. Snags may be marked for cutting only after retaining the best available snags in sufficient numbers to meet 100% of potential population levels of these four species. The 100% population potential for white-headed woodpeckers was reported at 0.60 conifer snags (ponderosa pine and Douglas-fir) per acre in forested habitats. These snags must be at least 15 inches dbh (or largest available) and in soft decay stages and must be provided in stands of ponderosa pine and mixed pine/Douglas-fir (USDA and USDI 2001). Tables 52, 53, and 54 show the snag requirements east and west of the Northwest Forest Plan.

The white-headed woodpecker is identified in the Conservation Strategy for Landbirds of the East-Slope of the Cascades Mountains in Oregon and Washington as a focal species for ponderosa pine forests with large patches of old forest that include large snags and large trees (Altman 2000). The biological objectives for habitat where ecologically appropriate is to initiate actions to provide: (1) a mean of 10 live trees/acre >21 inches dbh with at least 2 of those trees >31 inches dbh for foraging and replacement snags; (2) a mean of 1.4 snags per acre >8 inches dbh with over half of those >25 inches dbh in a moderate to advanced state of decay; and (3) a mean canopy closure of 10 to 40%. In addition, where ecologically appropriate, these conditions should provide >350 acres in predominantly old growth stands and more than 700 contiguous acres in 26 to 75% of these old growth stands.

A long-term study on the white-headed woodpecker occurred on the Deschutes and Winema National Forests from 1997 to 2004. Both the white-headed woodpecker and pygmy nuthatch prefer similar diameter trees as the Lewis' woodpecker for nesting, averaging 23 inches dbh for the pygmy nuthatch and 31 inches dbh for the white-headed woodpecker (Wisdom et al. 2000). Frenzel (2000) calculated the

mean dbh for white-headed woodpecker nest trees to be 26.2 inches while Dixon (1995) found similar results (mean diameter of 25.6 inches dbh). Unharvested sites or sites with greater than 12 trees per acre >21 inches dbh had a success rate of 63.1% while nests at previously harvested sites or with lower densities of large trees had a success rate of 39.8% (Frenzel 2003). On the Winema National Forest, white-headed woodpeckers used small-diameter trees, logs in a slash pile, and upturned roots (6-13 inches dbh) where large snags were uncommon (Frenzel 2002).

Ponderosa pine stands in the watersheds have shade tolerant trees established in the understory, creating dense multi-story stands. Fire suppression had also resulted in increased shrub cover which has led to an increase in small mammal and avian predation on white-headed woodpeckers (Frenzel 1999).

Table 52. Snag numbers for white-headed woodpeckers (WHWO) by vegetative series and snag size for areas west of the NWFP line on the Deschutes National Forest (WLTL).

White-headed woodpecker						
Vegetative Series	**Species**	**Minimum Snag Diameter (inches dbh)**	**Snags per 100 acres to support various % woodpecker population levels**			
			100%	**80%**	**60%**	**40%**
Ponderosa Pine	WHWO	>10	60	48	36	24
Mixed Conifer	WHWO	>10	60	48	36	24

Table 53. Snag numbers for white-headed woodpeckers by vegetative series and snag size for areas east of the NWFP line on the Deschutes National Forest (WLTL).

White-headed woodpecker		
Vegetative Series	**Minimum Snag Diameter (inches dbh)**	**Snags per 100 acres to support 100% maximum potential population**
Ponderosa Pine	>20 inches dbh	14
	>15 inches dbh	211
Total		**225**

Table 54. Snag requirements for white-headed woodpecker regarding potential population levels.

White-headed woodpecker					
	Veg Type/Series	**Target % Potential Population Level**	**Minimum Snag Size (inches dbh)**	**Snags Per Acre Required**	**Comments**
Des WLTL and NWFP	Ponderosa Pine and Mixed Conifer	100%	>20	0.60	Retain all possible
	Ponderosa Pine and Mixed Conifer	40%	>10	0.24	
Eastside Screens	Ponderosa Pine	100%	>15	2.25	
	Mixed Conifer	100%	>15	2.25	

Snag Distribution in White-headed Woodpecker Nesting Habitat on the Deschutes National Forest

There are approximately 198,330 acres of pileated woodpecker nesting habitat on the Forest. Table 55 shows the existing snag distribution ≥10 and ≥20 inches dbh in nesting habitat on the Forest by tolerance level. Approximately 51% of the nesting habitat with snags ≥10 inches dbh and 74 of the nesting habitat with snags ≥20 inches dbh do not contain any snag habitat, making it unlikely to be suitable nesting habitat. Approximately 7% of the nesting habitat provides for the majority of individuals as this habitat

contains snags ≥20 inches dbh which are preferred for nesting (at the >80% tolerance level). The remaining 49% of the habitat with snags ≥10 inches dbh and 18% of the habitat with snags ≥20 inches dbh provide varying levels of habitat for individuals.

Table 55. White-headed woodpecker snag tolerance levels on the Deschutes National Forest.

White-headed woodpecker			
Snags ≥10 inches dbh			
Tolerance Level	**Snags per acre**	**Forestwide Nesting Habitat Acres**	**% of Habitat**
0	0	101,219	51
>0-29.9%	>0 to 0.4	2,930	1
30%-49.9%	>0.4 to 2.0	36,722	19
40%-59.9%	>2.0 to 4.0	16,243	8
>80%	>4.0	41,215	21
	Total	**198,330**	**100%**
White-headed woodpecker: Snags ≥20 inches dbh			
0	0	147,469	74
>0-29.9%	>0 to 0.5	4,748	2
30%-49.9%	>0.5 to 1.8	24,014	12
40%-59.9%	>1.8 to 3.8	7,545	4
>80%	>3.8	14,555	7
	Total	**198,330**	**100%**

Snag Distribution in White-headed Woodpecker Nesting Habitat in the Watersheds

There are 14,935 acres of white-headed woodpecker nesting habitat in the North Unit Diversion Dam – Deschutes River watershed, which is 8% of the habitat available forestwide. Table 56 shows the existing snag distribution ≥10 and ≥20 inches dbh in nesting habitat in the watershed by tolerance level. Approximately 67% of the nesting habitat with snags ≥10 inches dbh and 88% of the nesting habitat with snags ≥20 inches dbh do not contain any snag habitat, making it unlikely to be suitable nesting habitat. There is no habitat for a majority of individuals as this habitat contains snags ≥20 inches which is the snag density preferred by this species. The remaining 33% of the habitat with snags ≥10 inches dbh and 11% of the habitat with snags ≥20 inches dbh provide varying levels of habitat for individuals.

Table 56. Existing snag distribution ≥10 and ≥20 inches dbh in potential white-headed woodpecker nesting habitat in the North Unit Diversion Dam – Deschutes River watershed by tolerance level.

White-headed woodpecker: North Unit Diversion Dam – Deschutes River Watershed			
Tolerance Level	**Snags per acre**	**Watershed Nesting Habitat Acres**	**% of Habitat**
Snags ≥10 inches dbh			
0	0	10,023	67
>0-29.9%	>0 to 0.4	117	1
30-49.9%	>0.4 to 2.0	2,214	15
50-79.9%	>2.0 to 4.0	1,219	8
≥80%	>4.0	1,363	9
	Total	**14,935**	**100%**
Snags ≥20 inches dbh			
0	0	13,202	88
>0-29.9%	>0 to 0.5	157	1

30-49.9%	>0.5 to 1.8	1,320	9
50-79.9%	>1.8 to 3.8	2215	1
≥80	>3.8	41	0
	Total	**14,935**	**100%**

There are 3,384 acres of potential white-headed woodpecker nesting habitat in the Tumalo Creek watershed, which is 2% of the habitat available forestwide. Table 57 shows the existing snag distribution ≥10 and ≥20 inches dbh in nesting habitat in the watershed by tolerance level. Approximately 82% of the nesting habitat with snags ≥10 inches dbh and 92% of the nesting habitat with snags ≥20 inches dbh do not contain any snag habitat, making it unlikely to be suitable nesting habitat. There is no habitat at the snag density for snags ≥20 inches dbh preferred for nesting by a majority of individuals (>80% tolerance level). The remaining 19% of the habitat with snags ≥10 inches dbh and 8% of the habitat with snags ≥20 inches dbh provide varying levels of habitat for individuals.

Table 57. White-headed woodpecker snag tolerance levels in the Tumalo Creek watershed by tolerance level.

White-headed woodpecker: Tumalo Creek Watershed			
Tolerance Level	**Snags per acre**	**Watershed Nesting Habitat Acres**	**% of Habitat**
Snags ≥10 inches dbh			
0	0	2,759	82
>0 to 29.9%	>0 to 0.4	0	0
30 to 49.9%	>0.4 to 2.0	53	2
50 to 79.9%	>2.0 to 4.0	343	10
>80%	>4.0	229	7
	Total	**3,384**	**100%**
Snags ≥20 inches dbh			
0	0	3,116	92
>0 to 29.9%	>0 to 0.5	0	0
30 to 49.9%	>0.5 to 1.8	102	3
50 to 79.9%	>1.8 to 3.8	163	5
>80%	>3.8	2	0
	Total	**3,384**	**100%**

Snag Distribution in White-headed Woodpecker Nesting Habitat in the West Bend Project Area

There are 8,815 acres of nesting habitat for the white-headed woodpecker in the West Bend project area which is 4% of the habitat available forestwide. Table 58 shows the white-headed woodpecker snag tolerance levels in the project area. Approximately 81% of nesting habitat with snags ≥10 and ≥20 inches dbh has no snags per acre, making it unlikely to provide suitable nesting habitat. There is no habitat at the snag density preferred for nesting by a majority of individuals (>80% tolerance level) as this habitat contains snags ≥20 inches dbh which is preferred by this species. The remaining snag densities provide minimal habitat.

Table 58. White-headed woodpecker snag tolerance levels in the West Bend project area.

White-headed woodpecker			
Tolerance Level	**Snags per acre**	**Nesting Habitat Acres in Project Area**	**% of Habitat**
Snags ≥10 inches dbh			
0	0	7167	81
>0 to 29.9%	>0 to 0.4	7	0

30% to 49.9%	>0.4 to 2.0	572	7
40%-59.9%	>2.0 to 4.0	951	11
≥80%	>4.0	118	1
	Total	**8,815**	**100%**
Snags ≥20 inches dbh			
0	0	8394	95
>0 to 29.9%	>0 to 0.5	7	0
30% to 49.9%	>0.5 to 1.8	386	4
40%-59.9%	>1.8 to 3.8	25	1
≥80%	>3.8	2	0
	Total	**8,815**	**100%**

Black-backed Woodpecker

The black-backed woodpecker and northern three-toed woodpecker are sympatric with overlapping ranges. However, the three-toed woodpecker occupied areas between 4500 and 5600 foot elevations while black-backed woodpeckers occupied lower elevations Goggans et al. (1989). Trees dead less than 2 years or live trees with lodgepole pine were preferred for foraging. Use declined 2-3 years after mortality when trees dry out and bark beetles decline. Populations are irruptive in response to bark beetle outbreaks in recently fire-killed forests or where trees are susceptible to bark beetle attacks due to maturity. It is identified as a focal species for old-growth lodgepole pine for the East Cascades Landbird Strategy. However, it is also highly associated with post-fire environments. The West Bend project area does not have any recent post-fire habitats; therefore, this species will be analyzed for impacts to green tree replacements. Tables 59 and 60 show the tolerance levels for black-backed woodpeckers in DecAID.

Table 59. Tolerance levels for snag size used by black-backed woodpeckers for nesting, roosting, or foraging.

Use	Black-backed woodpecker: DecAID Tolerance Levels for snags		
	30% Snag Size (inches dbh)	50% Snag Size (inches dbh)	80% Snag Size (inches dbh)
Nesting	8.1 to 8.8	10.7 to 13.2	13.5 to 20.5
Roosting	6.7 to 6.9	10.9	16.5 to 16.8
Foraging	8 to 12.0	12.1 to 14.8	18.2 to 19.2

Table 60. Tolerance levels for dead wood for the black-backed woodpecker as reported in DecAID in green stands.

Black-backed woodpecker: DecAID Tolerance Levels for dead wood in green stands			
Dead Wood	**30% tolerance level**	**50% tolerance level**	**80% tolerance level**
≥10 inches dbh Snags (#/ac)	2.5	13.6	29.2
≥5.5-6.0 inches dbh (% cover)	4.7	13	25.1
Reported in DecAID Version 2.1: Tables EMC_S/L.sp-22 and PPDF_S/L.sp-22; Tables EMC_S/L.sp-24 and LP_S/L.sp-24			

Snag Distribution for Black-backed Woodpecker Nesting habitat on the Deschutes National Forest

There are approximately 446,003 acres of potential black-backed woodpecker nesting habitat on the Deschutes National Forest. Table 61 shows the existing snag distribution ≥10 inches dbh in black-backed woodpecker nesting habitat forestwide. Currently, 42% of nesting habitat does not contain any snag

habitat ≥10 inches dbh, making it unlikely to provide suitable nesting habitat. Only 3% of the nesting habitat available on the Forest provides for the majority of individuals as this habitat contains snags ≥10 inches dbh at densities which are preferred by this species for nesting. The remaining 58% of the habitat with snags ≥10 inches dbh provides varying levels of habitat for individuals.

Table 61. Existing snag distribution ≥10 inches dbh in black-backed woodpecker nesting habitat on the Deschutes National Forest by tolerance level.

Black-backed woodpecker			
Tolerance Level	**Snags per acre**	**Forestwide Nesting Acres**	**% of Habitat**
0	0	187,931	42
>0-30%	>0 to 2.5	92,581	21
>30-50%	>2.5 to 13.6	126,256	28
>50-80%	>13.6 to 29.2	24,145	5
≥80%	>29.2	15,090	3
	Total	**446,003 acres**	**100%**
Based on DecAID Version 2.1: Tables EMC_S/L.sp-22 and PPDF_S/L.sp-22			

Table 62 compares the current forestwide black-backed woodpecker nesting snag habitat to the forestwide HRV. Approximately 42% of the potential black-backed woodpecker nesting habitat with snags ≥10 inches dbh contains no snags, making it unlikely to be suitable nesting habitat. This is higher than the percent of the landscape with snags ≥10 inches dbh (18-25%) displayed for HRV for the EMC habitat type. When comparing the 0 to 29.2 snags per acre category to the corresponding 0 to 24 snags per acre HRV category, the existing condition (54%) is slightly less than the HRV values of 59 to 69%. The percent of existing conditions on the landscape with >29.2 snags per acre (3%) is also less than the corresponding HRV values of >24 snags per acre (11 to 17%), which has negative implications for the black-backed woodpecker. However, recent mortality in the lodgepole pine habitat types due to a mountain pine beetle outbreak is providing high-density snag patches, which black-backed woodpeckers prefer.

Table 62. Comparison of existing black-backed woodpecker nesting habitat with snags ≥10 inches dbh to HRV.

Black-backed woodpecker	**Snag Density (snags per acre)**		
	0	**0-29.2 (DecAID) 0-24.0 (HRV)**	**>29.2 (DecAID) >24.0 (HRV)**
HRV	18 to 25%	59 to 69%	11 to 17%
Existing Nesting Habitat	42%	54%	3%

Snag Distribution for Black-backed woodpecker Nesting Habitat in the Watersheds

There are 16,359 acres of nesting habitat in the North Unit Diversion Dam – Deschutes River watershed, which is 4% of the habitat available forestwide. Table 63 shows the existing snag distribution ≥10 inches dbh in black-backed woodpecker nesting habitat in the watershed. Approximately 54% of the nesting habitat has no snags, making it unlikely to be suitable nesting habitat. There is no habitat provided at the snag density preferred for nesting by a majority of individuals (>80% tolerance level). The remaining 46% of habitat provides varying levels of habitat for individuals.

Table 63. Existing snag distribution ≥10 inches dbh in black-backed woodpecker nesting habitat in the North Unit Diversion Dam –Deschutes River watershed.

Black-backed woodpecker: North Unit Diversion Dam – Deschutes River Watershed			
Tolerance Level	**Snags per acre**	**Watershed Nesting Acres**	**% of Habitat**
0	0	8,820	54
>0-30%	>0 to 2.5	3,761	23
>30-50%	>2.5 to 13.6	2,919	18
>50-80%	>13.6 to 29.2	816	5
>80%	>29.2	43	0
	Total	**16,359**	**100%**
Based on DecAID Version 2.1: Tables EMC_S/L.sp-22 and PPDF_S/L.sp-22			

There are 3,914 acres of nesting habitat in the Tumalo Creek watershed, which is 1% of the habitat available forestwide. Table 64 shows the existing snag distribution ≥10 inches dbh in black-backed woodpecker nesting habitat in the watershed. Approximately 64% of the nesting habitat has no snags, making it unlikely to be suitable nesting habitat. Approximately 3% of the habitat provides habitat at the snag density preferred by a majority of individuals for nesting (>80% tolerance level). The remaining 23% of habitat provides varying levels of habitat for individuals.

Table 64. Existing snag distribution ≥10 inches dbh in black-backed woodpecker nesting habitat in the Tumalo Creek watershed.

Black-backed woodpecker: Tumalo Creek Watershed			
Tolerance Level	**Snags per acre**	**Watershed Nesting Acres**	**% of Habitat**
0	0	2,505	64
>0-30%	>0 to 2.5	484	12
>30-50%	>2.5 to 13.6	577	5
>50-80%	>13.6 to 29.2	227	6
≥80%	>29.2	121	3
	Total	**3,914**	**100%**
Based on DecAID Version 2.1: Tables EMC_S/L.sp-22 and PPDF_S/L.sp-22			

Snag Distribution for Black-backed Woodpecker Nesting Habitat in the West Bend Project Area

There are 7,067 acres of nesting habitat for the black-backed woodpecker in the West Bend project area which is 2% of the habitat available forestwide. Table 65 shows the existing snag distribution ≥10inches dbh in black-backed woodpecker nesting habitat in the project area by tolerance level. Approximately 75% of the nesting habitat has no snags, making it unlikely to be suitable nesting habitat. There is no habitat provided at the snag density preferred for nesting by a majority of individuals (>80% tolerance level). The remaining 23% of habitat provides varying levels of habitat for individuals. 11% of north unit

Table 65. Existing snag distribution ≥10 inches dbh in the West Bend project area by tolerance level.

Black-backed woodpecker: West Bend project area			
Tolerance Level	**Snags per acre**	**Nesting Acres in Project Area**	**% of Habitat**
0	0	5,270	75
>0-30%	>0 to 2.5	1496	21
>30-50%	>2.5 to 13.6	147	2

>50-80%	>13.6 to 29.2	136	2
≥80%	>29.2	18	0
	Total	**7,067**	**100%**
Based on DecAID Version 2.1: Tables EMC_S/L.sp-22 and PPDF_S/L.sp-22			

Down Wood Distribution for Black-backed Woodpecker Reported in DecAID

Table 66 displays the tolerance levels for down wood percent relative to the black-backed woodpecker for down wood ≥6 inches dbh and down wood ≥5.5 inches dbh in eastside mixed conifer, small and large trees (EMC_S/L) and lodgpole pine, small and large trees (LP_S/L).

Table 66. Tolerance levels for black-backed woodpecker down wood cover as reported in DecAID.

Black-backed woodpecker			
Snag Size	**30% tolerance level Down Wood Cover (%)**	**50% tolerance level Down Wood Cover (%)**	**80% tolerance level Down Wood Cover (%)**
≥6.0 inches dbh	4.7	13	25.1
≥5.5 inches dbh	4.7	13	25.1

Down Wood Distribution in Black-backed Woodpecker Nesting Habitat on the Deschutes National Forest

Down wood distribution was also analyzed on the 446,003 acres of potential black-backed woodpecker nesting habitat on the Deschutes National Forest. Table 67 shows that 11% of nesting habitat with down wood ≥5 inches dbh does not contain any downed wood habitat making it unlikely to be suitable nesting habitat. The remaining 89% of the habitat with down wood ≥5 inches dbh provides varying levels of habitat for individuals.

Table 67. Existing down wood distribution ≥5 inches dbh in black-backed woodpecker nesting habitat on the Deschutes National Forest.

Black-backed woodpecker			
Tolerance Level	**% Down Wood Cover**	**Forestwide Nesting Acres**	**% of Habitat**
0	0	48,286	11
>0-30%	>0 to 4.7	300,173	67
>30-50%	>4.7 to 13.0	89,834	20
>50-80%	>13.0 to 25.1	7,710	2
>80%	>25.1	0	0
Total		**446,003**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-24 and LP_S/L.sp-24			

Table 68 compares the current forestwide black-backed woodpecker nesting habitat to the forestwide HRV down wood. Approximately 11% of the potential black-backed woodpecker nesting habitat contains no down wood ≥5 inches dbh, which is less than the forestwide HRV of 22 to 30%, which means that there is more down wood available today for black-backed woodpeckers than historically. When comparing the 0 to 13% down wood cover category to the corresponding 0 to 16% down wood cover forestwide HRV category, the existing condition (87%) is higher than the HRV values of 69 to 79%. The same is true for the percent of the landscape with higher down wood percent cover. The existing condition for percent of the landscape with >13.0 percent down wood cover (2%) is more than the corresponding HRV values of >16.0 percent down wood cover (0%) which is beneficial for the black-backed woodpecker. This is likely due to a combination of factors. Fire suppression, in addition to insect

and disease events, has resulted in high mortality in the smaller size class trees. These smaller sized trees have high fall down rates, thus end up as down wood material.

Table 68. Comparison of existing forestwide black-backed woodpecker nesting habitat to HRV.

Black-backed woodpecker	Down Wood Percent Cover		
	0	0 to 13.0 (DecAID) 0 to 16.0 (HRV)	>13.0 (DecAID) >16.0 (HRV)
Forestwide HRV	22 to 30%	69 to 79%	0%
Existing Nesting Habitat	11%	87%	2%

Down Wood Distribution in Black-backed Woodpecker Nesting Habitat in the Watersheds

Down wood distribution was also analyzed on the 16,359 acres of potential black-back nesting habitat in the North Unit Diversion Dam – Deschutes River watershed and on the 3,914 acres in the Tumalo Creek watershed. Table 69 shows that the distribution of nesting habitat is roughly similar in both watersheds, with 17 to 18% of the habitat in the watershed not providing down wood and the majority of the habitat providing down wood cover for less than 30% of the individuals (the >0 to 30% tolerance level). Very little habitat is provided at the >50-80% tolerance level and none is provided at the >80% tolerance level.

Table 69. Down wood distribution in the watersheds by tolerance levels for black-backed woodpeckers for down wood ≥5 inches dbh.

Black-backed woodpecker: Down wood size: ≥5 inches dbh			
North Unit Diversion Dam – Deschutes River Watershed			
Tolerance Levels	**% Down Wood Cover**	**Watershed Nesting Habitat Acres**	**% of Habitat**
0	0	2,700	17
>0-30%	>0 to 4.7	11,532	70
>30-50%	>4.7 to 13.0	1,970	12
>50-80%	>13.0 to 25.1	158	1
>80%	>25.1	0	0
	Total	**16,359**	**100%**
Tumalo Creek Watershed			
Tolerance Level	**% Down Wood Cover**	**Watershed Nesting Habitat Acres**	**% of Habitat**
0	0	719	18
>0-30%	>0 to 4.7	2,808	72
>30-50%	>4.7 to 13.0	312	8
>50-80%	>13.0 to 25.1	75	2
>80%	>25.1	0	0
	Total	**3,914**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Down Wood Distribution in Black-backed Woodpecker Nesting Habitat in the West Bend Project Area

There are 7,067 acres of nesting habitat for black-backed woodpecker in the West Bend project area which is 2% of the habitat forestwide. Table 70 shows the down wood percent cover for potential Black-backed woodpecker nesting habitat in the project area by tolerance level. Approximately 23% of the habitat has no down wood making it unlikely to be suitable nesting habitat. There is no down wood cover

at the density preferred by majority of individuals (>80% tolerance level). The remaining 77% provides varying levels of habitat for individuals.

