



United States  
Department of  
Agriculture



Forest  
Service

June 2004

# 18 Fire

# Recovery Project

## Draft Environmental Impact Statement

## Summary



# 18 FIRE RECOVERY PROJECT

## Draft Environmental Impact Statement

United States Department of Agriculture – Forest Service  
Pacific Northwest Region – Deschutes National Forests

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**Date Comments Must Be Received:** **August 9, 2004**

### Abstract:

This Draft Environmental Impact Statement (DEIS) describes the effects of implementing 3 alternatives for the recovery of National Forest System lands that burned in the 18 Fire of 2003 on the Deschutes National Forest in Central Oregon. The fire burned approximately 3,810 acres of National Forest on the Bend/Fort Rock Ranger District. The preferred alternative (Alternative 2) would implement specific combinations of actions to promote the development of future forest on approximately 1,936 acres. This combination of actions includes salvage removal of fire-killed trees and reforestation.

In the other action alternative, reforestation without salvage harvest is proposed on approximately 1,936 acres.

Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. This will enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decision making process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions. *Vermont Yankee Nuclear Power Corp. v. NRDC*, 435 U.S. 519, 553 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement. *City of Angoon v. Hodel* (9th Circuit, 1986) and *Wisconsin Heritages, Inc. v. Harris*, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980). Comments on the draft environmental impact statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

# 18 FIRE RECOVERY PROJECT

## DRAFT ENVIRONMENTAL IMPACT STATEMENT – SUMMARY

### Introduction

This document is a summary of the 18 Fire Recovery Project Draft Environmental Impact Statement (DEIS). The DEIS considers the effects of various alternatives to promote the recovery of the 18 Fire area that was burned by wildfire in July of 2003.

To request a copy of the full DEIS, contact:

Jim Schlaich, IDT Leader or Mark Macfarlane, Writer/Editor  
Bend/Ft Rock Ranger District  
1230 NE 3<sup>rd</sup> Street, Suite A -262  
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Send comments to:

Walt Schloer, District Ranger  
Bend/Fort Rock Ranger District  
1230 NE 3<sup>rd</sup> Street, Suite A -262  
Bend, OR 97701  
Send e-mail comments to: comments-pacificnorthwest-deschutes-bend-ftrock@fs.fed.us

The full DEIS is also available on the internet at:

<http://www.fs.fed.us/r6/centraloregon/projects/units/bendrock/18fire/18-deis.shtml>

### Background

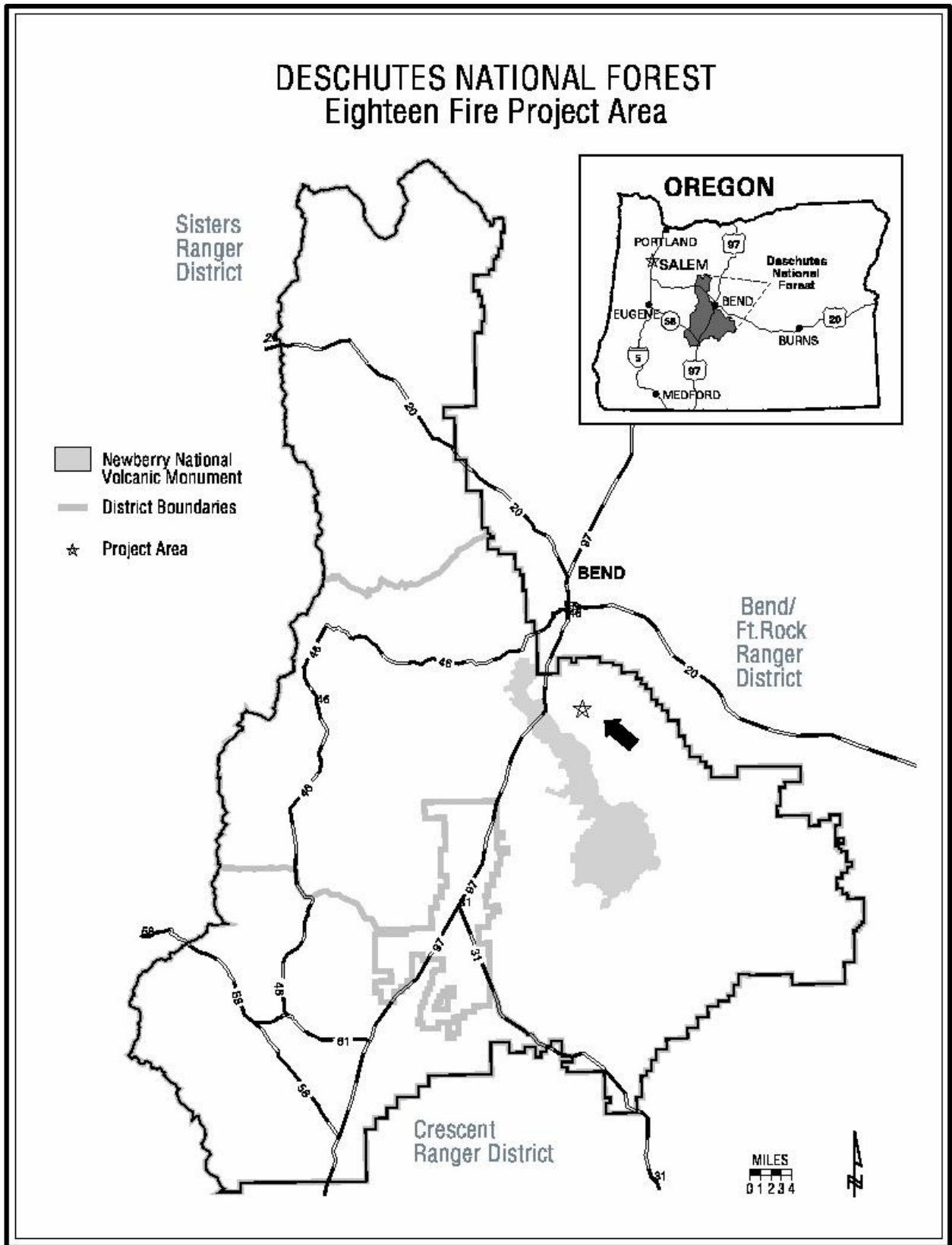
The 18 Fire area is located 3.5 miles southeast of Bend, Oregon. The fire started on July 23, 2003. It was determined to be human-caused and started in an area of heavy needle cast and bitterbrush. Weather conditions quickly created extreme fire behavior. The fire spread rapidly and burned approximately 3,810 acres of National Forest System lands before it was reported contained on July 24, 2003.

Fire intensity was moderate or high on over 64 percent of the 18 Fire. These areas experienced greater than 95 percent mortality.

### The Project Area

The 18 Fire Recovery Project area totals approximately 3,810 acres of Deschutes National Forest lands within Deschutes County: T 19 S, R 12; Willamette Meridian.

Figure 1-1. 18 Fire Project Location



The terrain is gentle. Elevations range from just over 4,200 feet to 5,120 feet at the summit of Luna Butte.

## **Purpose and Need for Action**

The overriding purpose of entering the 18 Fire is to:

- Recover commercial value.
- Expedite the establishment and restoration of a dry, ponderosa pine forest following a stand replacing fire.
- Reduce future fuel loadings to lessen the potential effects of future fire behavior potential.

Habitat recovery following a stand replacing fire within the dry ponderosa pine forest type has a number of factors to consider including shrub response (competition), browsing by big game, seed source, and future fuel loadings. Natural regeneration of ponderosa pine is dependent on seed dispersal from healthy, live trees. In many areas, particularly within the interior areas of the fire, adjacent seed sources are no longer available. The majority of the high mortality area is located within deer winter range (deer habitat). Based on shrub response, browse damage, and experience within adjacent wildfires, such as the Bessie Butte, Skeleton, and Evans West Fires of 1996, interior areas with high tree mortality would require reforestation by planting ponderosa pine in order to ensure and expedite forest restoration.

Lowering fuel loads to a level that reduces the future likelihood of a high severity fire occurring in the 18 Fire area could help promote the long-term survival and growth of planted trees. Over the next 20 years, the majority of the fire-killed, standing trees within the 2,420 acres of stand replacement will fall down and become a heavy surface fuel load of 38 to 62 tons per acre versus a desired level of 5 to 20 tons per acre for warm dry ponderosa pine (Brown 2003). A future fire ignition in the heavy surface fuels created by the 18 Fire could increase the duration of elevated temperatures to levels capable of altering soil properties and affecting site productivity in addition to complicating efforts to suppress a new fire in a young, reestablished ponderosa pine forest. This would also complicate the use of prescribed fire in the future.

## **Forest Plan Management Areas and Forest Plan Direction**

The project area lies entirely within the Deschutes National Forest. Relevant management direction is found in the Deschutes National Forest Land and Resource Management Plan (“LRMP”), as amended by the 1995 Regional Forester’s Eastside Forest Plans Amendments #2 and Inland Native Fish Strategy. The following summary presents a discussion of the Management Areas.

**M9 – Deer Habitat (approximately 76% of the project area):** 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 (Forest Plan, p. 4-113).

**M8 - General Forest (approximately 23% of the project area):** Within the General Forest MA, 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 (Deschutes LRMP, p 4-117).

**M9 - Scenic Views (approximately 1% of the project area):** The project area contains scenic views in the foreground and midground. The goal of scenic views management areas is to provide high quality scenery that represents the natural character of Central Oregon. 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 (Deschutes LRMP, p 4-121). There will be no salvage harvesting of trees in the Scenic Views Management Area.

## Scoping and Public Involvement

The 18 Fire Recovery Project was initially presented to the public in a letter dated November 14, 2003. A Notice of Intent to prepare an Environmental Impact Statement was published in the Federal Register on December 16, 2003. The proposed action also was placed on the Deschutes National Forest's public website and included in the Schedule of Proposed Action.

As a result of scoping, 8 written comments, electronic mail responses or phone calls were received. Additional public involvement took place throughout the winter and spring of 2004, including field tours with Oregon Natural Resources Council (Tim Lillebo, field representative), Blue Mountain Biodiversity (Karen Coulter), PROWL (Lisa Blanton), United States Fish and Wildlife (Sandra Ackley), and Oregon Department of Fish and Wildlife (Glenn Ardt).

## Identification of Issues

Issues are points of discussion, debate, or dispute about environmental effects that may occur as a result of the proposed action. They provide focus and influence alternative development, including development of mitigation measures to reduce or eliminate impacts. The issues are also used to display differing effects between the alternatives. The Interdisciplinary team identified issues and categorized them as Key or Analysis. The following environmental components were analyzed in the DEIS to show effects and compare alternatives: Threatened and Endangered Species, Botany, Noxious Weeds, Cultural Resources, Fire and Fuels, Forest Vegetation and Timber Management (Beschta, Passive Recovery vs. Active Management), Recreation, Range, Economics and Social Analysis, Insects and Decay, Air Quality, Scenic Quality, Roads and Transportation, and Other Disclosures. Key Issues were used to develop the alternatives and design activities and are described as follows:

### *Effects on Soils Productivity*

Salvage harvest and associated activities can potentially have adverse impacts on soil productivity through physical disturbances and adverse changes in organic matter levels. Past management practices, the 18 Fire, and fire suppression activities have affected the soil resource within the project area. The proposed salvage harvest and associated activities may cause cumulative increases in detrimental conditions by increasing compaction and soil displacement, reducing effective ground cover, and increasing the potential for accelerated erosion.

### *Effects to Wildlife Habitat*

What are the effects of the proposed activities on wildlife habitat, specifically effects on deer winter range, snags and coarse woody debris habitat? Deer winter range is within the 18 Fire Recovery Project area. Effects of the alternatives are a concern for the deer winter range habitat. The current and future levels of snags and CWD habitat is a concern expressed by several commenters. There is a direct connection between the number of trees removed for salvage and those left to provide snag and down log habitat.

## Comparison of Alternatives and Descriptions

The Key Issues led the agency to fully develop and analyze three alternatives. The two action alternatives (2 and 3) demonstrate a range of possible courses of action to meet the purpose of reforesting the post-fire landscape. Actions include salvage harvesting, fuels reduction, conifer planting, and road closing and decommissioning. The component that varies between the alternatives is salvage logging. Salvage logging is only considered with Alternative 2.

### *Alternative 1*

No Action. This alternative is required by law and serves as a basis for comparison of the effects of all of the alternatives. Under Alternative 1 there would be no change in current management direction or in the level of ongoing management activities, such as road maintenance. Work previously planned in the analysis area would still occur.

*Alternative 2* (Proposed Action)

This alternative includes minor adjustments made to the proposed action based on site-specific information derived from input received during scoping. For example, no live trees would be salvaged, no treatment would occur within scenic views, and clumps of dead snags associated with rock outcrops would be retained within salvage Units 1, 4, and 8.

**Alternative 2 Actions**

<b>Commercial Salvage (acres)</b>	
Ground-based	1,936
<b>Reforestation (acres)</b>	
Conifer Planting within Salvage Units	1,936
<b>Fuels Treatments and Reductions (acres)</b>	
Leave-tops-attached or whole-tree-yard	1,936
<b>Road Management (miles)</b>	
Road Closure	2.9
Road Decommissioning	7.0
Temporary Road Development	3.5

*Alternative 3* (Reforestation) This alternative is similar to Alternative 2 except there is no timber salvage.

**Alternative 3 Actions**

<b>Reforestation (acres)</b>	
Conifer Planting within Salvage Units	1,936
<b>Road Management (miles)</b>	
Road Closure	2.9
Road Decommissioning	7.0

**Mitigation and Resource Protection Measures**

Mitigation and Management Requirements that apply to all action alternatives are detailed in the DEIS (Chapter 2, page 22). They include protective measures pertaining to wildlife, soils, water, recreation, scenery, and cultural resources.

**Scope of the Project and Decision Framework**

The scope of the project and the decision to make are limited to: commercial salvage; snag retention; fuels reduction; reforestation; road management; hazard reduction; and mitigation and monitoring within areas burned by the fire of 2003. Chapter 2 details the designs of these actions. The project is limited to National Forest System lands within the project area.

The Responsible Official for this proposal is the Forest Supervisor of the Deschutes National Forest. After completion of the Draft EIS, there will be a 45-day public comment period. Based on response to this draft EIS and the analysis disclosed in the Final EIS, the Responsible Official will make a decision and document it in a Record of Decision (ROD) which will accompany the Final EIS. The Responsible Official can decide to:

- Select the proposed action, or
- Select an action alternative that has been considered in detail, or

- Modify an action alternative, or
- Select the no-action alternative
- Identify what mitigation measures will apply.

The decision regarding which combination of actions to implement will be determined by comparing how each factor of the project purpose and need is met by each of the alternatives and the manner in which each alternative responds to the key issues raised and public comments received during the analysis. The alternative which provides the best mix of prospective results in regard to the purpose and need, the issues and public comments, will be selected for implementation.

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United States  
Department  
Of Agriculture



Forest  
Service

June 2004

# Draft Environmental Impact Statement



## 18 Fire Salvage Recovery Project

Bend/Fort Rock Ranger District, Deschutes National  
Forest

Deschutes County, Oregon

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# PURPOSE AND NEED FOR ACTION

## Introduction

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The Forest Service has prepared this Draft Environmental Impact Statement (DEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This Draft Environmental Impact Statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into a summary, four chapters, and appendix data as described:

- **Summary:** Project location, project design criteria, specific activities proposed, and a concise list of the affected resources are drawn from the entire Environmental Impact Statement and condensed to provide a single overview of the document.
- **Chapter 1:** Purpose and Need for Action: This chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- **Chapter 2:** Alternatives, including the Proposed Action: This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- **Chapter 3:** Affected Environment and Environmental Consequences: This chapter describes the relevant natural and social environment, and the environmental effects of implementing the proposed action and other alternatives. The chapter is organized by resources, with those resources that are "key" to the analysis identified.
- **Chapter 4:** Preparers and Contributors: This chapter provides a list of preparers and individuals consulted during the development of the Environmental Impact Statement.
- **Appendices:** The appendices provide more detailed information to support the analyses presented in the Environmental Impact Statement. Reference the Table of Contents for the location and subject of specific appendix files.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Bend/Fort Rock Ranger District, Bend, Oregon.

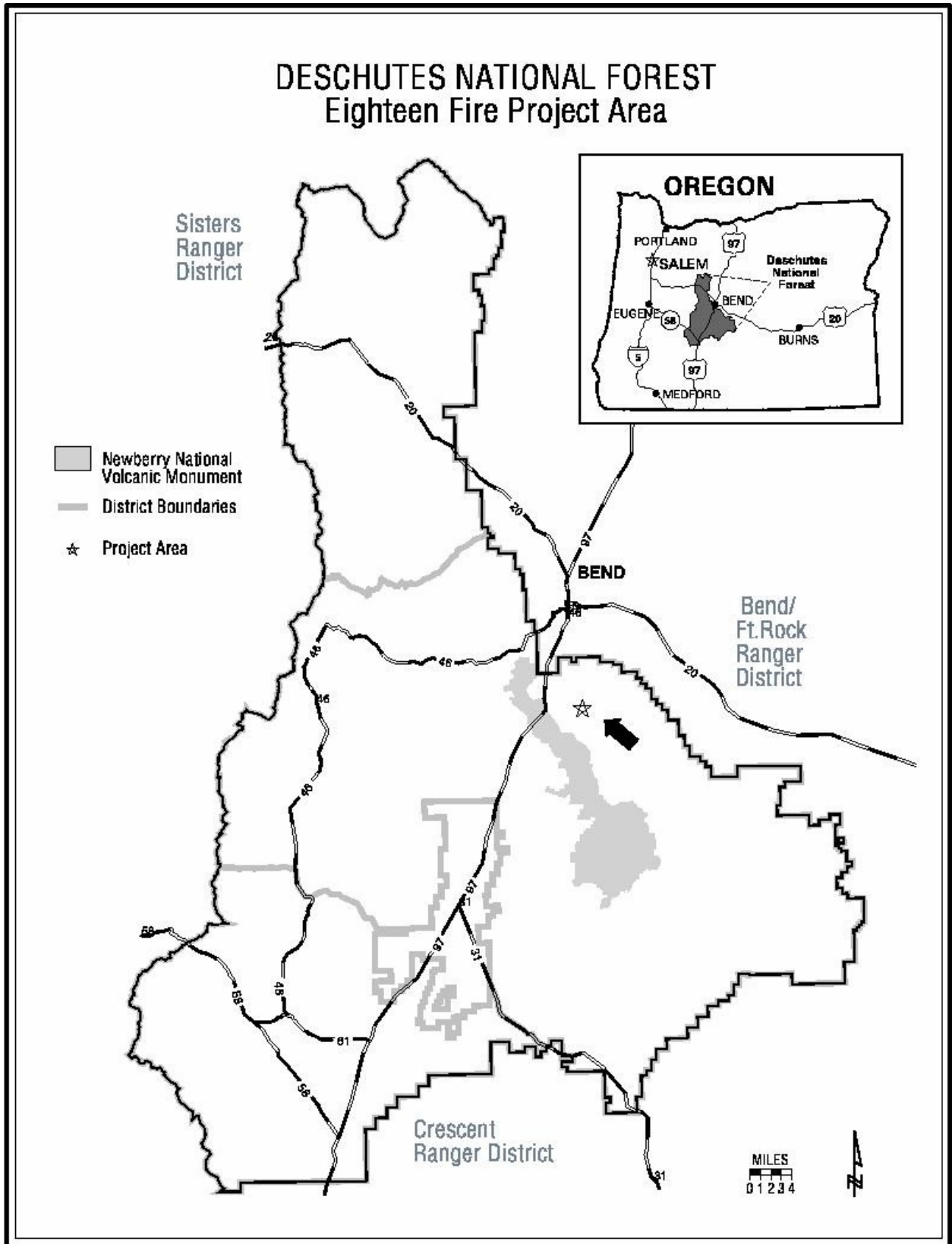
**Project Location**

The 18 Fire is located approximately 3.5 miles southeast of Bend. The legal description is:

Township 19 South, Range 12 East, Sections 2, 3, 10, 11, 14 – 16, 21 – 23, and 26 – 28.