Table 70. Existing down wood distribution ≥5 inches dbh in black-backed woodpecker nesting habitat in the West Bend project area by tolerance level.

Tolerance Level	% Down Wood Cover	Nesting Acres in Project Area	% of Habitat
0	0	1,632	23
>0-30%	>0 to 4.7	5,267	75
>30-50%	>4.7 to 13.0	164	2
>50-80%	>13.0 to 25.1	4	0
>80%	>25.1	0	0
	Total	**7,067**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-24 and LP_S/L.sp-24			

Three-toed Woodpecker

The three-toed woodpecker has been identified as a "bark beetle specialist" found in high elevation forests near the Cascade crest (Marshall et al. 2003). The three-toed woodpecker is highly associated with post-fire environments but is also found in unburned forests. Since the West Bend project area does not have any post-fire environments (in the last 5 years), the analysis of this species will only be discussed as it relates to snags and GTRs.

Goggans et al. (1989) found that three-toed woodpeckers habitat selection was for mature and overmature forested stands, and against younger stands and logged areas on the Deschutes National Forest. Utilization-availability analysis showed lodgepole pine stands were selected for nesting, and mixed conifer stands were avoided. Three-toed woodpeckers occupy areas between 4500'-5600' elevations while the black-backed woodpecker occupied lower elevations. Goggans et al. (1999) found that lodgepole pine trees with heart rot were used exclusively for nesting by three-toed woodpeckers with 75% of the nests in snags. They found this species of woodpecker used stands with a mean diameter of 8 inches dbh for nesting with a mean nest tree diameter of 11 inches dbh suggesting selection for single-storied mature/overmature stands. All nests in the study were in lodgepole pine stands and appeared to have heartrot. Both live and dead trees were used for nesting. The mean canopy closure for nests in uncut stands was 27%, and for nests in cut stands, 18%, while the percent log cover was 17%.

Tables 70 and 71 show the snag density ≥10 and ≥20 inches dbh and habitat type utilized by three-toed woodpeckers reported in DecAID.

Table 70. Tolerance levels for snag densities ≥10 and ≥20 inches dbh for the three-toed woodpecker.

Snag Size (inches dbh)	30% tolerance level Snag Density (#/acre)	50% tolerance level Snag Density (#/acre)	80% tolerance level Snag Density (#/acre)
≥10	2.5	13.6	29.2
≥10	44.4 to 57.2	64.4 to 82.4	94.3 to 119.2
≥20	0	1.4	5.7
Reported in DecAID Version 2.1: Tables EMC_S/L.sp-22 and PPDF_S/L.sp-22; Tables EMC_PF.sp-22 and PPDF_PF.sp-22			

Table 71. Tolerance levels for snag size used by three-toed woodpeckers by habitat type.

	Tolerance Levels

Habitat Type	30% Snag Size (inches dbh)	50% Snag Size (inches dbh)	80% Snag Size (inches dbh)
Eastside mixed conifer	8.8 to 11.4	10.8 to 14.7	14.0 to 19.7
Eastside mixed conifer Post-fire	9.7	12.0	15.9
Ponderosa Pine/Douglas-fir (Foraging)	7.5	9.4	12.1
Ponderosa Pine/Douglas-fir Post-fire	9.6	12.1	15.8

Snag Distribution for Three-toed Woodpecker Nesting Habitat on the Deschutes National Forest

There are approximately 367,499 acres of potential three-toed nesting habitat on the Forest. Table 73 shows the existing snag distribution ≥10 inches dbh in three-toed woodpecker nesting habitat on the Deschutes National Forest. Currently, 39% of nesting habitat does not contain any snags ≥10 inches dbh making it unlikely to be suitable nesting habitat. The remaining 61% of the habitat with snags ≥10 inches dbh provides varying levels of habitat for individuals. Approximately 4% of the nesting habitat provides for the majority of individuals as this habitat contains snags ≥10 inches dbh at densities which are preferred by this species for nesting.

Table 73. Existing snag distribution ≥10 inches dbh in three-toed woodpecker nesting habitat on the Deschutes National Forest.

Three-toed woodpecker			
Tolerance Level	**Snags per acre**	**Forestwide Nesting Habitat Acres**	**% of Habitat**
0	0	143,498	39
>0-30%	>0 to 2.5	71,201	19
>30-50%	>2.5 to 13.6	112,784	31
>50-80%	>13.6 to 29.2	24,512	7
>80%	>29.2	15,504	4
Total		**367,499 acres**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Table 74 compares the current forestwide three-toed woodpecker nesting snag habitat to the forestwide HRV. Approximately 39% of the potential three-toed woodpecker nesting habitat with snags ≥10 inches dbh contains no snags, which is higher than the forestwide HRV (18 to 25%). When comparing the 0 to 29.2 snags per acre category to the corresponding 0 to 24 snags per acre HRV category, the existing condition (57%) is slightly less than the HRV values of 59-69%. The percent of existing conditions on the landscape with >29.2 snags per acre (4%) is also less than the corresponding HRV values of >24 snags per acre (11 to 17%), which has negative implications for the three-toed woodpecker. However, recent mortality in the lodgepole pine habitat types due to a mountain pine beetle outbreak is providing high-density snag patches, which three-toed woodpeckers prefer.

Table 74. Comparison of existing three-toed woodpecker nesting habitat with snags ≥10 inches dbh to HRV.

Three-toed woodpecker	Snag Density (snags per acre)		
	0	**0-29.2 (DecAID) 0-24.0 (HRV)**	**>29.2 (DecAID) >24.0 (HRV)**
Forestwide HRV	18 to 25%	59 to 69%	11 to 17%
Forestwide Existing	39%	57%	4%

Nesting Habitat			

Snag Distribution for Three-toed Woodpecker Nesting Habitat in the Watersheds

There are 10,832 acres in the North Unit Diversion Dam – Deschutes River watershed and 2,973 acres in the Tumalo Creek watershed, of potential three-toed woodpecker nesting habitat, accounting for 3% and 1% respectively of the nesting habitat forestwide. Table 75 shows the existing snag distribution in the watersheds by tolerance levels for snags ≥10 inches dbh. Roughly 50% of both watersheds do not contain snags ≥10 inches dbh (zero snags per acre). Less than 1% of the nesting habitat in the North Unit Diversion Dam – Deschutes River watershed and 6% of the Tumalo Creek watershed provide habitat at densities preferred by this species for nesting (≥80% tolerance level). The remaining 49% of the North Unit Diversion Dam – Deschutes River watershed and 42% of the Tumalo Creek watershed provide varying levels of habitat for individuals.

Table 75. Existing snag distribution in the watersheds by tolerance Levels for three-toed woodpeckers for snags ≥10 inches dbh.

Three-toed woodpecker			
North Unit Diversion Dam – Deschutes River			
Tolerance Level	**Snags per acre**	**Watershed Nesting Habitat Acres**	**% of Habitat**
0	0	5,430	50
>0-30%	>0 to 2.5	2,012	19
>30-50%	>2.5 to 13.6	2,609	24
>50-80%	>13.6 to 29.2	740	7
≥80%	>29.2	40	<1
Total		**10,832**	**100%**
Tumalo Creek Watershed			
Tolerance Level	**Snags per acre**	**Watershed Nesting Habitat Acres**	**% of Habitat**
0	0	1,551	52
>0-30%	>0 to 2.5	243	8
>30-50%	>2.5 to 13.6	708	24
>50-80%	>13.6 to 29.2	285	10
>80%	>29.2	186	6
	Total	**2,973**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Snag Distribution for Three-toed Woodpecker Nesting Habitat in the West Bend Project Area

There are approximately 2,799 acres of nesting habitat for the three-toed woodpecker in the West Bend project area which is 1% of the habitat available forestwide. Table 76 shows the existing snag distribution for snags ≥10 inches dbh in the project area by tolerance level. Approximately 81% of the nesting habitat does not contain snags making it unlikely to be used for nesting. There is no habitat with the snag density preferred by a majority of individuals (>80% tolerance level). The remaining 29% of the habitat provides snags at varying levels for individuals.

Table 76. Existing snag distribution ≥10 inches dbh for the three-toed woodpecker in the West Bend project area by tolerance level.

Three-toed woodpecker			
Tolerance Level	**Snags per acre**	**Nesting Habitat Acres in Project Area**	**% of Habitat**

0	0	2,263	81
>0-30%	>0 to 2.5	270	10
>30-50%	>2.5 to 13.6	121	4
>50-80%	>13.6 to 29.2	128	5
>80%	>29.2	18	0
	Total	**2,799**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Down Wood Distribution in Nesting Habitat for Three-toed Woodpecker on the Deschutes National Forest

Down wood distribution was also analyzed on the 367,499 acres of potential three-toed nesting habitat on the Deschutes National Forest. Table 77 shows the existing down wood distribution ≥5 inches dbh in three-toed woodpecker nesting habitat. Approximately 9% of nesting habitat does not contain down wood habitat ≥5 inches dbh, while the remaining 91% of the habitat with down wood ≥5 inches dbh provides varying levels of habitat for individuals.

Table 77. Existing down wood distribution ≥5 inches dbh in three-toed woodpecker nesting habitat on the Deschutes National Forest.

Three-toed woodpecker			
Tolerance Level	**% Down Wood Cover**	**Forestwide Nesting Habitat Acres**	**% of Habitat**
0	0	33,709	9
>0-30%	>0 to 6.5	279,740	76
>30-50%	>6.5 to 17.0	54,050	15
>50-80%	>17.0 to 32.0	0	0
≥80%	>32	0	0
Total		**367,499 acres**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Table 78 compares the current forestwide three-toed woodpecker nesting habitat with the percent of down wood cover to the forestwide HRV for eastside mixed conifer. Approximately 9% of the potential three-toed woodpecker nesting habitat has no down wood ≥5 inches dbh which is lower than the HRV for down wood cover in the East Mixed Conifer habitat type. When comparing the other down wood cover categories to HRV, the existing condition is higher. There are currently greater amounts of downed wood now than what would have been expected historically, which is beneficial for the three-toed woodpecker.

Table 78. Comparison of existing three-toed woodpecker forest-wide nesting habitat to HRV.

Three-toed woodpecker	**Down Wood Percent Cover (%)**		
	0	**0 to 6.5 (DecAID) 0 to 8.0 (HRV)**	**>6.5 (DecAID) >8.0 (HRV)**
HRV for eastside mixed conifer	22 to 30%	66 to 73%	3 to 6%
Existing nesting habitat forest-wide: 367,499 acres	9%	76%	15%

Down Wood Distribution in Nesting Habitat for Three-toed Woodpecker in the Watersheds

There are 10,832 acres in the North Unit Diversion Dam – Deschutes River watershed and 2,973 acres in the Tumalo Creek watershed, of potential three-toed woodpecker nesting habitat, accounting for 3% and 1% respectively of the nesting habitat forest-wide. Table 79 shows the down wood distribution in the

watersheds by tolerance levels. Approximately 13% of the nesting habitat in the North Unit Diversion Dam – Deschutes River watershed and 17% of the nesting habitat in the Tumalo Creek watershed has no down wood.

Table 79. Down wood distribution ≥5 inches dbh in the watersheds by tolerance levels for three-toed woodpeckers.

Three-toed woodpecker: Down wood size: ≥ 5 inches dbh			
North Unit Diversion Dam – Deschutes River Watershed			
Tolerance Levels	**Down Wood/Acre**	**Acres**	**% of Habitat**
0	0	1,461	13
>0-30%	>0 to 6.5	7,690	71
>30-50%	>6.5 to 17.0	1,681	16
>50-80%	>17 to 32.0	No data fits this category	0
≥80%	>32.0	No data fits this category	0
	Total	**10,832 acres**	**100%**
Tumalo Creek Watershed			
Tolerance Levels	**Down Wood/Acre**	**Acres**	**% of Habitat**
0	0	500	17
>0-30%	>0 to 6.5	2,141 (1% of habitat forestwide)	72
>30-50%	>6.5 to 17.0	331	11
>50-80%	>17 to 32.0	No data fits this category	No data
≥80%	>32.0	No data fits this category	No data
	Total	**2,973 acres**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Down Wood Distribution in Nesting Habitat for Three-toed Woodpecker in the West Bend Project Area

There are 2,799 acres of nesting habitat for the three-toed woodpecker in the West Bend project area which is 1% of the habitat available forestwide. Table 80 shows the down wood ≥5 inches dbh in the project area by tolerance level. Approximately 25% of the nesting habitat does not have down wood. The remaining 75% provides habitat at varying levels for individuals.

Table 80. Down wood distribution ≥5 inches dbh for the three-toed woodpecker in the West Bend project area for by tolerance level.

Three-toed woodpecker			
Tolerance Level	**Down Wood/Acre**	**Nesting Habitat Acres in Project Area**	**% of Habitat**
0	0	709	25
>0-30%	>0 to 6.5	1,977	71
>30-50%	>6.5 to 17.0	113	4
>50-80%	>17.0 to 32.0	No data fits this category	0
>80%	>32	No data fits this category	0
	Total	**2,799 acres**	**100%**
Based on DecAID Version 2.1: Table EMC_S/L.sp-22			

Hairy Woodpecker

Hairy woodpeckers are found primarily in mixed conifer and ponderosa pine forests and can use deciduous stands during the breeding season. Nests sites are surrounded by open forest conditions

characterized by few trees and large snags and low canopy cover. Ponderosa pine is a preferred nest tree, but hairy woodpeckers are known to nest in other species (lodgepole pine, western larch, Douglas-fir, and aspen) except grand fir. Most nests are in dead trees less than 5 years and preferred snags are 10 to 20 inches dbh. Tables 81, 82, and 83 show the snag requirements for vegetative series and for areas west and east of the Northwest Forest Plan line.

Table 81. Snag numbers for hairy woodpeckers by vegetative series and snag size for areas west of the NWFP line on the Deschutes National Forest (WLTL).

Hairy woodpecker					
Vegetative Series	**Minimum Snag Diameter (inches dbh)**	**Snags per 100 acres to support various % woodpecker population levels**			
		100%	**80%**	**60%**	**40%**
Ponderosa Pine	>10 inches dbh	192	154	115	77
Mixed Conifer					
White (Grand) Fir					
Lodgepole Pine					

Table 82. Snag numbers for hairy woodpeckers by vegetative series and snag size for areas east of the NWFP line on the Deschutes National Forest (WLTL).

	Hairy woodpecker	
Vegetative Series	**Minimum Snag Diameter (inches dbh)**	**Snags per 100 acres to support 100% maximum potential population**
Ponderosa Pine	>20	14
	>15	211
	Total	**225**
Mixed Conifer	>20	14
	>15	211
	Total	**225**
Lodgepole Pine	>12	59
	>10	121
	Total	**180**

Table 83. Snag requirements for the hairy woodpecker regarding potential population levels.

Hairy woodpecker				
	Veg Type/Series	**Target Percent (%) Potential Population Level**	**Minimum Snag Size (inches dbh)**	**Snags Per Acre Required**
Des WLTL and NWFP	Ponderosa Pine, Mixed Conifer, and Lodgepole	60%	>10	1.54
	Ponderosa Pine, Mixed Conifer, and Lodgepole Pine	40%	>10	1.15
Eastside Screens	Ponderosa Pine	100%	>15	2.25
	Mixed Conifer	100%	>15	2.25
	Lodgepole Pine	100%	>10	1.80

Table 84 shows the tolerance levels for hairy woodpecker snag densities ≥10 inches dbh as reported in DecAID.

Table 84. Nesting parameters for snag density ≥10 inches dbh for the hairy woodpecker as reported in Bate (1995).

Hairy Woodpecker Nesting Habitat				
Snag Size ≥10 inches dbh	**No Nesting Habitat**	**Minimal Nesting Habitat**	**Nesting Habitat**	**Optimal Nesting Habitat**
Snags per acre	0	0.1	3.7	>3.7

Snag Distribution in Hairy Woodpecker Nesting Habitat on the Deschutes National Forest

Table 85 shows the existing snag distribution ≥10 inches dbh in hairy woodpecker nesting habitat on the Deschutes National Forest. There are approximately 507,920 acres of potential hairy woodpecker nesting habitat forestwide. Approximately 51% of the acres do not contain snags ≥10 inches dbh making it unlikely to be suitable nesting habitat. Approximately 19% of the landscape provides optimal nesting habitat for the majority of individuals as this habitat contains snags ≥10 inches dbh which are preferred by this species for nesting. The remaining 30% on the Forest contains providing varying levels of nesting habitat for individuals.

Table 85. Existing snag distribution ≥10 inches dbh in hairy woodpecker nesting habitat on the Deschutes National Forest.

Hairy woodpecker		
Snags per acre	**Forestwide Nesting Habitat (Acres)**	**% of Habitat**
0	259,208	51%
>0 to 0.1	No data fits this category	0%
>0.1 to 3.7	154,193	30%
>3.7	94,520	19%
Total	**507,920**	**100%**

Table 86 displays HRV information for the percent of the landscape with snags ≥10 inches dbh in the eastside mixed conifer habitat type. This is the dominant habitat type and size used by this species.

Table 86. Forestwide HRV analysis with >10 inches dbh snags in the eastside mixed conifer habitat type.

Hairy woodpecker							
Habitat Type	**Percent (%) of the Forest for Snags ≥10 inches dbh: Snags per acre**						
	Snag Density	**0**	**>0 to 6**	**>6 to 12**	**>12 to 24**	**>24 to 36**	**>36**
EMC	**HRV**	18 to 25	28 to 31	15 to 165	16 to 22	6 to 105	5 to 75
	Existing	15	30	24	16	8	8

The existing condition (15%) for the percentage of the landscape with no snags is less than those documented for historic levels (18 to 25%). In addition, the existing condition for the >6 to 12 snags per acre category is also above HRV at 24% as is the high density snag category of >36 (8%). The existing condition for the remaining snag density categories are within historic levels. The increases are likely due to a combination of factors. Fire suppression in mixed conifer stands has led to over-stocked stands where white fir is encroaching. Competition for resources has led to increased mortality particularly in

the smaller diameter sizes. In addition, the forest has experienced large-scale wildfires in the last 10 years with many areas experiencing stand replacement or mixed severity fire.

Table 87 compares the existing hairy woodpecker habitat with the HRF in the EMC habitat type. Approximately 51% of the potential hairy woodpecker nesting habitat with snags ≥10 inches dbh as mapped contains no snags. This is well above the percent of the landscape with snags ≥10 inches dbh (18-25%) displayed for HRV for the eastside mixed conifer habitat type. When comparing the remaining snags per acre categories to the corresponding snags per acre HRV categories, the existing condition (49%) is lower than the HRV values of 70-86% which is not beneficial for the hairy woodpecker.

Table 87. Comparison of existing hairy woodpecker nesting habitat to HRV.

Hairy Woodpecker	Snag Density (snags per acre)	
	0	>0.1 (Bate) >0 (HRV)
Forestwide HRV in EMC	15%	70 to 86%
Existing Nesting Habitat in EMC	51%	49%

Snag Distribution in Hairy Woodpecker Nesting Habitat in the Watersheds

There are approximately 45,004 acres of potential hairy woodpecker nesting habitat in the North Unit Diversion Dam – Deschutes River watershed (9% of habitat forestwide) and 6,982 acres in the Tumalo Creek watershed (1% of forestwide habitat). Table 88 shows the snag density distribution by nesting parameter for snags ≥10 inches dbh. For the North Unit Diversion Dam – Deschutes River watershed, there are 28,505 acres that do not provide nesting habitat, 12,815 acres that provide nesting habitat, and 3,683 acres that provide optimal nesting habitat. For the Tumalo Creek watershed, there are 5,324 acres that do not provide nesting habitat, 1,025 acres that provide nesting habitat, and 633 acres that provide optimal nesting habitat.

Table 88. Snag distribution for snags ≥10 inches dbh for the hairy woodpecker in the watersheds.

Hairy woodpecker					
Nesting Parameters	**No Nesting Habitat**	**Minimal Nesting Habitat**	**Nesting Habitat**	**Optimal Nesting Habitat**	**Total Acres**
Snags per acre	**0**	**>0 to 0.1**	**>0.1 to 3.7**	**>3.7**	
North Unit Diversion Dam – Deschutes River Watershed	28,505 acres (63%)	No data to fit this category	12,815 acres (28%)	3,683 acres (8%)	45,004 acres (9% of habitat forestwide)
Tumalo Creek Watershed	5,324 acres (76%)	No data to fit this category	1,025 acres (15%)	633 acres (9%)	6,982 acres (1% of habitat forestwide
Based on Bates 1995 as reported in DecAID 2.1					

Snag Distribution in Hairy Woodpecker Nesting Habitat in the West Bend Project Area

There are 17,683 acres of potential hairy woodpecker nesting habitat in the West Bend project area which is 4% of the habitat available forestwide. Table 89 shows the existing snag distribution ≥10 inches dbh in the project area by tolerance level. Approximately 77% of the potential habitat does not have any snags making the use of these acres for nesting unlikely. Only 2% of the nesting habitat has snag densities preferred by a majority of individuals. The remaining 21% of the nesting habitat provides varying levels of habitat for individuals.

Table 89. Existing snag distribution ≥10 inches dbh in hairy woodpecker nesting habitat in the West Bend project area.

Hairy woodpecker		
Snags per acre	**Nesting Habitat Acres in Project Area**	**% of Habitat**
0	13,617	77
>0 to 0.1	No data fits this category	0
>0.1 to 3.7	3,679	21
>3.7	388	2
Total	**17,683 acres**	**100%**

Northern Flicker

The northern flicker nests in large diameter snags and live trees with moderate to heavy decay (Marshall et al. 2003). Most studies have found flickers prefer to nest in open habitats characterized by low basal area, low canopy cover, large snags, and high herbaceous cover. Ponderosa pine stands provided nest sites adjacent to grasslands where flickers foraged. In addition, stands used for nesting contained an average of 7% log cover of ≥10 inches dbh. Northern flickers nest in a large variety of tree species including ponderosa pine, douglas-fir, aspen, and western larch.

Northern flickers require open space for nesting and foraging (Marshall et al. 2003). Open space or open habitat has been lost due to fire suppression leading to over-stocked stands of trees and shrubs. In addition, this leads to increased risk of loss of large trees (future snags) and snags from wildfire. Forest management activities also result in the loss of large, decayed snags which reduces nesting habitat and could lead to further population declines.

Post-fire salvage of large fire-killed trees reduces nesting habitat. This has implications for many other cavity nesters as the northern flicker creates more cavities than any other cavity nester (Hutto and Gallo 2006) and larger cavities that can be used by a wide variety of species (Hutto and Gallo 2006).

Potential Northern Flicker Nesting Habitat on the Deschutes National Forest

There are approximately 219,576 acres of potential northern flicker nesting habitat on the Deschutes National Forest. Tables 90, 91 and 92 shows the snag numbers developed for each vegetative series and for areas west and east of the Northwest Forest Plan line.

Table 90. Snag numbers for northern flicker by vegetative series and snag size for areas west of the NWFP line on the Deschutes National Forest (WLTL).

Northern flicker					
Vegetative Series	**Minimum Snag Diameter (inches dbh)**	**Snags per 100 acres to support the northern flicker at various % woodpecker population levels**			
		100%	**80%**	**60%**	**40%**
Ponderosa Pine	>12	48	38	29	19
Mixed Conifer	>12	48	38	29	19
White Fir	>12	48	38	29	19
Lodgepole Pine	>12	48	38	29	19

Table 91. Snag numbers for northern flickers by vegetative series and snag size for areas east of the NWFP line on the Deschutes National Forest (WLTL).

Northern flicker		
Vegetative Series	**Minimum Snag Diameter (inches dbh)**	**Snags per 100 acres to support 100% maximum potential population**

Ponderosa Pine	>20	14
	>15	211
	Total	**225**
Mixed Conifer	>20	14
	>15	225
	Total	**225**
Lodgepole Pine	>12	59
	>10	121
Total		**180**

Table 92. Snag requirements for the northern flicker regarding potential population levels.

Northern flicker					
	Veg Type/Series	**Target % Potential Population Level**	**Minimum Snag Size (inches dbh)**	**Snags Per Acre Required**	**Comments**
Des WLTL and NWFP	Ponderosa Pine, Mixed Conifer, White Fir, and Lodgepole Pine	100%	>20	0.48	Retain all possible
	Ponderosa Pine, Mixed Conifer, White Fir, and Lodgepole Pine	40%	>15	0.19	
Eastside Screens	Ponderosa Pine	100%	>12	2.25	
	Mixed Conifer	100%	>12	2.25	
	Lodgepole Pine	100%	>12	1.80	

Table 93 shows the Tolerance level information reported in DecAID for snag size relative to the northern flicker use for nesting or foraging in eastside mixed conifer, small and large trees (EMC_S/L) and open habitats (EMC_O) and ponderosa pine/douglas-fir, small and large trees (PPDF_S/L) as cited in DecAID (Mellen McLean et al. 2009). In addition, tolerance level information for snag size in post-fire habitats is also displayed for eastside mixed conifer (EMC_PF), ponderosa pine/douglas-fir (PPDF), and montane mixed conifer (MMC_PF).

Table 93. Tolerance levels for snag size used by northern flickers for nesting or foraging by habitat type.

Habitat Type	Size	Use	Tolerance Levels		
			30% Snag Size (inches dbh)	50% Snag Size (inches dbh)	80% Snag Size (inches dbh)
Eastside mixed conifer	Small and Large Trees	Nesting	17.7	22.2	30.6
Eastside mixed conifer	Small and Large Trees	Foraging	18.2	21.8	27.2
Eastside mixed conifer	Open Habitat	Nesting	17.7	24.4	41.3
Ponderosa Pine/Douglas-fir	Small and Large Trees	Nesting	17.2	21.8	28.8
Ponderosa Pine/Douglas-fir	Small Trees	Foraging	18.2	21.8	27.2
Eastside mixed conifer	Post-fire	Nesting	13.8	18.0	24.4

Ponderosa Pine/Douglas-fir	Post-fire	Nesting	15.2	19.5	25.4
Montane Mixed Conifer	Post-fire	Nesting	11.6	18.8	29.5

Northern Flicker Nesting Habitat in the Watersheds

There are 16,028 acres of potential northern flicker nesting habitat in the North Unit Diversion Dam - Deschutes River watershed and 3,428 acres in the Tumalo Creek watershed, accounting for 3% and less than 1% of these watersheds respectively. Tolerance levels for the acres of potential northern flicker habitat specific to the watersheds are not available based on information reported in DecAID.

Northern Flicker Nesting Habitat in the West Bend Project Area

There are 8,829 acres of potential northern flicker nesting habitat in the West Bend project area which is approximately 2% of the habitat available forestwide, 39% of the habitat available in the North Unit Diversion Dam – Deschutes River, and 77% of the habitat available in the Tumalo Creek watershed.

Landbird Focal Species

Pygmy Nuthatch

Pygmy nuthatches can be found at densities of 4 to 19 pairs per 99 acres in suitable habitat and are ranked as 'apparently Secure" in Oregon (Natureserve, 2011). White-headed woodpeckers and pygmy nuthatches share similar habitat of large open ponderosa pine, low shrub levels and large snags. The white-headed woodpecker is a primary cavity excavator of soft snags, while the pygmy nuthatch is a secondary cavity nester and can take advantage of natural cavities as well as woodpecker created cavities. The white-headed woodpecker is the only woodpecker species to rely heavily on seeds of ponderosa pine for food (Marshall et al. 2003 p. 364).

Both the white-headed woodpecker and pygmy nuthatch are identified in the Conservation Strategy for Landbirds of the East-Slope of the Cascades Mountains in Oregon and Washington as focal species for Ponderosa Pine Forests with large patches of old forest with large snags and large trees respectively (Altman 2000). The biological objectives for habitat for both species where ecologically appropriate are to initiate actions to provide a mean of 10 live trees/acre >21 inches dbh with at least 2 of those trees >31 inches dbh for foraging and replacement snags, a mean of 1.4 snags per acre >8 inches dbh with over half of those >25 inches dbh in a moderate to advanced state of decay, and a mean canopy closure of 10 to 40%. In addition, where ecologically appropriate, provide the before mentioned conditions to provide >350 acres in pre-dominantly old growth and in 26 to 75% of old growth provide >700 contiguous acres. Nest snags used by pygmy nuthatches in the eastern Cascades of Oregon were all ponderosa pine averaging 24 inches dbh (Frenzel unpublished data cited in Mellen et al. 2003).

The Landbird Conservation Strategy in ponderosa pine forest emphasizes maintaining healthy ecosystems through representative focal species for three habitat conditions mentioned above (i.e. large trees, large snags, and open understory). Conservation strategies for management of this habitat include: use of prescribed burning and/or thinning when and where appropriate to reduce fuel loads and accelerate development of late-seral conditions; retain all large trees, especially ponderosa pine >20 inches dbh; initiate snag creation and recruitment where necessary; retain all existing snags and broken-topped trees in units; implement road closures (obliteration); and minimize invasion of exotic and noxious weeds and soil erosion.

Flammulated Owl

The flammulated owl uses mosaic habitats which include a mix of forested conditions in relation to open habitats. Many of the species included in this type require a mix of habitat elements including green trees, snags, down logs, and open habitats to meet their needs for foraging and nesting.

Flammulated owls are found in a mosaic of open forests containing mature and old growth ponderosa pine or mixed conifer plant associations with interspersed dense thickets and grassy openings. They utilize cavities in live or dead trees created by pileated woodpeckers, hairy woodpeckers, and northern flickers (McCallum and Gehlbach 1988). Average diameter of snags and trees used for nesting were 24 inches dbh but used snags 6 and 52 inches dbh as evidenced by the 30 and 80 percent tolerance levels for nest snag diameter in DecAID (Mellen et al. 2009). McCallum and Gehlbach (1988) found that flammulated owls select nest cavities with more open vegetation in front of the cavity as this species dive steeply when leaving the cavity then level off and fly 3 to 6 feet above ground. It forages primarily on arthropods and other insects.

The flammulated owl is identified in the Conservation Strategy for Landbirds of the East-Slope of the Cascades Mountains in Oregon and Washington as a focal species for mixed conifer late successional forests with interspersed grassy openings and dense thickets (Altman 2000). The biological objectives for habitat where ecologically appropriate are to initiate actions in mixed conifer late-successional forests to maintain or provide habitat with greater than 10 snags/100 acres >12 inches dbh and 6 feet tall, greater than 8 trees/acre >21 inches dbh to provide recruitment snags, at least one large or two small dense, brushy thickets of sapling/pole trees for roosting habitat, and at least one large or two small grassy openings.

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APPENDIX G - Consideration of Public Comments on Draft EIS

During the public comment period (April 19, 2013 – June 3, 2013), 24 individuals, agencies or organizations responded by submitting letters or emails. Consistent with the National Environmental Policy Act, 40 CFR 1503.4(b), this document focuses on addressing substantive comments on the DEIS. Substantive comments include those which challenge the information in the DEIS as being inadequate or inaccurate, or which offer specific information that may have a bearing on the decision. Non-substantive comments are those that express opinions or position statements without any accompanying factual basis or rationale to support the opinion.

A process for responding to comments on a DEIS has been outlined in the Forest Service Handbook (1909.15 Chapter 20) which states that the agency preparing the EIS must "review, analyze, and respond to substantive comments on the draft EIS." Possible responses to substantive comments include:

1. Modify alternatives including the proposed action.
2. Develop and evaluate alternatives not previously given serious consideration by the agency.
3. Supplement, improve, or modify its analyses.
4. Make factual corrections.
5. Explain why the comments do not warrant further agency response, citing the sources, authorities, or reasons which support the agency's position, and, if appropriate, indicate those circumstances which would trigger agency reappraisal or further response.

Agencies, individuals, and organizations that submitted comments during the 45-day comment period:

Carol Vetterick, Central Oregon Horse	Jerry Gilmour
Tyler Miller	Tim Lillebo, Oregon Wild
Stu Garrett	Doug Heiken, Oregon Wild & Cascadia Wildlands
Ron Carpenter	Kreg Lindberg
Chad Willems	Chuck Burley, Interfor
Carmyn Fortier	Irene Jerome, American Forest Resource Council
Lydia Garvey	Alex Gloster
Randy Sallee	Maria Farinacci
Fred Gientke	Karen Coulter, Blue Mountains Biodiversity Project
Linda Driskill, Grant County Conservationists	George Wuerthner, Alliance for the Wild Rockies
Sophie Lopardo	Glen Ardt, Oregon Dept. of Fish and Wildlife
Christine B. Reichgott, Environmental Protection Agency	Alan Unger, Deschutes Collaborative Forest Project Steering Committee
Tad Hodgert	

This document does not include the general statements of support, opposition, or alternative preference that were received in most letters. All comments received are public record and are on file at the Bend/Ft. Rock Ranger District office. Letters received from federal agencies are included in full at the end of the appendix.

The following comments, arranged by topic, are followed by the Forest Service response. Similar comments are grouped and given one response. Some comments have been summarized or paraphrased.

PURPOSE AND NEED

Comment: *Why does the forest need thinning at all? Forest fires are natural occurrences in life and our forests could not survive without them. Maybe you're afraid a fire like Pole Creek last year will appear again? But it was natural and no people died from it.*

Response: The purpose of thinning is to reduce the tree density. Trees that have more resources available to them are healthier, more vigorous, and more resilient to insects and disease. Fuel reduction includes the understory tree treatments, shrub mowing, and prescribed burning. Much of the West Bend project area is high priority for fuels reduction because of the amount of wildland-urban interface, recreation infrastructure, and recreational use in the area (FEIS pp. 1-5).

Comment: *Our forest was perfectly fine for hundreds of years and it will be for hundreds more if we take care of it. Fires are a fact of life and no forest thinnings will change that.*

Response: The forests of the project area are not the same as they were hundreds of years ago. Fire suppression and early logging that removed most of the large trees have left a forest that is at risk of higher severity fire than would have occurred historically. Thinning and fuels reduction can create conditions where a wildfire would not cause as much mortality of trees as would occur under current conditions (Wildfire hazard and risk analysis FEIS pp. 104, 137-156). See also pp. 131-133 on science and reasoning to support thinning and fuels reduction.

Comment: *We can see some value in thinning encroaching small trees from under larger trees in dry forest types, but this project goes beyond the commonly supported restoration actions to include regen harvest, logging in moist forest types that may not need it, and logging too large of a fraction of the project area.*

Response: The purpose of the various harvest types are described in the FEIS Table 1 p. 6, pp. 44-46, and Appendix B pp. 531-535. These address the purpose and need for action (pp. 2-5).

Comment: *We disagree that the area is "overly dense" or at "risk" of insects, disease and wildfire.*

Response: The FEIS relies on the best available science to determine when stands are at risk of serious mortality from insects (FEIS pp. 86-877). Lidar data shows that stands proposed for thinning are above the Upper Management Zone. Analysis also shows that 36% of the project area is in an extreme wildfire hazard condition (FEIS p. 128).

Comment: *I fully support "contributing wood products and restoration work to the local and regional economy as part of the purpose and need. In addition a brief statement should be added under the "needs" that supports the purpose by emphasizing the "need" to maintain the current forest products industry infrastructure in the region, without which, the ability to maintain and restore resilient forests will be lost.*

Response: The importance of the forest industry infrastructure and workforce is noted in Chapter 1, p. 4. It is recognized that active management requires local mill infrastructure and a skilled contractor base. This project will help to maintain existing infrastructure that supports forest restoration work. This infrastructure and workforce helps implement restoration activities and provides markets that can help reduce the per-acre costs.

Comment: *The West Bend timber sale is obviously planned to heavily log this forest for short-term profit for the timber industry, not to protect and maintain valuable natural resources and recreational opportunities as claimed by the Forest Service. Blue Mountains Biodiversity Project volunteers extensively field-checked the West Bend sale units over the last two summers and found that the majority of the area is not "overly dense" as claimed. Nor is it at any uncharacteristic "risk" of insects, disease, and wildfire....*

Response: The purpose of the project is to create resilience in the forested stands. Our review of the project area shows that ponderosa pine stands proposed for thinning are above the Upper Management Zone and therefore at risk (FEIS p. 3). Wildfire hazard mapping shows about 36% of the area would exhibit moderate to extreme fire hazard (FEIS p. 128).

Comment: *The FS should focus on decommissioning and closing roads; improving fish passage and water quality; using non-chemical means to reduce exotic invasive plants; diversifying monoculture ad*

homogenous plantations; restoring riparian shrubs; using wildfire to accomplish objectives rather than suppressing wildfire; using ecologically sound restoration techniques to heal existing damage from logging, mining, recreation, and other management actions; and ending ecologically destructive practices such as virtual clearcutting.

Response: The project includes a strategy to address roads that were already identified for closure where either the closure needs maintenance or the road was not effectively closed to begin with. The Forest will also close user-created roads (FEIS p. 52, Appendix E).

There are no fish passage problems within the West Bend Project area. The focus here is on the forested vegetation where water quality is protected, objectives for wildlife habitat are incorporated, measures are in place for invasive plant prevention, and the needs of recreationists are incorporated into the design and implementation planning.

ALTERNATIVES / RANGE OF ALTERNATIVES

Comment: *Count our support for at least a restoration alternative with no commercial logging.*

Comment: *Make a restoration only alternative (no logging/roading).*

Comment: *We want a restoration only alternative that does not include commercial logging and roading.*

Comment: *There is very little difference between the action alternatives offered. Why isn't the public allowed to choose an alternative that logs far less of this large area or to opt for a "restoration only" plan that does not do further commercial logging and roading damage to a forest area recovering well from past clear-cutting?*

Response: Restoration is a matter of bringing the landscape back to a level where the structure and natural processes are found at a natural or historic scale. The idea of no commercial logging would not change the densities or species composition to levels that might sustain the natural processes. In other words, the purpose of creating a more resilient forest landscape could not be met without thinning trees that are of commercial size. Thinning just non-commercial size trees would not adequately reduce density and the re-introduction of fire would have unwanted effects in stands that are not thinned first. The importance of thinning to reduce crown fire susceptibility and long-range spotted is discussed on p. 133 of the FEIS. Management of the lodgepole pine stands also requires commercial removal. The project also provides an important source of wood products including saw timber. The No Action alternative provides the no-logging option for a comparison of effects.

Comment: *While the amount of commercial logging decreases marginally from alternative 2 to 4, understory small tree thinning and the use of shrub mowing and prescribed burning increases, even in parts of the forest that are naturally denser due to higher elevation and longer lasting snow pack, and that were historically subject to infrequent stand replacement fire. All the action alternatives propose the same activities on a similar scale in the same area.*

Response: Action alternatives were developed to address key issues raised during scoping. The alternatives still must meet the purpose and need. Because a goal of the project is to have a landscape-scale effect on forest health and resilience, Alternatives 2 and 3 differ in the approach to thinning (in order to create diversity and variability) rather than by where or how much to thin. Alternative 4 differs by foregoing treatments in some locations (thermal cover in Key Elk area, thermal cover in Deer Habitat). Although some issues were addressed by dropping commercial harvest in Alternative 4, the project's overall purpose and need is still met on the landscape.

The EIS describes how vegetation changes with the increase in elevation within the project area. The project's objectives also change with the increase in elevation. Table 1 (FEIS pp. 6-7) describes the management area, treatment objectives, and associated wildlife focal species in the different landscape areas.

KEY ISSUES – #1 - LANDSCAPE VARIABILITY

Comment: *Re: optimal mix of treated and untreated. DEIS p. 166 says "Alternative 2 is the most thorough approach to reducing the risk of insects, disease, and stand-replacing wildfire but does not provide the greatest amount of habitat diversity." Alternatives 3 and 4 are almost as bad because they also treat an almost equally large fraction of the planning area. This lack of landscape diversity is one of our greatest concerns with this project. Achieving landscape variability is very important.*

Response: The amount of treatment within the project area is not expected to create or increase homogeneity. Rather, it will improve variability across an area that is currently relatively homogenous because it is second growth ponderosa pine that has become overly dense (FEIS pp. 108-109). Thinning prescriptions will tend to increase gaps in the stands as well as maintaining clumps of trees. Retention areas such as deer hiding cover provide larger patches of dense forest across the landscape. Much of the forest is relatively young – the blackbark ponderosa pine is around 80 years old. The kind of landscape diversity that may have occurred historically cannot be achieved in the short term; however, actions taken now to create resilience means that structure can continue to develop over the long term.

Comment: *DEIS figure 36 showing wildfire hazard map for Alternative 2 shows the homogenization that results from extensive logging with a focus on fuel reduction instead of forest diversity. More landscape diversity can be accommodated when stands with higher density are spatially isolated by stands of lower density.*

Response: A goal of the project is to achieve fire hazard reduction at the landscape level; however, the reduction of fire hazard rating across a large area cannot be equated with homogenization of the forest. The fire hazard rating describes the forest's resistance to control once a fire starts. Flame length and fire type are the measurements that go into the rating (FEIS p. 127). Variable density (clumpiness and gaps) can be achieved across the landscape while also meeting fire hazard reduction goals. The goshawk territory treatments in particular provide for higher density stands in the core, with thinning levels radiating out (pp. 534-535).

KEY ISSUE #2 – LODGEPOLE PINE OVERSTORY / SEED TREE TREATMENTS

Comment: *Regeneration harvest, such as seedtree cut and overstory removal and salvage, will result in a future shortage of snags and dead wood. This is because regen harvest removes so many trees that the snag recruitment process is significantly adversely affected.*

Response: Treatment with regeneration methods covers 586 acres in Alternatives 3 and 4. Within the watershed, lodgepole pine habitat type occurs on 28,489 acres. The objective for lodgepole pine stands is to remove dead trees where there has been heavy beetle mortality. Those units include retention. Under Alternatives 3 and 4, in final removal units, the seed trees that are infested with mistletoe will be girdled creating snags, instead of being cut and removed. Stands proposed for seed tree harvest will include a 15% retention area to fulfill the green tree replacement component of the NWFP. The analysis shows that green tree replacements will be adequate to provide for future recruitment of snags and down wood (FEIS p. 310). See other responses below relating to snags and down wood.

KEY ISSUE #6 – DEER HABITAT (MA-7) THERMAL COVER

Comment: *All action alternatives include a Forest Plan amendment to allow the elimination of winter range deer cover further below the science-based Forest Plan standard requiring cover over up to 40% of the area (currently at 30%) and with thermal cover comprising three-quarters of the total (currently at only 12%). While Alternative 4 would retain more thermal cover, it would still require the amendment to allow for planned up to 10 acre clearcuts within existing cover. We find it pathetic that the FS is not even willing to manage for adequate deer habitat any more.*

Response: The Forest Plan states "Ideally, cover and forage areas should be in close proximity for optimum use by big game, with cover making up 40 percent of the land area. Approximately ¾ of cover areas should be thermal cover and some stand conditions may satisfy both kinds of cover." Canopy cover should be managed at the highest percentage that will maintain healthy stand conditions with a low risk of extensive damage due to insects or disease. Providing good quality thermal cover is difficult in the area because although site productivity allows for development of adequate canopy cover, it is not sustainable. The value of thermal habitat in the project area is marginalized because of high levels of recreation use, which makes hiding cover more important.

The existing condition is far from ideal for providing thermal cover. The Forest is using the best available information and consulting with the Oregon Department of Fish and Wildlife to implement an appropriate thinning strategy including group opening creation to develop high quality hiding cover, which is the most limiting factor in the area.

Treatments of mule deer winter habitat focuses on opening up stands to provide better winter forage, while maintaining hiding cover to limit disturbance. Through the spatial arrangement of forage and cover, mule deer treatments also accelerate the development of LOS ponderosa pine stands and maintains small dense patches of regenerating ponderosa pine. This landscape approach to mule deer and other MIS objectives, provides a better management approach for deer across their winter habitat and also provides a more thorough approach to multi-species management.

TRAIL / RECREATION IMPACTS / SCENIC VIEWS

Comment: *The FS should be protecting the valuable natural resources and recreational opportunities of this area, rather than destroying it for short term timber industry profit. Destroying the scenic views along Highway 46 and Roads 41 and 4601 is unnecessary and will detract from the area's recreational appeal. The forest along these roads, especially along 46 is already pretty thin, allowing for plenty of road sun.*

Response: The Forest recognizes the importance of recreation and how scenery is a component of the recreation experience in the West Bend project area. The scenery management specialist works with the interdisciplinary team to design vegetation management to enhance the views from the highway, prevent unwanted effects, and maintain scenic views. The Forest has considerable experience working within the scenic corridors. This type of thinning in scenic corridors has recently occurred along Highway 97 with the Lava Cast project, Cascade Lakes Scenic Byway with the Sparky and Snow projects, and along Skyliners Road with the East Tumbull, West Tumbull, and Fry projects.

The stands proposed for thinning and to increase the amount of sunlight reaching the pavement are in need of thinning. These stands have the same level of stocking as much of the rest of the project and were specifically identified for thinning by Forest's Landscape Architect (who also serves as the Scenic Byway program manager). The amount of sun reaching the road was monitored during the winter to determine how much sun was reaching the road at this time.

The picture above shows the Cascade Lakes Scenic Byway in the fall. In ponderosa pine stands the scenic objective is to create opportunities for growing and viewing large, old ponderosa pine and improve visual diversity in tree species and size class.

***Comment**: Think of how many people's lives would change for the years of trail and forest work. Most people go to Phil's trail to get some exercise, or walking dog on the Deschutes River Trail, or cross-country skiing at Virginia Meissner. Our town would lose the beauty of our nature and would have old boring ways to exercise. Many people would be cross at not getting to enjoy their town's nature.*

***Comment:** This project targets entirely and exclusively the area of Phil's Trails. I have to stress the value of this area to the people and economy of Bend. It needs to be protected from large-scale man-made disturbances as well as fire and disease. My concern is that these new activities are going to negatively impact the use of Phil's trails on a large scale, and change the character of recreation west of Bend for the foreseeable future.*

Response: The Forest is carefully planning implementation of this project so that impacts to trail users and other Forest visitors are minimized. The vast majority of the Forest will remain accessible while areas where large equipment is operating ay have trail closures for safety purposes. Effects to recreation use and experience are described in the FEIS pp. 330-367. Resource protection measures to protect recreation infrastructure and provide for public safety are listed on pages 54-5. This area has been thinned before and although short-term first order effects will occur (FEIS pp. 112-114 for example), the beauty of the forest would not be lost.