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Figure 1-1. 18 Fire Project Location



## Background

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On the afternoon of July 23<sup>th</sup>, 2003 a human caused wildfire was ignited on the north side of the China Hat Road. Despite fire crew line construction and air tanker retardant suppression, the fire grew rapidly in flat terrain with daytime temperatures reaching around 90 degrees Fahrenheit. The fire was fueled by bitterbrush, needle cast, and ponderosa pine with a few scattered juniper and lodgepole trees and was contained on July 24<sup>th</sup>, at approximately 3,810 acres.

All 3,810 acres that burned are on Deschutes National Forest (DNF) land. Within the fire's perimeter, 2,420 acres (greater than 95 percent mortality) of the 3,810 acres experienced stand replacement.

The area burned is the focus of this environmental impact statement, though all of the fire area and adjacent lands are considered in the analysis process (Figure 1-1). All of the area on the DNF is located on the Bend/Fort Rock Ranger District.

## Project Area

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The project area is located approximately 3.5 miles southeast of the city of Bend, Oregon and ranges in elevation from 4,200 to 5,120 feet. There are no perennial, intermittent or ephemeral streams, wetlands, or water bodies within or adjacent to the 18 Fire. The nearest watercourse is the Deschutes River located 7 miles to the west. The entire project area was clearcut harvested by a private company in the 1920s and subsequently acquired by the federal government for incorporation into the DNF. The plant association group is primarily ponderosa pine woodlands and bitterbrush with occasional juniper and lodgepole trees. The area encompasses lands within the DNF Land and Resource Management Plan (LRMP) as amended by the Northwest Forest Plan (NWFP), Inland Native Fish Strategy (INFISH), and Regional Forester's Eastside Forests Plan Amendment No.2 (Eastside Screens).

The 18 Fire Recovery Project DEIS analysis is within the Pilot Butte Watershed. The burn effect of the 18 Fire on vegetation across the landscape was primarily of a high intensity. Typically wildfires burn according to fuels, weather and topographic conditions and vary by location within a landscape and over time.

The effects on the resources surrounding (and adjacent to) the 18 Fire boundary have been considered, and are included in the project analysis. The proposed harvest of fire killed trees would only occur within the boundaries of the July 2003, 18 Fire.



## Additional Resource Recovery Projects

The 18 Fire Recovery Project DEIS proposal is one of several projects planned to occur within the 18 Fire area. This DEIS focuses on the activity of salvage of commercial timber and connected actions, such as reforestation, fuels treatment and road closures.

Management activities for restoration of the 18 Fire area would continue based on separate NEPA projects, contingent on funding, and independent of any selected alternative. Restoration actions which have been accomplished and are planned follow.

**Hazard Trees:** Trees along primary roads, which pose an imminent hazard to human safety were felled and harvested in the winter months of 2004. The removal of felled hazard trees was included in the Decision Memo for the 18 Fire Roadside Salvage Categorical Exclusion (CE).

**Reforestation:** Approximately 73 acres will be planted under the hazard tree Decision Memo for the 18 Fire Roadside Salvage Categorical Exclusion (CE). In addition to 73 acres of planting, a ½ acre study plot was planted on Bessie Butte in the spring of 2004.

**Road Management:** A Roads Analysis has been completed under a separate NEPA analysis (Kelsey Environmental Assessment) for the 18 Fire Recovery Project and surrounding area previous to the wildfire. In addition to not identifying the need for any permanent roads in the 18 Fire Recovery Project area, the following roads are not needed for long-term administrative or recreational access and would be obliterated: 1810300, 1810485, 9711600, 9711820, and 9711910 (see Chapter 2, Alternative 2 map). The portion of the Kelsey analysis area that is within the 18 Fire Recovery Project will be incorporated into this DEIS. To improve deer habitat effectiveness road management activities, including Knutson-Vandenberg Act (KV) road decommissioning and road inactivation, are addressed in this analysis.

**Weed Treatment:** Treatment and monitoring of noxious weeds was approved under the Burned Area Emergency Rehabilitation (BAER) process and the Deschutes National Forest Noxious Weed Control Environmental Assessment September, 1998. Treatment is ongoing and considered in the analysis. Other weed treatments may be planned as needed through the monitoring of weed populations.

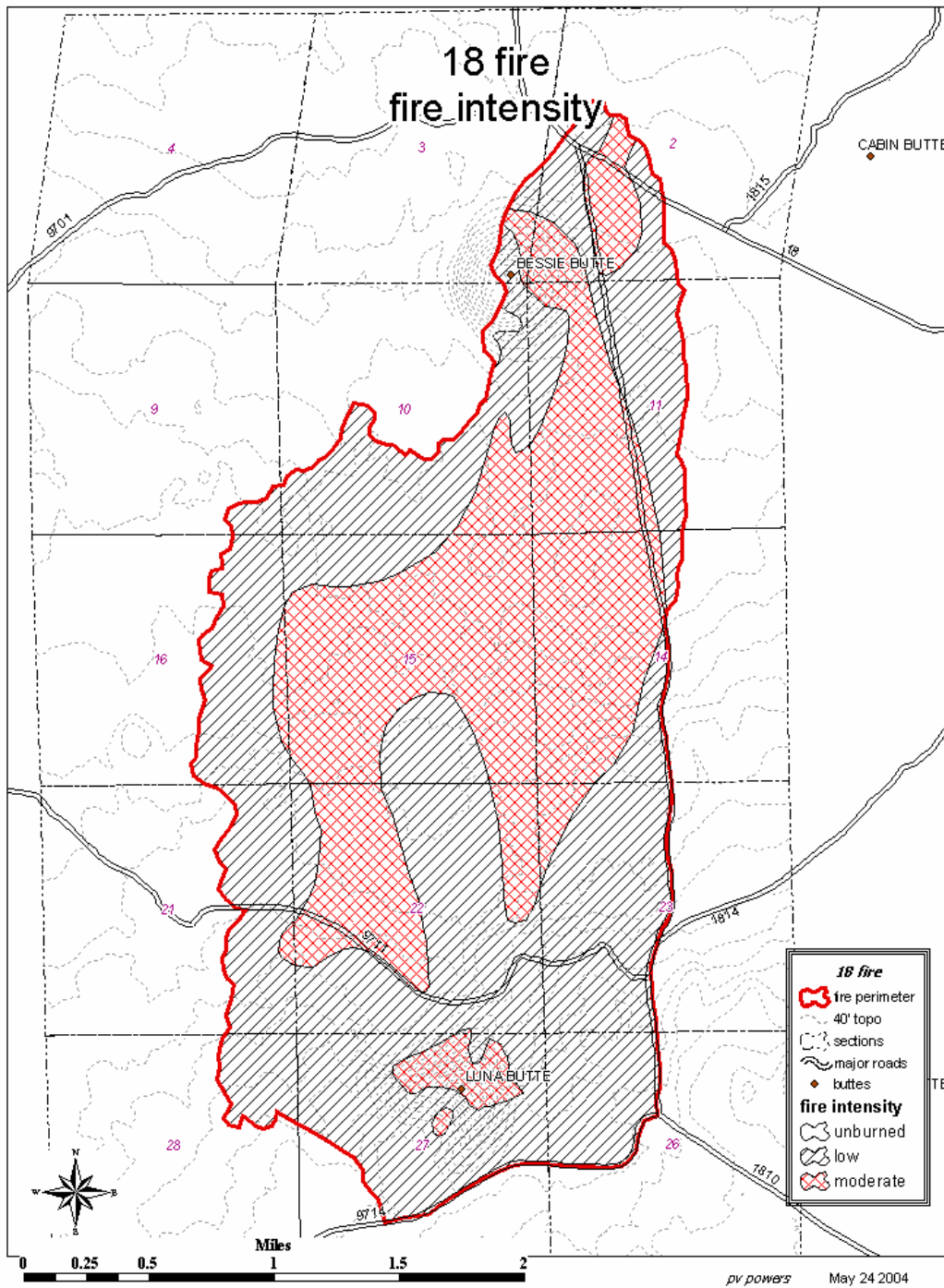
**Area Closure:** An area closure restricting motor vehicle use to designated open roads is in place and would likely continue to be in effect for 2 years (through 2005) in order to prevent additional resource impacts to the area affected by the fire. Exemptions to this closure include individuals with an issued permit, and federal, state, or local officials performing work related duties.

## **Purpose Of and Need for Action**

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Fire intensity is the appearance of post-fire canopy conditions. Within the 18 Fire, fire intensity was separated into the following three categories: High (no needles left and 99 percent mortality), moderate (mosaic of no needled and brown needled trees with 95 percent mortality), and low (mosaic of brown and green needles with individual and scattered pockets (<3 acres) of fire-killed trees). An estimated 2,420 acres burned at moderate to high intensities with tree mortality from 95 to 99 percent and the forests within this portion of the fire have reverted to the stand initiation stage (see map on following page).

Figure 1-2. 18 Fire Burn Intensity



The overriding purpose of entering the 18 Fire is to:

- Recover commercial value.
- Expedite the establishment and restoration of a dry, forest ponderosa pine forest following a stand replacing fire.

- Reduce future fuel loadings to lessen the potential effects of future fire behavior potential.

Habitat recovery following a stand replacing fire within the dry ponderosa pine forest type has a number of factors to consider including shrub response (competition), browsing by big game, seed source, and future fuel loadings. Natural regeneration of ponderosa pine is dependent on seed dispersal from healthy, live trees. In many areas, particularly within the interior areas of the fire, adjacent seed sources are no longer available. The majority of the high mortality area is located within deer winter range (deer habitat). Based on shrub response, browse damage, and experience within adjacent wildfires, such as the Bessie Butte, Skeleton, and Evans West Fires of 1996, interior areas with high tree mortality would require reforestation by planting ponderosa pine in order to ensure and expedite forest restoration.

Lowering fuel loads to a level that reduces the future likelihood of a high severity fire occurring in the 18 Fire area could help promote the long-term survival and growth of planted trees. Over the next 20 years, the majority of the fire-killed, standing trees within the 2,420 acres of stand replacement will fall down and become a heavy surface fuel load of 38 to 62 tons per acre versus a desired level of 5 to 20 tons per acre for warm dry ponderosa pine (Brown 2003). A future fire ignition in the heavy surface fuels created by the 18 Fire could increase the duration of elevated temperatures to levels capable of altering soil properties and affecting site productivity in addition to complicating efforts to suppress a new fire in a young, reestablished ponderosa pine forest. This would also complicate the use of prescribed fire in the future.

## Proposed Action

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**What:** The Forest Service proposes to address the purpose and need by meeting 3 goals.

1. Recover commercial value.
2. Expedite the establishment and restoration of a dry, forest ponderosa pine forest following a stand replacing fire.
3. Reduce future fuel loadings to lessen the potential effects of future fire behavior potential.

This action includes salvage of commercial timber and fuels reduction on approximately 1,936 acres. Areas identified for salvage are high or moderate intensity burn areas within stands of ponderosa pine.

Reforestation by hand planting ponderosa pine is proposed on the 1,936 acres of commercial timber salvage. Dead trees (snags) and down wood would be retained in a mosaic of varying densities across the landscape. Within the 1,874 acre portion of the fire not included in the fire salvage proposal, is an estimated 411 acres of high mortality that will not be replanted in order to provide for high quality wildlife habitat.

Commercial logging would utilize modern, ground-based, feller-buncher systems, and designated skid roads to minimize soil disturbance. Only dead trees would be salvaged. Fuels reduction would be accomplished by whole tree yarding of salvaged trees. An estimated 3.5 miles of temporary roads would be needed to access commercial salvage areas. All temporary roads would be obliterated following their use. Road densities, as proposed under the roads analysis would exceed the target open road density of 1 to 2.5 miles of open road per square mile (LRMP, M7-22, pg. 4-115) when considering the area within the fire perimeter, only.

**Why:** Due to the high intensity of the fire a majority of the area that burned is no longer providing thermal or hiding cover in Deer Habitat (deer winter range), Management Area 7. The burned area is also not meeting its land allocation goals under General Forest, Management Area 8, which emphasizes timber production while providing forage production, visual quality, wildlife habitat and recreational opportunities for public use and enjoyment. An estimated 19 million board feet were killed by the fire. With the exception of the 73 acres of roadside salvage none of the economic value has been recovered.

**When:** The project implementation would begin in 2004. The salvage would be completed by the summer of 2005 and the other resource activities would be completed within 5 years.

**How:** The project would be implemented through a combination of timber sales, service contracts, force account crews and partnerships. No permanent, system roads would be created. As an outcome of the salvage treatment described above, an estimated 7 million board feet of wood would be commercially removed from 1,936 acres.

The location of the proposed action is shown on map figure 1-1. The following issues were considered in the development of the proposed action. Where issues cannot be resolved through project design or mitigation, they may be the basis for developing alternatives to the proposed action.

*Soil Productivity/fuel loading:* Maintenance of soil productivity is an important objective in the project area. Although much of the 18 Fire had high mortality of overstory trees, ground level heat intensity (fire severity) was typically not elevated to temperatures capable of altering soil properties and affecting site productivity. Exceptions to this would include localized areas under large logs and adjacent to stumps and tree boles that were consumed during the fire. Impacts from the fire, suppression activities, and past management practices have had an effect on the soil resource, and in some areas soils may be sensitive to additional impacts. In addition, future impacts to soils in the event of a re-burn could be a concern if fuel loadings are allowed to reach high levels.

*Wildlife Habitat:* To provide habitat for woodpeckers and other cavity nesters, some dead and dying trees would be retained within the areas proposed for salvage. Some portions of the fire would not be salvaged to provide high quality foraging areas for birds

and to reduce sight distances for big game. In the short-term, this will provide an abundance of snags; however, in the long-term, (20 to 30 years), snags will be lacking as the current snags fall over.

*Insects and Diseases:* Bark beetle and other insect populations increase following a wildfire and have the potential to increase tree mortality in stands within and adjacent to the fire.

*Noxious Weeds:* Potential spread of noxious weeds is a concern across the fire area. Noxious weeds compete with native plant communities and can reduce the diversity of plant and animal species.

*Scenic Quality:* Approximately 22 acres of the 18 Fire are within the Scenic Views management area. Bessie Butte can be seen from numerous spots in Bend. With the exception of hand planting pine trees, no activities are planned on either Bessie or Luna Buttes, or within Scenic Views.

*Access-* No permanent road construction is planned. None of the areas being considered for commercial fiber salvage are within or adjacent to inventoried roadless areas.

*Timber value/reforestation* – The average diameter of the dead ponderosa pine trees is 12 inches. Prompt utilization of the small diameter trees is necessary if they are to be used for dimension lumber. Ceanothus, manzanita and grass can be expected to resprout vigorously within the fire. To minimize forest restoration costs, salvage operations are planned to occur in 2004 followed by reforestation with hand planted pine beginning in the spring of 2005. Planted trees would likely require both animal damage (tubing or fencing) and vegetation control (slash mat and/or manual release). Approximately 95 percent of the 1,936 acres proposed for salvage and reforestation is within the Deer Habitat management area. The number of trees planted would reflect the levels required to provide the optimum levels of forage, hiding cover and thermal cover for big game.

## **Management Direction**

The alternatives of the project respond to the goals, objectives, standards and guidelines described for the area in:

### **Deschutes NF Land and Resource Management Plan (LRMP) Management Areas**

Deschutes National Forest Land and Resource Management Plan (LRMP) completed in 1990, establishes management areas, and forest-wide resource direction for the 18 Fire Recovery Project area. None of the 18 Fire falls within the Northwest Forest Plan (NWFP). Management Area composition within the project area and goals are described below.

The following describes land management allocations from the Deschutes National Forest Land and Resource Management Plan (Forest Plan), as amended, for the 18 Fire Recovery Project area:

**Deer Habitat – Management Area 7**

*Goal:* 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 (Forest Plan, p. 4-113).

**Forest Plan Standard and Guideline M7-3:** Generally, programmed timber harvest is appropriate when required to regenerate new cover stands, maintain tree vigor for resistance to stand-threatening insect damage, or encourage desirable forage in deficient areas. (Forest Plan p. 4-113)

Timber salvage is proposed within this management allocation.

**General Forest – Management Area 8**

*Goal:* To emphasize timber production while providing forage production, visual quality, wildlife habitat and recreational opportunities for public use and enjoyment (Forest Plan, p. 4-117).

Timber salvage is proposed within this management allocation.

**Scenic Views – Management Area 9**

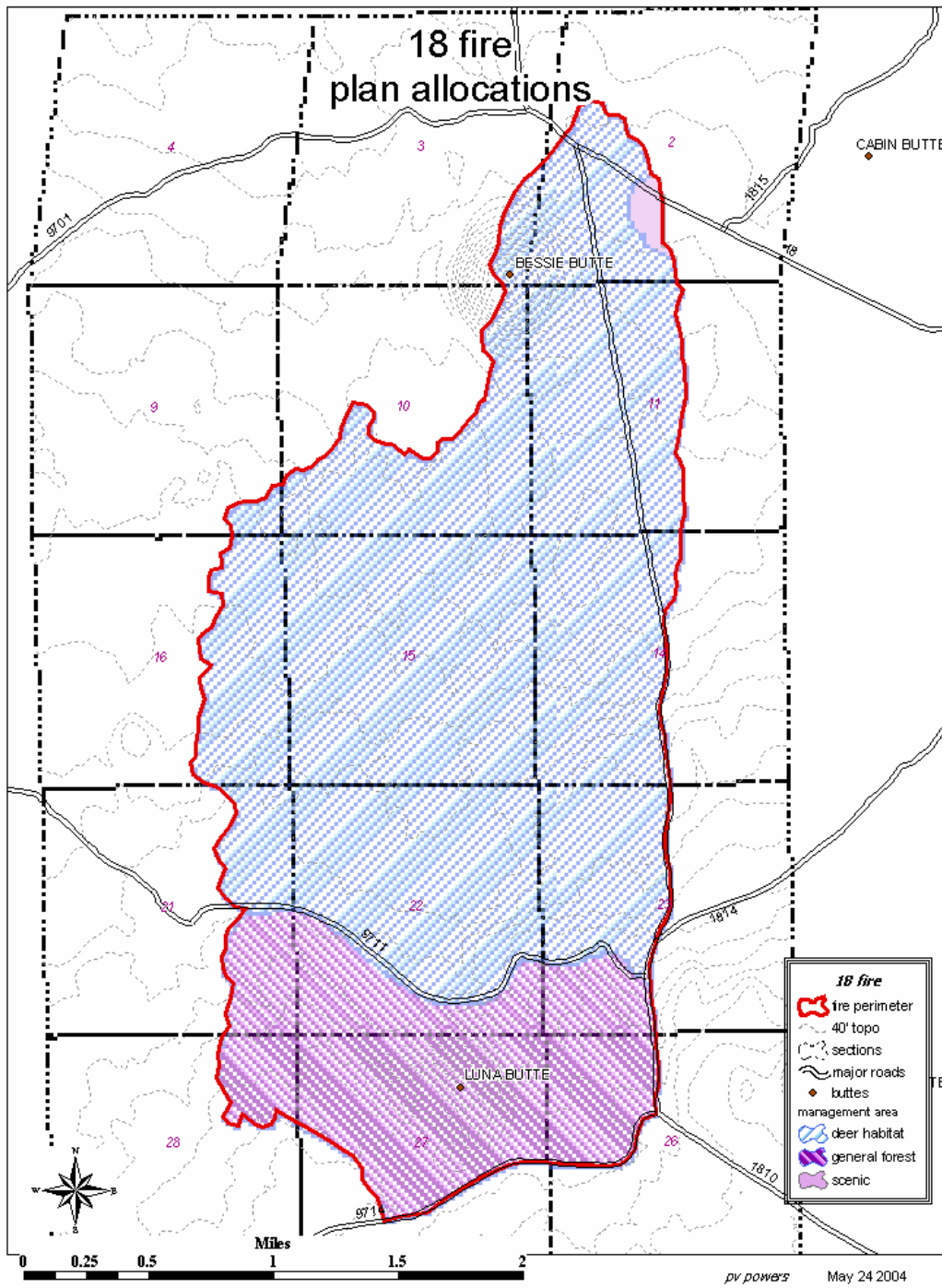
*Goal:* To provide Forest visitors with high quality scenery that represents the natural character of Central Oregon (Forest Plan, p. 4-121).

In response to public scoping no salvage activity or reforestation is proposed within this management allocation.