The Forest Service and the Deschutes Collaborative Forest Project have held meetings and field trips with local recreation stakeholders including the Collaborative's recreation subcommittee, Central Oregon Trail Alliance, CogWild, Meissner Nordic, and Central Oregon Nordic Club. The goals of these meetings were to solicit feedback on the proposed action related to the protection of recreation infrastructure, recreation experience, access, and revenue. The Forest will continue to work with these groups throughout project implementation and monitoring.

***Comment**: I noticed on the map that the areas near the Deschutes are marked as "intensive recreation" but the Phil's trail area is noted as "deer habitat." It is in its entirety slated for commercial thinning, and salvage with some over story removal at the western end.*

Response: The area allocated to Deer Habitat (Management Area 7) was identified in the Forest Plan with a goal to manage vegetation to provide optimum habitat conditions on deer winter and transition ranges. Recreation use and miles of trail have increased since the Forest Plan was adopted in 1990.

The FEIS briefly explains the conditions and the purpose and need for thinning and other harvest across the project area (pp. 2-5).

***Comment**: I would like to know what is being done to protect trail use, and the quality of the trails themselves. Some forest thinning or clearing projects have left trails that are torn up, very exposed, and (even more) quickly turn to loose dust.*

***Comment:** Treat legendary trails with boundaries such as wildlife corridors or riparian boundaries (i.e. minimally touch the 100 feet on either side).*

***Comment:** I would ask that you try and close sections at a time, not the whole thing for a super long time. This would allow us to use sections while work is done on the rest.*

***Comment:** I hope you work closely with COTA to minimize trail impact and keep open as many trails as possible while completing the project*

***Comment**: The absence of vegetation makes for even less interesting trails in an area that barely has the topography for interesting trails in the first place. I would hope that various densities of forest and underbrush around established trails can be tolerated, rather than creating thousands of acres of a mowed down, artificial forest landscape.*

***Comment**: This area is a major economic benefit to Bend, and it contributes year after year, not just once every few decades. The Forest Service has acknowledged this by noting the need for a large paved parking lot and welcome center. A significant degradation of this area will have a significant impact on my business and my income, not to mention the quality of life to the thousands of us who lie here and enjoy it.*

***Comment**: I hope there will be some sensible thought and planning into the amount of trees logged in the area. The trails west of Sisters are unrecognizable compared to several years ago before it was "thinned." It would be a shame if the same fate came to Phil's Trail Complex.*

Any time there is so much logging that the wind blows through the forest and it becomes windy in the trees (as is the case at Peterson Ridge trails) that appears to be excessive. Would that not increase blow-down? I fear that new parking lot and thinning will make Phils look depressing.

Response: The Forest is carefully planning the vegetation management around the trails in the project area. We have developed a set of project design elements that are intended to help implement near trails in a way that avoids extensive adverse effects. Resource protection measures to protect recreation infrastructure and provide for public safety are listed on pages 54-55. Similar work around trails has led to continued learning and improvements in operating in a way to maintain trail integrity and vegetation structure essential to the trail. At the same time, the Forest is working to educate forest users of the importance of active management in this area to increase resilience in the forest. Extensive outreach and collaboration has occurred with user groups such as COTA.

***Comment:** Create additional parking and access by paving the staging areas that will be created during reconstruction of Skyliner Road, the Bend waterline project, and the West Bend thinning project. This will provide recreation parking without further damaging nature.*

Response: Creating additional parking and access in the project area is not part of the purpose and need for action and so is outside the scope of the EIS. Phil's Trailhead Improvements, Welcome Station and Welcome Station Trails Connections are projects identified in the cumulative effects section and are designed to

***Comment:** Mountain biking in Bend is quickly becoming a multi-million dollar a year industry. I deeply hope that you have no plans of eliminating any of the trails.*

Response: No National Forest System trails will be eliminated as part of this project. However, user-created roads and trails may be rehabbed and obliterated during project implementation with a focus on reducing unauthorized motorized access (FEIS p. 52).

Comment: *This area is moving in the direction of the primary recreational activities consisting of non-motorized users, which, through road closures for resource protection and restoration, could also reduce user conflicts long-term.*

Response: The FEIS describes the road closure strategy that is intended to restore vegetation and reduce resource damage and wildlife disturbance (FEIS p. 52 and Appendix F).

Comment: *I request that the Good Dog! Area (between Entrada and Widgi, units 89 to 100 on the DEIS maps) be excluded from all activities proposed in this project. Given the substantial costs and modest benefits, it is not appropriate to include the Good Dog! Area in this project. Costs associated with: invasive plant spread (cheat grass); big game thermal cover reduction; visual impacts; cost to trail users.*

The Good Dog! area is the only legal access in summer to the Deschutes River for off-leash recreationists. Activities likely will impose a much higher level of costs on this user group than on others.

Comment: *The purpose and need describes the intended benefits of the project, but these will be modest to non-existent in the Good Dog! area. In part, this is because the area recently burned, in the Awbrey Hall fire. In part it is because the area was recently burned and mowed via the East Tumbull project. And in part, it is because the concerns underlying the purpose and need (e.g. dense stands of lodgepole) simply do not exist in the area.*

Ponderosa pine is the dominant species. In addition, there are existing fire breaks, including the Meadow Camp road to the west, Century Drive and the Haul Road to the north, and the Deschutes River to the south (there is very low tree density to the east).

Response: This area is a block of National Forest System land between the edge of Bend, Widgi Creek Resort, and the Meadow Camp day use area. This area is considered Wildland-Urban Interface where in 1990 the Awbry Hall fire burned at a high intensity, destroying forest and 22 homes within the fire's first burning period. Existing roads and the Deschutes River did not stop that fire. The Greater Bend CWPP goals for federal lands are to start treatments within a ¼ mile buffer (wherein lies the Good Dog area) of adjacent communities at risk, and work out in increments until the WUI boundary is reached. Although this area has previously been treated, the CWPP also prioritizes maintenance of previously treated lands as an important component to keeping communities safe.

The reduction of tree densities will enhance the longer term health, insect and fire resilience of these stands while mowing and burning will continue to maintain the improved fuels reduction work from the East Tumbull and Katalo projects. The benefits to treating this area are more than modest. Additionally, dog owners have the option of accessing the Deschutes River on trails by observing leash requirements.

Comment: *Unofficial trails exist because of the District's leash restrictions via local orders. The appropriate alternative is legal alternatives, rather than rehabilitation of the unofficial trails. In the case of mountain biking, the District has not only legalized unofficial trails, but has also facilitated the creation of dozens of miles of new legal trails. They have done neither in the case of off-leash recreationists, despite repeated requests.*

Response: The requirement to control dogs on recreation trails is outside the scope of this EIS. The restoration of areas that are de-forested or damaged because of user-created roads or trails meets the purpose and need for restoring forest health. The main focus in the project area is to reduce motorized use of unauthorized routes. Also additional trail connections are being considered under a separate NEPA process for the Welcome Station Trail Connections project.

Comment: *The DEIS recognizes (p. 67) the safety concerns of pungi sticks; however, this will occur only on and near official trails. Due to the closures and lack of alternatives, many humans and their dogs use unofficial trails and go off-trail in that area. Mowing will create a danger for both.*

Response: Resource protection measure #15 is specific to system trails and applies to about 140 miles of winter and summer trails in the project area. It is not feasible for the Forest Service to eliminate

sticks, stumps, or branches throughout the Forest. Dog owners and other recreationists who are concerned about off-trail hazards in the Forest are free to use official trails.

Comment: *The District has engaged in outreach with Meissner Nordic and Central Oregon Trail Alliance. It is noted that DogPAC is a trail adopter in that area, but no outreach was conducted with that organization. I encourage the District to collaborate with that group on this project and others that relate to forest recreation involving dogs.*

Response: The Deschutes Collaborative Forest Project provides an excellent opportunity for public involvement and outreach. Members of the collaborative group, including a recreation subcommittee, represent the larger stakeholder community, such as trail users. A DogPAC member has been involved in the collaborative planning that has taken place with the West Bend project. This project has also been discussed at the Deschutes Trail User Group meetings, which are usually attended by member(s) of DogPac. Throughout implementation and monitoring, the Forest Service will work with local stakeholders and trail adopters to keep the public informed about the project and reduce the impacts to the recreation resource and access. DogPac will be included in these efforts.

Comment: *When residents of Bend go out into nature they expect to see a peaceful forest, not a wasteland full of barely any trees. We expect to enjoy our outing in nature, to take in all of our surroundings, to live in the pleasures of our natural forest. We don't want to go out in nature to see no wildlife and so few trees.*

Response: The FEIS provides an extensive review of the kinds of recreational use in the project area and describes how these uses may be affected by vegetation management activities and how the project is designed to minimize adverse impacts while creating a more resilient forest (FEIS pp. 330-360). Users are enjoying the area surrounding Phil's trailhead following implementation of the East Tumbull project. We are also receiving positive responses from users following the implementation of the West Tumbull project around the Skyliner recreation area.

Comment: *Any substantial removal of trees by logging makes the forest look ravaged. This loss of scenic values is important to the economic health of this area.*

Comment: *Logging destroys scenery.*

Comment: *Landings made of rock, bark, and dirt left behind are little more than an eye-sore. They usually end up as an unloading platform for people to dump their refuse from, or a target range with the trash left behind.*

Response: Impacts to the scenery of the area are addressed in the FEIS pp. 363-367. We expect the quality of the scenic views to be maintained or improved over time. Goals and objectives within the Scenic View corridors such as providing opportunities for viewing large old growth ponderosa pine can be reached through the use of prescribed fire and thinning to maintain and enhance large tree structure.

Thinning has occurred throughout the project area in the past, including along the Cascade Lakes Scenic Byway. There is some short-term trade-offs where the first order effects of vegetation management are noticeable, but in the long-term improved forest health, reduced wildfire hazard, and the retention and enhancement of large tree structure will continue to provide a positive experience for Forest visitors.

Landings are to be located where impacts are minimized and where past activities created landings, these will be re-used where possible. In scenic areas landings will be located away from the scenic corridors where possible and will be rehabilitated.

Comment: *The FS wants to amend the standard from its existing allowance of one to two years for visible effects from logging to recover "to allow visible effects of harvest cleanup and fuels reduction for approximately five years."*

Comment: *The FS wants to eliminate the requirement to restrict prescribed burning to 5 acres or less in foreground areas in scenic view zones, though not everywhere needs to be burned to reduce fire risk to travel corridors and non-commercial thinning could be used instead.*

Response: The Scenic areas in the West Bend project area are also identified as primary routes of ingress/egress to allow opportunities for safe evacuation of public, as well as opportunities for safe and active fire suppression. This addresses recommendations in the CWPP for the area. Burning is just one part of the treatments. The purpose of the amendment is to allow for the visible effects of prescribed burning following implementation. The effects of prescribed fire on trees would be a less drastic change than the effects of wildfire, but when written over twenty years ago, the Forest Plan did not explicitly provide for the use of prescribed fire in scenic views standards and guidelines. Current science supports the use of prescribed fire for fuels reduction purposes. The reasons are to reduce fine fuels which do not get treated with most mechanical treatments, increase the longevity of treatments, decrease brush reproduction and to work towards restoring more natural processes to the landscape.

FUELS TREATMENTS / FIRE RISK

Comment: *I don't want to see any blackening or scarring damage to the lower canopies of the trees, like seen in the Skyliner Road vicinity.*

Response: Prescribed underburning (FEIS p. 47, 112-115) is necessary for meeting the purpose and need elements of 1) reducing the threat of large scale wildfire effects because it reduces the surface fuels in the forest; and 2) reintroducing fire in the fire-dependent ecosystems.

***Comment*:** *I support thinning of former plantations. I support prescribed fire in the area. Indeed I believe prescribed fire rather than commercial logging should be the primary mechanism used for management, except for logging the aforementioned plantations.*

Response: The larger plantations were established in the 1950s and 1960s. The blackbark ponderosa pine stands were established in the 1920s and 1930s. So although about 30 years older than the plantations, most of the ponderosa pine in the project area is relatively young and in need of thinning. Prescribed fire, if used to reduce tree stocking, would also increase the fuel loadings to much higher levels than removal of the trees. The level of fuels would be beyond what is presently in the area and would advance even worse fire expectations.

Comment: *While we can understand the desire to reduce fire threat to homes built in the WUI, the best research suggests that reducing the flammability of homes, rather than trying to fire proof the forest works more effectively and is far more cost effective. If thinning does occur, it should be done in the immediate area around homes. Research by Jack Cohen and others finds that thinning no more than 100-200 feet is sufficient to protect homes.*

Response: The project area does include WUI (FEIS pp. 4, 117-118). But the purpose and need is to reduce the threat of large scale wildfire effects to people, property, and important ecosystem components including habitat for interior forest wildlife species. The need is expressed for the landscape, and not just near homes or within the WUI. As stated in the purpose and need the thinning also addresses the need to increase the resilience of stands to fire and insect mortality not just to the fuels condition. It is also recognized that the loss of a large part of this forested area to high fire or insect mortality would not be in the greater interest of the community. See also the Desired Conditions and Related Strategies discussion on pp. 131-133 of the FEIS.

A recent assessment of the effectiveness of hazardous fuel treatments states "Modeling demonstrates that fuel reduction treatments are effective at reducing fire behavior (severity) where implemented, and can successfully reduce fire risk to communities. However, it also shows that fuel reduction treatments that occur at broader scales would have bigger impacts on the overall reduction of crown fire. Perhaps most importantly, the results show that WUI-only treatments result in areas of unchanged crown fire potential across the untreated landscape, therefore leaving it vulnerable to large, severe, and expensive

landscape-scale fire." (Ecological Restoration Institute. 2013. The efficacy of hazardous fuel treatments: A rapid assessment of the economic and ecologic consequences of alternative hazardous fuel treatments: A summary document for policy makers. Northern Arizona University. 28 pp.

Comment: *What is the FS's plan to maintain fuel reductions? Numerous studies have shown that effectiveness of fuels reductions wanes over time. What is the probability that a fire will burn through the planned fuel reductions in the time period when they are effective? Estimates suggest that 10-20 years is the maximum effective period for ponderosa pine. Is there funding for this maintenance?*

Response: The FEIS acknowledges that vegetation management activities such as thinning followed by mowing and prescribed fire have beneficial effects for an average of about 15 years (FEIS p. 119). Returning to the project area after that time for maintenance of the fuel profiles would be addressed in future NEPA documentation. We're unable to speculate about future funding or planning efforts.

Comment: *Low basal area modifies the microclimate to make the stands hotter, dryer, and windier, while maintaining more canopy can moderate those adverse effects on fire microclimate, as well as help suppress the growth of future ladder fuels.*

Comment: *We urge the FS to focus fuel treatments on the understory. Canopy fuels in mature forests are not a significant fire hazard (because they are held high above most surface fires) and forest canopies provide many competing benefits (e.g. habitat, microclimate control, scenery, carbon storage, etc.). Canopy trees also contributing to fire hazard mitigation by moderating the microclimate and suppressing growth of surface ladder fuels, etc.*

Modeling shows that canopy fuel reduction is accomplished at the expense of increasing surface fire intensity.

Models show that maintaining canopy cover is a useful way to reduced fire hazard, while removing canopy increases fire hazard.

Response: The FEIS notes (Table 46, p. 131) that where sufficient treatment of surface fuels occurs, the overall reduction in expected fire behavior and fire severity usually outweigh the changes in fire weather factors such as wind speed and fuel moisture. Few of the stands in the West Bend project area are mature by any sense of the description, and thinning is not just to decrease canopy fire potential, it is also to increase the resilience of stands to stresses such as drought cycles and insects.

The action alternatives are expected to substantially reduce the fire hazard ratings across the project area. Action alternatives result in as much as 22,463 acres in a low fire hazard rating. This means that if the area experiences a fire, the flame lengths will be low and the potential for passive or active crown fire are reduced (FEIS pp. 137-138). Thus the level of mortality expected in the remaining stand is expected to be much lower.

Comment: *We support prescribed fire a fuel management technique but fire management must be carefully planned so as to realize the full benefits of fire and minimize effects on wildlife, soil, site productivity, and large trees, down woody debris, and snags. Like all tools, we must also be careful not to overuse fire.*

Comment: *When using fire as a restoration treatment keep in mind that "pyrodiveristy begets biodiversity" so please strive for a variety of fire effects to enhance biodiversity. This means that fires should be done at different times of year, during different weather and fuel moisture conditions (within limits of course), and with different proportions of burned and unburned patches within the mosaic. Also apply maintenance fire at different time intervals so that some areas get treated more often, and other areas are treated less often.*

Response: Underburning would occur when fuel and weather conditions are conducive to achieving planned fuel reduction and resource objectives (FEIS p. 112) and the desired vegetative condition (pp. 131-133). Prescribed underburning is recognized as an important component of fuels reduction and

the desired treatment in stands that have been proposed for both mowing and/or underburning (FEIS p. 114).

Comment: *Fall burning should be considered because that is when nature would have done most of the burning. The effects of spring burning on the life-cycles of plants and wildlife must be fully considered in the NEPA process. See p. 13 of Oregon Wild comments for excerpts from: Arthur R. Tiedemann, James O. Klemmedson, Evlyn L. Bull (2000), Solution of forest health problems with prescribed Fire: are forest productivity and wildlife at risk?*

Response: The FEIS states that burning must occur when the weather and fuel moistures are conducive to meeting resource objectives (FEIS pp. 47, 112).

Comment: *Burning of any forest material should be avoided because of the extensive damage to the forest. The Skyliner and Black Butte burns scarred the forest with unsightly 20 foot high trunk burns, desirable trees were accidentally burn-killed, and the bottom of the forest canopy blackened and branch-killed. These undesirable impacts in these two areas will last for years and cannot be repeated in future projects.*

Response: The FEIS acknowledges that some mortality can occur during burning operations. However, the overall objectives of fuels reduction can be met with prescribed underburning. Scorching of the bark on trees is an effect that is disclosed in the FEIS and the intent within scenic corridors is to maintain crown scorch at less than 30 percent and minimize bole scorch up to 10 feet in height. Removing lodgepole pine, white fir, and smaller understory trees makes stands much more resilient to fire (FEIS pp. 55, 105, 106, 121). The visual impact is a short-term trade-off for longer term resilience. Without treatments, visual impacts of wildfire are much greater.

Comment: *If the USFS believes the project will reduce the probability of a wildfire entering Bend, could this event be analyzed via mathematical modeling?*

Response: The risk of wildfire occurring across the project area is analyzed in the Fire and Fuels section of the FEIS as Measure 2, pp. 139-140, 145-147, 152-153. Burn probability is an output of the mathematical and scientifically supported models built within FlamMap (scientific citations found in FEIS pp. 119-122) and, specifically, is a part of the minimum travel time fire growth model to be used as an indicator of potential fire spread rates and associated landscape attributes, like fuel conditions. The outputs from the mathematical modeling are shown both spatially and in tablature format throughout pp. 135-156.

Comment: *The relevant CWPPs only received mention in passing in the West Bend DEIS. Is it safe to assume that individuals in these areas were contacted in the course of the West Bend scoping and project development? These communities, as already evidenced in the deadly fires such as Awbrey Hall, that burned through this area are extremely vulnerable to wildfire coming off federal lands.*

Response: CWPPs were collaboratively developed and are summarized in the FEIS at pp. 117-118. Adjacent landowners have been included in outreach efforts during the planning of this project. These communities are also extremely vulnerable to wildfire coming through private land.

SMOKE / AIR QUALITY

Comment: *I don't want any smoke resulting from prescribed fire in the project area. Given the dominant winds, prescribed fire would produce smoke that would impact the city of Bend.*

Comment: *The USFS should provide a substitute burn area far to the south in the Deschutes Forest to avoid the high population areas around Bend. Avoid impacts to highly popular recreation areas.*

Comment: *While some mention is made of potential health hazards to the surrounding population from factors such as smoke, there is no mention of any mitigation plans related to these hazards, simply a statement that these hazards will likely exist.*

Comment: *I oppose the project primarily because of the burn elements from which tons of carcinogenic and toxic smoke and particulate matter will envelope both the residents of Bend and adjacent communities and our water supply watershed (Bridge Creek) for a number of years (although the project's duration is not specified according to staff).*

Bend and the Bridge Creek watershed lie to the east and west respectively of the project area. The fact that you state you will comply with air quality regulations in the DEIS is insufficient comfort since in fact you can and will not comply because of the proximity of Bend, the watershed, and the unpredictability of wind shifts.

Response: The Forest conducts burning in compliance with National Ambient Air Quality Standards under the Oregon Smoke Management Plan. The FEIS describes the conditions under which burning would occur and how monitoring occurs to ensure compliance with the smoke management program. (FEIS pp. 118, 134, 137, 143, 148, 154-155).

Comment: *As proof of smoke's unpredictability, the smoke plume from your 5/14/2013 burn near Sisters/LaPine reversed direction from the southeast to the north, northwest, and enveloped and irritated residents in Bend for several hours. Prediction and avoidance of these wind shifts is beyond your capability and is the reason burning should not be part of this plan.*

Response: Sisters and LaPine are located in two different directions from the City of Bend, so it is incorrect to lump the smoke activity from burning that occurred in each of these locations on 5/14. Underburning on any Forest Service lands that occurred on 5/14 was conducted in compliance with National Ambient Air Quality Standards under the Oregon Smoke Management Plan. As a part of that compliance, the plan for underburning was reported to Oregon Department of Forestry through proper reporting channels. Smoke activity and impacts to Bend were properly monitored and reported. The objective of the Oregon Smoke Management Plan is 'to prevent smoke resulting from burning on forest lands from being carried to or accumulating in designated areas or other areas sensitive to smoke, and to provide maximum opportunity for essential forest land burning while minimizing emissions…' (Oregon State Smoke Management Plan, OAR 629-43-043).

Comment: *EIS should include smoke plume modeling with graphics to illustrate the scope, intensity, and direction of the plume over the days and years that burning is proposed.*

Comment: *The carcinogenic harm to residents of Bend needs to be more clearly and extensively calculated and discussed. For all practical purposes, the DEIS avoids this topic and the DEIS should provide a worst-case burn and carcinogenic scenario. The token discussion of the smoke and air quality issues is unacceptable (p. 11).*

Comment: *The DEIS provides more impact analysis on terrestrial, aquatic, and vegetative species than it does on humans. The USFS needs to re-balance this analysis and assess harm to residents.*

Response: The FEIS discloses effects to recreation and special use in the area (FEIS pp. 330-367), human health and safety (pp. 481-483). Other social issues addressed in the FEIS include scenic views (362-366), wilderness potential (396-418), and economics (467-474). The FEIS also measures potential for production of particulate matter (PM) 10 and 2.5 for each of the alternatives (pp. 134,137, 143, 148, 154-155), including a comparison to the worst-case scenario of a wildfire burning in the project area.

Comment: *The DEIS states on p. 111 that the proposed fire plan is not in place at this time. The FS should suspend public notification and involvement until the fire plan is in place together with all foreseeable consequences.*

Response: A fire plan needs to be in place prior to using unplanned ignitions (e.g. lightning strikes) to meet burning objectives and would be completed prior to utilizing any unplanned ignitions.

Comment: *The DEIS states the wind azimuth used was 315 degrees and as such the expected plume drift direction would be westerly away from Bend. That would put the plume and carcinogens directly over the Bridge Creek watershed with its associated damage. Tabulated data supporting this 315 degrees*

needs to be provided since at this latitude (Bend, the wind direction is on average 90 degrees or to the east.

Response: The azimuth been corrected in the FEIS to 290 degrees, which is still a west wind. Wind azimuths are cited in meteorology and fire weather forecasts as the azimuth from which the wind is coming from, not the azimuth from which the wind is going to (Appendix C p. 570).

FORESTED VEGETATION – HARVEST PRESCRIPTIONS

Comment: *The DEIS says that 15% of each unit should be left in matrix regen units but not elsewhere. We urge the FS to incorporate skips at multiple scales, including within harvest units. Skips help provide wildlife cover, recruit snags, store carbon, and provide a diversity of microclimate conditions and vegetation structural conditions within stands.*

Response: The West Bend project includes several strategies that will impart skips and gaps throughout the units and across the project area (see landscape area objectives Table 1, p. 6; Key Issue #1 description pp. 9-11; description of thinning p. 44; and description of stand management prescriptions pp. 531-535).

Comment: *60 square feet of basal area per acre is too low to maintain and recruit large trees and snags into the future. We encourage the FS to retain more trees in a variable density pattern that includes patches that are both more dense and less dense than the average.*

Comment: *Commercial thinning would reduce the forest to only 20 to 60 square feet of basal area, a virtual clearcut, left wide open to dry out and become infested with invasive plants.*

Response: Basal area is used as a measurement for average residual stand density and the residual basal area is an average across a unit. There are no intended clearcuts with commercial thinning, although small group openings are proposed in some stands (FEIS p. 532-533).

The visual appearance of thinning is dependent on the size of the trees in the stand. A stand with small trees thinned continues to look relatively dense compared to a stand with large trees thinned to the same basal area. The purpose of thinning is to reduce density to below the Upper Management Zone of the stand density index, so the resulting stands will vary depending on size of trees and site productivity.

The project includes invasive plant prevention measures (FEIS pp. 61) to reduce invasive plant introduction and spread. Ongoing treatments of invasive plant sites are reducing the amount of plants and number of plant sites in the project area which reduces the risk of them spreading throughout treatment units.

Comment: *We urge the FS to retain large trees even if they are infected with mistletoe. Large trees have important habitat values. Mistletoe also has important habitat values. Removing mistletoe will have limited benefits for stand development, and in the long-term, the fuel modification proposed here could actually perpetuate mistletoe in these stands because it will marginally reduce the probability of stand replacing fire.*

Response: Thinning from below retains the largest and healthiest trees in a stand (FEIS p. 43). Removal of large trees with mistletoe occurs where the future stand beneath individual trees is at risk of infection. Overstory infection limits the health and development of younger stands of trees.

FORESTED VEGETATION – PONDEROSA PINE

Comment: *The second growth stands in the project area provide a unique opportunity to implement a range of forest management strategies to move this area to more resilient and vigorous conditions. There is tremendous opportunity to create large structure as well as to create both horizontal and vertical structural diversity interspersed with openings and vigorous young stands of desirable species.*

Response: Alternatives 3 and 4 increase the amount of variability within and between stands by focusing on other resource objectives in prescriptions.

Comment: *We disagree with the statement "compared to the forest structure that would have been sustained historically, mid-seral stages are greatly over-represented and what was once mostly pure ponderosa pine forest in the lower 2/3 of the project area is now a mixture of lodgepole and ponderosa pine." This assumes that forest succession did not occur....The fact that mixed conifer or even lodgepole can and is growing in these pine forests suggests that the sites are not really pine sites, but rather forest sites more of mixed to subalpine forests. Pine can grow here, particularly immediately after a stand-replacement event like a major fire when the sites are hotter and drier.*

Comment: *Recent work by Baker, for instance, suggests that much of this area had denser forests than previously thought –due to the bias of past methodologies used to characterize the forest.*

Response: Some of the sites within the West Bend project are being managed for ponderosa pine in order to move towards the historic structure and increase resilience to insects and fire. These stands can support other tree species; however this was historically limited with fire and is not considered sustainable for long time frames or with using fire as a management tool. Stocking of original stands was considered through observing the amount and distribution of original stand stumps. It is clear through these observations that there were far fewer trees present originally than are presently on these sites.

Comment: *The Forest suggests that many ponderosa pine stands are too dense. Yet it goes on to suggest that "many stands have been thinned at least once but are now stocked at a level where the trees exhibit low vigor and they are susceptible to bark beetle mortality." Why can't the FS allow beetles to reduce stand density? The beetles will do a better job of determining which trees should be eliminated, plus they create wildlife habitat at the same time.*

Response: "Thinning" by the mountain pine beetle does not look like thinning from below which is common in light limiting stands west of the cascades. East of the Cascades where water limiting occurs and mortality agents such as mountain pine beetle attack stressed trees and stands the "thinning" is in all size groups attacking especially the larger trees in a contagion effect. Thus it is not much of a thinning but more of a group killing type attack.

Comment: *In dry forest types the FS should consider the restoration concepts, vision, priorities, and recommended prescriptions described by Tim Lillebo and Oregon Wild's Practical Guide for Ecological Restoration of Eastern Oregon's Dry Forests.*

Response: The Forest has this document and has reviewed it.

Comment: *New ideas for implementing variable spacing are offered by Churchill et al (2013). Churchill, D.J., M.C. Dalhgreen, A.J. Larson, and J.F. Franklin. 2013. The ICO approach to restoring spatial pattern in dry forests: Implementation guide. Version 1.0 Stewardship Forestry, Vashon, Washington*

USA. And Derek J. Churchill, Andrew J. Larson, Matthew C. Dahlgreen, Jerry F. Franklin, Paul F. Hessburg, and James A. Lutz 2013. Restoring forest resilience: From reference spatial patterns to silvicultural prescriptions and monitoring. Forest Ecology and Management 291 442-457.

Response: The guide by Churchill et al. has been reviewed and will be a helpful guide during implementation. Analysis of other thinning projects on the District has shown that the clumping as prescribed in the ICO approach is occurring at most levels except for the large clump size. During implementation, methodologies for implementing the large clump structure will be tried.

FORESTED VEGETATION - LODGEPOLE PINE

Comment: *The entire section on lodgepole appears to distort the ecology of this species. Lodgepole pine is well known for long fire free periods. It's not kept young by frequent fires. That is total ecological maleficence. Lodgepole pine does not burn frequently because it is typically too wet to burn. Unless the ecology of lodgepole is radically different here than everywhere else it is found, the idea that fire suppression has had any effects on fire cycles is absurd and not substantiated by the science.*

Response: The commenter apparently misread the DEIS. Pages 92 of the FEIS states "In all succession and size groups, closed canopy would have dominated most of the landscape due to the infrequency of fire, reproductive capacity of white fir and lodgepole pine and the relative tolerance of both species to dense canopies. Page 123 describes lodgepole pine PAGs "as seral communities that arise from stand-replacement fires. Fires are stand-replacing severity and typical fire return intervals are 35-100+ years."

Fire suppression has occurred in the lodgepole pine and it is not considered too wet to burn. Lodgepole pine types usually take a stand-changing event like bark beetles or storms to accumulate enough down fuels to create larger stand-replacing fires such as the Paulina fire, Crane Fire, Davis Fire, Yellowstone Fire or the Snow Creek Complex. This can occur as early as 35 years or as long as hundreds of years.

Comment: *Beetles are natural and native to lodgepole. Forests thinned by beetles, released from competition grow faster. It's absurd to argue that these forests require any management. Here the FS is really distorting all that is known about lodgepole pine ecology.*

Response: Beetle thinning as shown in the West Bend project area tends to thin the largest trees in a lodgepole pine stand. The remaining released trees tend to be understory intermediate, smaller diameter trees. In the case of West Bend mistletoe is common and in the intermediate class trees, tree crowns are small and general health is low. Removal of the dead allows for longer term management of regeneration while removal of the remaining low vigor overstory reduces mistletoe infection on the new stand. See photo, previous page.

Comment: *No treatment of lodgepole pine. The plans propose up to 800 acres of overstory removal because otherwise the trees might die from pine beetles. Why is logging or girdling needed? If beetles kill the overstory trees, they will be thinned and young trees will grow up.*

Response: The overstory removal of seed tree and shelterwood trees is identified as a need on page 3 of the FEIS due to the mistletoe infection of regenerated stands. The fear of beetle mortality in these is not the purpose for removing them.

Comment: *Re: lodgepole seed tree-shelterwood, overstory removal, and salvage treatment strategies. We see that the acres of seed tree/overstory removal have been decreased and respectfully request that a prescribed burn strategy be seriously considered for part of the lodgepole treatment stands.*

Response: Using a prescribed fire strategy would not necessarily meet the objectives for this area. There would be a possible loss of overstory trees thus requiring more expensive tree planting as a regeneration method. The Forest Plan calls for managing advanced regeneration where it is viable.

FORESTED VEGETATION – HISTORIC RANGE OF VARIABILITY / LARGE TREE STRUCTURE

Comment: *Arbitrary and capricious misapplication of definitions to define late and old structure (LOS): The Eastside Screens definition of LOS: a term used in the interim wildlife standard, refers to the structural stages where large trees are common. The Eastside Screens definition of LOS above has absolutely no specific number as to age or size. However, p. 49 of the DEIS states in the footnote at the bottom that stands are LOS if they contain "more than 13 large trees per acre." The district planning forester said on a field trip last year that the stands were LOS because they had 13 or more trees per acre that were over 21" dbh. These definitions simply are not correct. When I asked the district planning forester about his definition he did say the 13 trees per acre over 21" came from the interim eastside old growth definitions.*

Also, p. 49 of the DEIS says "all treated areas would remain in an LOS condition because all trees > 21" dbh would be retained." Again, the 21" diameter is not in the Eastside Screens definition of LOS and should [not] be used.

This is a serious issue for several primary reasons. First, the forest staff should not be making up or inappropriately using definitions. To take part of the definition of old growth (13 tpa > 21") and use it to define LOS is inappropriate to say the least.

Second, these stands are second-growth, black bark plantations. Just because they are good sites and these relatively young trees have achieved diameters near or exceeding 21" that does not make it old growth nor does it make it LOS. When we stood in the stand last year, I could see one tree that was truly a legacy pine. So when the Screens say "large trees are common" it was one large tree relative to the majority of the stand. Nearly all the stand is of the 60-80 year age class as the DEIS admits on p. 477.

Third, if these stands are designated LOS, then all future blackbark, second-growth stands will be LOS. Why is this an issue? Because the Screens require greater analysis and justification to do anything in LOS (no net loss below HRV). It makes no sense to take a stand that most agree needs treatment and create additional analysis and limitations on what can actually be done by designating it as LOS.

Remove the LOS designation from all the blackbark pine stands. This would negate the need to do the HRV analysis and forest plan amendment to treat LOS stands.

Comment: *I'm grappling to understand the designation of these stands as "Late and Old Structure" or LOS as it is referred to in forest service and eastside screens parlance. There is nothing "late" referring to late successional conditions, or "old" about 70 to 80 year old stands.*

Labeling stands in West Bend as LOS is egregious as well as misleading to the general public and has the potential to set a precedent for the future management of the thousands of acres of black bark stands in central Oregon and other areas in the region. Further it totally defies the intent that precipitated the creation of the eastside screens.

Response: The EIS defines large tree structure (p. 81, 84) and makes clear that the identification of large tree structure does not rely on age or seral stage. The EIS also makes it clear that the stands that fall within the Eastside Screens area are second-growth stands that had been clearcut in the 1920-30s so most trees are around 80-90 years old. The Forest has to determine where large trees are common because this is a structural stage with specific standards and guidelines in the Eastside Screens.

The Screens require Forests to identify large tree structure when planning timber sales. The Screens direction, unfortunately, uses the term late and old structure (LOS) when discussing large tree structure (it also states that the intention is for identifying stands where "large trees are common" without identifying age). The Forest defines common as 13 large trees per acre; the commenter has provided no alternative methodology. The Forest has made the distinction between what defines "old growth" and how it determines where large trees are common.

Regardless of definitions used, an HRV analysis must be completed when planning timber sales in the Eastside Screens area. The Screens are not intended to prevent the Forest Service from conducting needed vegetation management; rather they were intended as a short-term measure to ensure that the shortage of large trees was not exacerbated by timber sales that did not consider the habitats of large tree structure and the great reduction of this on the landscape and the lack of large structure and old forest on private lands. The Forest has determined that based on the SDI of stands in the project area, thinning to control density is important for the longevity of the large tree structure.

As blackbark stands across the Forest continue to grow, and where density is controlled through thinning, they will all eventually reach a point where they have large tree structure or even where large trees are common. The rate of that development is dependent on site productivity and stocking level control.

Comment: *On p. 2 in Table 1.2 the DEIS states the "mid-seral species are greatly over represented" in the project area. There are no old growth areas mapped within the West Bend project boundary. In the R6 Interim Old Growth Definitions (Hopkins, Simon, et al. 1992) there is a table under ponderosa pine that defines required minimums for late seral or "old growth." Those minimums are diameters >= 21" at breast height and at least 13 trees per acre and an age of at least 150 years. Although the eastside screens do not dictate tree age or minimum number of trees per acre, they do require that all trees >= 21 inches at DBH be left regardless of whether the other parameters are met. What reason is there to designate the stands in the West Bend area as LOS, by selecting the parameter of 13 trees per acre from the table while ignoring the minimum age of 150 years, when all trees >21 inches will be left anyway. All this does is add another layer of complexity in "converting unmanaged stands to managed stands" to quote MA-8 in the LRMP. The LOS label creates additional inflexibility.*

Response: As the commenter points out, there are very few truly old stands of trees in the West Bend project area. The analysis for LOS used 13 tree large trees per acre to identify where large trees are "common" as the Screens do not offer a definition. It is not intended to identify old growth and we did not identify old growth because of the lack of stands > 150 year.

The Forest Service initiated the Screens as short-term protection of large tree structure but acknowledges that where ecologically necessary, thinning should occur whether or not stands have large tree structure present.

Comment: *The FS needs to provide more evidence that its estimates for burning of the forests was as high as suggested. Saying that 40-50k acres burned annually in low intensity fires would apply primarily to drier forests...means it would burn every 10 years. This is an extremely short fire interval and there are more and more critical reviews of these kinds of estimates. Short fire intervals are based on a few small studies that have flawed methodology and extrapolation. See Baker's Fire Ecology in Rocky Mountain Ecosystems.*

Response: The referenced statement has been revised in the FEIS. Baker argues that "the most effective action is to rapidly limit and redesign people-nature interfaces to withstand fires" rather than re-establishing past fire regimes or focusing on fuels reduction and fire suppression. Fuels reduction and the re-introduction of fire into the West Bend project area are based on the direction in the Forest Plan as amended, the CWPPs, and the nature of the project area as a highly-visited recreation forest.

Comment*: No logging in mixed conifer and lodgepole pine....In mixed conifer and lodgepole forests, the average fire frequency is the wrong matrix to use, rather the distribution of fires is important and there are often long periods without fire naturally – with or without fire suppression. Fires can't burn unless there is a confluence of drought, low humidity, high winds, and high temperatures. Without those factors, fires do not burn well. Because of these features, neither of these forest types are outside the historic variability.*

Response: The purpose for entering lodgepole pine and mixed conifer stands that are dominated by lodgepole pine is to regenerate stands where the dominating overstory is mostly dead due to the past

decade beetle outbreak. This will reduce the fuels accumulation and as stated on page 7 of the FEIS "maintain lodgepole pine in single age stands on the landscape." This is to emulate the historical single age structure of lodgepole pine which would have occurred if natural processes had been allowed to cycle through on the landscape.

Comment: *There is even disagreement about "historic variability" in drier forests like ponderosa pine. Everywhere where researchers have looked, they are finding that stand replacement blazes are not outside the "historic variability" for these kinds of forests, including ponderosa pine. Many of the studies on fire history for this region have multiple flaws in their methodology that tends to skew fire frequency to shorter intervals. This includes targeted sampling, composite fire intervals and averaging fires instead of using the distribution of fires. All of these can distort fire history data. Given climate change, the historic variability is more likely to be similar to past dry periods like the medieval warm period where larger fires were the norm.*

Response: The purpose of the project is to restore resilience so that disturbance events will not lead to large-scale loss of the Forest. As a high-use recreation area it's not a forest where "stand replacement blazes" are desired. Fire regimes are addressed in the FEIS pp. 123-124 and Appendix C. The commenter suggests that William Baker's book Fire Ecology in Rocky Mountains Ecosystems is evidence of the disagreement within the scientific community on historic variability in drier forests. A recent paper by Keala Hagmann, Jerry Franklin, and K. Norman Johnson uses extensive historical cruise data to identify stocking levels. "A historical landscape emerges which supports current working hypotheses that frequent, low- to moderate-severity wildfires maintained a predominantly low-density forest dominated by large, fire- and drought-tolerant ponderosa pines across a significant moisture and productivity gradient from the driest ponderosa pine to the mixed-conifer habitat types."

The body of science cited at FEIS pp. 125-126 includes science to support the methodologies behind cited studies, like targeted sampling, composite fire intervals, and averaging fires, regarding historic fire frequencies.

Comment: *Analysis of the HRV should go beyond just structural classes, to address the historic abundance of large trees and large snags. Efforts to move toward the HRV of structural classes can move the landscape away from the HRV of future large trees and snags.*

Response: The emphasis in the project area is to maintain the largest trees. The methodology for determining the HRV is outlined in the Eastside Screens.

Comment: *The 20-year analysis used in the DEIS fails to disclose the fact that accelerating growth on a few stems, while it may accelerate the attainment of large stems, also removes may stems which can never grow to become large trees so the number of large trees and snags over the long-term will be adversely affected.*

Response: This comment assumes that all trees would continue to grow to become large trees in the absence of density reduction. The best available science shows that stands above the UMZ will experience increased mortality and the overstory trees are susceptible rather than the smaller trees. The limiting factor on these sites is moisture, there is a maximum amount of biomass/leaf area available on moisture-limited sites. Thinning redistributes moisture.

Thinning does not remove natural mortality agents. Lightening, fire, and insects will still cause mortality; the rate of that mortality is likely to be more similar to historic rates following thinning (FEIS p. 89). The stocking levels that result from thinning will reach a level where the stand is again susceptible to higher bark beetle mortality in about 20 years (FEIS p. 89). This indicates that the number of trees left to become large snag sin the future is sufficient.

Comment: *683 acres of open canopy LOS forest would be treated in violation of the screens. We do not object to prescribed fire in open canopy LOS, but we do not support the further removal of habitat structure (future large trees and snags) from stands that already have open canopies.*

***Comment**: It doesn't make sense to cut late succession, open canopy ponderosa pine stands, when that is what you claim to be creating through the proposed logging. Cutting mature trees, even if trees over 21 inches are left, will have significant impacts on wildlife.*

***Comment:** The FS is also proposing an amendment to allow the commercial logging of late and old structure (old growth) forest that is already below the historic range of variability (abundance) for that particular biophysical environment within a watershed.*

The FS contradicts itself by wanting to eliminate more of the late succession/open canopy ponderosa pine stands than currently allowed by the Forest Plan through logging, even though that's the type of stands that the FS claims to be creating through the logging.

Response: This comment incorrectly aligns LOS with "old growth." The difference between the two is pointed out in the FEIS p. 83. Simply put, stands that have large tree structure have been labeled as LOS under the eastside screens. 3e Region 6 definition of old growth (over 150 years old).

The FEIS clearly shows that there is no elimination of ponderosa pine LOS. Units included in the thinning proposal are in need of thinning because tree density has reached a point where the trees are stressed. Open canopies in the different biophysical setting occur which are still over the UMZ because the sites are high productivity sites and can provide dense canopies; however, the trees are still susceptible to bark beetle mortality and the species mix is not what was present historically. There are many stands which were historically ponderosa pine and now have components of white fir and lodgepole pine, reducing the resilience to bark beetles and fire.

Thinning from below (smallest trees first) reduces the density, maintains the large trees, and allows the stands to continue to grow. This is essential to meeting the purpose and need for increasing resilience.

***Comment:** The FS claims that these stands would remain in LOS because they would retain all trees greater than 21" dbh, but there would be a great reduction in the number of mature trees that would otherwise be the next generation of old growth trees, as well as reduction in the future recruitment of large snags and logs essential to old growth habitat that would otherwise come from the removed trees now close to old growth size.*

Response: None of the trees to be removed by thinning would be considered "mature." The largest trees are maintained, while thinning trees below 21" which are blackbark (70-80 years old) or younger to reduce density. The recruitment of large snags and logs and development of old growth habitat occurs over the long term.

FORESTED VEGETATION – SIZE OF TREES

***Comment:** No logging any trees over 21 inches.*

***Comment:** Do not cut any trees over 21" dbh in Northwest Forest Plan areas, to provide more large tree structure.*

Response: The commenter provides no supporting information for the recommendation to not remove trees over 21 inches diameter at breast height (21" dbh). Nevertheless, in the West Bend project, areas east of the range of the spotted owl are subject to the Eastside Screens which requires retention of trees over 21" dbh. This project will adhere to that standard and guide. West of the range of the spotted owl, trees over 21" dbh can be removed with timber harvest. In addition, in this project, two action alternatives call for retaining white fir trees that are over 24" dbh as well as retaining old-character trees regardless of size.

***Comment:** We recommend adding a project-specific forest plan amendment to exempt this project from the 21" diameter limit and instead use the Van Pelt guidelines. In addition, there should be no diameter restrictions on harvesting if Van Pelt is utilized. It should be one or the other to determine if desired conditions are met.*

Response: Areas to the west of the spotted owl range are not subject to the restriction on removing trees over 21" dbh with timber harvest. Where the project is subject to the restriction, it is not expected to prevent achieving project objectives. The project design element that calls for retaining old-character trees referencing Van Pelt is also not expected to prevent achieving project objectives.

FORESTED VEGETATION – OLD GROWTH & OLD TREES

Comment: *Does the project retain all old growth trees of all species? We respectfully request all alternatives retain all old growth of all species via Van Pelt guide.*

Re: mistletoe strategy that MAY cut old growth trees. We do not want any old growth trees cut for mistletoe management purposes. Please consider other strategies to reduce mistletoe where old growth is present, such as thinning or clearing small trees, planting with non-susceptible species, prescribed fire, pruning or other treatments.

Response: Project design element #4.5 has been clarified. This is especially applicable within the larger plantation units ("skid and deck" units). It is not the intent to cut old growth trees.

Comment: *Old trees provide significant ecological values. We urge the FS to retain old trees regardless of size or species. We urge the FS not to rely on ladder fuels or mistletoe as excuses to remove old trees.*

Response: The R6 definition of old growth > 150 years; however, we use the physical characteristics to define old "character" trees. Very few old trees remain in the project area and it will be a rare occurrence in West Bend to encounter old trees creating ladder fuels near large trees. The project design element has been rephrased to make it clear that old-character trees "regardless of size" will be retained.

Comment: *The industry does not support the use of arbitrary and inflexible age and diameter limits in determining how to thin stands. Interfor and the industry throughout the eastside have repeatedly called for rescinding the Screens and particularly the 21-inch diameter limit. We have even advocated for ways to replace the 21" limit with other, less onerous and less arbitrary guidelines. Instead more restrictions are added using Van Pelt guidelines.*

Response: Retaining trees over 21" in the area of the Eastside Screens will not prevent meeting the purpose and need for the project. If analysis had shown that retaining all trees over 21" would result in unacceptable residual stand density, an amendment would have been incorporated into the project design as has been done in other areas.

Comment: *The Eastside Screens went through the NEPA process and were incorporated into the LRMPs via a forest plan amendment. The Van Pelt guidelines have not gone through rigorous scientific review. Nor have they gone through the NEPA environmental analysis and public comment process and they were added to the DEIS via an errata sheet.*

They are not part of the LRMP and unless you intend to amend the forest plan to incorporate the Van Pelt guidelines for this project (and any others) we believe you are violating both the intent and the letter of the law.