**Table 1-1. Salvage Harvest by Management Area**

LRMP Management Area	Acres	Percent of Mgmt. Area Burned	Acres Salvaged Proposed Action Alternative 2	Percent of Area Salvaged
General Forest	901	23%	68	7% of General Forest
Deer Habitat	2,887	76%	1868	65% of Deer Habitat
Scenic Values	22	1%	0	0% of Scenic Values
<b>Total</b>	<b>3,810</b>	<b>100%</b>	<b>1936</b>	<b>51% of burned area</b>

Figure 1-3. 18 Fire LRMP Management Areas.





## Scoping and Public Involvement

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### Scoping

Scoping and public involvement are ongoing processes used to invite public participation and to obtain input on a particular proposed action. Information received during these processes is used to determine the extent of analysis needed to reach an informed decision. The Council on Environmental Quality regulations (40 CFR 1501.7) was followed to determine the scope of issues and opportunities to be addressed in the environmental analysis and to identify major concerns related to the Proposed Action. Public comment was sought through several means, including those summarized below.

### Individuals and Agencies Contacted

Individuals and agencies contacted include identified stakeholders; elected officials; federal, state, and local agency personnel; press and media in communities affected; and others on the Bend/Fort Rock Ranger District mailing list. Those contacted for scoping and to receive a copy of this DEIS are listed in Chapter 4.

In addition, the 18 Fire area was reviewed with Oregon Natural Resources Council (Tim Lillebo, field representative), Blue Mountain Biodiversity (Karen Coulter), PROWL (Lisa Blanton), United States Fish and Wildlife (Sandra Ackley), Oregon Department of Fish and Wildlife (Glenn Ardt). The complete record of the public involvement process to date is available for review in the project file.

### Public Notices

Public notices concerning the Proposed Action include the following:

Fall 2003 - Schedule of Projects

November 14, 2003 - Scoping Letter

December 16, 2003 - Notice of Intent to Prepare an EIS, Federal Register

### Consultation with Affected Tribes

As the result of scoping at a government-to-government level, the Confederated Tribes of the Warm Springs Reservation, Burns Paiute, and Klamath Tribes were informed, but no comments were received on the proposed action.

## Issues

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- **Key Issues:** Issues used to develop alternatives or specific activities of the action alternatives.

- **Analysis Issues:** Issues addressed in the effects analysis and used to compare alternatives. They are described in detail and analyzed in Chapter 3.
- **Issues not addressed in detail:** Issues or concerns that were either already addressed through alternative design or mitigation, are not affected by the proposed actions, or are beyond the scope of this project.

## Key Issues

The alternatives respond to the following key issues identified during scoping. The key issues are specific to the proposed action and the project area. Indicators for each issue will help to evaluate how each of the alternatives addresses key issues.

**Key Issue 1: Soil Productivity:** Salvage harvest and associated activities can potentially have adverse impacts on soil productivity through physical disturbances and adverse changes in organic matter levels. Past management practices, the 18 Fire, and fire suppression activities have affected the soil resource within the project area. The proposed salvage harvest and associated activities may cause cumulative increases in detrimental conditions by increasing compaction and soil displacement, reducing effective ground cover, and increasing the potential for accelerated erosion.

What are the best ways to mitigate these impacts?

The following indicators will be evaluated for each of the alternatives:

1. The extent of detrimental soil conditions within individual activity areas proposed for mechanical treatments.
2. The amount of coarse woody debris (CWD) and surface organic matter that would be retained to provide ground cover protection and a long-term source of nutrients on treated sites.
3. The probable success in project design and implementation of management requirements and mitigation measures that would be applied to minimize adverse impacts to soil productivity.

## Key Issue 2: Wildlife Habitat

What are the effects of the proposed activities on wildlife habitat, specifically effects on deer winter range, snags and coarse woody debris habitat? Deer winter range is within the 18 Fire Recovery Project area. Effects of the alternatives are a concern for the deer winter range habitat. The current and future levels of snags and CWD habitat is a concern expressed by several commenters. There is a direct connection between the number of trees removed for salvage and those left to provide snag and down log habitat.

The following indicators will be evaluated for each of the alternatives:

1. Amount of acres reforested.
2. Miles of open road density (miles/per/square mile).
3. Snag and down log levels, including display of effects of the alternatives using Decayed Wood Advisor for Managing Snags (snags per acre by diameter class), Partially Dead Trees, and Down Wood for Biodiversity (measured in percent) in Forests of Washington and Oregon, DecAID.

### **Analysis Issues**

Issues or concerns listed below (identified by the IDT Team or through the scoping process) were identified and have been tracked through the analysis.

#### **Air Quality**

Alternative 2 includes pile burning activities for treating fuels related to the salvage operations. Bend is a Designated Area with a high population and air quality concern and located approximately 3.5 miles north from the 18 Fire area. The City of Bend is closely monitored for smoke intrusion and effects from prescribed fire.

Pile burning would comply with the Clean Air Act and would be coordinated with the Oregon State Department of Environmental Quality and Oregon State Department of Forestry. All burning would be in compliance with State smoke management plans. Landing piles would only be ignited under prescribed conditions.

Effects of the alternative on air quality will be measured by the emissions expected.

#### **Beschta**

The “Beschta Report” formally known as the 1995 “Wildfire and Salvage Logging, Recommendations for Ecologically Sound Post-Fire salvage Management and Other Post-Fire treatments” found evidence that post-fire logging results in additional significant damage to the ecosystem and suggests there is no ecological need for immediate human intervention on post-fire landscape. In the interim other conflicting scientific reports and papers have highlighted the controversy regarding the effects of salvage logging after a wildfire. In light of these scientific uncertainties and unknown risks this DEIS was prepared. Scientific research and literature was reviewed and discussed in Chapter 3 and in Appendix G.

#### **Economic and Social**

Consideration must be given to the financial efficiency of the proposed action and alternatives. Some commenters want the Forest Service to salvage fire-killed trees in a timely manner to avoid drastic loss in value. Economic and social analysis focuses on the communities of Central Oregon and their ties to forest management through employment, income, recreation, fuelwood, and sport.

#### **Fire and Fuels**

Comments were received expressing concern for the potential of heavy fuel loading, which may occur as a result of salvage operations or as standing dead trees fall contributing to the potential intensity of future wildfire. Treatment of fuels resulting from the proposed salvage activity is a connected action included in Alternative 2.

Effects of the alternative on fire and fuels will be measured by displaying estimated tons per acre within 20 years.

**Insects and Decay**

Comments were received related to damage from insects and disease. Potential for insect and disease related damage and effects on forest trees is addressed in Chapter 3 of the DEIS.

**Noxious Weeds**

Comments were received expressing concern for the effects of the proposed actions on noxious weeds. Design elements aimed at preventing the spread of noxious weeds are incorporated into the action alternatives. The effects of the alternatives on noxious weeds are described in Chapter 3 of the DEIS.

**Wildlife** – In addition to the wildlife key issue, the following items will be analyzed and compared by alternative: Survey and Manage Species; Management Indicator Species; and Resident and Migratory Landbirds.

**Recreation (transportation/roads)**

Several comments were received in response to scoping expressing concern over proposed road management, specifically against any road closures that would reduce access for motorized recreational pursuits.

Road management proposed actions have been identified as a result of an interdisciplinary road analysis for the 18 Fire area. The proposed road management includes actions to implement road strategies identified in the road analysis for existing roads. The road management actions are intended to aid the restoration of the 18 Fire area and are included because they are part of a potential resource enhancement project (KV).

The effects of the alternatives on recreation will be measured by describing changes to the recreation experience.

**Scenic Quality**

There is concern for the effects of the 18 Fire and proposed actions on the scenic quality of the area. Within the 18 Fire Recovery Project area is Scenic View, Management Area 9 (MA-9). The current allocation area within the fire boundary is 22 acres. There are no proposed treatments within MA 9.

The effects of the proposed salvage and connected actions on scenic quality are described for alteration or enhancement of scenery and amount of affected area on short-term scenery within middle and foreground landscapes.

**Threatened, Endangered and Sensitive (TES) Species**

Several comments were received regarding the effects of the proposed action on TES species. There are no TES species within the project area. The effects of the proposed salvage and connected actions will review TES species and are described in Chapter 3 of the DEIS.

**Range**

Comments were received related to range allotments. There is an active grazing allotment subject to periodic livestock grazing within the 18 Fire Recovery Project area, although no grazing has occurred in the allotment since 1990. The 18 Fire Recovery Project area overlaps the Bessie Grazing Allotment. The effect of the proposed salvage and connected actions related to the grazing allotment are described in Chapter 3 of the DEIS.

**Issues Not Addressed in Detail**

Issues or concerns that were either already addressed through alternative design or mitigation, are not affected by the proposed actions, or are beyond the scope of this project. These resource areas are not discussed further in this analysis.

**Cultural Resources**

Proposed activities will have no effect on cultural resources. All sites are being avoided.

**Wilderness/Roadless Characteristics**

There is no designated Wilderness within or adjacent to the project area. The nearest wilderness is the Three Sisters Wilderness, approximately 27 miles west of the project area. There are no Inventoried Roadless Areas or unroaded characteristics within or adjacent to the project area. As previously identified the project area was clearcut harvested in the 1920s and the open road density is 3.6 miles per square mile.

**Wild and Scenic River/Essential Fish Habitat**

There are no wild and scenic river corridors within or adjacent to the project area. The Deschutes Wild and Scenic River corridor is approximately 7 miles west of the project area. There is no essential fish habitat or potential bull trout habitat within 7 miles of the project area.

**Water Quality**

There would be no flow impacts to the Deschutes Basin, based on the existing condition of no streams within or adjacent to the project area and soils that allow for rapid infiltration of precipitation without the potential of overland flow reaching perennial stream channels.

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# ALTERNATIVES, INCLUDING THE PROPOSED ACTION

## Introduction

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The purpose of this chapter is to describe how the alternatives were generated, reviewed, and either eliminated from detailed study or considered in detail. Various alternatives proposed by the Interdisciplinary (ID) Team and generated through the public scoping process are discussed. This chapter also includes a comparison of the alternatives. Mileage and acreage figures used throughout this document are approximate figures.

## Development of Alternatives

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The process used in developing the alternatives began with a review of the purpose of and need for action by the ID Team. The ID Team also considered the 18 Burned Area Emergency Rehabilitation (BAER) report, Kelsey Environmental Assessment, comments received during the scoping process, the Beschta Report (Beschta, 1995) and the applicable direction in the Forest Plan.

Three alternatives are analyzed in detail. All action alternatives meet the objectives described in the purpose of and need for action section of Chapter 1, and respond to one or more of the key issues.

## Alternatives Considered in Detail

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Alternatives were developed and analyzed in response to the purpose and need of the proposed action. Additionally, they address social and environmental issues, respond to public and agency concerns and input, and satisfy Council on Environmental Quality (CEQ) regulations and the National Environmental Policy Act (NEPA). The NEPA process requires the Forest Service to consider a range of reasonable alternatives, which may include a multitude of options.

One of the goals in developing the action alternatives for this DEIS was to ensure that each option was “technically and physically feasible,” as well as reasonable as specified by 40 CFR 1502.14. The alternatives developed should provide the Forest Service decision-maker and the public with a range of reasonable options to consider. The following questions were typical of those considered by the ID team during the alternative development process.

- Economically viable
- Do the action alternatives meet the purpose and objectives of salvaging timber?

- Do the action alternatives conform to the time restrictions anticipated for timber harvest given the expected deterioration of the timber resource after the fire?
- Can the action alternatives be implemented with little or no new road construction while fully utilizing the existing Forest road system within the 18 Fire burned area?
- Do the alternatives protect soils and wildlife habitat while allowing for economic recovery of the timber resource?
- Are the selected action alternatives technically feasible?
- Would the alternatives, while meeting the purpose and need of the action, result in a low level of environmental degradation?
- Do the alternatives interfere with any rights or obligations of the Forest Service or other Government agencies under their legal and regulatory jurisdiction?

Under Alternative 2 (salvage/reforestation) and Alternative 3 (reforestation) treatments would take place within designated units, subject to legal, safety, and environmental stipulations established by the Forest Service. Alternative 2 would, by design, be subject to these conditions (outlined in this Chapter, under section Mitigation and Management Requirements). All harvest units offered for competitive sale would be bound by the provisions of the standard Forest Service timber sale contract and additional clauses used to implement mitigation measures selected by the decision maker.

Table 2-3, Comparison of 18 Fire Recovery Alternatives, presents a comparison of the various components of all alternatives. The locations of the units proposed for timber harvest or reforestation are displayed on Map 1, Alternative 2 Proposed Timber Harvest, and Map 2, Alternative 3 Proposed Reforestation.

Within each designated harvest and treatment unit, practices would be carried out as detailed in section Project Management Requirements.

A synopsis of the alternatives analyzed is presented in the discussion that follows.

## Alternative 1– No Action

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### Objective

Under the No Action Alternative, current management plans would continue to guide management of the project area. Separate “Additional Resource Recovery Projects”, (Chapter 1, *section heading*) would not be affected with the selection of this (or any other) alternative.

**Salvage Harvest**

No salvage activities or timber outputs would result from this alternative.

**Hazard Trees**

Trees that pose a hazard to public safety on open roads and in recreation areas would continue to be monitored and felled when identified as a hazard according to the R6 Hazard Tree standard (Harvey, Jr. & Hessburg, Sr., 1992). Utilization of felled trees for commercial use would not occur under this alternative.

**Forest Roads**

No roads would be closed or decommissioned.

**Fuels Treatment**

No fuels treatments would occur.

**Reforestation**

As noted under Additional Resource Recovery Projects a total of 73 acres of roadside salvage would be hand planted in the spring of 2005.

**Snags and Coarse Woody Debris**

Under the No Action Alternative existing snag levels would remain. No treatments are planned that would affect snags or future coarse woody debris.

**Alternative 2 – Proposed Action** 

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**Objective**

This alternative is the proposed action. Proposed activities were designed to meet the purpose of and need for action as described in Chapter 1 and are consistent with existing Forest Plan direction. *Map 1* (Alternative 2) at the end of this chapter, displays proposed timber salvage and reforestation proposed under this alternative.

**Salvage Harvest**

With the implementation of Alternative 2, salvage would remove dead trees on approximately 1,936 acres. Minimum diameter of salvage trees would generally be 12 inches for ponderosa pine. An estimated total volume of 7.0 million board feet (MMBF) from fire killed trees would be harvested under this alternative. All areas would be salvaged with ground based systems utilizing designated skid roads and boom-mounted shears or logging over snow and/or frozen ground. Landing and major skid roads used during salvage operations would be restored by subsoiling and tree planting.



Table 2-1. Alternative 2 Salvage and Reforestation Acres by LRMP Management Area

LRMP Man. Area	Acres	Acres Salvaged Alt. 2	Percent of Area Salvaged
Deer Habitat	2,887	1,868	64.7%
General Forest	901	68	0.7%
Scenic	22	0	0.0%
<b>Total</b>	<b>3,810</b>	<b>1,936</b>	<b>50.8%</b>

### Hazard Trees

Trees determined to be a hazard to human life or property, according to the R6 Hazard Tree standard (Harvey, Jr. & Hessburg, Sr., 1992), would be felled and utilized in this alternative. Hazard trees may be included in salvage operations within the project area along haul routes for the salvage operations.

### Forest Roads

Access to designated units for harvest and hauling of logs would predominately be on existing forest roads. An estimated 3.5 miles of temporary road construction would be required to access harvest units not readily accessible from existing forest roads. Temporary roads would be closed after purchaser use in addition to 7.0 miles of road decommissioning and 2.9 miles of closures. Subsoiling followed by planting of bitterbrush would be used to decommission the 7.0 miles of road.

### Fuels Treatment

All 1,936 acres within salvage harvest units would have whole tree yarding or leave tops attached to reduce slash generated by the salvage logging of dead trees. Landing piles would be burned or chipped if economically feasible for the biomass energy market.

### Reforestation

Alternative 2 will reforest approximately 1,936 acres in the spring of 2006. As noted under Additional Resource Recovery Projects a total of 73 acres of roadside salvage would be hand planted in the spring of 2005. Reforestation in the Deer Winter Range (deer habitat) area will be designed to move towards providing 40 percent hiding and thermal cover. To help meet this objective a 640 acre fence would be built in deer winter range to eliminate browsing by big game. Fencing done in the winter range area will be done in a manner that will maintain access to at least minimal forage resources by deer and elk and to allow free movement of animals through the winter range. The fence would be removed when the planted trees are above browse height. In the General Forest Management Area trees will be planted to provide for appropriate stocking levels (minimum of 100 trees per acre).

The Alternative 2 map (*Map 2*,) displays the proposed salvage and reforestation units.

**Snags and Coarse Woody Debris**

Alternative 2 includes management requirements to leave snags consistent with levels described in Chapter 3, 18 Fire DEIS, *Wildlife, Snags, Green Trees, and Coarse Woody Debris*. Snags would be left at levels based on ponderosa pine Plant Association Groups (PAG) to provide current and future coarse woody debris. All green trees within salvage units would be retained as replacements. Only dead trees 12 inches diameter-at-breast-height (dbh) or larger would be salvaged. A dead tree is a tree with no green needles.

In Units 1, 4, and 8, ten percent of the gross acres would be left for wildlife. The areas left for wildlife retention would range from ½ acres to 15 acres in size and where feasible be located around rock outcrops. These areas would not be salvaged or planted. An average of 3 dead trees per acre larger than 13.5 inches dbh would be retained on salvaged acres.

Existing CWD that was not completely consumed by the fire on the ground would be retained and protected to the greatest extent possible from disturbance during treatment (such as yarding), which might otherwise destroy the integrity of the substrate.

**Alternative 3**

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**Objective**

Proposed activities in this alternative were designed in part to address scoping comments that requested a non salvage restoration only alternative, and the issue of Deer Winter Range habitat recovery (key issue). Proposed activities emphasize reduced area of disturbance from post-fire activities while also promoting vegetative recovery within the fire perimeter. The emphasis on reducing post-fire disturbance to resources would result in no fuels treatment.

**Salvage Harvest**

No salvage activities or timber outputs would result from this alternative. No fuels treatments would be implemented beyond activities that are approved by the Deschutes National Forest Land and Resource Management Plan. Reforestation would occur on 1,936 acres.

**Hazard Trees**

Trees that pose a hazard to public safety on open roads and in recreation areas would continue to be monitored and felled when identified as a hazard according to the R6 Hazard Tree standard (Harvey, Jr. & Hessburg, Sr., 1992). Utilization of felled trees for commercial use would not occur under this alternative.

### Forest Roads

Access to designated units for harvest and hauling of logs would predominately be on existing forest roads. A total of 7.0 miles of road decommissioning and 2.9 miles of closures would occur under this alternative. Subsoiling followed by planting of bitterbrush would be used to decommission the 7.0 miles of road.

### Fuels Treatment

No fuels treatments would occur under this alternative.

### Reforestation

Alternative 3 will reforest approximately 1,936 acres in the spring of 2006. As noted under Additional Resource Recovery Projects a total of 73 acres of roadside salvage would be hand planted in the spring of 2005. Reforestation in the Deer Winter Range (deer habitat) area will be designed to move towards providing 40 percent hiding and thermal cover. To help meet this objective a 640 acre fence would be built in deer winter range to eliminate browsing by big game. Fencing done in the winter range area will be done in a manner that will maintain access to at least minimal forage resources by deer and elk and to allow free movement of animals through the winter range. The fence would be removed when the planted trees are above browse height. In the General Forest Management Area trees will be planted to provide for appropriate stocking levels (minimum of 100 trees per acre).

The Alternative 3 map (*Map 2*,) displays the proposed reforestation units.

**Table 2-2. Alternative 3 Acres by LRMP Management Area**

LRMP Man. Area	Acres	Acres Reforested Alt. 3	Percent of Area Reforested
Deer Habitat	2,887	1,868	64.7%
General Forest	901	68	07.5%
Scenic	22	0	0.0%
<b>Total</b>	<b>3,810</b>	<b>1,936</b>	<b>50.8%</b>

### Snags and Coarse Woody Debris

Under Alternative 3 existing snag levels would remain the same with the exception of snags felled adjacent to the big game fence to avoid damage. No treatments are planned that would affect future coarse woody debris.

## Mitigation and Management Requirements

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

resources that would be affected by the alternatives, or rectifying the impact by restoring the affected environment (40 CFR 1508.02). Management requirements are also mitigation measures typically derived from LRMP standards and guidelines, but other sources can also be existing laws or regulations, or guidelines for practices required by extraordinary conditions. They are listed here separately to avoid repeating them in each alternative description. A majority of these only apply to the salvage harvest associated with Alternative 2.