Response: This project incorporates resource protection measures to ensure compliance with the Forest Plan and other requirements as well as to address public issues (e.g. maintaining safe access to recreation sites during implementation). This project also incorporates methods of meeting restoration goals such as thinning, removal of fire-sensitive species from ponderosa pine dominated stands, leaving the largest most fire resistant trees, and leaving the old legacy trees which may be more fire resistant and increase the stand diversity of age structure. Van Pelt's handbook is used as a guide to identify the older trees by the presence of specific characteristics, so that a consistent definition is applied by anyone faced with implementing the project.

Comment: *The DEIS calls for the use of the Van Pelt guidelines for selecting trees to be left on the West Bend project. I fail to understand what the point of this is in stands that are second growth. The guide*

was written for stands in eastern Washington and I have not seen an appropriate scientific analysis to determine whether they can be appropriately applied to stands in central Oregon.

Response: Because very old trees and old character trees are rare on the landscape, the FEIS provides a means for retaining them. Additionally, the Deschutes Collaborative Forest Project has incorporated the retention of old trees into their blackbark restoration recommendations.

NATURAL ECOLOGICAL PROCESSES (Ratio of Treated to Untreated)

Comment: *The plan appears to have a bias against natural ecological processes. Insects, fire, dwarf mistletoe including stand replacement blazes are critical to production of dead trees, many wildlife species, and ecological processes. Logging does not emulate these natural events, and in particular removes important biomass that is critical to long-term forest health. Logging destroys or degrades many of these natural processes.*

Comment: *The determination to control the very complex forest is contrary in our opinion to a goal of focusing on the enhancement of biodiversity and natural processes.*

Comment: *Logging removes dead wood, and can sometimes reduce the occurrence of natural processes like insect attack and large wildfires that create such wood in the future.*

Comment: *Logging can disrupt natural ecological processes like beetle attack, dwarf mistletoe effects and fire effects.*

Comment: *Natural events like wildfire and insect attacks are episodic. It is the very large blazes or large insect outbreaks that the agency is trying to thwart that does all the ecological work in the forest. If the FS wants to manage for natural ecological processes, large fires must be encouraged.*

Response: The West Bend project area is not a landscape where very large blazes or large insect outbreaks are the desired condition (see management area goals and objectives pp. 12-15). The project is not intended to eliminate natural processes and mortality from insects is expected to occur. As described before, the project area was extensively cut and regenerated in the 1920s and 30s, so the forest is not in a natural condition – they stands are young, dense, and extensive. The project will create landscape-scale conditions where natural processes may occur – i.e. more natural/historical structure and a more natural/historical scale. Thinning does emulate these natural processes and does remove biomass, which is a constant input to fire hazard.

Comment: *Reduction in stand density is given as the rationale for logging to reduce insects, dwarf mistletoe and fire – all of which reduce stand density. There is a bias against natural thinning agents like mistletoe and insects like pine beetle.*

Response: Mistletoe will not be eliminated and it is expected that beetle activity will continue to occur (FEIS p. 88-90, 106). The majority of the project area falls within land management allocations that promote addressing forest health issues in a proactive way. FEIS pp. 12-15. Following recommendations of the Deschutes collaborative, the project is attempting to set up the landscape so natural processes may occur in a more natural/historical structure and a more natural/historical scale.

Comment: *This project removes commercial wood from more than 2/3 of a large 25,000 acre landscape. This rate of treatment is excessive. It will "capture mortality" at a landscape scale and reduce recruitment of snags over a large area. This extensive logging proposal, combined with past logging and recent fires, will result in unacceptable cumulative impacts. It is important to identify the proportion of the planning area that should be retained untreated so that natural processes like tree growth and mortality can produce natural levels of snags and dead wood which are critical habitat elements.*

The DEIS did not consider a range of alternatives in terms of the optimal mix of treated and untreated portions of the landscape. All three alternatives treat over 21,000 acres and commercially log a similar proportion. [one way to determine an approp. Mix is to identify 50-80% tolerance levels of snag-

associated species and use this to determine how much stem density is required to attain those tolerance levels over time through natural processes and then create a mosaic of treated/untreated areas that accomplishes objectives related to both tree vigor and mortality processes.]

Comment: *DEIS p. 306 says that thinning will result "in the long-term... there will be more large trees that can be recruited into down wood." This is not supported by the evidence. Commercial logging will likely reduce the number of pieces and volume of large down wood. Loss of dead wood recruitment should be viewed as an adverse effect that needs mitigated rather than beneficial effect.*

Focusing on growth of individual trees rather than growth at stand scale is misleading because it doesn't account for lost habitat value associated with trees that are removed by logging; doesn't account for reduction in population of live trees available for future recruitment is incomplete and inadequate.

Response: DecAid tolerance levels could be used to determine the appropriate Green Tree Reserves to maintain specific densities required to attain tolerance levels over time, if we were solely managing the project area and associated watershed for snag-dependent species. Due to the fact that; 1) there are a variety of Management Indicator Species/Species of Concern associated with the project area, and 2) habitat varies greatly within the project area east to west, the project area was divided into habitat types. These habitat types were defined by the ecotones that cover the project area moving up in elevation from east to west. (Table 1, page 6 of the DEIS). Focal species were identified that best represent each eco-tone/habitat type and an analysis of habitat for each focal species was completed to determine where to maintain suitable habitat as well as apply restoration activities to promote future habitat on the landscape. For example MCW – Northern Spotted Owl, Mixed Conifer Dry/Ponderosa Pine Wet – Northern Goshawk, and Low elevation Ponderosa Pine Dry – white headed woodpecker/Mule Deer/Elk.

Since not all of these species are associated with snags, specific management direction from recovery plans, recent science and guidance, and the Forest Plan Standards and Guides, were used and applied to these areas. For example, a landscape assessment was completed with the Tumalo winter range for Mule deer thermal and hiding cover. Treatment on mule deer winter habitat focuses on opening up stands up to provide better winter forage, while maintaining hiding cover to limit disturbance. Through the spatial arrangement of forage and cover, mule deer treatments also accelerate the development of Late and Old Structure ponderosa pine stands and maintains small dense patches of regenerating ponderosa pine. These treatments retain residual snags for white-headed woodpecker nesting, but also enhance these potential nest stands by reducing densities which minimizes nest predation and maintains sufficient forage. Through this landscape assessment for mule deer it not only provides a better management approach for deer across their winter habitat, but also give the flexibility to manage for other specie objective for a more thorough approach to multi-species management.

Comment: *The DEIS (e.g. p. 244) describes logging in favorable terms saying that wildlife will continue to use logged stands "where interlocking crowns remain in the overstory." This is another example of where the FS should find the optimal level of low-density and higher-density conditions.*

Response: This comment does not acknowledge the extensive analysis in the FEIS and Appendix F. The FEIS points out that habitat for some species benefits while habitat for other species is reduced or degraded.

RIPARIAN RESERVES / RIPARIAN HABITAT CONSERVATION AREAS / WATER QUALITY

Comment: *The DEIS never says how much logging is proposed within RHCAs and riparian reserves.*

The DEIS mentions logging adjacent to the Deschutes River but there are other streams that will be impacted.

The DEIS indicates there are 23 units that overlap with RHCAs and that mechanical "booms" can be used to remove commercial trees closer than 50 feet from streams. This is likely to cause unacceptable impacts on aquatic and terrestrial objectives.

Comment: *Planned logging near the Deschutes River seems risky and unnecessary based on our field checking. The use of heavy equipment most likely to introduce sediment to the river would be allowed up to 100 feet from the River. Commercially logged area would be visible from trails in the W&S River corridor which is supposed to be protected.*

Response: The FEIS describes all vegetation management activities within Riparian Reserves and Riparian Habitat Conservation Areas on pages 434-435. A total of 202 acres would be treated, not accounting for buffers. No vegetation management activities are proposed within the RHCA of Tumalo Creek.

Environmental Effects to streams are described in the FEIS on pages 436-449and in the INFISH RMO and Aquatic Conservation Strategy Objective sections on pages 457-463.

The FEIS shows there are 18 units along intermittent streams (5 units within RHCAs, 13 within RR's) totaling 105 acres on page 435. The actual acres treated would be less because of the equipment setbacks. The FEIS notes these intermittent channels have no surface connection to perennial water (pages 432-433). Environmental effects to the intermittent channels are included in the Environmental Effects section on pages 434-458, 444-447, and in the Aquatic conservation Strategy Objective summary on pages 457-463.

Tree stocking density exceeds the Upper Management Zone in stands along the Deschutes River and are at risk of insect and disease damage (FEIS page 445).

The FEIS references a study that concluded stream buffers as little as 25 feet were effective in limiting sedimentation after timber harvest but recommended a minimum of 50 feet. This project uses a 100 foot setback for machinery along the Deschutes River. Restrictions on the size and height of trees that can be removed within the machinery buffer will retain shade and allow for continued growth of larger streamside trees to eventually provide the large woody debris that is lacking in the river (FEIS p. 448).

The FEIS describes the low potential for sedimentation to the Deschutes River on page 448. Vegetation treatments are on generally flat to gentle terrain with highly permeable soils, there is abundant ground cover, and riparian vegetation would be left intact. Water Quality and Riparian Vegetation Resource Protection Measures are listed on pages 58-61 of the DEIS.

Vegetation management activities would be visible from trails within the Deschutes River Wild and Scenic River corridor. Trail resource protection measures are listed on page 54 of the FEIS. Vegetation treatments within the Wild and Scenic corridor is consistent with the Upper Deschutes Wild and Scenic River and State Scenic Waterway Comprehensive Management Plan.

Comment: *Drop all the Deschutes RHCA units to just noncommercial thinning by hand only within the RHCAs and to a maximum of 10" dbh outside the RHCAs in units 401, 409, and 410.*

Response: This suggestion was not raised during scoping. Dropping commercial harvest within the RHCA and limiting the harvest to 10" dbh or less outside of RHCAs within units 401, 409, and 410 would result in higher tree density and not effectively meet the Purpose and Need of promoting and sustaining late and old structured forested stands, reduce the susceptibility of to bark beetles and dwarf mistletoe infestation, and reduce the fuels and resultant fire hazard within these units. Aquatic resources would be at risk in a stand replacing wildfire or insect and disease outbreak scenario.

Comment: *Sale units adjacent to Tumalo Creek and the Deschutes River need larger riparian buffers. Some of the units back right up on Tumalo Creek with extreme slopes leading down to the creek.*

Response: None of the action alternatives propose vegetation management activities within the RHCA of Tumalo Creek (FEIS page 424), which has a RHCA width of 300 feet from either

streambank. Vegetation management activities along Tumalo Creek would occur more than 300 feet from the edge of Tumalo Creek on either side of the stream. Vegetation management activities would occur on generally flat to gentle slopes on the lands at the top of the canyon that Tumalo Creek drains. The FEIS references studies where much narrower buffers than prescribed under this project for the Deschutes River were effective in limiting sedimentation of streams (FEIS pages 446-447). Mechanized equipment is restricted within 100 feet of the Deschutes River and 25 feet from wetland vegetation (FEIS pages 58-59). In the case of a wetland adjacent to the river being 100 feet or more wide, then the width of the restriction for mechanized equipment would be 125 feet or more from the river.

Comment: *We urge the FS to reconsider its refusal to develop an alternative that avoids commercial removal in riparian areas. The general rule in the NWFP is that logging is prohibited. Logging is only permitted if it is needed to meet ACS objectives. This places a burden on the FS to show that action is needed and that it will be effective and that it will maintain and not retard aquatic objectives.*

Response: The water features that intersect this project area within the area of the Northwest Forest Plan are limited to one intermittent channel less than 4 miles in length that has no surface connection to a perennial stream or lake (in the North Unit Diversion Dam-Deschutes River watershed), and one small intermittent stream and two small perennial channels in the Tumalo Creek watershed (Table 194, p. 423). The vegetation management that intersects the riparian reserves (RRs) of these channels is listed in Table 198, p. 436.

Within the NWFP area, vegetation management would only occur within the RR of the 4 foot wide intermittent channel. Commercial trees would not be removed from within riparian vegetation but would be removed from within the riparian reserve.

No activities occur on perennial stream RRs. The IDT did not develop an alternative that avoided commercial removal in the RRs because during scoping it not rise to the level of a key issue. The aquatic conservation strategy objectives are analyzed in the FEIS pp. 458-463.

Comment: *Commercial logging will capture mortality and reduce recruitment of much needed woody structure.*

These effects indicate that it is unlikely that the FS can maintain RMOs related to large wood.

Our scoping comments suggested that riparian management areas are good places to rely on natural processes operate to maintain and restore habitat conditions. "We urge that riparian reserves and RHCAs not be entered because stream density is low in this area and protection is necessary to provide landscape heterogeneity, dispersal habitat functions, shade, and large wood recruitment. If any logging is proposed in riparian land allocations, the FS must carefully document that adverse effects on dead wood recruitment over time and explain how such logging will not retard aquatic and riparian objectives in violation of the ACS and INFISH."

Response: Commercial harvest would occur 100 feet or more from the Deschutes River on 37 acres. An extensive trail system parallels the Deschutes River. With trail resource protection measures emphasizing retention of trees (FEIS Table 18), commercial harvest between 100 and approximately 150 feet of the river would be further reduced. The height of a site potential tree is estimated at 100-120 feet. Trees targeted for harvest would be dominated by heights less than 100 feet, as these trees have not matured to the point of reaching site potential height. Commercial harvest of trees less than 21" dbh more than 100 feet from the Deschutes River on 37 acres would result in mortality of very few, if any, trees that have the potential to reach the Deschutes River. Commercial treatments, along with non-commercial thinning of trees <10" dbh, are prescribed to move stands toward a condition of more larger diameter and taller trees to benefit future large woody material recruitment and shade to the river, and more resistance to insects disease and fire (FEIS 98, 448, 458). The treated ponderosa pine stands along the river would have more large trees per acre and larger average diameter over time when compared to untreated stands (Figures 28 and 32, pages 101 and 107 of FEIS).

Compliance with the ACS of the NWFP and the RMO's of INFISH are located on pages 458-165 of the FEIS.

Comment: *The Oregon DEQ has already listed the Deschutes River as water quality impaired for temperature, sedimentation, turbidity, dissolved oxygen, and chlorophyll a. The proposed logging adjacent to the Deschutes River will lead to further sedimentation and exacerbates these water quality issues. Do not log within the sedimentation delivery zone of 300 feet.*

Comment: *The FS nonetheless plans to log well within the sediment delivery zone of 300 feet (as defined by the Ochoco NF and regional direction for protection of rivers with anadromous fish).*

Response: The Deschutes National Forest has not defined a sediment delivery zone width. Landscape characteristics, such as soil types and slopes, differ between the Ochoco and Deschutes forests. There are no anadromous fish species within the West Bend Project area. The rationale for low potential of sedimentation and other parameters for which the Deschutes River is water quality impaired (ODEQ 303(d) list) are explained on pages 449-450 of the FEIS.

Resource Protection Measure #58 displays the RHCA zones of the Deschutes River and how restrictions on operations within those zones. All other water quality best management practices are listed on pages 56-59. The water quality parameters listed above are addressed in the analysis (p. 441-448) and no measurable effects are anticipated.

Comment: *Potential impacts to water quality could affect inland Columbia River redband trout.*

Response: Environmental effects to the inland Columbia Basin Redband trout from implementation of the action alternatives are found in the FEIS on pages 449 and 453-454. The action alternatives were found to have No Impact to redband trout.

BOTANY / INVASIVE PLANTS

Comment: *Logging is one of the major ways that exotic weeds are spread.*

Response: This is acknowledged in the FEIS pp. 322-323. Prevention practices are included in the project design.

Comment: *The threat of invasive and noxious weed introduction and spread is another consideration for physically closing or decommissioning roads. Motor vehicles are one of the primary means of weed seed dispersal.*

Response: The project includes maintaining closures on level 1 roads and user-created roads to reduce vehicle traffic in the area.

Comment: *Resource Protection Measure 91 requires logging contractors to clean equipment before entering NFS lands. What requirements are in place to ensure that FS vehicles are clean to prevent the introduction and spread of invasive plants? What about the general public? I saw no analysis of direct, indirect, and cumulative effects of the introduction and spread of invasive plants in West Bend as a result of the increased recreation and hunting opportunities that this project will provide. All-terrain and off-road vehicles are notorious for spreading invasive plants.*

Response: The project is not expected to increase recreation or use in the project area, although it is recognized that there is already a lot of use by the public which contributes to invasive plant problems.

ROADS / TEMPORARY ROADS / TRANSPORTATION SYSTEM

Comment: *Will the logging trucks make dirt roads? If so, is there an alternative to dirt roads?*

Response: The FEIS describes where temporary road access will be necessary and how they will be developed (FEIS p. xx). These temp. roads are rehabbed following project activities.

Comment: *Conspicuously absent from the EIS is any discussion of impact on the community surrounding the project area, where roads and transportation of forest products and equipment are concerned. There is no information regarding possible or probable routes for ingress and egress through the surrounding communities and the impact such ingress and egress would have on the infrastructure, safety and quality of life issues. There is also no discussion regarding mitigation of hazards within the communities with respect to such transportation (dust, traffic, school crossings, noise, neighborhood impacts, property values, enforcement costs, road conditions issues, etc.)*

Response: The roads within the National Forest will be maintained to the degree necessary for support of the project. Once the product leaves Forest Service jurisdiction, commercial vehicles are subject to State, County, and local agency jurisdiction for commercial haul. The FEIS can make an estimate of the major routes that are likely to be used for haul, but the Forest Service has no control over the routes of haul once the product leaves National Forest System lands. Local agencies receive compensation through the collection of Department of Transportation and PUC permits to pay for haul over roads deemed appropriate for commercial use.

Comment: *Re: level 1 closed roads and temporary roads that will be used during implementation, the department recommends the District have, in place, the necessary regulations to post these roads as being closed to the public and be able to enforce this closure until these roads are physically closed or decommissioned.*

Response: The use of carsonite signs has been added to Appendix E strategy as a possible means of improving road closure effectiveness.

Comment: *Re: many miles of new construction temp. roads 29-39? We are a little confused as to the actual number of miles. We respectfully request a further analysis or roads and units to see if a significant portion of the new road construction can be avoided.*

Comment: *Specifying the road construction requirements for each harvest unit can help identify which units have unacceptable trade-offs. Those units with a high ratio of new roads to acres treated would be good candidates for closer evaluation to see if those areas should be dedicated to the untreated portion of the mosaic of treated/untreated areas.*

Response: The project area is large (25,696 acres) and the action alternatives will enter a substantial amount of that area. The existing road density in a project area is another factor in the total amount of temporary access that will be needed. Compared to other projects, the ratio of acres treated to temp road access is not excessive. The FEIS describes how these will be obliterated and rehabbed to return to a productive state after activities are completed.

Comment: *The environmental effects of temporary roads are long-lasting and should be avoided. The one paragraph analysis of the effects of temporary roads on page 326 of the DEIS does not provide the kind of site-specific analysis required by NEPA. Where will the roads be located? What are the road standards? Will they be "put to bed" during the wet season? What are the affected soil types? What is the proximity to sensitive sites like streams, wetlands, meadows, rare plants, big game habitat? Where are the greatest risks of unauthorized use by OHVs?*

Comment: *This project involves excessive road construction impacts. The location of temporary roads must be identified in advance so that sensitive sites can be identified and avoided.*

Response: Locations are displayed in Figures 5, 8, and 11. Because these are not "roads" there are no road standards to apply. These are for temporary use only and built to the minimum level necessary to meet project objectives (FEIS pp. 51). Locations are approximate. A through set of resource protection measures are incorporated into the project design to ensure that temporary access is not provided at the expense of the resources we're attempting to maintain and improve. For example, RPM #9 is intended to ensure that temp roads do not become future unauthorized travel routes; #27 limits temp road location on certain sensitive soils; #38 requires on ground locations to be approved by Forest Service; #42-47 list design elements; #70 specifies that no temp roads will be located in riparian reserves or

RHCAs; and #79 specifies what condition they will be returned to after use. Because they will be obliterated and rehabbed following activities, the effects are not expected to be long-lasting. The effects of temporary roads are discussed throughout Chapter 3: p. 326, 338,353, 361, 378, 386-394, 418-419, 437, 448, 459, 461.

WILDLIFE

Comment: *Converting what is now multi-layered canopy to single layer canopy will reduce habitat for neotropical birds, northern goshawk, Cooper's hawk, and other species dependent on multi-layered, denser canopy closure. Any commercial thinning should retain more trees and canopy closure than 60 sq. feet basal area.*

Response: The FEIS discloses effects to those MIS species listed in the comment (Chapter 3.63). Residual basal area will be variable across stands.

Comment: *With mowing the forest's underbrush we may be killing little animals that you think would not matter; they actually play a big part in the food chain...many organisms depend on the forest underbrush for life support such as: mammals, birds, insects, rodents, plants, arachnids, mostly all living creatures in the forest....By thinning trees and mowing underbrush all animal populations would become endangered or extinct species in the habitat and forest would become unnatural and a quiet wasteland.*

Response: Mowing causes some loss of down woody material and brush which can degrade prey species habitat, but this project would not cause any populations to become endangered or extinct. It will benefit those species whose habitats are lacking on the landscape due to fire suppression and past harvest practices.

Comment: *I have had sightings of Cascade red fox along the Cascade Lakes Highway in the project area. I am wondering if the Forest is going to analyze the impacts of logging on the fox. I know of at least four sightings in the area and it is extremely rare....Roads can increase access for coyotes which may have detrimental effect on this rare fox. I hope you will look into the impacts of logging on the red fox.*

Response: Montane Fox are not a T.E.S. species for R6 of the Forest Service or an MIS species for the Deschutes NF. The Deschutes NF is aware of the sighting along the Cascade Lake Highway, in addition the Deschutes has participated in Winter Carnivore Monitoring in this area as well as across the Forest through a partnership with ODFW. From carnivore monitoring and sighting occurrences across the Forest, this species has been seen utilizing a variety of habitat types. It appears to be somewhat of a generalist, but utilizes high elevation habitat. Including the area around the lodge at the Hoodoo ski resort where one was sighted and photographed frequently. No new roads construction is associated with this project

Comment: *The FS does not analyze the impact of logging on native bees, hence pollination, and so forth.*

Response: The Biological Evaluation determined that the action alternatives would have no impact on western bumblebee: Most common management activities should not directly affect underground nests however, bumble bees above ground in grasses would be vulnerable to fire and to mowing if the blade is low enough to destroy them. Hibernating queens could be very vulnerable to prescribed burns if they are above ground in dry microhabitats. Prescribed burning may have positive or negative effects: direct mortality to the pollinators and change in vegetation composition and structure (NatureServe 2012). Maintaining a diverse assemblage of primarily native flora such that flowers would be constantly available throughout the active season (April to September) would benefit bumble bees (NatureServe 2012).

Comment: *Logging disturbs sensitive wildlife.*

Response: Potential for disturbance effects are disclosed throughout the wildlife sections 3.5 and 3.6.

Comment: *Logging does not create wildlife cover or promote spotted owl connectivity.*

Response: The FEIS describes effects to spotted owl connectivity (p. 168) where foraging habitat will remain untreated to provide connectivity to nesting, roosting and foraging habitat within and adjacent to the project area.

Comment: *The Department wants to recognize the fish and wildlife benefits this project proposes, including creating more forage and cover areas for mule deer, maintaining wildlife movement corridors, re-closing closed roads and closing user-created trails. The Department supports all of these actions.*

Response: Thank you for the comment.