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

Effectiveness ratings of High, Moderate or Low are based on the following criteria:

- a) Literature and Research
- b) Administrative Studies (local or within similar ecosystem)
- c) Experience (judgment of qualified personnel by education and/or experience)
- d) Fact (obvious by reasoned, logical response)

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

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

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

## Soils

### Mitigation and Management Requirements

The management requirements listed for the soil resource are to be implemented during or after the project in order to meet the stated objectives for protecting and maintaining soil productivity. These requirements represent standard operating procedure for the protection of Forest resources, and they are generally addressed in timber sale contract provisions or sale layout.

### Mitigation Measure:

The following mitigation measures are designed to avoid or minimize potentially adverse impacts to soils by controlling equipment operations to locations and conditions that are less susceptible to resource damage. This type of mitigation is built into the action alternatives as part of the implementation guidelines.

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

- Use existing log landings and skid trail networks (whenever possible) or designate locations for new skid trails and landings.
- Maintain spacings of 100 to 150 feet for all primary (main) skid trail routes, except where converging at landings. Closer spacing due to complex terrain must be approved in advance by the Timber Sale Administrator. Main skid trails spaced 100 feet apart would limit soil impacts to 11 percent of the unit area. For the larger activity areas (greater than 40 acres) that can accommodate wider spacing distances, it is recommended that distance between main skid trails be increased to 150 feet to reduce the amount of detrimentally disturbed soil to 7 percent of the unit area (Froehlich, 1981, Garland, 1983). This would reduce the amount of surface area where restoration treatments, such as subsoiling, would be required to mitigate impacts to achieve soil management objectives.
- Restrict grapple skidders to designated areas (that is roads, landings, designated skid trails) at all times, and limit the amount of traffic from other specialized equipment off designated areas. The use of harvester machines will be authorized to make no more than two equipment passes on any site-specific area to accumulate materials.
- Avoid equipment operations during times of the year when soils are extremely dry and subject to excessive soil displacement.
- Avoid equipment operations during periods of high soil moisture, as evidenced by equipment tracks that sink deeper than during dry or frozen conditions.
- Operate equipment over frozen ground or a sufficient amount of compacted snow to protect mineral soil. If this option is selected, equipment operations should be discontinued when frozen ground begins to thaw or when there is too little compacted snow and equipment begins to cause soil puddling damage.
- Prevent additional soil impacts in random locations of activity areas, between skid trails and away from landings, by machine piling and burning logging slash on existing log landings and skid trails that already have detrimental soil conditions.

**Objective:** Reduce displacement and compaction damage to soils by limiting the amount of surface area covered by logging facilities, and limiting equipment operations to specified areas and ground conditions.

**Enforcement Mechanism:** Timber Sale Contract

**Effectiveness:** HIGH

**Basis:** Forest Plan Standards and Guidelines (SL-1 and SL-3); Timber Management BMPs T-2, T-4, T-9, T-11 and T-12; Forest Service Soil and Water Conservation Practices Handbook (FSH 2509.22); Froehlich et al 1981; Clayton, 1990; Garland, 1983; Fact; Experience

The following mitigation measure is designed to rectify impacts to the soil resource by reducing cumulative levels of detrimental soil conditions. Impacts to the soils resource before or after restoration would not exceed Regional and LRMP standards and guidelines.

- Reclaim all temporary roads, all log landings and approximately 500 feet of all primary (main) skid trails that lead into log landings by applying appropriate soil restoration treatments in all eight activity areas proposed under Alternative 2. Decommission (obliterate) approximately seven miles of local system roads which are recommended for removal from the transportation system (FS Road Numbers are identified in the Roads and Transportation Section of this EIS). Road decommissioning treatments would apply to both of the action alternatives. Options for mitigating the effects of project activities include the use of subsoiling equipment to loosen compacted soils, redistributing humus-enriched topsoil in areas of soil displacement damage, and pulling available slash and woody materials over the treated surface to establish effective ground cover protection.

**Objectives:** Reduce the extent of detrimentally disturbed soil to meet management objectives. Restore and stabilize detrimentally disturbed soils prior to seasonal runoff events.

**Enforcement Mechanism:** Timber Sale Contract

**Enforcement Responsibility:** Contract Administrator

**Effectiveness:** HIGH

**Basis:** Forest Plan Standards and Guidelines for Soil, Water and Riparian Resources (SL-1 and SL-4); Watershed Management BMP W-1; Cafferata, 1983; Garland, 1983; Johnson, 1995; Experience, Logic

**Management Requirement:**

Application of appropriate Best Management Practices (BMPs) would be included in Alternatives 2 and 3 for all ground-disturbing management activities as described in General Water Quality Best Management Practices (Pacific Northwest Region, 1988). These BMPs are tiered to the Soil and Water Conservation Practices (SWCP) Handbook (FSH 2509.22), which contains conservation practices that have proven effective in protecting and maintaining soil and water resource values. The Deschutes Forest Plan states that BMPs will be selected and incorporated into project plans in accordance with the Clean Water Act for protection of waters of the State of Oregon (Forest Plan 4-69). Specific BMPs commonly used to minimize the effects of road systems, fuels and timber management activities on the soil resource are briefly described for this project proposal.

- Use old landings and skidding networks whenever possible. Based on harvest history, approximately 151 acres of past harvest overlap a portion of proposed Unit 01. Assure that water control structures are installed and maintained on skid trails that have gradients of 10 percent or more. Ensure that erosion control structures are stabilized and working effectively (LRMP SL-1; Timber Management BMP T-16, T-18). *High effectiveness.*

- In all proposed activity areas, locations for new yarding and transportation systems would be designated prior to the logging operations. This includes temporary roads, spur roads, log landings, and primary (main) skid trail networks. (LRMP SL-1 & SL-3; Timber Management BMP T-11, T-14 & T-16). *Moderate effectiveness.*
- *Surface Drainage on Temporary Roads* – minimize erosive effects of concentrated water through the proper design and construction of temporary roads (Road BMP R-7). *Moderate effectiveness*
- *Road Maintenance* – conduct regular preventive maintenance to avoid deterioration of the road surface and minimize the effects of erosion (Road BMP R-18, R-19). *Moderate to high effectiveness.*
- *Coarse Woody Debris (CWD)* - Retain adequate supplies of large coarse woody debris (greater than 3-inches in diameter) to provide organic matter reservoirs for nutrient cycling following completion of all project activities (LRMP SL-1). It is recommended that a minimum of 5 to 10 tons per acre of woody debris be retained on dry, ponderosa pine sites to help maintain long-term site productivity. *Moderate effectiveness.*
- *Maintain duff layer* – Strive to maintain existing sources of unburned or partially-consumed, fine organic matter (organic materials less than 3-inches in diameter; commonly referred to as the duff layer), wherever possible, within planned activity areas. (LRMP SL-6; Fuels Management BMP F-2; Timber Management BMP T-13). *Moderate effectiveness.*

Elements and features of the action alternatives (2 and 3) are similar. They are described here to avoid repetition. Management requirements are intended to meet standards and guidelines set forth in the Deschutes Forest Plan (as amended), and for protection of water quality in the State of Oregon through planning, application and monitoring of Best Management Practices.

The Forest Service would require that Best Management Practices (BMPs) and mitigation measures be used to minimize possible adverse effects associated with timber salvage operations. Implementation of management requirements, BMPs and mitigation measures would be the responsibility of the Forest Service and those companies contracted to conduct salvage operations. Enforcement of BMPs and mitigation measures would be within the jurisdiction of the Forest Service. Mitigation measures and management requirements were developed to target specific resource needs. It is anticipated that BMPs would have a moderate to high degree of effectiveness relative to reducing adverse impacts.

## Wildlife Habitat

### Mitigation Measures:

- Re-vegetate closed/decommissioned road beds with native shrubs, forbs, grasses and trees.

**Objectives:** Reducing open road density. To move towards management objectives for forage, hiding, and thermal cover.

**Enforcement Mechanism:** Service Contract or volunteer work crew.

**Enforcement Responsibility:** Contract Officer Representative.

**Effectiveness:** HIGH

**Basis:** Forest Plan Standards and Guidelines for Wildlife (M7-5, M7-13, and M7-22). Experience, Fact.

### Management Requirements:

- In coniferous forest, sufficient snags (or clumps of snags) will be maintained to provide 40 percent of potential population levels of cavity nesting species...live replacement trees (i.e. GTRs) will be left during any harvest to assure 60 percent of cavity nesting potential. Specific guidelines will be provided by the Deschutes National Forest Wildlife Tree Implementation Plan (WL-37, 38). The Eastside Screens specify that 100 percent of cavity nesting potential will be provided with snags and green tree retention (however, “salvage” sales are exempted). Incorporate the latest scientific findings, which require a minimum of 3 snags per acre and retention of the remaining green trees. *High effectiveness.*
- Fallen trees and other woody debris will be retained in sufficient quantity, distribution, and physical characteristics to provide habitat for viable populations of dependent wildlife species over time (WL-72, 73). The Eastside Screens require 3 to 6 logs of 12” diameter (small end) per acre (however, “salvage” sales are exempted). Incorporate the latest scientific findings, which require a minimum of 1.4 percent of CWD coverage per acre. *High effectiveness.*
- Reforestation will plant ponderosa pine within pre-determined deer hiding/thermal cover patches (200 to 300 trees per acre), movement corridors, and roadside screens to meet the long-term desired conditions. A maximum of 40 percent of the acres of the deer habitat within units 1, 2, 3, 4, 6, and 8 as well as all of units 5 and 7 would be planted for this objective. Refer to the Implementation Guidelines in the Wildlife Report for details. Vexar tubes, fencing, vegetation matting or fertilization may be employed within cover, corridor and screen patches to promote survival and growth. *High effectiveness.*
- Reforestation will plant ponderosa pine on deer forage areas (that is 60 percent of the acres of the deer habitat within units 1, 2, 3, 4, 6, and 8) in a variable spacing



(50 trees per acre) of individual trees, patches of trees, and openings. The objective is to emulate a natural mosaic of open canopied pine forest and to establish an average of 35 large diameter (that is 21 inches + dbh) ponderosa pine trees per acre. Patch size should average 1.2 acres (Harrod et al. 1998). The estimated number of trees to achieve these objectives would be determined by considering site factors of productivity, vegetation competition, and other site characteristics. The use of vexar tubes and fencing (see map in Chapter 3, page 98) to reduce animal browse damage is acceptable. *High effectiveness.*

## Noxious Weeds

### Mitigation Measures:

- Machinery involved in the harvest activities, road building, and road closures must be washed prior to entry into the project area. Use the timber sale contract equipment washing clause to reduce the possibility of importing noxious weeds to the area.
- Machinery involved in project activities must be washed prior to going to the next work site.

**Objectives:** Reduce or eliminate the introduction or spread of noxious weeds.

**Enforcement Mechanism:** Timber Sale Contract

**Enforcement Responsibility:** Contract Administrator

**Effectiveness:** Moderate to High effectiveness

**Basis:** Forest Service Manual (FSM) 2081.03, 29). Experience, fact

- The district botanist will identify and flag out areas of weed infestation, if present, for implementers to avoid; she or he will closely coordinate this with those doing the implementing.

**Objectives:** Reduce or eliminate the introduction or spread of noxious weeds.

**Enforcement Mechanism:** Timber Sale Contract

**Enforcement Responsibility:** Contract Administrator

**Effectiveness:** Moderate effectiveness

**Basis:** Forest Service Manual (FSM) 2081.03, 29). Experience, logic

## Cultural Resources

### Mitigation

- Install interpretive/protective signage at the approach to the site from Road 18/200. The presence of visitors in an area of cultural resources vulnerable to vandalism tends to discourage would be vandals.

**Objectives:** Inform public of a historic railroad logging camp of local interest.

**Enforcement Mechanism:** Interpretive signage.

**Enforcement Responsibility:** Heritage Department.

**Effectiveness:** High effectiveness

**Basis:** Forest Plan Standards and Guidelines for CR-1, CR-2, CR-3, CR-4, and CR-7. Experience, logic

**Management Requirements:**

- Known heritage resource sites would be avoided by all proposed activities. *High effectiveness.*
- Heritage resource sites discovered during harvest operations would be avoided from any further disturbance. *High effectiveness.*

## Scenic

**Management Requirements:**

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

- Flush cut stump (12 inches or less) within immediate Foreground landscape (0 to 300 feet) of a sensitive travel corridor, such as along Forest Road 18 (China Hat Road), 1810 and 9711. *High effectiveness.*
- Where possible, design and locate skid trails and landings at least 300 feet away from Forest Road 18 (China Hat Road), 1810, 9711. *Moderate to High effectiveness.*

Removal of ribbons and other timber harvest markers as part of post treatment activity following the completion of the project. *Moderate to High effectiveness.*

## Range

**Management Requirements:**

The following management requirements are designed to avoid or minimize affects to range improvements and range resources.

- Protect existing fence T-posts within Unit 3 (1,368 feet) and 4 (2,100 feet) by avoidance. *High effectiveness.*

## Fuels Treatment and Air Quality

**Management Requirements:**

- The proposed action would salvage fire-killed trees on approximately 1,936 of the 3,810 acres. Whole-Tree-Yard (WTY) or Leave-Tops-Attached (LTA) to the last

log would be used on all salvage acres to help eliminate salvage activity fuels.  
*High effectiveness.*

- Approximately 142 landing piles with an estimated 2,130 tons of limbs, needles, and tops from the salvaged trees would be burned. Utilization of fuel in landing piles would be an option for disposal depending on markets and economics. Brush disposal or appropriated funds would be collected from the salvage sale to dispose of the landings and pay smoke management fees. All slash pile burning would be in accordance with Oregon State Smoke Management Guidelines. *High effectiveness.*

### **Monitoring**

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

#### Wildlife:

Objective: To increase wildlife habitat effectiveness.

Monitor Elements: Determine if road closures and decommissioning were completed and effective.

Suggested Methodology: Annual field review for 2 years.

#### Soil Quality

Objective: To determine if post-implementation soil productivity is within parameters consistent with regional standards and guidelines for soil quality.

Monitoring Elements: Percentage of detrimental disturbance.

Area of Consideration: Salvage units.

Suggested Methodology: Shovel probe

#### Reforestation

Objective: To evaluate reforestation success.

Monitoring Elements: Tree survival and animal damage.

Area of Consideration: Reforestation units.

Suggested Methodology: Survival of planted trees will be monitored through annual visits in the fall following the first and third season after planting. Impacts by damaging agents including animals and falling trees will be assessed annually or bi annually with a walk through inspection. Monitoring will be conducted twice a year for the first four years following planting. If damage occurs an assessment of level of damage will be made and the decision on whether to control the gopher populations will be made at that time. Monitoring of seedling damage will be conducted at the time of maintenance of vexar tubes and fencelines. Effectiveness of protection will be evaluated and removal of fence or vexar when appropriate.

#### Noxious Weeds

Objective: To determine the introduction of new infestations or expansion of existing infestations of invasive plant species.

Monitoring Elements: Area covered by infestations and their locations.

Area of Consideration: 18 Fire project area.

Suggested Methodology: Inspect travel routes annually during field season.

## Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

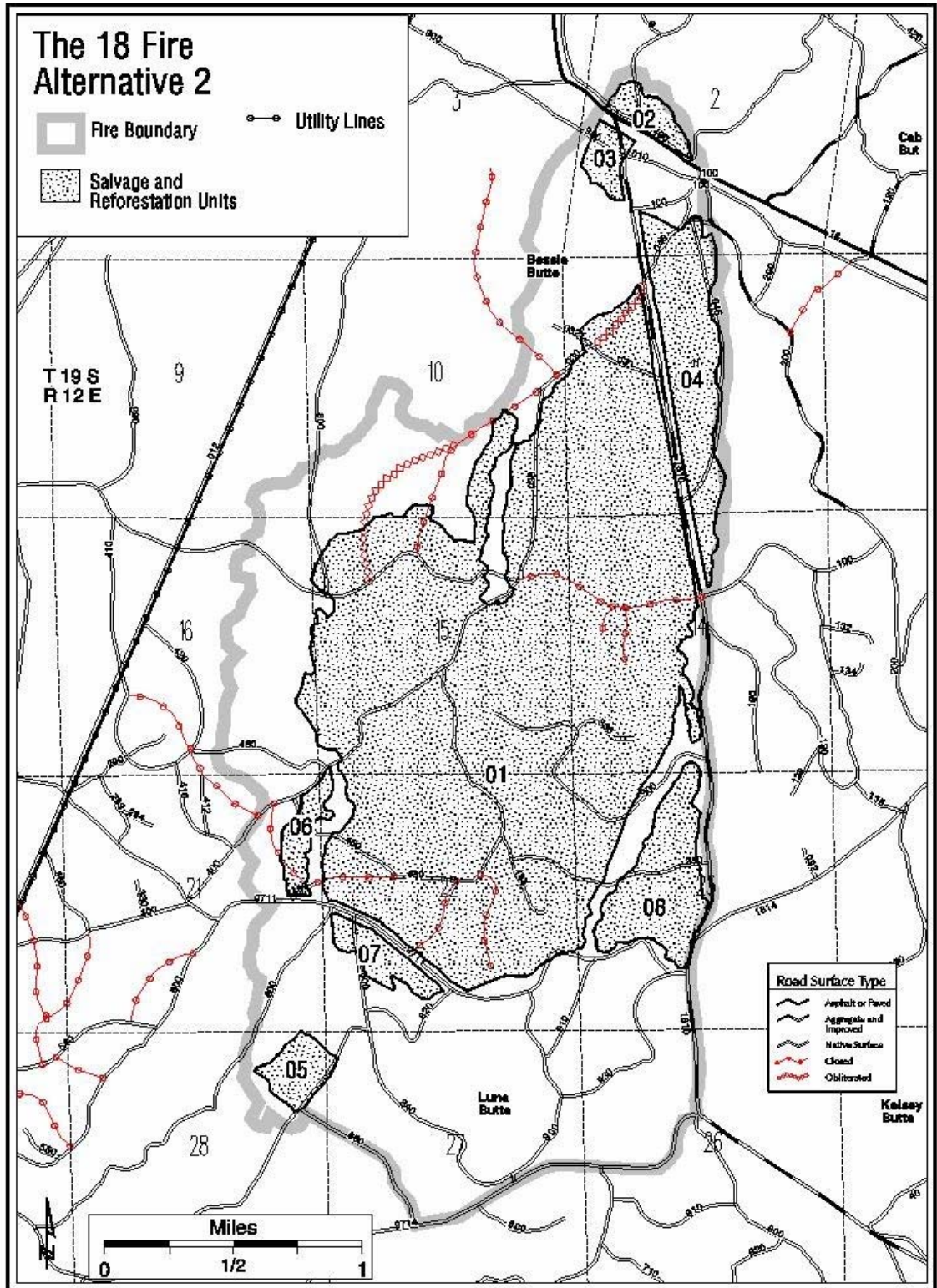
**Table 2-3. Comparison of 18 Fire Recovery Alternatives**

	Alternative 1	Alternative 2	Alternative 3
Volume Salvaged/MMBF	0	7.0	0
Net Sale Value/ Thousands \$	0	301	0
Jobs Maintained/Created	0	58	10
Deer Habitat acres salvaged/planted	64	1,868/1,868	0/1868
Deer Habitat area not treated	2823	1019	1019
General Forest acres salvaged/planted	9	68/68	0/68
Area of fire not salvaged	98%	47%	98%
Average number of trees salvaged/acre (Note this is for the acres of salvage only)	0	31.2	0
Acres of roads & logging facilities subsoiled within units	0	56.9	4.8 (roads)
Acres of roads subsoiled outside units	0	5.6	5.6
Coarse Woody Debris/Tons per acre	40 to 60	15 to 20	40 to 60
Coarse Woody Debris/Percent Cover	8.1	3.2	8.1
Miles of road obliterated	0	7.0	7.0
Miles of road closed	0	2.9	2.9
Miles of open road/square mile	3.6	1.9	1.9
Temporary road miles	0	3.5	0
Number of acres replanted at 300 TPA*	73	252	252
Number of acres replanted at 200 TPA**	0	530	530
Number of acres replanted at 50 TPA***	0	1,227	1,227
Fence acres in Unit 1	0	640	640

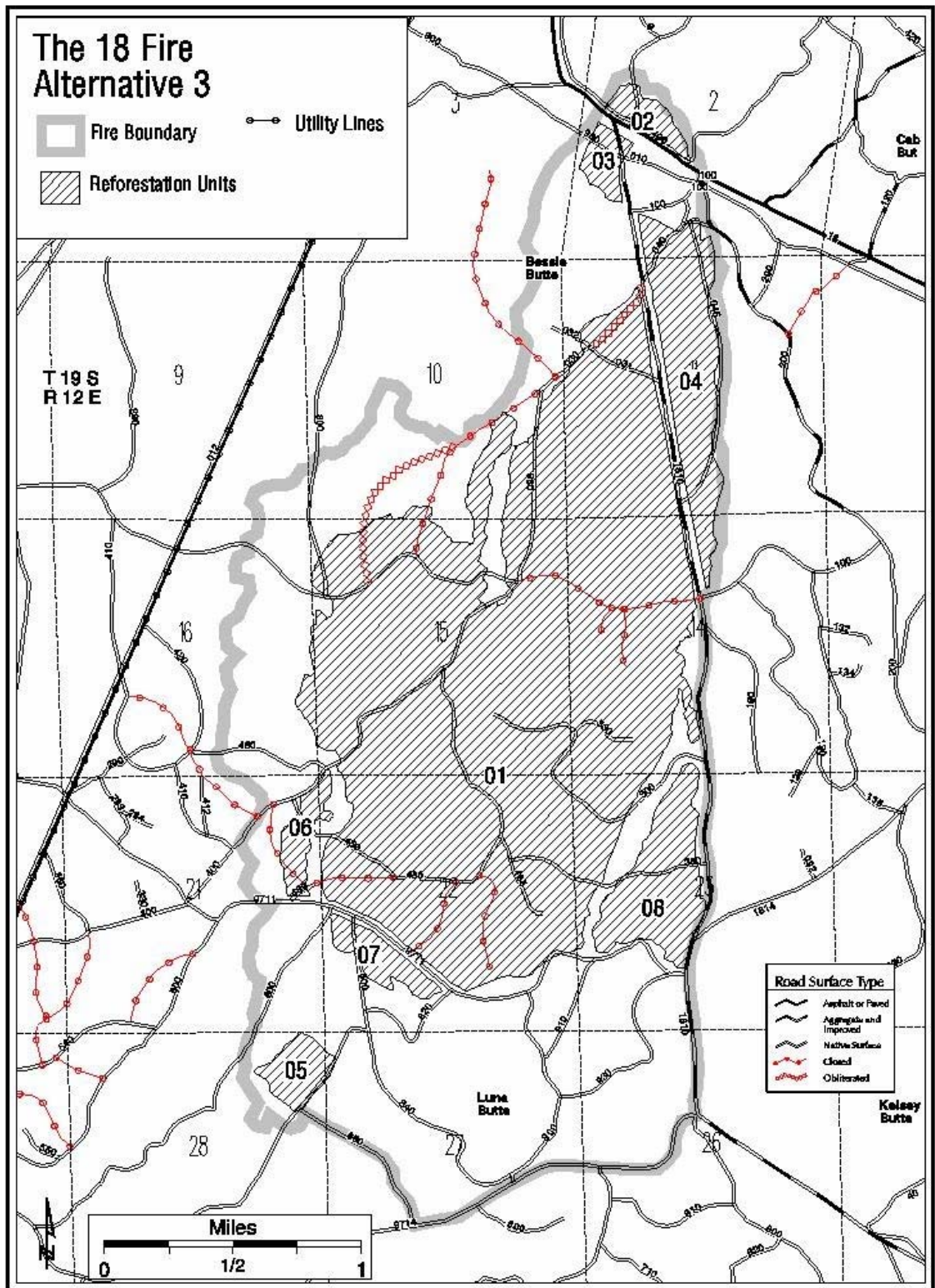
\* 154 acres in Unit 1; 14 acres in Unit 4; 11 acres in Unit 8. A total of 73 acres of planting was included from the Decision Memo for the 18 Fire Roadside Salvage CE and display in 300 TPA for all alternatives.

\*\* 462 acres in Unit 1; 34 acres in Unit 5; 34 acres in Unit 7

\*\*\* 923 acres in Unit 1; 27 acres in Unit 2; 23 acres in Unit 3; 128 acres in Unit 4; 29 acres in Unit 6; 97 acres in Unit 8









## CHAPTER 3

# AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

### Introduction

This chapter of the DEIS describes both the existing conditions of the area and the environmental consequences that would affect the area and resources, based on the alternatives described in *Chapter 2, Alternatives* and summarized immediately below.

**Alternative 1 No Action:** This alternative would leave the project area as it is post-fire. There would be no salvage harvest, reforestation plantings, or road closures. The area would be allowed to naturally restore itself. The establishment of coniferous trees would be slow and uneven. Grasses, forbs, and some shrub species should recover relatively quickly. However, they would compete with the natural conifer seedlings, and further extend the time of reforestation. Large amounts of dead and down trees would accumulate through time. This may benefit some species, but potentially negatively affect some others, such as deer movement.

**Alternative 2 Proposed Action:** The proposed action would salvage harvest within a 1,936 acre area of the fire, which had a gross acreage of 3,810 acres. Approximately 7.0 million board feet of logs would be removed from 8 individual harvest units (refer to the Alternative 2 map in Chapter 2). Existing (~1.0 mile) and temporary roads (~2.5 miles) would be used in removing the material. No new, permanent roads would be constructed. After harvest, road/area closures to motorized vehicles would be implemented that would reduce the current density. Seven miles of existing roads would be obliterated and 2.9 miles of road would be closed. The area would be reforested after harvest with variable densities of tree planting with dense planting in pre-identified locations for deer cover, movement corridors, and roadside screens. A temporary fence of approximately 640 acres would be built to reduce the reforestation cost associated with protecting seedling from big game browse.

**Alternative 3 Reforestation:** This alternative would not do any salvage harvest. Reforestation, road closures and obliteration would be identical to the Alternative 2 Proposed Action.

For ease in presentation and comparison, the analysis discussions are separated into individual resource areas, such as soil quality, air quality, wildlife habitat, and botany. Although the anticipated environmental effects of alternatives were analyzed for each resource, impact analyses (adverse and beneficial) emphasize those decisions that relate to the key issues and concerns identified in Chapter 1, Purpose and Need for Action. Some impacts are expressed in qualitative terms (such as wildlife habitat or scenic resources), others in quantitative terms (such as timber salvage or economic).

Impact descriptions under each resource area are divided into the following categories:

- Effects of the no-action alternative



- Effects common to all action alternatives, if applicable
- Effects unique to each action alternative, if applicable

Impacts and Commitments are defined as follows:

- **Impacts** – *Direct effects*: Those which occur at the same time and in the same general location as the activity causing the effects. *Indirect effects*: Those which occur at a different time or different location than the activity to which the effects are related.
- **Cumulative Impacts** – Those effects, which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions.
- **Irreversible Commitments** – Those commitments that cannot be reversed, except in perhaps the extreme long-term.
- **Irretrievable Commitments** – Those commitments that are lost for a period of time.

Mitigation measures to be implemented for any timber salvage operations are addressed in Chapter 2, under, Mitigation and Monitoring. By design, each alternative has built in mitigation in the form of standard and special contract clauses that would be added to the approval of any timber salvage sale. Effective mitigation avoids, minimizes, rectifies, reduces, or compensates for potential impacts. After mitigation is applied, any unavoidable adverse impacts to each resource area are addressed.

## Soil Productivity (Key Issue 1) \_\_\_\_\_

Issues are used to formulate alternatives, prescribe mitigation measures, and analyze the environmental effects of management activities. Key issues regarding the 18 Fire Recovery Project were originally identified by the Interdisciplinary Team (IDT) and emphasized by the public during scoping. A summary of the soil productivity issue and indicators used for tracking how each of the alternatives addresses this issue are provided below.

**Issue Statement:** Salvage harvest and associated activities can potentially have adverse impacts on soil productivity through physical disturbances and adverse changes in organic matter levels. What are the best ways to mitigate these impacts?

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

Past management practices, the 18 Fire, and fire suppression activities have affected the soil resource within the project area. The proposed salvage harvest and associated activities may cause cumulative increases in detrimental conditions by increasing compaction and soil displacement, reducing effective ground cover, and increasing the potential for accelerated erosion.

**Indicators:**

- 1) The extent of detrimental soil conditions within individual activity areas proposed for mechanical treatments.
- 2) The amount of coarse woody debris (CWD) and surface organic matter that would be retained to provide ground cover protection and a long-term source of nutrients on treated sites.
- 3) The probable success in project design and implementation of management requirements and mitigation measures that would be applied to minimize adverse impacts to soil productivity.

**Soil Productivity Introduction****Scope of the Analysis**

The soil resource may be directly, indirectly, and cumulatively affected within each of the activity areas proposed within the project area. An activity area is defined as “the total area of ground impacted activity, and is a feasible unit for sampling and evaluating” (FSM 2520 and LRMP, page 4-71). For this project proposal, activity area boundaries are considered to be the smallest identified area where the potential effects of different management practices would occur. Thus, the discussion of soil effects and soil quality standards will be focused on the units proposed for silvicultural treatments. The activity areas range from approximately 23 acres to 1,539 acres in size.

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

**Project Description**

The proposed actions would authorize commercial salvage harvest and fuel reduction treatments on approximately 1,936 acres to expedite the establishment and restoration of ponderosa pine stands and reduce the potential for high-severity fires in the future due to heavy fuel loadings from fallen fire-killed trees. Mechanical harvest would likely be accomplished using modern, track-mounted machines equipped with a felling head (harvester shear), and felled trees would be whole-tree yarded to designated skid-trail networks and transported to landings using grapple skidders. Mechanical harvesters would only be allowed to make a limited number of equipment passes on any site-specific area. Skidders would be restricted to designated skid trails at all times. Main skid trails would be spaced approximately 100 feet apart on average. Most of the slash generated from harvest activities would be machine piled and burned on log landings and/or main skid trails. Dead trees (snags) and down woody materials would be retained in a mosaic of varying densities across the landscape. Reforestation by hand-planting ponderosa pine is proposed on approximately 1,936 acres following the salvage harvest and fuel reduction treatments.

There would be no new construction of roads that would remain as classified system roads. Approximately 3.5 miles of temporary road would be constructed to allow access to some activity areas, but these roads would be obliterated upon completion of harvest activities. The roads analysis identified several segments of local system road, which are recommended for obliteration (road decommissioning) treatments because they are no longer needed for long-term access. Soil restoration treatments (subsoiling) would also be applied to primary skid trails and log landings to reduce cumulative levels of detrimentally compacted soil within the proposed activity areas.

## **Background Information for Existing Condition Assessment**

### **Wildfire Effects**

The current biological condition of soils varies depending on the ground-level burn severity of the 18 Fire and approximately 77 acres of re-burn that overlapped portions of the Bessie Butte Fire (1996). The magnitude of fire effects depends on soil resiliency, post-fire erodibility, precipitation events, and the time it takes to re-vegetate burned sites. The Burned Area Emergency Rehabilitation (BAER) team concluded that the fire burned irregular and patchy as evidenced by the classic mosaic pattern of moderate and lightly burned areas (BAER Soil Specialist Report, 2003). Based on field reconnaissance of post-fire soil conditions, approximately 2,324 acres (61 percent) were classified as low burn severity and 1,476 acres (39 percent) classified as moderate burn severity. Low severity burns generally do not remove the litter and duff layer, and most organic matter remains incorporated in the soil surface. The re-burn portions of the Bessie Butte Fire were low-to-moderate severity burns that consumed mainly brush patches in previously burned areas.

Severely burned soil is a detrimental soil condition that usually results from extreme surface temperatures of long duration. Although the fire caused high mortality of overstory trees over most of the burned area, ground-level heating was typically not elevated to temperatures capable of altering soil properties that affect site productivity. The minor extent of severely burn soil was generally confined to “micro-sites”, or isolated spots beneath downed logs or around root crowns of individual trees. These sites were minor inclusions in areas mapped as moderate burn severity and likely comprise less than one percent of the burned acreage. Therefore, severely burned soil was not included as an existing source of detrimental soil conditions within the activity areas proposed for this project.

Although there are no sensitive soils with high erosion hazards, all burned areas are susceptible to short-term increases in surface runoff and erosion from water and wind until vegetative recovery takes place. Most areas that burned with moderate severity still have about half of the surface organic materials in place; remaining ground cover consists of a few charred logs, partially consumed duff and litter, needle-fall from scorched tree crowns, and surface rock fragments. This surface cover will effectively slow the velocity of any overland flow that may occur from intense rainfall events, thereby reducing the potential for surface erosion in burned areas with gentle slopes. The north and east aspects of Bessie and Luna buttes sustained moderate severity burns that removed greater amounts of ground cover. Exposed soils on the steeper slopes of these landforms are much more susceptible to dry ravel and accelerated surface erosion during the fire recovery period. The lightly burned areas sustained only minor losses of organic matter and existing woody debris. Re-growth of sprouting shrubs and herbaceous forbs and grasses are already establishing live cover in most of these areas. The extent of exposed mineral soil is estimated to range from 10 to 20 percent in areas of low burn severity and 20 to 40 percent of the moderate severity burn acres (BAER Soil Specialist Report, 2003).

All soils are susceptible to soil movement whenever rainfall intensities or snowmelt are great enough to cause overland flow. In localized areas where coarse woody debris and surface litter are completely consumed by fire, extreme temperatures can volatilize organic compounds and interfere with the hydrologic function of soils. Measurements of post-fire infiltration rates of surface soils affected by moderate severity burns did not indicate elevated levels of hydrophobic (water repellent) soil conditions that would lead to increased surface runoff and extended periods of soil erosion. Water infiltration through exposed mineral soil and partially consumed litter was comparable to unburned mineral soil outside the fire perimeter (BAER Soil Specialist Report, 2003). At the present time, adequate soil cover currently exists to control accelerated erosion rates within tolerable limits. Therefore, accelerated soil erosion is not expected to have any long-term adverse effects to soil productivity during the fire recovery period. The absence of stream channels within or adjacent to the project area assures that there is no potential for eroded sediments to reach any listed 303(d) water bodies or cause indirect, adverse effects to essential fish habitat (Walker, 2003).

Fire affects nutrient cycling and the physical, chemical, and biological properties of the underlying soil (Debano, 1991). Most of the nutrient exchange takes place in the surface organic matter on the forest floor. The loss of soil nutrients from fire volatilization of coarse woody debris and surface organic matter will likely have the greatest impact on site productivity during the fire recovery period. Although some nutrients were volatilized and lost in localized areas of severe burning, most plant nutrients were made more available over extensive areas of land that were affected by low and moderate severity burns. Nitrogen is an important plant nutrient that is chemically bonded to soil particles, and it gradually becomes available to plants over time. Nitrogen becomes more soluble with partial consumption of organic matter, and this increases the amount of available nitrogen as well as increases in the amount of nitrogen lost through leaching. The dry climatic conditions associated with this forest habitat type do not support nitrogen-fixing shrub species, such as ceanothus, that would contribute to rebuilding nitrogen supplies. However, the nitrogen lost is quickly replaced with new organic matter, and available nitrogen levels are expected to return to near pre-fire conditions in the short-term.

Decaying wood and organic litter are critical for maintaining the soils ability to provide biotic habitat for microorganism populations. Soil microorganisms decompose woody material, cycle minerals, increase nutrient availability, and help nutrient uptake by plant roots. The relationship between soil heating and soil microbial populations is complex, and responses are primarily influenced by the duration and severity of soil temperatures. Losses of soil microbial and fungal populations most likely occurred where forest litter and duff layers were completely consumed in localized areas. However, heat penetration did not cause severe burning within 2 centimeters of the soil surface in representative burn areas (18 Fire, BAER Soil Specialist Report, 2003). The post-fire soil environment likely maintained viable populations of soil biota which are capable of responding to nutrient increases and the natural recovery of vegetation.

The effects of biomass consumption and loss of nutrients are difficult to quantify. Reductions in site productivity were greatest in localized areas where coarse woody debris (CWD) and surface litter were completely consumed by fire. The effects of low intensity fire do not easily consume material much larger than 3 inches in diameter, and charring does not substantially interfere with the decomposition or function of coarse woody debris (Graham et al., 1994). Under natural conditions, the amount of down woody debris will gradually increase as fire-killed standing trees fall to the ground over time. Based on samples collected for three similar fires on the Bend/Fort Rock Ranger District, over half of the smaller diameter snags (less than 10 inches) could be expected to fall within 3 to 5 years (Awbrey-Hall Fire of 1990 and Horse Butte Fire of 1992), and all dead trees (less than 17 inches) could be recruited to the forest floor within 8 years (Inn Fire of 1988). The larger diameter

snags (greater than 17 inches) may stand for 10 or more years, depending on the rate of decay and local wind conditions. Over the next 20 years, it is expected that the majority of these dead trees will become heavy fuel loadings that increase the risk for future wildfires to an unacceptable level. Post-fire sampling estimates indicate that potential biomass from down woody debris could range from 40 to 60 tons per acre within areas affected by stand-replacement fire (Plot Sampling, 2003). High-to-extreme fire hazard and potential for excessive soil heating exists when downed woody debris exceeds 30 to 40 tons per acre (Brown et al., 2003).

Short-term increases in available nutrients will benefit the recovery of ground-cover vegetation that will eventually provide new sources of organic matter. Vegetative recovery is expected to occur at rapid rates comparable to those observed on the adjacent Bessie Butte, Evans West, and Skeleton fires of 1996 (BAER Soil Specialist Report, 2003). The establishment of herbaceous forbs and grasses is expected to take two to three growing seasons, whereas deep-rooted shrubs and conifers may take five years or longer. The recovery of understory vegetation improves soil permeability by creating pathways for water infiltration along plant roots.

### **Fire Suppression and Emergency Rehabilitation Activities**

Soil disturbances from fire suppression activities were mitigated immediately following control of the fire. Disturbed sites, including approximately 5.5 miles of dozer fire line, drop points, and the safety zone on top of Bessie Butte were stabilized to prescribed rehabilitation requirements for controlling soil erosion. Hand lines were not used to control the spread of fire within the interior of the fire perimeter. Dozers were mainly used to clear strips of brush along the western and northern fire boundaries. Rehabilitation efforts focused mainly on pulling back litter, vegetation and displaced soil that was removed during construction. It is estimated that approximately 50 percent of the surface area on these sites still have detrimental soil conditions due to soil displacement. Natural processes (that is root penetration, frost heaving, freeze-thaw cycles) will likely restore soil porosity in compacted areas. The establishment of native vegetation and the accumulation of litter and organic materials will gradually improve areas of soil displacement over time. None of the existing sources of detrimental soil conditions caused by suppression activities occur within any of the activity areas proposed for restoration treatments. Soil disturbances from suppression activities do not increase the estimated percentages of existing detrimental soil conditions in Table 3-3.

Fire suppression activities also included the use of fire retardant dropped on fuels in front of advancing flames. Initial accumulations and movement of individual nutrients and compounds are primarily determined by the timing and duration of precipitation events capable of dissolving retardant residues following the fire. Residues on the surface of organic matter or mineral soil were likely dissolved in moisture derived from rainfall and/or snowmelt and have subsequently infiltrated into the soil profile. Since fire retardant mainly consists of ingredients used in agricultural fertilizer, these materials likely provided short-term increases in available nutrients that benefited the re-growth of ground-cover vegetation during the early stages of the recovery period. There is no potential for overland flow of sediments to reach stream channels outside of the project area (Walker, 2003).

## **Affected Environment or Existing Condition**

### **Existing Condition of the Soil Resource**

The current condition of soils is directly related to soil porosity and the quantity and quality of surface organic matter within the project area. Natural disturbance patterns (such as precipitation events, droughts, insect and disease epidemics, and wildfires) have influenced erosional processes and how

ecosystems function within the landscape. Ground-disturbing management activities (such as timber harvest, road building, recreation use and livestock grazing) have caused some adverse changes to soil quality in previously managed areas, especially where mechanical disturbances removed vegetative cover, displaced organic surface layers, or compacted the soil.