Comment: *As a connected project action, we recommend identifying roads for physical closure or decommissioning that were used during project implementation, affect fish and/or wildlife resources, and are not an essential part of the sustainable road system needed to manage resources long-term throughout the project area.*

Table 26 in the DEIS identifies 155.29 miles of roads that are open for motor vehicle travel in the project area. This is a very high density of roads for the District to have identified as being essential for forest management, particularly after project restoration treatments have been completed. Is this density of roads really necessary for the sustainable road system on a long-term basis? Add another 140 miles of trails, most of which are mountain bike trails, for 300 miles of routes, and one can see how fragmented the project area has become.

The cumulative combination of roads and trails, frequently used across the project area, significantly affects habitat use by wildlife. Extensive research has been conducted documenting the impact motor vehicles have on wildlife and their habitat. The Deschutes NF biologist did an excellent job documenting this research and associated impacts in the Travel Management Project....District is aware that this is a veg project and not a travel management project, but viewed as a connected action, this project can further reduce wildlife habitat fragmentation and restore habitat use by wildlife by closing or decommissioning roads used in the project area that are not an essential part of the sustainable road system. The dept. recommends the District review habitat fragmentation measures the Prineville BLM used for their Tumalo Vegetation and Trail Management Project as a method of assessing fragmentation and tracking patch size across the project area over time.

Response: Various planning projects overlapping the area have closed and decommissioned roads over the last several years through NEPA decisions. The District has not identified a minimum or "sustainable" road system for West Bend area, but will be taking this on over the next year for the entire Bend/Ft. Rock District. It's important to note that the project area includes about 65 miles of routes that could be considered essential (25 miles of Deschutes County and State of Oregon roads and highways, 4 miles of safety act roads (heavily used for recreation), and 36 miles of 4-digit collector roads).

For West Bend, the Forest chose to make an effort to work on implementing those decisions that had yet to be implemented, to maintain road closures where in need of maintenance to be effective, and to rehabilitate user-created travelways which create the same kinds of disturbance as open system roads. This will go a long way in increasing habitat effectiveness in the project area.

The IDT made a concerted effort to design the project so as to retain existing identified hiding cover patches because of the high amount of public use in the area and to address the critical need for mule deer which is large areas of early seral browse in areas of limited disturbance by creating. So the project overall has potential to benefit big game.

Comment: *The DEIS relies on "residual untreated areas" to mitigate for adverse effects on great grey owls. This is a good example of why it is necessary to optimize the mix of treated and untreated areas, instead of maximizing the fuel reduction objective.*

Response: There are no known occurrences of great grey owls in the project area. The FEIS describes effects to existing suitable habitat (primarily thinning from below in second growth ponderosa pine) as potentially negatively impacting prey species and potentially beneficially impacting risk to existing

suitable habitat and facilitating development of future habitat. The analysis concludes that "Overall, treatments proposed will improve great gray owl habitat conditions by promoting the development of large structure and reducing the risk of loss of existing habitat from other large-scale disturbances. FEIS pp. 220-223.

Comment: *The proposed plan amendment is based in part on a flawed rationale that recreation use has diminished the value of big game cover in this area. That is a reason to maintain or increase cover, not diminish cover further. Where adverse effects on big game habitat are already occurring, the FS should not add to the cumulative impacts but rather reduce impacts or mitigate for them.*

The DEIS does not do a great job describing the effects of logging on big game, in particular whether a basal area of 60 is adequate to provide cover for big game, and the spatial arrangement of cover and forage areas. Cover/forage is another way to optimize mix of treated/untreated.

DEIS p. 260 says that big game hiding cover will be 31% after logging. Is this hiding cover "dispersed throughout the key areas" in patches to meet LRMP guidelines? Extensive areas of treatment raise concerns that big game will not find adequate cover, thus reducing potential forage benefits of the project.

Comment: *The LRMP says that wildlife requirements are "minimums" not preferred conditions, and that the FS should strive to provide higher levels of habitat where possible. The FS should not make a bad situation worse by amending the LRMP and further reducing marginal cover that might exist.*

Comment: *The LRMP discourages actions that would increase winter recreation use in areas used by big game. How will this be avoided, when the forest is opened across 12-15,000 acres and more than 50 miles of temp roads are built?*

Response: Hiding cover is maintained through project design. Treatments under the preferred alternative provide long-term foraging opportunities while retaining existing hiding cover and developing future hiding cover throughout summer and winter habitat (FEIS p. 261). The ODFW has promoted the development of future high quality hiding cover, in areas away from roads and trails, because of the high amounts of disturbance that occurs.

Comment: *The DEIS (p. 165) says that logging will reduce fire hazard to owl habitat, but it does not say to what extent logging will reduce the owl dispersal habitat or prey populations or foraging opportunities. Logging causes trade-off for spotted owl conservation, but the DEIS only discloses one side of the equation.*

Response: Effects to dispersal habitat is addressed on pages 166-168 for the action alternatives. The alternatives include a connectivity strategy to provide dispersal opportunities in a north to south continuum throughout the project area. This provides dispersal habitat on a stand level basis to connect the small amount of suitable NRF in the project area to suitable habitat outside the project area. Under Alternatives 3 and 4, more incorporation of diversity in the thinning prescriptions will do even more to create better connectivity in habitat. The total reduction in dispersal by alternative is disclosed in Table 72, p. 173.

Comment: *The DEIS analysis of effects on raptors does not adequately disclose the character and magnitude of the trade-offs involved with logging suitable habitat for the raptors. Merely listing potential negative and positive effects is not enough. The DEIS must disclose more about the magnitude and probability of the different effects. For instance, the decision-maker and public need to know that benefits of logging are improbable (dependent on fire affecting the stand during period when fire behavior modification is effective) while adverse effects are certain (raptors prefer dense forests and will find thinned forests less hospitable).*

Response: The benefits of thinning and fuels reduction are based on the best available science as are the wildlife habitat objectives of the preferred alternative. Habitat for interior forest species will see some negative impacts while facilitating the maintenance of larger trees and development of future

habitat (see for example FEIS p. 202). These tradeoffs are described for wildlife species throughout Chapter 3.5. This project takes a landscape level approach to creating conditions of lower fire hazard and increased resilience. The timeframe for effectiveness of these conditions is disclosed in the FEIS (p. 119), as are the timeframes for the effects to wildlife (FEIS p.).

Comment: *The DEIS p. 201 description of the effects of the no action 160wk habitat. It's not fair or accurate to describe it as all negative.*

Response: The FEIS describes the habitat needs of northern goshawk on pp. 199-201. The FEIS states that there are 9,803 acres of northern goshawk habitat in the project area and then discussed the effects of No Action as a continuation of existing trends, describing what will happen to that habitat over time. The FEIS states that the most significant effect of high stand densities will be the gradual loss of the existing large tree component/nesting habitat (FEIS p. 204).

Comment: *I am concerned about the proposed logging impact on the Cascade fox. I have seen and reported two sightings of the fox along the Cascade Lakes Highway in the West Bend project area. These foxes are very rare and were previously thought to be Sierran red fox. I want to FS to analyze how logging might impact the fox. (see excerpts from listing petition included in George Wuerthner 5/31/13 email).*

Response: Montane Fox are not a TES for R6 of the Forest Service or an MIS species for the Deschutes NF. The Deschutes NF is aware of the sighting along the Cascade Lake Highway, in addition the Deschutes has participated in Winter Carnivore Monitoring in this area as well as across the Forest through a partnership with ODFW. From carnivore monitoring and sighting occurrences across the Forest, this species has been seen utilizing a variety of habitat types. It appears to be somewhat of a generalist, but utilizes high elevation habitat. Including the area around the lodge at the Hoodoo ski resort where one was sighted and photographed frequently. No new roads construction is associated with this project.

Comment: *This forest needs more cover left for deer and elk, more canopy left for accipiter hawks, and no logging in late and old successional forest stands.*

Response: The purpose and need and objectives for action is described in the FEIS pp. 2-6. Needs of the species listed are addressed in Chapter 3.6

Comment: *Mule deer need denser cover for hiding from predators and protection from winter storms. This area currently has only 30% cover for deer in important winter range habitat. This is already 10% less cover than what is required by science-based Forest Plan standards. Further decreasing the amount of cover for deer and elk is unacceptable.*

Response: Hiding cover for mule deer is addressed in the FEIS pp. 250-264. Hiding cover in the project area is maintained at Forest Plan standard and guideline levels.

Comment: *Drop clearcutting of lodgepole pine to provide deer cover as well as habitat for woodpeckers. Drop all logging in moister and transitional mixed conifer stands to leave habitat intact for northern spotted owl, American marten, Pacific fisher, and pileated woodpecker.*

Drop all commercial logging in historic northern goshawk territories. Drop all units in northern spotted owl connectivity stands.

Response: The FEIS describes landscape-scale wildlife habitat objectives for the project area (p. 6-7 and throughout Chapter 3.5). Effects and benefits are described for the species listed.

Comment: *The forest is proposing to create mule deer hiding cover patches by clear-cutting up to 10 acre patches through the forest, also claiming to "promote spotted owl connectivity habitat" by heavily logging existing suitable habitat and proposing heavy logging along the scenic highway corridor to Mt. Bachelor to promote sun-lighting on the highway. This is truly Orwellian logic. Do you think we can't see through it and recognize it as rationalization for maximizing commercial logging, no matter what the*

cost to listed and management indicator wildlife, fish, sensitive plants, ecological integrity, biodiversity, and recreational values?

Response: The objectives for the treatments are described in the FEIS in Chapter 2 and Appendix B pp. 530-534.

Comment: *Further, the FS would be converting what is now multi-layered canopy in mixed conifer areas with ponderosa pine to single layer canopy, reducing habitat for neotropical birds, northern goshawk, Cooper's hawk, and other species dependent on multi-layered denser canopy closure.*

Response: Effects to these species and other wildlife MIS are disclosed in the FEIS sections 3.6. According to the HRV analysis, single story ponderosa pine is far below the proportion that would have occurred historically.

WILDLIFE: SNAGS and DOWN WOOD / DECAID ANALYSIS

Comment: *It would be useful to know: how many tree/acre will be removed by logging? How many trees/acre will be retained? How many green tree/acre are needed to ensure continuous recruitment of 50% and 80% tolerance levels for key wildlife?*

Response: An extensive analysis of snags, down wood, and green tree replacements is included in Appendix F. The number of trees per acre remaining in a stand is dependent on the existing number of trees and the objectives for the stand. It is also dependent on the size of the trees in the stand. Table 153 displays the estimated number of green tree replacements that would be needed by habitat type.

Comment: *DEIS Appendix F indicates that the project area currently contains very little habitat with abundant snags and down wood meeting 50-80% tolerance levels for American marten, Williamson's sapsucker, pileated woodpeckers, white-headed woodpecker, black-backed woodpecker, three-toed woodpecker, and hair woodpecker. Logging won't improve these conditions; it will make them worse requiring mitigation alternatives and more untreated skips within and among treatment units.*

Response: The existing conditions and tolerance levels for species associated with snags and wood is described in Appendix F. The needs for these species varies as some prefer old-forest, singles-storied ponderosa pine and some prefer recently dead lodgepole pine. The project does include untreated skips and stand-level retention (see Table 1).

Comment: *The DEIS does not show whether logging will move the landscape toward or away from the desired conditions for key wildlife associated with snags and dead wood.*

Response: The conclusions for these species are disclosed throughout Chapters 3.5 and 3.6 and vary by the type of habitat they rely on. For example, on pages 179-181 states that long-term benefits to habitat for Lewis' woodpecker will occur under all action alternatives and Alternatives will promote Lewis' woodpecker habitat; and p. 295 states that on the watershed level, treatments will reduce the amount of suitable habitat available for black-back woodpeckers, but it is a short-lived habitat that is extensively available on the Forest.

Comment: *We urge the FS to avoid salvage logging and dedicate areas subject to significant mortality to meet the needs of black-backed woodpecker and other wildlife that thrive in that habitat type.*

Comment: *The DEIS defines "salvage" as removal of dead lodgepole in excess of wildlife standards, but the FS lacks credible standards for wildlife such as black-backed woodpeckers that thrive in dense stands of dead lodgepole. Existing LRMP standards are outdated because they are based on scientifically discredited "potential population" methodology. New information indicates the need to retain and recruit far more snags to meet the life needs of snag-associated wildlife.*

Response: Vast areas are subject to significant mortality. The FEIS shows that 20,273 acres of habitat for the black-backed woodpecker are currently available in the watershed and 446,152 acres available in the Forest. The species is considered secure globally, nationally, and state-wide (FEIS p. 295).

Comment: *The DEIS analysis of MIS starts with a summary of key findings, including consistency with LRMP S&Gs. This is misleading because S&Gs are outdated and inadequate to meet the needs of MIS associated with snags and dead wood.*

Response: Newer scientific information is provided throughout the analysis of wildlife, but an assessment of consistency with the Forest Plan is required.

Comment: *The DEIS says that it is meeting Landbird Strategy for BBWP by leaving > 1,000-acre patch of unmanaged lodgepole. It is doubtful this is enough to ensure viability of BBWP populations. How many 1,000-acre patches are necessary and how many should be left in this project? i.e. what is optimal mix of treated/untreated.*

Response: Forest-wide there is approximately 446,152 acres of habitat available for BBWP. The Forest has seen a considerable amount of fire-related mortality over the last decade. The FEIS concludes that the BBWP, (which is a Forest Management Indicator Species, not Regionally Sensitive or federally listed as threatened or endangered) the action alternatives would benefit the species by reducing the risk of stand replacing fire. By thinning and reducing fuel concentrations it will allow for small events to occur that provide habitat and maintain populations across the landscape rather than large expanses of habitat from large wildfires that are beneficial for only a short time (FEIS p. 297).

Comment: *We're concerned about using DecAID's data on unmanaged stands to represent the historic range of variability for snags. DecAID includes caveats which clearly indicate that they lack data from unsalvaged disturbances that were an important part of the evolutionary landscape of eastern Oregon, so DecAID reference conditions understate the level of snags that should be considered "natural."*

Response: Other sources of information on the HRV of snags are provided in the FEIS (p. 302-303) and Appendix F.

Comment: *DEIS p. 306 says that 10% "retention patches" will mitigate for loss of snags. The FEIS needs to conduct an analysis to see if 20% or 30% would better meet objectives over the long term.*

Response: The FEIS describes retention strategies based on the elevation and focal species (FEIS pp. 6-7). In the lower elevation, low-productivity ponderosa pine sites, retention is a combination of untreated areas that comprise at least 10% of the area, clumps within stands, and existing hiding cover that is within and outside units. Natural mortality is expected to continue within stands due to lightening, wind throw, insects, or prescribed fire; natural mortality is expected to be at a higher rate in the retention areas. Different species utilize different habitat types; therefore, in this area where large trees and snags are lacking, the long-term objectives are primarily focused on developing and maintaining large trees by creating resilience.

Comment: *The DEIS doesn't use information in DecAID to shed light on effects of logging in terms of resulting tolerance levels for species associated with dead wood.*

Response: Information from DecAID is summarized for species in Appendix F. Effects to each species are addressed in Chapter 3.6 and an overall conclusion on snags and down wood in the project area is provided on page 313.

SOILS

Comment: *Logging removes biomass from the forest. Biomass is critical to the long-term productivity of the forest.*

Response: Treatments will remove some of the biomass temporarily, but much will be left too. Treatments will induce new growth and increase growth rates so that the forest will generate new biomass. Too much biomass can create poor growing conditions, jeopardize forest health, and put stands at risk of total loss by wildfire. Regulation of biomass is important in maintaining a healthy forest. In natural conditions, competition and disturbance regulate biomass production. In managed

conditions, regulation of biomass production is achieved by manipulating stand density so that growth and health are maximized.

Comment: *Logging requires soil compaction*

Response: There will be some compaction that results from mechanical treatments such as logging. There will also be areas in treatment units where compaction will not occur. Not all compaction is detrimental, and there is a measure of detrimental soil disturbance which is expected and considered acceptable. There are S&Gs in the Deschutes NF LRMP that set limits to the extent of detrimental soil impacts (such as heavy compaction) considered acceptable. Effects of the proposed treatments on soil resources is analyzed and disclosed in the DEIS. BMPs, PDCs, and mitigation are prescribed in the DEIS so that the extent of detrimental soil conditions is contained, and not to exceed LRMP S&Gs.

Comment: *Logging creates soil erosion.*

Response: Soil erosion occurs naturally and varies depending on location and the biophysical environment. In Central Oregon where intense runoff events occur only periodically, the soils have high infiltration rates, and streams are few the natural rates of erosion are low. But logging can cause accelerated erosion. For ground-based mechanical treatments like those prescribed in the DEIS, accelerated erosion is typically associated with hardened surfaces such as the skidding network (i.e., roads, landings, and skid trails) where runoff can be intercepted, concentrated, and routed. The DEIS prescribes BMPs, PDCs, and mitigation to limit the extent of the skidding network, and analyzes the effects of proposed treatments on soil and water resources. Additionally, erosion control is mandated by law to be included as standard required specifications in all contracts governing the removal of merchantable timber from National Forest lands, so that accelerated erosion is prevented or minimized.

TIMBER AND OTHER WOOD PRODUCTS

Comment: *Bring back logging and harvesting of timber from the Deschutes NF and others throughout the Northwest. We are blessed to have such a wonderful renewable resource in our backyard and utilizing it with timber sales and then replanting is the sensible and WISE thing to do for our community to create jobs as well as hopefully prevent another catastrophic fire from destroying our great forests.*

Response: The Deschutes NF regularly conducts timber harvest. This project would contribute between 26.5 and 31.8 mmbf and would create or maintain between about 155 and 190 jobs (FEIS p. 471).

Comment: *Maximize the use of wood for heating homes in efficient burn devices...far better than slash piles and forest fires. Minimize all barriers to non-commercial wood cutters.*

Response: This project will provide some opportunities for firewood cutting although most work will be completed through stewardship contracting or timber sales.

Comment: *Define the West Bend forest as recreation nirvana, manage it as a park. Such is its highest economic value today and grows the healthiest forest for when mills are in place decades in the future. Such will keep our one mill and biofuel plants pegged to capacity.*

Response: The Deschutes LRMP as amended (FEIS pp. 12-17) provides the goals and objectives for each management allocation as well as Forest-wide goals. Other laws and regulations provide additional direction and sideboards on how the Forest will be managed (FEIS pp. 18-19).

ECONOMICS / SOCIAL IMPACTS

Comment: *What are you going to do with the money you make from the logs?*

Response: When thinning and harvesting timber, what happens with the money depends on how we sell the logs. With a traditional timber sale, the money received for the logs goes to the U.S. If we use

stewardship contracts, the value of the logs is used to pay for restoration work in that portion of the forest such as small tree thinning, fuels reduction, road closures, etc. In other words, with stewardship projects, the money stays here on the Deschutes National Forest.

Comment: *Keep the Gilchrist Mill fully employed and healthy. It is jobs and we need someplace to utilize the logs from excess trees in our overcrowded forest. Having said that, our forest's highest community economic value is recreation.*

Response: The FEIS acknowledges a need to maintain forest management infrastructure and workforce (FEIS pp. 3-4). This project will supply approximately 31.8 mmbf and will create or maintain about 190 jobs (FEIS p. 471). The value of the area's recreation is recognized throughout the FEIS (pp. 2, 5, 52-54. 329-361).

Comment: *Mountain biking in Bend is quickly becoming a multi-million dollar a year industry. I deeply hope that you have no plans of eliminating any of the trails.*

Response: This project does not propose to eliminate any of the system trails.

Comment: *While the economic analysis appears to be adequate there certainly wasn't any time spent on analyzing the social effects of the West Bend project. What are direct, indirect, and cumulative social effects of the various alternatives on the region?*

Response: The FEIS considered potential impacts to forest users including motorized access to the area (pp. 325-328); recreation use and experience (pp. 329-361); scenery and aesthetics (pp. 362-366; wilderness/potential wilderness (pp. 395-416); civil rights and social justice (p. 477); and human health and safety (p. 480).

POTENTIAL WILDERNESS / ROADLESS AREAS

Comment: *Drop all timber sales overlapping Oregon Wild's Tumalo Creek roadless area and any other roadless areas or potential wilderness in the unit.*

Comment: *Re: possible un-inventoried roadless area in cutting units. We respectfully request a further analysis of the uninventoried roadless area situation that may be included in cutting units. We submitted maps of possible uninventoried roadless. There is some obvious old cutting inside our areas and simple "ground-truthing" should verify if it is roadless or not.*

Response: Most uninventoried roadless areas identified by Oregon Wild are to be treated with mowing and underburning or precommercial thinning (Table 192, p. 416). These units are in an area between Inventoried Roadless and private property where fuels reduction is important. As described below unit 355, which has a commercial component has been modified to about 40% of its original area (down from 92 to 36 acres), and will be completed with commercial firewood contractor eliminating temp road access. And Unit 341 will also be completed with commercial firewood contractor which will eliminate the temp road access needed because they can work form the existing winter trails. Unit 379 has been dropped.

Comment: *We urge the FS to drop the proposed logging in potential wilderness adjacent to the Bend Watershed IRA as well as other undeveloped lands. Large blocks of habitat are rare and under-represented on the landscape. Such areas represent unique opportunities to allow natural processes to operate with less human interference.*

Response: The areas determined to be PWA are contiguous with and adjacent to the larger Bend Inventoried Roadless Area, which is contiguous with Wilderness to the west so the undeveloped block is a very large area where natural processes will operate. Treatments within the PWA are along winter recreation trails and private property and have been modified as described in previous response.

Comment: *We urge the FS to use a more inclusive definition of potential wilderness that does not apply such a large "buffer" adjacent to roads. The 300 foot buffers often used by Region 6 to determine the*

boundaries of PWAs are exceedingly large and unsupported by logic and evidence. The FS must remember they are looking for "potential" wilderness, so they should be inclusive....when constructing new roads, the FS never discloses adverse effects extending 300 feet on either side of a road....firewood cutting w/i 300 feet of roads is not justification for the wide buffers in PWA analysis. See pp. 16-17 Oregon Wild comments re: PWA analysis.

Response: Step 3 of the PWA inventory process documents the rationale based on professional judgment (evidence of recognizable stumps, skid trails etc.), existing decisions (Forest-wide Travel Management EIS of 2011), data stored in the INFRA database, and local knowledge (danger tree removal, firewood cutting activities, roadside maintenance) to determine the road edge effect and resulting buffer. The inventory process is outlined in the PWA report, Appendix A which is located in the project file and incorporated by reference in the FEIS (p. 400).

MISCELLANEUS

Comment: *Another problem I see is vandalism of equipment which leads to leaking fuels, oils, and hydraulics – soil contaminations. An unarmed presence from dusk to dawn is a great deterrent.*

Response: Contractors are responsible for ensuring the safety of their equipment that is staged in the forest.

Comment: *I want you to consider the effect of logging on forest genetics. A study in Ontario found that logging significantly reduced the genetic variety in forests compared to unlogged forests. Given climate change, reduction in genetic variability could significantly reduce the ability of forests to cope with changing climate. Certainly foresters are not qualified to determine which trees possess favorable genetics that will be valuable in coming years. (Effects of harvesting on genetic diversity in old growth eastern white pine in Ontario, Canada. Buchert et al 2002).*

Response: "Logging" as described in the paper by Buchert was a long-term sustained effort of develop the genetic diversity of a stand on a less than 1 hectare plot. The sample comparison was from 96 trees to 25 trees and the genetic diversity between the two populations. The thinning design in the West Bend project selects the largest healthiest trees present, leaves the stands stocked, and removes most of the less improved trees. The genetic diversity is not on a hectare but on a landscape. Dysgenic tree selection in this manner does not occur, however the original "logging" in the 1920s may have left as residual seed trees or undesired products the intermediate, overtopped small trees which may have had poor genetic condition. The current stands are expected to be genetically diverse since dysgenic selection was not repeatedly conducted.