## Landscape Characteristics

The 18 Fire Recovery Project area covers approximately 3,810 acres within the Newberry Volcano physiographic area, where essentially all landforms, rocks, and soil are products from volcanic events that occurred over various time periods. The landscape is generally characterized by gentle to uneven lava plains with a few cinder cones and buttes associated with the Newberry Crater complex. Elevation ranges from about 4,300 feet at the junction of FS roads 18 and 1810 to 5,235 feet on the summit of Luna Butte. Mean annual precipitation varies across the landscape due to changes in elevation, but it generally ranges from about 10 to 20 inches.

The project area includes portions of the Bessie Butte and Green Mountain 6<sup>th</sup> field subwatersheds. Both 6<sup>th</sup> field watersheds are in the 5<sup>th</sup> field Pilot Butte watershed. Most of the water yielded from these lands is delivered to streams as deep seepage and subsurface flows that emerge at lower elevations. The nearest perennial stream is the Deschutes River, approximately 7 miles west of the project area. There are no perennial, intermittent, or ephemeral stream channels within the project area. Consequently, there would be no effects to any Oregon Department of Environmental Quality 303(d) listed waterbodies or essential fish habitat (Walker, 2003).

The project area contains 10 landtype units based on similarities in landforms, geology, and climatic conditions that influence defined patterns of soil and vegetation (Soil Resource Inventory, Larsen, 1976). The biophysical characteristics of these landtype units can be interpreted to identify hazards, suitabilities, and productivity potentials for natural resource planning and management.

Approximately 93 percent of the planning area is comprised of gently sloping plains and uneven lava flows that lie below and surround two cinder cones that account for approximately 7 percent of the total acreage. Dominant landforms have average slope gradients that range from 0 to 15 percent with occasional, short steep pitches up to 30 percent associated with the rough edges of lava flows. Bessie and Luna Buttes are cinder cones with butte escarpments and smooth convex slopes that range from 30 to 70 percent.

Except for occasional areas of exposed bedrock associated with some of the youngest lava flows, the majority of the planning area (over 95 percent) has been covered by a moderately thick layer of volcanic ash and pumice deposits from Mount Mazama (Crater Lake) and the Newberry-Crater shield volcano. The volcanic ash-influenced soil generally varies from 20 to 40 inches thick and consists mostly of sand-sized soil particles. Previously developed soils typically overlay hard bedrock that consists dominantly of basalt lava. The cindery soil materials of Besse and Luna buttes are generally exposed on the top portions, while ash deposits have accumulated to greater depths on the northern and mid-to-lower slope positions of all aspects due to wind and dry ravel erosion.

Soil profile characteristics and productivity potentials have been influenced by differences in topography and their position on the landscape. Slope shape controls important properties such as soil depth and soil moisture. Usually, the less productive soils are commonly found on south and west aspects and on convex slope positions such as basalt ridges and side-slopes of buttes and cinder cones. Approximately 15 percent of the project area is comprised of landtypes that contain shallow soils (less than 20 inches) and areas of exposed bedrock that generally produce surface runoff only during high

intensity storms. The more productive soils are commonly found on north and east aspects, and on concave slope positions such as toe slopes, swales and depressions. The deep soils (40 inches or more in depth) associated with these landscape positions commonly reflect areas of dense vegetation. Dominant soils are moderately deep (20 to 40 inches) to deep with loamy-sand textures that readily drain excess moisture over much of the project area. The underlying residual soils and bedrock materials have a moderate capacity to store water.

The sandy textures of these ash-influenced soils have high infiltration and percolation rates that account for low amounts of overland flow and natural erosion on undisturbed sites with adequate ground cover protection. Surface erosion by water is generally not a concern because dominant landtypes have gentle slopes and low-to-moderate erosion hazard ratings. The moderately deep and deep soils on Bessie and Luna buttes have a moderate erosion hazard. Exposed soils on the steep slopes (greater than 30 percent) of these landforms are much more susceptible to accelerated erosion during high-intensity rainfall events.

Soils derived from Mazama ash tend to be non-cohesive (loose) and they have very little structural development due to the young geologic age of the volcanic parent materials. Dominant soils have naturally low bulk densities and low compaction potential. Mechanical disturbances can reduce soil porosity to levels that limit vegetative growth, especially where there is a lack of woody debris and surface organic matter to help cushion the weight distribution of ground-based equipment. Due to the absence of rock fragments on the surface and within soil profiles, these soils are well suited for tillage treatments (subsoiling) that loosen compacted soil layers and improve the soils ability to supply nutrients, moisture, and air that support vegetative growth and biotic habitat for soil organisms. The sandy-textured surface layers are also easily displaced by equipment operations, especially during dry moisture conditions. The maneuvering of equipment is most likely to cause soil displacement damage on the steeper landforms.

### **Land Suitability and Inherent Soil Productivity**

The suitable lands database for the Deschutes National Forest LRMP identifies areas of land, which are considered to be suitable for timber production using criteria affecting reforestation potential (FSH 2409.13). This data was developed to designate a broad-scale timber base area for forest-wide planning purposes. Project level planning requires that lands proposed for harvest have their suitability verified based on the criteria outlined in the Forest Service Handbook (FSH 1909.12). Lands that do not meet these criteria are considered unsuitable or partially suitable for timber harvest due to regeneration difficulties or the potential for irreversible damage to resource values from management activities.

The productivity of forest soils can be measured as the Cubic Foot Site Class (Mean Annual Increment in cubic feet/year) for primary tree species growing on undisturbed or minimally disturbed sites. These volume indices provide valuable baseline information regarding soil productivity potential for each soil type in the Deschutes SRI (Soil Resource Inventory, Larsen, 1976). On the Deschutes National Forest, site classes range from very low (Site Class 7) to high (Site Class 4). Soil types having Site Class 7 are considered unsuited for forest production because the mean annual increment is generally less than 20 cubic feet per year.

Dominant landtypes within the 18 Fire Recovery Project area generally have moderate productivity ratings. All activity areas proposed for timber salvage and fuel reduction treatments meet the criteria for suitability that would allow them to be regenerated or resist irreversible resource damage. Approximately 34 acres of land (SRI map Unit 80) were identified as unsuited due to droughty

conditions on south facing slopes of Bessie Butte. The action alternatives exclude this area from management consideration.

### Sensitive Soil Types

Criteria for identifying sensitive soils to management are listed in the (Deschutes LRMP, Appendix 14, Objective 5). These criteria include slopes over 30 percent, frost pockets, seasonal or year-long high water tables, extremely rocky areas, and soils that have high or severe erosion hazard ratings.

Sensitive soils within the 18 Fire Recovery Project area include: 1) soils on slopes greater than 30 percent, 2) soils associated with frost pockets in cold air drainages, and 3) soils that occur in localized areas of rocky lava flows. There are no potentially wet soils with high water tables or sensitive soils with high erosion hazard ratings.

Approximately 22 percent (849 acres) of the project area contains landtypes with localized areas of sensitive soils (Table 3-1). It should be emphasized that only portions of these total landtype acres contain localized areas with sensitive soils. Sensitive soil areas that occur within proposed activity areas are discussed under the direct and indirect effects of implementing the action alternatives. Figure 3-1 shows locations of the proposed activity areas and their proximity to sensitive soils on steep slopes (greater than 30 percent).

**Table 3-1: Landtype Acres Containing Localized Areas of Sensitive Soils within the 18 Fire**

SRI Map Unit Symbol	Geomorphology (Representative landforms)	Type of Concern**	Landtype Acres
76, LG	Rough, uneven lava flows	3	312
6G	Depressions or Flats	2	268
80, 81, 82	Cinder cones	1	269

**\*\*Management Concerns**

- 1) On slopes greater than 30 percent, loose sandy soils are susceptible to soil displacement.
- 2) Very low productivity due to frost heaving, low fertility, and temperature extremes.
- 3) Sensitive soils with variable depths in pockets and cracks of rocky, uneven lava flows.

### Erosional Processes

Erosion is a function of many soil and environmental factors that affect soil particle detachment and movement by runoff water. The severity of soil erosion depends on many factors, including slope gradient, inherent soil erodibility, the amount of bare ground, and the intensity of precipitation events. All soils are susceptible to soil movement whenever rainfall intensities or snowmelt are great enough to cause overland flow. On undisturbed sites with gentle slopes, surface erosion occurs at naturally low rates because soils are protected by vegetation and organic litter layers. Accelerated erosion occurs at a rate greater than natural, which is usually associated with disturbances that reduce vegetative cover, displace organic surface layers, or reduce soil porosity through compaction. Steep slopes with sparse vegetation generally have greater amounts of surface runoff which increases the erosion potential. Due to the lack of structural development, volcanic ash-influenced soils are easily eroded where water becomes channeled on disturbed sites such as road surfaces, skid trails, water-bar outlets, and road drainage structures.

Inherent erosion hazard is a relative rating for surface erosion based on the ability of the soil to take in water, resistance of the soil surface to the impact of rainfall and water movement, and the effect of topography or slope gradient. The rating for surface erosion potential assumes that the surface cover of vegetation or litter has been disturbed or destroyed and bare surface soils are exposed to the elements of erosion. The following adjective ratings are intended for planning purposes to indicate relative potential erosion hazards.



**Low:** Soils are generally on gentle to moderate slopes with no appreciable hazard for erosion.

**Moderate:** Some loss of surface materials can be expected, but soils are sufficiently resistant to erosion to permit limited and temporary exposure of bare soil during development or use.

**High:** Considerable loss of surface materials can be expected. Unprotected soils will erode sufficiently to severely damage productivity.

There are no sensitive soils with high erosion hazards within the project area. Dominant soils consist of moderately deep and deep soils on gentle slopes with low hazards for water erosion. Exposed soils on the steeper landtypes, such as Bessie and Luna buttes, have moderate erosion hazards and these areas are much more susceptible to accelerated soil erosion during high-intensity rainfall events.

LRMP standard and guideline SL-6 (page 4-70 and 4-71) provides ground cover objectives to minimize accelerated erosion rates on disturbed sites with unprotected soils (Table 3-2). Effective ground cover includes all living or dead herbaceous or woody materials and rock fragments greater than three-fourths of an inch in diameter in contact with the ground surface, including tree or shrub seedlings, grass, forbs, litter, and woody biomass. Effective ground cover is measured as a percent of natural conditions for representative soils and landtypes. In order to minimize soil erosion by water or wind, the following ground cover objectives should be met within the first two years after completion of ground-disturbing management activities.

**Table 3-2. Minimum Ground Cover Objectives to Minimize Soil Erosion by Water and Wind**

Surface Soil Erosion (Deschutes Soil Resource Inventory)	Minimum Effective Ground Cover (Percent of Natural)	
	<u>1<sup>st</sup> Year</u>	<u>2<sup>nd</sup> Year</u>
<b>Low</b>	20 – 30	31 – 45
<b>Moderate</b>	31 – 45	46 – 60
<b>High</b>	46 – 60	61 – 75
<b>Severe</b>	61 – 75	76 – 90

At the present time, adequate soil cover currently exists to control erosion on the dominant soils and landforms that were affected by the 18 Fire. Accelerated erosion is not expected to have any long-term adverse effects to soil productivity during the recovery period.

### **Mass Movements (Landslide Hazards)**

Mass movements, or landslides, occur when earthen materials become unstable and slide downslope in response to gravity. There are no natural or management-related landslides known to exist within the project area. The high permeability of the ash-influenced soil materials generally precludes the buildup of hydraulic pressures that could trigger landslides. There are no seeps or springs on steep slopes and dominant landtypes do not meet criteria for landslide prone terrain.

## **Management-Related Disturbances**

### **Timber Management**

During the 1920s, railroad logging was used to remove most of the large-diameter ponderosa pine, leaving a scattered overstory of seed trees to provide natural regeneration. Over the past 70 to 80 years, it is expected that natural processes (that is root penetration, frost heave, rodent activity, freeze-

thaw and wetting-drying cycles) have gradually restored soil porosity in compacted areas, while the establishment of native vegetation and accumulation of organic matter has improved areas of past soil displacement.

Based on more recent harvest history, various silvicultural prescriptions including thinning treatments, intermediate salvage harvest, and regeneration harvest have occurred within the project area between 1979 and 1992. Temporary roads, log landings, and primary skid trails were constructed and used to access individual harvest units of past timber sales. Research studies and local soil monitoring have shown that soil compaction and soil displacement account for the majority of detrimental soil conditions resulting from ground-based logging operations (Deschutes N.F., Soil Monitoring Reports; Page-Dumroese, 1993; Geist, 1989; Powers, 1999). Some long-term adverse effects to soil productivity still exist where surface organic layers were displaced and/or multiple equipment passes caused deep compaction.

Ground-based logging equipment disturbed soils in portions of approximately 398 acres that occur within the project area. Based on the extent of overlap with the eight activity areas, it was determined that about 178 acres of these previously managed areas occur within the largest of the proposed activity areas (Unit 1, 1,539 acres). There was no overlap of past harvest areas with the other seven activity areas proposed with this project.

In November of 2003, soil condition assessments were conducted on a representative sample of existing disturbance caused by past equipment operations within Unit 1. Qualitative assessments of soil surface conditions were made by establishing twelve transects and recording visual evidence of soil disturbance at 10 foot intervals within the 178 acre portion of Unit 1. Detrimental soil compaction on main skid trails was the primary disturbance category observed where equipment operations were intensive. Shovel probing was used to assess compaction using resistance to penetration as a measure. Soil displacement, as defined by FSM 2521.03, was more difficult to distinguish due to the establishment of native vegetation and the accumulation of forest litter. Observations suggested that equipment turns or movement generally caused more mixing of soil and organic matter than actual removal from a site.

Although subsoiling treatments have rehabilitated disturbed soil on some past logging facilities, it was concluded that most project-related impacts occurred on and adjacent to existing roads, skid trail systems, and log landings. Monitoring results indicate that the average amount of detrimentally disturbed soil is about 12 percent of the 178 acre assessment area. The sample area (178 acre) is a relatively small portion of the much larger Unit 1 (1,539 acres). The overall extent of soil impacts from past harvest activities only accounts for about one percent of the total area proposed for Unit 1. This amount is well within allowable LRMP limits for maintaining soil productivity.

Much of the random disturbance between main skid trails and away from landings has decreased naturally over time. Research has shown that the detrimental effects of soil compaction require more than 3 to 5 equipment passes over the same piece of ground (McNabb, Froehlich, 1983). Where logs were skidded with only 1 or 2 equipment passes, soil compaction was shallow (2 to 4 inches) and the bulk density increases did not qualify as a detrimental soil condition. It is expected that soils in these areas have returned to undisturbed density levels in the short-term (less than 5 years) through natural processes (that is root penetration, frost heave, rodent activity, freeze-thaw and wetting drying cycles). The establishment of ground cover vegetation and accumulation of organic matter has been improving areas of past soil displacement.

The effects of management activities on soil productivity also depend on the amount of coarse woody debris (CWD) and surface organic matter retained or removed on affected sites. Decaying wood on the forest floor is critical for maintaining the soils ability to retain moisture and provide both short and long-term nutrient supplies for the growth of vegetation. Mycorrhizal fungi and soil organisms depend upon the continuing input of woody debris and fine organic matter. A balance between management practices and ensuring adequate amounts of CWD is an important goal for maintaining long-term soil productivity. Using mycorrhizal fungi as a bio-indicator of productive forest soils, research studies were used to develop conservative recommendations for leaving sufficient CWD following management activities (Graham et al. 1994, Brown et al. 2003). A minimum of 5 to 10 tons per acre of coarse woody debris (greater than 3 inches in diameter) should be retained on dry, ponderosa pine sites to maintain soil productivity. The upper limit of this range seems appropriate in areas where most of the partially decomposed CWD and forest litter was consumed by fire (Brown et al. 2003). A sufficient number of standing dead snags and/or live trees should also be retained for future recruitment of organic matter.

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

## Roads

The project area contains approximately 21.4 miles (34 acres) of open system roads. Segments of these existing roads cross through portions of all eight activity areas proposed for treatment. The amount of detrimentally disturbed soil committed to existing roads is included in the estimated percentages displayed in Table 3-3 and is summarized by activity area as follows:

<b>Unit 1:</b> 9.2 miles (13.4 acres)	<b>Unit 2:</b> 0.6 miles (0.9 acres)
<b>Unit 3:</b> 0.3 miles (0.5 acres)	<b>Unit 4:</b> 0.8 miles (1.2 acres)
<b>Unit 5:</b> 0.3 miles (0.4 acres)	<b>Unit 6:</b> 0.3 miles (0.4 acres)
<b>Unit 7:</b> 0.1 miles (0.1 acres)	<b>Unit 8:</b> 0.3 miles (0.4 acres)

Roads detrimentally disturb soil properties and convert the soil resource to a non-productive condition. Most of the precipitation that falls on compacted road surfaces is transmitted as surface runoff, and roads are primary sources of accelerated surface erosion. Road condition surveys would be conducted to identify where improvements are necessary to correct drainage problems on existing roads that may be used as haul routes for this project.

The roads analysis identified several segments of local system road, which are recommended for long-term closures and road decommissioning (obliteration) treatments. Some local system roads are currently closed to public use, but segments of these roads may be re-opened to provide necessary access. These roads would either be closed again or decommissioned following harvest activities.

## Recreation Activities

The extent of detrimental soil conditions associated with recreation use is relatively minor in comparison to existing roads and past logging disturbances. There are no developed campgrounds or system trails for hiking and/or Off Highway Vehicle (OHV) use that cross through any of the proposed activity areas. Approximately one mile of developed horse trail occurs within the project area, but only about 500 feet of this trail crosses through one proposed activity area (Unit 4). The small amount of disturbed soil (less than 0.1 acre) does not increase the percentage of detrimental soil

conditions in this activity area. Developed recreation facilities do not increase the percentages of existing detrimental soil conditions within any of the proposed activity areas in Table 3-3.

Impacts from dispersed recreation activities are usually found along existing roads and trails. Field observations indicate little or no evidence of dispersed campsites within the proposed activity areas. User-created trails typically occur where vegetation has been cleared on or adjacent to old skid trail networks of past harvest areas. Conservative estimates were used to account for soil disturbances from existing logging facilities (such as main skid trails and landings), and the extent of these impacts is likely included in the estimates of existing detrimental soil conditions (Table 3-3). Consequently, recreational use is expected to have a negligible effect on overall site productivity within the individual activity areas proposed for this project.

### **Livestock Grazing**

The project area contains portions of the Bessie Grazing Allotment, which has been inactive since 1990. Livestock impacts to the soil resource are found mainly in localized areas of concentrated use, such as around water developments, salt licks, bedding areas, and major travel routes. The majority of detrimental soil conditions are confined to relatively small areas (about 1.0 acre) around water developments needed to manage livestock. Salt licks are commonly placed in the immediate vicinity of water sets and these sites are commonly used as bedding areas, especially where scattered trees exist to provide shade. Although there are three water sets within the project area, only one occurs within a proposed activity area (Unit 1). Approximately one acre of disturbed soil is estimated for this water set and it is included the estimated percentages of detrimental soil conditions (Table 3-3). The extent of detrimental soil conditions from this facility is less than 0.1 percent of the unit area.

There are no site-specific areas where livestock movement and grazing effects have caused unsatisfactory soil conditions within the individual activity areas proposed for this project. Prior to the fire effects to existing vegetation, current range records for representative analysis plots indicated that forage conditions were generally good and the vegetative trend was stable (see Range Section). The minor extent of incidental soil disturbances from grazing use in random locations of activity areas is not expected to increase the percentages of detrimental soil conditions.

Based on vegetative recovery rates for similar fires that burned in 1996 (Bessie Butte, Evans West, Skeleton), the natural recovery of most ground-cover vegetation is expected to be rapid (within the first two growing seasons). Therefore, livestock grazing within the project area would not resume until the fall of 2005. Due to the extent of moderate, light and unburned areas, the re-growth of sprouting shrubs and herbaceous forbs and grasses are already establishing live cover in affected areas. At the present time, adequate soil cover currently exists to control accelerated erosion rates during the fire recovery period.

### **Summary Discussion Relevant to the Issue Indicators**

#### **Indicator #1: Detrimental Soil Disturbance**

The 18 Fire burned irregular and patchy as evidenced by the classic mosaic pattern of moderate and lightly burned areas (18 Fire, BAER Soil Specialist Report, 2003). The re-burn portions of the 1996 Bessie Butte Fire (approximately 77 acres) were low-to-moderate severity burns that consumed mainly brush patches in previously burned areas. Although the fire caused high mortality of overstory trees, ground-level heating was typically not elevated to temperatures capable of altering soil properties that affect site productivity. Severely burned soil was generally confined to small, isolated spots beneath downed logs or around root crowns of individual trees where most of the coarse woody debris and surface litter were completely consumed by fire (BAER Soil Specialist Report, 2003).

These sites were minor inclusions in areas mapped as moderate burn severity and likely comprise less than one percent of the burned acreage. Therefore, severely burned soil was not included as an existing source of detrimental soil conditions within the proposed activity areas.

Accelerated surface erosion is not expected to have any long-term measurable effects to soil productivity within any of the proposed activity areas. Landforms have gentle slopes and there are no sensitive soils with high erosion hazards. The sandy textures of the dominant ash-influenced soils have high infiltration and percolation rates that account for low amounts of overland flow and natural erosion. Monitoring results of similar soils and previous fires on the district indicate that overland flow of water and evidence of surface erosion is typically nonexistent in burned areas with gentle slopes. There are no natural or management-related landslides known to exist within the project area, and the hazard for debris flows is low. Although the Eighteen Fire killed vegetation and reduced evapotranspiration rates, most of the water yielded from affected acres is expected to be delivered to streams as subsurface flows that emerge at lower elevations outside the project area.

All burned areas are susceptible to short-term increases in surface erosion from water and wind until vegetative recovery takes place. Approximately 39 percent of the acreage that burned with moderate severity still has about half of the surface organic materials in place. The current extent of exposed mineral soil in these areas is estimated to range from 20 to 40 percent. The lightly burned areas, approximately 61 percent of the burned area, sustained only minor losses of organic matter and pre-fire woody debris. Barren ground is estimated to range from 10 to 20 percent in these areas. Ground-level temperatures did not cause water-repellant soil conditions that would lead to increased runoff and extended periods of surface erosion. Existing soil cover and the re-growth of sprouting shrubs and herbaceous vegetation will effectively slow the velocity of any overland flow that may occur during the recovery period. Vegetative recovery is expected to occur at rapid rates comparable to those observed on the Bessie Butte, Evans West, and Skeleton fires which burned similar terrain in 1996 (BAER Soil Specialist Report, 2003). On previously undisturbed sites, adequate soil cover currently exists to control post-fire erosion rates within tolerable limits. These sandy textured soils are most susceptible to erosion where water becomes channeled on disturbed sites such as road surfaces, skid trails, water-bar outlets, and road drainage structures.

The absence of stream channels within or adjacent to the project area assures that there is no potential for eroded sediments to reach any listed 303(d) water bodies or cause indirect, adverse effects to essential fish habitat (Walker, 2003).

Fire suppression activities did not cause cumulative increases in detrimental soil conditions within any of the proposed activity areas. Dozer fire line was mainly used to clear strips of brush along the western and northern fire boundaries, outside of the planned treatment areas. Disturbed sites associated with dozer line, drop points, and safety zones were stabilized to prescribed rehabilitation requirements for controlling soil erosion. Fire retardant was used to control the spread of fire, and localized residues from these fertilizer-based ingredients were likely dissolved and provided short-term increases in available nutrients that benefited ground-cover vegetation during the early stages of the recovery period. Therefore, the effects of fire suppression activities did not increase the estimated percentages of existing detrimental soil conditions (Table 3-2).

The primary sources of detrimental soil conditions from past management are associated with existing roads and ground-based logging facilities which were used to access portions of approximately 398 acres of past timber harvest. It was determined that about 178 acres of these previously managed areas occur within the largest activity area (Unit 1). There was no overlap of past harvest areas with the other seven activity areas proposed with this project. Soil monitoring results indicate that the

average amount of detrimentally disturbed soil is about 12 percent of the 178 acre portion of Unit 1. This sample area is a relatively small portion of the much larger proposed activity area (1,539 acres). The overall extent of soil impacts from past harvest activities only accounts for about one percent of the total area within Unit 1. This amount is well within allowable LRMP limits for maintaining soil productivity.

Current management activities include the salvage removal of hazard trees along primary access roads within the project area. These roadside corridors are excluded from all of the proposed activity areas. The effects of these activities do not increase the estimated percentages of existing detrimental soil conditions within the treatment areas planned for this project.

Roads detrimentally disturb soil properties and convert the soil resource to a non-productive condition. A total of approximately 21.4 miles (34 acres) of open system roads cross through portions of all eight activity areas within the project area. The amount of disturbed soil associated with existing roads is included in the estimated percentages of detrimental soil conditions.

The extent of detrimental soil conditions associated with recreation use is relatively minor in comparison to existing roads and past logging disturbances. Approximately one mile of developed horse trail occurs within the project area, but only about 500 feet of this trail crosses through one proposed activity area (Unit 4). The small amount of disturbed soil (less than 0.1 acre) does not increase the percentage of detrimental soil conditions in this activity area. Impacts from dispersed recreation activities are usually found along existing roads and trails, and the extent of these disturbances is likely included in the estimates for roads and logging facilities.

Livestock impacts to the soil resource are found mainly in localized areas of concentrated use, such as around water developments. Although there are three water sets within the project area, only one of these facilities occurs within a proposed activity area (Unit 1). Approximately one acre of disturbed soil is included in the estimated percentages of detrimental soil conditions. The extent of detrimental soil conditions from this facility is less than 0.1 percent of the total unit area.

Table 3-3 displays land use sources and the extent of detrimental soil conditions in acres and percentages for each of the eight activity areas proposed with this project.

**Table 3-3. Current Sources and Extent of Detrimental Soil Conditions within Proposed Activity Areas of the 18 Fire Recovery Project**

Proposed Activity Area	Land Use Disturbed Acres			Existing Detrimental Soil Conditions
	Unit Number/ Unit Acres	Logging Facilities	Roads	Water Sets
01 / 1,539	21.4	13.4	1.0	2 %
02 / 27	0.0	0.9	0.0	3 %
03 / 23	0.0	0.5	0.0	2 %
04 / 142	0.0	1.2	0.0	1 %
05 / 34	0.0	0.4	0.0	1 %
06 / 29	0.0	0.4	0.0	1 %
07 / 34	0.0	0.1	0.0	<1 %
08 / 108	0.0	0.4	0.0	<1 %

**Indicator #2: Coarse Woody Debris (CWD) and Surface Organic Matter**

The effects of biomass consumption and loss of nutrients from fire volatilization are difficult to quantify. Potential productivity reductions are greatest in areas where CWD and surface litter were completely consumed by fire. Coarse woody debris and surface litter are currently deficient in some burned portions of the project area. Most areas that burned with moderate severity still have about half of the surface organic materials in place; whereas the lightly burned areas sustained only minor losses of organic matter and pre-fire woody debris. The effects of low intensity fire do not easily consume material much larger than 3 inches in diameter, and charring does not substantially interfere with the decomposition or function of coarse woody debris (Graham et al., 1994). The amount of down woody debris will gradually increase as fire-killed standing trees fall to the ground through natural processes of root decay and wind throw. Based on samples collected for two similar fires on the Bend/Fort Rock Ranger District, over 50 percent of the smaller diameter snags (less than 10 inches) would likely be recruited to the forest floor within 3 to 5 years.

Short-term increases in available nutrients will benefit the recovery of ground-cover vegetation that will eventually provide new sources of surface organic matter. Re-growth of sprouting shrubs and herbaceous forbs and grasses are already establishing live cover in most of the burned areas. The accumulation of small woody material from shrub and tree branches, annual leaf and needle fall, and the decomposition of grass and forb materials will continue to provide short-term nutrient supplies. The post-fire soil environment likely maintained viable populations of soil biota which are capable of responding to nutrient increases and the natural recovery of vegetation.

In the long-term, the larger diameter snags (greater than 17 inches) may stand for 10 or more years, depending on the rate of decay and local wind conditions. Over the next 20 years, it is expected that the majority of these dead trees will become heavy fuel loadings within the project area. Post-fire sampling data indicates that future downfall of CWD would average 40 to 60 tons per acre within areas affected by stand replacement fire (Plot Sampling, 2003). High-to-extreme fire hazard and potential for excessive soil heating exists when downed woody debris exceeds 30 to 40 tons per acre (Brown et al., 2003).

**Indicator #3: Project Design and Mitigation**

Cumulative levels of existing and predicted amounts of new soil disturbance need to be considered to determine if project plans need to include options for avoiding, minimizing, or mitigating potential adverse effects to soil quality.

**Management Direction****Soil Quality Standards and Guidelines**

The Deschutes Land and Resource Management Plan (LRMP) specifies that management activities are prescribed to promote maintenance or enhancement of soil productivity by leaving a minimum of 80 percent of an activity area, in a condition of acceptable productivity potential following land management activities (LRMP page 4-70, SL-1 and SL-3). This is accomplished by following Forest-wide standards and guidelines to ensure that soils are managed to provide sustained yields of managed vegetation without impairment of the productivity of the land. Standard and Guideline (SL-4) directs the use of rehabilitation measures when the cumulative impacts of management activities are expected to cause damage exceeding soil quality standards and guidelines on more than 20 percent of an activity area. Standard and Guideline (SL-5) limits the use of mechanical equipment in sensitive soil areas. Operations will be restricted to existing logging facilities (such as skid trails, landings) and

roads, whenever feasible. Standard and Guideline (SL-6) provides ground cover objectives to minimize accelerated erosion rates on disturbed sites with unprotected soils.

LRMP Management Areas MA-7, MA-8, and MA-9 do not contain specific standards and guidelines for the soil resource in this area. The Forest-wide standards and guidelines apply to this project proposal.

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

Detrimental Compaction in volcanic ash/pumice soils is an increase in soil bulk density of 20 percent, or more, over the undisturbed level.

Detrimental Puddling occurs when the depth of ruts or imprints is six inches or more.

Detrimental Displacement is the removal of more than 50 percent of the A horizon from an area greater than 100 square feet, which is at least 5 feet in width.

Severely Burned soils are considered to be detrimentally disturbed when the mineral soil surface has been significantly changed in color, oxidized to a reddish color, and the next one-half inch blackened from organic matter charring by heat conducted through the top layer.

Detrimental Surface Erosion requires visual evidence of surface loss in areas greater than 100 square feet, rills or gullies and/or water quality degradation from sediment or nutrient enrichment.

The Regional supplement to the Forest Service Manual (FSM 2520, R-6 Supplement No. 2500-98-1) provides policy for planning and implementing management practices which maintain or improve soil quality. An emphasis is placed on protection over restoration. The following excerpt is taken from FSM 2520.3:

“When initiating new activities:

1. Design new activities that do not exceed detrimental soil conditions on more than 20 percent of an activity area. (This includes the permanent transportation system).
2. In activity areas where less than 20 percent detrimental soil impacts exist from prior activities, the cumulative amount of detrimentally disturbed soil must not exceed the 20 percent limit following project implementation and restoration.
3. In activity areas where more than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and should move conditions toward a net improvement in soil quality”.



This Regional policy is consistent with the LRMP interpretation of Forest-wide standards and guidelines SL-3 and SI-4, which is filed in the Deschutes National Forest Supervisor's Office (Final Interpretations, Document 96-01, Soil Productivity, 1996).

### **Target Landscape Condition**

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

### **Environmental Consequences**

#### **Introduction**

The potential for detrimental changes to soil physical properties was quantitatively analyzed by the extent (surface area) of temporary roads, log landings, and designated skid trail systems that would likely be used to facilitate yarding activities within each of the proposed activity areas. Professional judgment was used to evaluate changes in the amount and composition of coarse woody debris and surface organic matter that provides surface cover, habitat for soil biological activity, and a nutrient reservoir for maintaining soil productivity.

The following section, Important Interactions, provides a discussion of the potential effects on soil and biological conditions from implementing various post-fire recovery activities. After this discussion, the environmental effects of each of the alternatives are presented and tracked by the issue indicators used to evaluate the estimated impacts on soil productivity.

#### **Important Interactions**

The proposed management activities include salvage timber harvest and fuel reduction treatments, reforestation by hand-planting tree seedlings, fence construction, and decommissioning (soil restoration) treatments on certain roads and logging facilities which would no longer be needed for future management. Most of the slash generated from harvest activities would be machine piled and burned at the log landings. There would be no machine piling of slash in random locations of activity areas. Prescribed underburning and/or hand treatments of activity-created fuels are not being considered at this time. Livestock would resume grazing when adequate recovery of herbaceous vegetation has taken place.

There would be no new construction of roads that would be retained as part of the transportation system. Approximately 3.5 miles (total) of temporary road would be constructed to allow access to some activity areas, but these roads would be obliterated upon completion of salvage activities. Some currently closed roads would be opened to provide necessary access, but these roads would be re-closed following salvage activities. An additional 4.0 miles of local system road, which are currently open, would be closed again following project activities. Road decommissioning (obliteration) treatments would be applied to approximately 7.0 miles of local system roads, which are recommended for removal from the transportation system. Currently, there is a temporary public

closure in the fire area to protect human safety and prevent inappropriate access off of the classified transportation system.

The best information about the proposed actions (DEIS Chapter 2, Alternative Descriptions) was used in conjunction with the location of activities to analyze the potential effects on the soil resource. Alternative 2 (Proposed Action) would implement all of the proposed activities listed above. The objective for Alternative 3 is to implement only the restoration activities; reforestation, road closures and decommissioning treatments on specific segments of local system road. Under Alternative 3 there would be no ground-based salvage harvest operations that would disturb soil properties or affect the amount of snags or down woody debris.

The effects of the fire and potential recovery activities will have varying short and long-term consequences on soil and biological conditions. The existing post-fire conditions were previously described under Existing Condition of the Soil Resource. Monitoring results of similar soils and previous fires on the district indicate that overland flow of water and evidence of surface erosion is typically nonexistent in burned areas with gentle slopes. Due to the extent of moderate, light, and unburned areas, there are no major concerns associated with ground-based harvest systems on the dominant soils and landforms affected by this fire. Ground-disturbing management activities vary in their intensity of site disturbance. Implementation of Alternative 2 would result in the greatest extent of physical soil impacts due to the development and use of temporary roads and logging facilities, but soil restoration treatments would be applied to reclaim and stabilize detrimental soil conditions on many of these facilities. It should be noted that the proposed actions also provide the greatest positive opportunity to reduce heavy fuel loadings before they accumulate on the forest floor and increase the hazard for high-severity ground fires in the future. Alternative 3 proposes no actions which would result in measurable amounts of detrimental soil disturbance because no additional land would be removed from production to build roads or logging facilities. Under Alternative 3, the potential risk for severe soil heating from future wildfires would be essentially the same as Alternative 1, No Action (Brown et al., 2003).

Alternative 2 proposes the removal of an estimated 7.0 million board feet of fire-killed trees (greater than 12 inches in diameter) on portions of approximately 1,936 burned acres. Salvage logging operations would occur on gentle to moderately sloping lava plains. The removal of dead trees would have no affect on evapotranspiration rates and potential increases in overland flow and surface erosion. There are no sensitive soils with high erosion hazards and the steep slopes on Bessie and Luna buttes are excluded from management consideration. Due to the minor amount of severely burned soil and adequate amounts of existing soil cover, the effects of ground-based salvage logging would likely be similar to those observed in unburned stands of live trees.

The development and use of temporary roads, log landings, and skid trail systems are the primary sources of physical disturbance that would result in adverse changes to soil productivity. Mechanical harvest and yarding systems would likely be accomplished using ground-based machines equipped with a felling head (harvester shear). Feller bunchers with a 24 foot boom (17 feet effective reach) are one of the most common harvester machines used in this geographic area. It is expected that similar equipment would be used in proposed activity areas for this project. Felled trees would be whole-tree yarded to main skid trail networks and rubber-tired grapple machines would then transport the bunched trees to landings for processing and loading. Mechanical harvesters would only be allowed to make a limited number of equipment passes on any site-specific area between skid trails or away from log landings. The skidding equipment would be restricted to designated skid trails at all times. The majority of soil impacts would be confined to known locations in heavy use areas that can be reclaimed when these logging facilities are no longer needed for future management.

Soil condition assessments for similar soils and the same types of ground-based harvest systems, research references, and personal communications with timber sale administrators were used to predict the extent of detrimental soil disturbance anticipated from mechanized harvest and yarding activities. On the Deschutes National Forest, soil productivity monitoring has shown that detrimental soil conditions increase each time a stand is treated with mechanical equipment. Monitoring results following initial harvest entries have shown that 15 to 30 percent of the unit area can be detrimentally disturbed by ground-based harvest systems depending on harvest prescriptions, the spacing of skid trails, and soil conditions at the time of harvest (Deschutes N.F. Soil Monitoring, 1995). Research studies and local soil monitoring have shown that soil compaction and soil displacement account for the majority of detrimental soil conditions resulting from ground-based logging operations (Deschutes N.F., Soil Monitoring Reports, 1996, 1997, and 1999; Page-Dumroese, 1993; Geist, 1989; Powers, 1999).

Estimates for predicted amounts of detrimental soil conditions following the proposed salvage harvest account for the expected amount of volume removal, the type of logging equipment, the spacing of skid trails, and the number of log landings that would be needed to deck accumulated materials. The amount of volume removal is expected to be relatively low (average of 30 trees per acre) for the biomass affected on this dry, ponderosa pine forest type. Due to the gentle terrain and the type of machines that would likely be used for yarding operations, it is expected that skid trail networks would have an average spacing distance of approximately 100 feet between main trails. Individual skid trails would have an average disturbed width of 12 feet. On moderately flat ground with small timber, research found that skid trail spacings of 100 feet would account for approximately 11 percent of the unit area (Froehlich, 1981, Garland, 1983).

The Forest average for the size of log landings is approximately 10,000 square feet (100 feet by 100 feet) for removing comparable volumes. Based on field inspections by a timber sale administrator (O'Reilly, personal communication) and the locations of existing access roads, the estimated number of landings for each of the proposed activity areas is as follows: Unit 1 = 113 landings (25.9 acres), Unit 2 = 2 landings (0.5 acres), Unit 3 = 3 landings (0.7 acres), Unit 4 = 10 landings (2.3 acres), Unit 5 = 2 landings (0.5 acres), Unit 6 = 2 landings (0.5 acres), Unit 7 = 3 landings (0.7 acres) and Unit 8 = 7 landings (1.6 acres). A total of approximately 33 acres of soil would likely be impacted by log landings within the eight activity areas. Disturbed area calculations for log landings are added to the acreage estimates for main skid trails to determine the overall disturbance in logging facilities.

Since there was only minor overlap of previously managed areas with the proposed activity areas, the above estimates for new logging facilities were used to calculate the disturbed area for the majority of activity areas. Existing facilities would be reutilized to the extent possible within the 178 acre portion of Unit 1, but it is expected that the creation of additional skid trails and log landings would likely cause a 7 percent increase in detrimental soil conditions. There was no overlap of past harvest areas within the other seven activity areas. Under Alternative 2, estimates of existing and predicted amounts of detrimental soil conditions associated with temporary roads and logging facilities are included in the percentages displayed for each of the proposed activity areas in Table 3-4.

Project design criteria, including operational guidelines for equipment use, would minimize the extent of detrimentally disturbed soil from harvest activities between main skid trails and away from log landings. The primary factor that would limit soil compaction is the limited amount of equipment traffic off designated logging facilities. Research has shown that the first few equipment passes over an area compacts the upper few inches of the soil. Additional passes cause greater increases in bulk density and compact the soil to greater depths. The detrimental effects of soil compaction generally

require more than 3 to 5 equipment passes (McNabb, Froehlich, 1983). The effects of only two passes by harvester machines on any site-specific area are not expected to qualify as a detrimental soil condition. Frost heaving and freeze-thaw cycles can generally offset soil compaction near the soil surface. Other natural processes that help restore soil porosity in soil surface layers include root penetration, rodent activity, wetting and drying cycles, and the accumulation of organic matter. On gentle to moderately sloping terrain, the maneuvering of equipment generally does not remove soil surface layers in large enough areas (at least 5 feet in width) to qualify as detrimental displacement (FSM 2520, R-6 Supplement). Smaller areas of gouging or the mixing of soil and organic matter would not constitute detrimental soil displacement. Conservative estimates were used to account for predicted amounts of detrimental soil conditions associated with logging facilities, and the relatively minor extent of these incidental soil disturbances is likely included in these estimates.