Comment: *The Deschutes NF is about 1,596,900 acres and the project area is a bit less than 22,000 acres. Doing the math and assuming it will take 3 years to complete the project, it will take the USFS about 217 years to cleanse the entire Deschutes forest. Ergo, why bother using these methods?*

Response: The purpose of the project is not to "cleanse" the forest but to create resilience and improve forest health. Vegetation management (thinning, harvest, fuels reduction) occurs across the Deschutes National Forest every year.

Comment: *The public really isn't being given much choice as to what is to be done to their forest.*

Response: Management of the Forest is guided by direction the Forest Plan as amended (FEIS pp. 12 - 17. The proposed action is based on goals and objectives outlined in the Forest Plan and is designed to meet the purpose and need for action. The Forest provided the public opportunities to provide input throughout the NEPA process, collaborated with a diverse group of stakeholders, (FEIS p. 8) and incorporated public concerns into the design of all alternatives. In addition, the public comment period provided additional opportunity for the public to provide input on the project and analysis of effects. This Appendix documents the consideration of public comment.

Comment: *The agency must avoid portraying the effects of the proposed action in uniformly positive terms, while describing the effects of no action in uniformly negative terms. NEPA requires disclosure of the trade-offs among competing uses. The West Bend DEIS could do a much better job highlighting and mitigating the trade-offs involved in such an extensive logging project..*

Response: The FEIS acknowledges and discloses both positive and negative effects. This is particularly true where wildlife habitat is concerned. For species that rely on more open conditions of ponderosa pine with larger trees, the project will be moving towards the desired condition. Species that are currently lacking in that habitat type are the Region 6 Sensitive white-headed woodpecker and Lewis' woodpecker. The FEIS shows long-term benefits by maintenance of large trees, opening stands and accelerating development of LOS (FEIS pp. 176-177). Conversely, for species that rely on denser conditions or even beetle outbreaks and burned forest would see some decrease in habitat.

Comment: *The biggest problems I've encountered is the great speed and carelessness of the log truck drivers (I have been run off the road, or taken to the ditch many times to avoid a head-on with careless drivers).*

Response: During operations there typically are signs that notify if there is truck traffic. The Forest Service is committed to ensuring public notification of where operations will be occurring, particularly because of the high amount of public use in the West Bend project area. The public will be asked to recreate in areas where timber operations are not occurring and avoid roads that are being used for log haul.

Scientific References Submitted with Comments

Referenced Document	Forest Service Consideration / Response
Kline, Jeffrey D.; Mazzotta, Marisa J. 2012. Evaluating tradeoffs among ecosystem services in the management of public lands. Gen. Tech. Rep. PNW-GTR-865. Portland, R: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 48 p. http://www.fs.fed.us/pnw/pubs/pnw_gtr865.pdf Comment: *"The West Bend DEIS could do a much better job highlighting and mitigating the trade-offs involved in such an extensive logging project."*	This Forest Service report reviews the economic theory of ecosystem services as it applies to public land management, and considers what it implies about the types of biophysical and other data needed to characterize management outcomes as changes in ecosystem services. The West Bend EIS provides detailed analysis of the expected effects of the proposed actions throughout Chapter 3. It also describes the expected benefits that will occur. Throughout much of the effects analysis there are apparent trade-offs.
New ideas for implementing variable spacing are offered by Churchill et al (2013). Churchill, D.J., M.C. Dalhgreen, A.J. Larson, and J.F. Franklin. 2013. The ICO approach to restoring spatial pattern in dry forests: Implementation guide. Version 1.0. Stewardship Forestry, Vashon, Washington, USA. http://www.cfc.umt.edu/ForestEcology/files/ICO_Manager_Guide.pdf and Derek J. Churchill, Andrew J. Larson, Matthew C. Dahlgreen, Jerry F. Franklin, Paul F. Hessburg, and James A. Lutz. 2013. Restoring forest resilience: From reference spatial patterns to silvicultural prescriptions and monitoring. Forest Ecology and Management 291 (2013) 442–457.	The referenced work describes a methodology for identifying clumpiness of historic stands and then applying clumpiness in the marking of stands for treatment. Identifying the distance between trees, which defines the clumping, and the percentage of trees in the different size clumps are two important parts to be able to implement this strategy. Monitoring of two recent projects on the Bend/Ft. Rock Ranger District using LiDar identified the clumping patterns of three different marking methods. This monitoring utilized methods similar to Churchill et al. The monitoring found that with typical marking on the District, many of the trees are found in small aggregations/clumps and there are few larger clumps. Implementation of the variability strategies in the preferred alternative may increase the amount of larger clumps that result.
Heiken, D. 2012. Thinking About Dead Wood in Managed Landscapes (Powerpoint) https://dl.dropbox.com/u/47741/dead%20wood%20slides%202012.ppt Comment*: "Statement DEIS p. 306 that thinning will*	The referenced document is not peer reviewed science. This Powerpoint presentation offers information on how dead wood functions in the forest ecosystem and suggests mitigations for the snag gap which is purportedly widened with salvage logging, clearcutting, and thinning.

result in more large trees in the long-term that can be recruited into down wood is not supported by the evidence. Logging will likely reduce number of pieces and volume of large down wood....should be viewed as an adverse effect of logging that needs to be mitigated rather than a beneficial effect that justifies logging."	The West Bend project relies on best available science (DecAID) to analyze dead wood habitat and the potential effects to species that rely on it. Comments concerning snags, down wood, etc. are included in this appendix pages 664-665.
Scott, Joe. 2003. Canopy Fuel Treatment Standards for the Wildland-Urban Interface. USDA Forest Service Proceedings RMRS-P-29. 2003. http://www.fs.fed.us/rm/pubs/rmrs_p029/rmrs_p029_029_038.pdf Comment: *"Modeling shows that canopy fuel reduction is accomplished at the expense of increasing surface fire intensity."*	This paper discusses recommended fuel treatment standards where the goal is protecting firefighters and homeowners in the wildland-urban interface in the event of a wildfire. It provides a guideline for creating a crown-fire-free zone. For WUI in the West Bend project, objectives for fire hazard reduction are based on the LRMP and CWPPs (FEIS p. 116-117). The project area includes fuel reduction strategies that are not related to protecting structures on private land. Strategies related to the desired condition for fuels are discussed on pp. 131-133.
Keeley, J.E.; Aplet, G.H.; Christensen, N.L.; Conard, S.C.; Johnson, E.A.; Omi, P.N.; Peterson, D.L.; Swetnam, T.W. 2009. Ecological foundations for fire management in North American forest and shrubland ecosystems. Gen. Tech. Rep. PNW-GTR-779. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 92 p. http://www.fs.fed.us/pnw/pubs/pnw_gtr779.pdf. Comment: "*Thinning is most effective when it removes understory trees, because larger overstory trees are more resistant to heat injury (Agee and Skinner 2005). In addition, shade and competition from larger trees slows the recruitment of younger trees in the understory."*	This is a general discussion of national fire regimes. From abstract: "This synthesis provides an ecological foundation for management of the diverse ecosystems and fire regimes of North America, based on scientific principles of fire interactions with vegetation, fuels, and biophysical processes. Although a large amount of scientific data on fire exists, most of those data have been collected at small spatial and temporal scales. Thus it is challenging to develop consistent science-based plans for large spatial and temporal scales where most fire management and planning occur...." Thinning will be from below, where the smallest trees are removed first and the largest trees are retained (FEIS p. 43). The comment made about thinning being effective when removing understory trees is addressed previously in this Appendix under "Forested Vegetation – Size of Trees."
Whitehead, R.J. G. Russo, B.C. Hawkes, S.W. Taylor, B.N. Brown, H.J. Barclay, and R.A. Benton. 2006. Effect of a spaced thinning in mature lodgepole pine on within-stand microclimate and fine fuel moisture content. In P.L. Andrews and B.W. Butler (compilers). Fuels Management - How to Measure Success. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado, Proceedings RMRS-P-41. Pp. 523-536. http://www.fs.fed.us/rm/pubs/rmrs_p041.html Comment: *"Removing approximately half of the basal area of a mature stand of lodgepole pine in southeastern British Columbia, by thinning from below to uniform 4 m inter-tree spacing, resulted in decreased canopy interception of rainfall and increased within-stand solar radiation, windspeed, and near surface air temperature."* Comment: *"We urge the FS to focus fuel treatments on the understory. Canopy fuels in mature forests are not a significant fire hazard...."*	This paper compared the fuels and weather characteristics in a thinned stand to an unthinned stand. The fuel moisture differences mostly occurred in early season or following rain events. As weather dries, the fuels in the thinned and control did not show statistical difference. The wind speeds in a thinned stand did not increase over an unthinned stand. This paper does not contradict any analysis in the West Bend EIS. Mature lodgepole pine forest occurs in the western portion of the West Bend project area. The FEIS notes (Table 46, p. 131) that where sufficient treatment of surface fuels occurs, the overall reduction in expected fire behavior and fire severity usually outweigh the changes in fire weather factors such as wind speed and fuel moisture. Fuel treatment effectiveness comments are addressed on pages 642-644 of this appendix. The differences in fuel moistures are minimal as fuels in thinned and unthinned areas dry. The fuels section identifies not only the fuels condition but the fuel hazard. The fuels section includes a fire hazard analysis which utilizes modeling based on best available science to include modeling of fuel moistures (which are influences by solar radiation and air temperature) and wind speeds. The fuel moisture and wind conditions for which the analysis was modeled can be found on pp. 118-120, as well as in Appendix C. The results of this analysis can be found in section 3.4. The focus on thinning in the West Bend project includes fire and insect resilience, not just crown fire susceptibility.

Rutherford V. Platt, Thomas T. Veblen, and Rosemary L. Sherriff. 2006. Are Wildfire Mitigation and Restoration of Historic Forest Structure Compatible? A Spatial Modeling Assessment. Annals of the Association of American Geographers, 96(3), 2006, pp. 455–470. http://www.colorado.edu/geography/class_homepages/geog_4430_f10/Platt%20et%20al_Wildfire%20Mitigation_AnAAG_2006.PDF. Comment: "*Models show that maintaining canopy cover is a useful way to reduce fire hazard, while removing canopy increases fire hazard....When all else is equal open canopies lead to reduced fuel moisture and increased midflame windspeed, which increase potential fireline intensity.*"	Abstract discusses ponderosa pine-dominated montane forest zone in Boulder County, Colorado mostly on private lands "and the need for wildfire mitigation and restoration of historic forest structure are potentially needed." Much of the West Bend project is dry east-side forests of central Oregon where one of the project's purpose and needs is to return fire to the landscape. The use of Lidar, satellite imagery, aerial photography, and fuels modeling helped resource specialists during their analysis. The FEIS notes (Table 46, p. 131) that where sufficient treatment of surface fuels occurs, the overall reduction in expected fire behavior and fire severity usually outweighs the changes in fire weather factors such as wind speed and fuel moisture. The fuel section includes a fire hazard analysis which utilizes modeling based on best available science, and it includes adjustments made to the canopy data (canopy base height, crown bulk density, canopy closure) based on proposed prescriptions under each action alternative. There is also a need to maintain and restore forest health, which includes the need to respond to influences like insects and disease.
Henry Carey and Martha Schumann. Modifying WildFire Behavior – The Effectiveness of Fuel Treatments — The Status of Our Knowledge. April 2003; http://web.archive.org/web/20070702114635/http://theforesttrust.org/images/swcenter/pdf/WorkingPaper2.pdf . Comment: *Models show that maintaining canopy cover is a useful way to reduce fire hazard, while removing canopy increases fire hazard.*	This unpublished review is outdated because it does not incorporate the recent compilation of new studies designed to characterize the ecological effects of thinning and prescribed fire as means of fuels reduction. See for example: Youngblood et al. 2008. Changes in fuelbed characteristics and resulting fire potentials after fuel reduction treatments in dry forests of the Blue Mountains, northeastern Oregon. Forest Ecology and Management 255: 3151-3169. Also: Stephens et al. 1009. Fire treatment effects on vegetation structure, fuels, and potential fire severity in western U.S. forests. Ecological Applications 19: 305-320. Also see- Ecological Restoration Institute. 2013. The efficacy of hazardous fuel treatments: A rapid assessment of the economic and ecologic consequences of alternative hazardous fuel treatments: A summary document for policy makers. Northern Arizona University. 28 pp. The most recent publication of Omi and Martinson, 2013 supports the basic principles of fire resilient forests cited on pg. 131 of the FEIS and recognizes the 'importance of opening the canopy in order to achieve the maximum benefits of hazard reduction.' The FEIS notes (Table 46, p. 131) that where sufficient treatment of surface fuels occurs, the overall reduction in expected fire behavior and fire severity usually outweigh the changes in fire weather factors such as wind speed and fuel moisture. The fuels section includes a fire hazard analysis which utilizes modeling based on best available science. This analysis includes adjustments made to the canopy data (canopy base height, crown bulk density, canopy closure) based on proposed prescriptions under each action alternative.
Tiedemann, A.R., Klemmedson, J. O., and Evelyn L. Bull, *Solution of forest health problems with prescribed fire: Are forest productivity and wildlife at risk?,* Forest Ecology and Management 127 (2000) 1±18 3, http://web.archive.org/web/20030618183637/http://147.46.94.112/forestfire/f14_20001271301.pdf Comment: "*The potential effects of prescribed burning on a landscape scale should be carefully examined to determine if changes caused by burning are compatible with other management objectives for wildlife.*"	The FEIS relies on the best available science to estimate the effects of prescribed underburning on wildlife and to incorporate project design measures to minimize unwanted effects).

NEPA states that comments on an EIS shall be as specific as possible (40 CFR 1503.3 Specificity of Comments). The following documents were submitted without any direct reference to the West Bend project. In this case the referenced document was evaluated for relevance to the project. The following explains the Forest Service rationale for categorizing these as non-substantive comments.

Lindenmayer, David B., Malcolm L. Hunter, Philip J. Burton, and Philip Gibbons 2009. Effects of logging on fire regimes in moist forests. Conservation Letters 2(2009) 271-277.
This paper addresses the changes that industrial logging practices in native forests may have on fire regimes and how that may affect biodiversity. The authors distinguish this relationship in moist forest from dry forest such as ponderosa pine forest. This paper was sent in with comments, but was not referenced within the written comments. As the paper points out, the environmental context is an important consideration in the proposed actions in the West Bend project area. The project area is expected to move closer to or be maintained within the historic range of variability following harvest and fuels reduction under all three action alternatives.

Baker, William L., and Donna S. Ehle. 2003. Uncertainty in fire history and restoration of ponderosa pine forests in the western United States. USDA Forest Service Proceedings RMRS-P29.
This paper argues that prescribed burning large areas of ponderosa pine forests at short intervals (e.g. less than 20 years) lacks a sound basis in science, and should not be done now if the goal is restoration of a pre-EuroAmerican fire regime. This paper was sent in with comments, but was not referenced in written comments. The West Bend project proposes to reintroduce fire into fire-dependent ecosystems. It does not prescribe a particular return interval for prescribed fire.

Hessburg, Paul F., R. Brion Salter, and Kevin M. James. 2007. Re-examining fire severity relations in pre-management era mixed conifer forests: inferences from landscape patterns of forest structure. Landscape Ecol http://www.fs.fed.us/rm/pubs/rmrs_gtr292/2007_hessburg.pdf. This study used forest structure to predict pre-management era fire severity across three bio-geoclimatic zones in eastern Washington. They determined that mixed severity fires were most prevalent, regardless of forest type and that evidence for low severity fires as a primary influence or of abundant old park-like patches was lacking in both dry and moist mixed conifer forests. The West Bend project area is dominated by ponderosa pine and mixed conifer dry influenced by the ponderosa pine. As the author mentions in the paper, the dominant mixed severity fire in dry types was a surface fire dominated regime which "looks like low severity fire" following the event. This is because most overstory trees survive. The author also warns that continuous fuels in current conditions have the potential to increase the patch sizes in these types compared to the fine or small patch size in the historical stands.

Baker, William. L. 2012. Implications of spatially extensive historical data from surveys for restoring dry forests of Oregon's eastern Cascades. Ecosphere 3(3):23. In this paper Baker questions the notions that high surface-fire frequencies can restore and maintain structure of ponderosa pine forests because of a lack of reliable fire-history research. Baker's study area is to the west of the West Bend project area in much more mixed conifer type stand with higher productivity than found in the range of the West Bend project.

A recent paper by Keala Hagmann, Jerry Franklin, and K. Norman Johnson uses extensive historical cruise data to identify stocking levels. "A historical landscape emerges which supports current working hypotheses that frequent, low- to moderate-severity wildfires maintained a predominantly low-density forest dominated by large, fire- and drought-tolerant ponderosa pines across a significant moisture and productivity gradient from the driest ponderosa pine to the mixed-conifer habitat types. [Hagmann, R. Keala, Jerry F. Franklin, and K. Norman Johnson. 2013. Historical structure and composition of ponderosa pine and mixed-conifer forests in south-central Oregon. Forest Ecology and Management (In Press).]

The lengthy body of science regarding fire-history research, which includes local fire-history research, is utilized to inform the historic condition and desired condition, as well as the strategy for West Bend and is cited at FEIS p. 125-126.

Marlon, Jennifer R., et al. 2012. Long-term perspective on wildfires in the western USA. PNAS E535-E543. www.pnas.org/cgi/doi/10.1073/pnas.1112839109. From the abstract: Understanding the causes and consequences of wildfires in forests of the western United States requires integrated information about fire, climate changes, and human activity on multiple temporal scales ..... there is now a forest "fire deficit" in the western United States attributable to the combined effects of human activities, ecological, and climate changes. Large fires in the late 20th and 21st century fires have begun to address the fire deficit, but it is continuing to grow. The West Bend project will reduce forest fuels, increase resilience to fire and other disturbances, and uses best available science and guiding

documents such as CWPPS and the LRMP in the project design. It is unclear how the paper on long-term perspectives on wildfires would be used to inform the project's objectives or effects analysis.

Pierce, Jennifer L., Grant A. Meyer, and A. J. Timothy Jull. 2004. Fire-induced erosion and millennial-scale climate change in northern ponderosa pine forests. Nature 432(4):87-90.

Jennifer Pierce and Grant Meyer. Long-term fire history from alluvial fan sediments: The role of drought and climate variability, and implications for management of Rocky Mountain forests.

Whitlock, Cathy, et al. 2008. Long-term relations among fire, fuel, and climate in the north-western US based on lake-sediment studies. International Journal of Wildland Fire. 2008(17): 72-83.

MacDonald, Glen M., and Roslyn A. Case. 2005. Variations in the Pacific decadal oscillation over the past millennium. Geophysical Research Letters. Vol. 32. L08703.

Kitzberger, Thomas, et al. 2007. Contingent Pacific-Atlantic Ocean influence on multi-century wildfire synchrony over western North America. PNAS 104(2): 543-548.
Several papers were submitted that review climate change and its relation to the history of wildfire. They were not specifically referenced in the comments. The West Bend EIS acknowledges that climate may be a factor in larger, more frequent, and more severe fires (FEIS p. 483). The proposed actions are expected to lead to more resilience should the climate become warmer and drier.

Drury, S.A., T. T. Veblen. 2007. Spatial and temporal variability in fire occurrence within the Las Bayas Forestry Reserve, Durango Mexico. Plant Ecol.
This paper documents the author's attempts to assess how climate variation, changes in land-use practices, habitat type, and topographic position influence the fire regime. The area of study is the Sierra Madrean pine-oak ecosystems in Mexico. This paper concludes that both climate and humans have influenced the fire regime in that area. The research does not contradict any research used in the West Bend project EIS regarding fire regimes of the project area.

Brown, Peter M., and Blaine Cook. 2005. Early settlement forest structure in Black Hills ponderosa pine forests. Forest Ecology and Management 223 (2006 284-290.
The results of this study of historic ponderosa pine forests in the Black Hills "largely support previous findings of changes in forest structure in ponderosa pine forests in response to timber harvest and loss of historical fire regimes" but also shows that the study area contained more structural variability than ponderosa pine in the southwest. This paper does not contradict any research used in the West Bend EIS regarding historical structure of the project area.

Rhodes, Johnathon J., William L. Baker. 2008. Fire probability, fuel treatment effectiveness, and ecological tradeoffs in Western U.S. public forests. The Open Science Forest Journal. 2008(1): 1-7. This paper presents a framework to examine the likelihood that wildfire will follow fuel treatments. The authors chose this research question because they felt that fuels will rebound after treatment, eventually negating treatment effects. From introduction: "Therefore, the necessary, but not sufficient, condition for fuel treatment effectiveness is that a fire affects a treated area while the fuels that contribute to high-severity fire have been reduced". Authors conclude: "Even in ponderosa pine forests that burn relatively frequently, our regional analysis indicates that after 17 cycles of treatments, only slightly more than 50% of treated areas could potentially have fire severity reduced, on average. Our results indicate that high-severity fire is far from inevitable in areas left untreated and is, instead, expected to affect only a relatively small fraction of such areas at the broad scale of our analysis. Factoring in the probability of fire, using our framework, can significantly improve the assessments of the risks posed to aquatic systems by treating or not treating forest fuels. Where site-specific data on fire probabilities exist, the framework can be used to help locate treatments where they are most likely to encounter higher severity fire, increasing the likelihood of treatment benefits. In fact, our results indicate that such efforts are crucial."

The authors point out that their estimate represents an initial, broad-scale first approximation of the potential of fire to affect areas with a given time frame, based on the assumption that fire and treatments are random. Further, they point out that although fire is not random, data are insufficient to accurately quantify more local patterns. Their analysis provides a West-side and regional first approximation of the likely upper bound of fuel treatment effectiveness, but is not applicable to all smaller analysis areas. A more appropriate empirical approach is that provided by Stephens, Scott L.; Moghaddas, Jason J.; Edminster, Carl; Fiedler, Carl E.; Haase, Sally; Harrington, Michael; Keeley, Jon E.; Knapp, Eric E.; McIver, James D.; Metlen, Kerry; Skinner, Carl N.; Youngblood, Andrew. 2009. Fire treatment effects on vegetation structure, fuels, and potential fire severity in western U.S. forests. Ecological Applications. 19(2): 305-320. Recent work in ponderosa pine forests at Black Mountain in northeastern California showed that tree survival after wildfire was greatest in those areas that had both thinning and prescribed

fire prior to the wildfire event. Survival was near zero for the untreated areas. Survival in thinned-only areas was greater than untreated areas but substantially less than the areas with both treatments. Ritchie et al. 2007. Probability of tree survival after wildfire in an interior pine forest of northern California: Effects of thinning and prescribed fire. Forest Ecology and Management 247: 200-208.

Fire Frequency and Intensity in Ponderosa Pine Forests. Summary of published reports. 2005. U.S.D.I. Park Service, Rocky Mountain National Park Continental Divide Research Learning Center.

This paper reviews the scientific basis for managing the Front Range of Colorado's Rocky Mountain National Park in its "natural" condition. Based on a study by Sherriff and Veblen, they conclude that higher elevation Front Range ponderosa pine forests have longer fire intervals and higher intensity fires that ponderosa forests in the southwest.

This paper is not relevant to the West Bend project. The National Park Service's review of scientific information pertinent to managing that area does not contradict the Forest Service's use of best available science in managing the West Bend project area.

Federal Agency Comments:
Environmental Protection Agency