Under Alternative 2, fuel reductions would be accomplished by whole tree yarding salvaged trees. Much of the unusable stemwood and tops would be machine piled and burned on log landings. There would be no machine piling of logging slash in random locations of activity areas. Although this method removes potential sources of woody debris off-site, it would not cause additional soil impacts because burning would occur on disturbed soils that already have detrimental conditions. Soil restoration treatments would be implemented to reduce the amount of detrimentally disturbed soil committed to log landings following these post-harvest activities. The proposed actions do not include prescribed burning or hand treatments for reducing and/or rearranging activity-created fuels.

Ponderosa pine seedlings would be planted using hand tools on approximately 1,936 burned acres. Shallow excavations and scalping to prepare sites for hand planting would not disturb large enough areas to qualify as a detrimental soil condition. Fencing and protective tubing would likely be used to help prevent animal damage and slash mat would be used to reduce plant competition around the planted seedlings. Fence would be constructed around approximately 640 acres of reforestation in Unit 1. Fence lines are not considered to be structures that convert the soil to a non-productive condition. The localized effects of installing fence posts and devices used for seedling protection would have a negligible effect on overall site productivity within activity areas. Planted seedlings generally take about 2 to 3 years to become established, but they would provide some additional cover to intercept raindrop impacts in localized areas of exposed mineral soil.

Table 3-4 displays existing and predicted amounts of detrimental soil conditions in acres and percentages for each of the eight activity areas proposed under Alternative 2.

**Table 3-4. Alternative 2: Estimates of Detrimental Soil Conditions following Mechanical Harvest and Soil Restoration Treatments by Activity Areas.**

<i>DEIS Unit Number</i>	<i>Unit Acres</i>	<i>Existing Detrimental Soil Conditions</i>		<i>Estimated Detrimental Soil Conditions After Salvage Harvest</i>		<i>Estimated Detrimental Soil Conditions After Restoration</i>	
		<i>Acres</i>	<i>Percent of Unit</i>	<i>Acres</i>	<i>Percent of Unit</i>	<i>Subsoil Acres</i>	<i>Percent of Unit</i>
01	1,539	35.8	2 %	228.2	15 %	46.5	12 %
02	27	0.9	3 %	4.4	16 %	0.7	14 %
03	23	0.5	2 %	3.7	16 %	1.3	10 %
04	142	1.2	1 %	19.1	13 %	3.3	11 %
05	34	0.4	1 %	4.6	14 %	0.7	11%
06	29	0.4	1 %	4.1	14 %	0.7	12 %
07	34	0.1	< 1 %	4.5	13 %	1.0	10 %
08	108	0.4	<1 %	14.3	13 %	2.7	11 %

### **Soil Restoration Treatments on Roads and Logging Facilities**

Under the action alternatives, soil restoration treatments would be applied with a self drafting, winged subsoiler to reclaim and stabilize detrimentally compacted soil on certain management facilities. Additional treatment options for improving soil quality on disturbed sites include redistributing topsoil in areas of soil displacement damage, pulling of available slash and woody materials over the treated surface, and planting shrubs and tree seedlings to establish ground cover protection. These activities would likely be funded with Knutson-Vandenburg (KV) monies or other sources, as available, but this is not mandatory mitigation that would be required to comply with Regional policy (FSM 2520, R-6 Supplement) and LRMP standards and guidelines SL-3 and SL-4 that limit the extent of detrimental soil conditions to 20 percent of an activity area.

Under Alternative 2, subsoiling treatments would be implemented on all temporary roads, all log landings, and approximately 500 feet of all main skid trails that lead into log landings following post-harvest activities (DEIS, Chapter 2, Mitigation Measures). Road decommissioning treatments would include subsoiling to alleviate compacted road surfaces on about seven miles of local system road. Approximately 3.3 miles of these roads cross through portions of two activity areas; Unit 1 = 3.1 miles or 4.5 acres, and Unit 3 = 0.2 miles or 0.3 acres. These road decommissioning acres were deducted in the overall assessment of detrimental soil conditions in Table 3-4.

Under Alternative 3, only the road decommissioning treatments would be implemented on specific segments of local system roads. These soil restoration treatments would result in a small, net improvement in soil quality (4.8 acres) within Units 1 and 3. Decommissioned road segments on the remaining 3.7 miles (5.6 acres) of road outside of activity areas would improve soil quality in other portions of the project area. Table 3-5 displays potential sources and extent of soil restoration opportunities for each of the activity areas proposed for this project.

As previously described under Affected Environment, extensive areas of the project area have been covered by loose, non-cohesive ash deposits that consist of sandy textured soils with little or no structural development. Although equipment traffic can decrease soil porosity on these soil materials, compacted sites can be mitigated by tillage with a winged subsoiler (Powers, 1999). Dominant soils within the proposed activity areas are well suited for tillage treatments due to their naturally low bulk densities and the absence of rock fragments within soil profiles.

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

**Table 3-5. Potential Sources and Extent of Soil Restoration Opportunities within Proposed Activity Areas of the 18 Fire Recovery Project**

Proposed Activity Area	Land Use Disturbed Acres			Extent of Detrimental Soil Conditions
	Unit Number/ Unit Acres	Logging Facilities	Temporary Roads	Local System Roads
01 / 1,539	37.2	4.8	4.5	3 %
02 / 27	0.7	0.0	0.0	3 %
03 / 23	1.0	0.0	0.3	6 %
04 / 142	3.3	0.0	0.0	2 %
05 / 34	0.7	0.0	0.0	2 %
06 / 29	0.7	0.0	0.0	2 %
07 / 34	1.0	0.0	0.0	3 %
08 / 108	2.3	0.4	0.0	3 %

### Direct, Indirect, and Cumulative Effects

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

### Summary of Environmental Consequences Relevant to the Issue Indicators

#### Alternative 1 – Direct and Indirect Effects

##### Indicator #1: Detrimental Soil Disturbance

Under Alternative 1 (No Action), the management activities proposed in this document would not take place. No additional land would be removed from production to build permanent roads or logging facilities for salvage harvest operations. This alternative would defer opportunities for road decommissioning treatments that would reclaim and stabilize detrimentally compacted soil committed to local system roads which are no longer needed for long-term access. The current extent of detrimental soil conditions would likely remain unchanged for an extended period of time.

Disturbed soils would continue to recover naturally from the effects of the fire and past management activities. Livestock would not resume grazing within the project area until the fall of 2005. A temporary closure would prevent inappropriate access off classified roads in the project area. Soils were not severely burned in the project area. Reductions in site productivity were greatest in small, localized areas where CWD and surface litter were completely consumed by fire. At the present time, adequate soil cover currently exists to control erosion rates within tolerable limits. Accelerated erosion is not expected to have any long-lasting, adverse effects to soil productivity.

Soil productivity would not change appreciably unless future catastrophic wildfires cause intense soil heating that results in detrimental changes to soil properties. The No Action Alternative would defer fuel reduction opportunities at this time. If a large amount of fuel is present during a future wildfire, soil temperatures can remain high for long duration and excessive soil heating would be expected to produce large changes in soil chemical, physical, and biological properties (DeBano, 1991).

#### **Indicator #2: Coarse Woody Debris (CWD) and Surface Organic Matter**

As previously described under Existing Condition of the Soil Resource, the amount of coarse woody debris will gradually increase as fire-killed trees fall to the ground over time. Short-term increases in available nutrients will benefit the recovery of ground-cover vegetation that will eventually provide new sources of surface organic matter. The natural recovery of herbaceous vegetation is expected to take two to three growing seasons, whereas deep-rooted shrubs and conifers may take five years or longer. Since there would be no reforestation by planting trees, the recovery of coniferous vegetation and the cover it provides would be the slowest under this alternative.

In the long-term (10 to 20 years), the majority of dead trees will become heavy fuel loadings that increase the re-burn hazard to an unacceptable level. The larger diameter snags (greater than 17 inches) may stand for 10 or more years, depending on the rate of decay and local wind conditions. Sampling data for the Inn Fire (1988) indicates that over 98 percent of this larger diameter material fell within 15 years. High-to-extreme fire hazard and potential for excessive soil heating exists when downed woody debris exceeds 30 to 40 tons per acre (Brown et al., 2003).

#### **Indicator #3: Project Design and Mitigation**

Under Alternative 1, there would be no cumulative increases in detrimental soil conditions from ground-disturbing management activities. Therefore, implementation of project design criteria and mitigation measures would not be necessary.

### **Alternative 2 (Proposed Action) – Direct and Indirect Effects**

The proposed management activities are identified in the Alternative Descriptions (DEIS, Chapter 2). Alternative 2 is designed to expedite the restoration of fire-affected forest land by removing dead trees through salvage timber harvest, reducing future fuel loads, and planting tree seedlings on portions of eight activity areas. Commercial logging would utilize modern, ground-based equipment and designated skid trail systems to minimize soil disturbance. Fuel reductions would be accomplished by whole-tree yarding and the logging slash would be machine piled and burned on log landings. Ponderosa pine seedlings would be planted using hand tools. The nature of these effects has already been described under “Important Interactions”.

#### **Indicator #1: Detrimental Soil Disturbance**

Under Alternative 2, the proposed activity areas avoid areas with sensitive soils, and the effects of ground-based logging would likely be similar to those observed in unburned stands of live trees. The development and use of temporary roads, log landings, and skid trail systems are the primary sources of physical disturbance that would result in adverse changes to soil productivity. The majority of soil impacts would occur on and adjacent to these heavy-use areas where multiple equipment passes typically cause detrimental soil compaction. Project design criteria would be applied to avoid or minimize the extent of soil disturbance in random locations between main skid trails and away from log landings. Although the removal of fire-killed trees would have no effect on evapotranspiration rates, logging slash and fallen dead trees would provide additional ground cover that would improve the soils ability to resist surface erosion.

The amount of disturbed area associated with temporary roads and logging facilities would be limited to the minimum necessary to achieve management objectives. Since there was only minor overlap with previously managed areas, opportunities to reuse existing skid trail networks and log landings would be limited. As previously described under Important Interactions, an estimated total of approximately 206 acres of soil would be removed from production for designated skid trails and an additional 33 acres would likely be impacted by log landings within the eight activity areas proposed for ground-based salvage harvest. Table 3-4 displays existing and predicted amounts of detrimental soil conditions in acres and percentages for each of the activity areas proposed under Alternative 2.

Approximately 3.5 miles (5.2 acres) of temporary road would be developed to allow access within two activity areas (Unit 1 and Unit 8). None of the temporary road locations would require excavation of cut-and-fill slopes because they are located on nearly level to gentle slopes (less than 5 percent gradient). These temporary road segments would be decommissioned following their use, so the disturbed area estimates in Table 3-4 are balanced by subsoiling treatments that would reclaim and stabilize compacted soils to improve soil quality within the short term.

Reforestation would be accomplished by using hand tools to plant tree seedlings. Shallow excavations and scalping to prepare sites for planting would not disturb large enough areas to qualify as a detrimental soil condition (FSM 2520, R-6 Supplement). These trees would increase water infiltration into the soil as root systems develop, and they would also provide some additional cover to reduce raindrop impacts on exposed mineral soil.

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

Under Alternative 2, an estimated total of approximately 40 acres of soil is currently impacted by existing roads and management facilities within the proposed activity areas. It is predicted that the direct effects of project implementation would result in a total increase of approximately 243 acres of additional soil impacts associated with temporary roads, main skid trails and log landings. Soil compaction would account for the majority of these impacts and the total amount of detrimental soil conditions would be approximately 283 acres prior to soil restoration activities. Subsoiling treatments would be applied to rehabilitate approximately 57 acres of detrimentally compacted soil within portions of the eight activity areas.

Based on these disturbed area estimates, the percentages of detrimental soil conditions would increase above existing conditions by approximately 8 to 11 percent in each of the proposed activity areas. None of these activity areas would exceed the LRMP standard of 20 percent following implementation of project and restoration activities. Therefore, the proposed actions comply with LRMP standards and guidelines SL-3 and SL-4, and Regional policy (FSM 2520, R-6 Supplement No. 2500-98-1) for maintaining soil productivity.

### **Sensitive Soils**

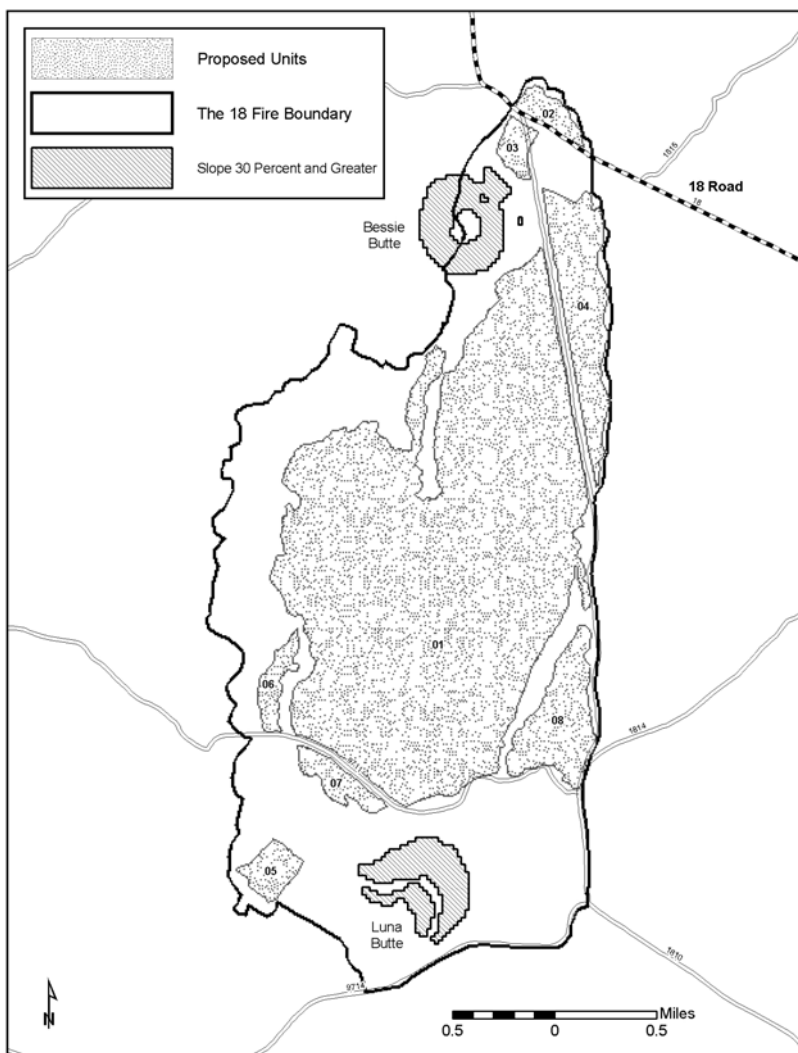
Sensitive soils within the project area include: 1) soils on slopes greater than 30 percent, 2) soils associated with frost pockets in cold air drainages, and 3) soils that occur in localized areas of rocky lava flows. There are no potentially wet soils with high water tables or sensitive soils with high erosion hazard ratings that would require special mitigation. The map figure below (Figure 3-1) shows locations of the proposed activity areas and their proximity to sensitive soils on steep slopes (greater than 30 percent) of Bessie and Luna buttes. In order to avoid soil displacement damage, none



of the activity areas were located on sensitive soils with steep slopes that would require specific design elements to avoid or minimize potential soil impacts from equipment operations.

The potential for successful regeneration is limited by properties such as soil depth, soil fertility, and temperature extremes on low productivity sites such as frost pockets, cold air drainages, and localized areas of rocky lava flows. These sites may require replanting in order to achieve adequate stocking levels in a desired amount of time. Modified harvest prescriptions or other, less intensive treatments are management options that do not apply to reforestation objectives in areas affected by stand-replacement wildfires.

**Figure 3-1: Locations of Proposed Activity Areas and their Proximity to Sensitive Soils on Steep Slopes within the 18 Fire Recovery Project.**



**Indicator #2: Coarse Woody Debris (CWD) and Surface Organic Matter**

The indicator for CWD and surface organic matter was evaluated qualitatively based on the probable success of implementing appropriate design elements and Best Management Practices (BMPs) that address adequate retention of woody debris and organic matter to meet soil productivity and wildlife habitat objectives (see Wildlife Section). A minimum amount of 5 to 10 tons per acre of CWD is recommended to ensure desirable biological benefits for maintaining soil productivity without creating an unacceptable fire hazard for a potential high-severity reburn (Brown et al., 2003). Under Alternative 2, salvage harvest operations would be expected to accelerate the accumulation of woody debris where these materials are currently lacking within portions of some activity areas. Existing sources of woody debris would be retained on-site and protected from disturbance to the extent possible. Enough fallen trees and other organic materials would likely be available after salvage activities to meet this recommended guideline in the short-term.

Although little can be done to control organic matter loss during wildfires, every opportunity must be taken to revegetate the site so that organic litter can be restored as quickly as possible (Debano, 1991). Coarse woody debris (greater than 3 inches in diameter) is needed for biological activity and long-term nutrient cycling. Small woody material and surface litter (that is leaves, twigs, and branches less than 3 inches in diameter) are needed for erosion control and short-term nutrient cycling.

Commercial harvest and whole-tree yarding can affect soil productivity through the removal of nutrients in the form of tree boles, limbs and branches. Although these forest management practices remove potential sources of future CWD, ground-based harvest activities also recruit CWD to the forest floor through breakage of limbs and tops and toppling of some trees during felling and skidding operations. Many of the smaller-diameter dead trees (less than 12 inches) and logging slash created from unusable stemwood would accelerate the accumulation of woody debris where these materials may be currently deficient. This would expedite decomposition processes and input of organic materials into the soil surface. These materials would also provide additional soil cover that improves the soils ability to resist surfact erosion. The removal of tree boles would have little or no effect on nutrient cycling processes during the recovery period. Most of the tree's short-term nutrient supply is stored in the leaves (needles), branches, and roots. Whole-tree yarding will only remove approximately 30 trees per acre. Due to the burn intensity of the 18 Fire and the time period between the fire and the salvage most of these trees have no needles. Needles that have not burned up have largely fallen to the ground. Available nutrients stored in fine organic matter and soil surface layers will benefit the recovery of ground cover vegetation that will eventually provide new sources of surface organic matter.

On undisturbed sites, woody materials (less than 12 inches) are expected to fall to the ground within 3 to 5 years. The larger residual trees that remain following harvest would become future sources of CWD. Some of these residual trees would be felled to protect a fence line that would be constructed around 640 acres of planted seedlings in Unit 1. This would provide only localized benefits within this large activity area. Over the next 10 to 20 years, the amount of CWD after salvage harvest is predicted to average an acceptable range of 15 to 20 tons per acre within each of the activity areas.

Experience and logic suggest that less intensive future wildfires would result in areas where some of the hazardous fuels are removed through management treatments as opposed to re-burns in areas where heavy fuels were allowed to accumulate with no treatment. All other conditions being equal, the lower the fuel loading, the lower the fire intensity and burn severity. Implementation of Alternative 2 would result in a lower risk for future wildfires than Alternatives 1 and 3.

**Indicator #3: Project Design Criteria and Mitigation**

The management requirements and project design criteria built into Alternative 2 are all designed to avoid or minimize potentially adverse impacts to the soil resource. Operational guidelines are included in design elements that provide options for limiting the amount of surface area covered by logging facilities and controlling equipment operations to minimize the potential for soil impacts in random locations of activity areas. The steep slopes on Bessie and Luna buttes were excluded from all proposed activity areas in order to avoid soil displacement and potential erosion damage. Existing logging facilities would be reutilized to the extent possible on approximately 178 acres of past harvest that overlaps a portion of Unit 1. There was no overlap of past harvest areas within the other seven activity areas. Grapple skidders would only be allowed to operate on designated skid trails spaced on average of 100 feet apart (11 percent of the unit area). Other examples include limiting the amount of traffic off designated areas or operating equipment over frozen ground or a sufficient amount of compacted snow. The successful application of these management practices would help lower the estimated percentages of detrimental soil conditions displayed in Table 3-4.

Soil restoration treatments (subsoiling) would be applied to reduce the cumulative amount of detrimentally compacted soil within all of the proposed activity areas. This would include subsoiling all temporary roads, all log landings, and approximately 500 feet of all main skid trails that lead into log landings following post-harvest activities. Road decommissioning treatments would include subsoiling to alleviate compacted road surfaces on about seven miles of local system road which are no longer needed for long-term access. Soil restoration treatments within proposed activity areas were deducted in the estimated percentages of detrimental soil conditions in Table 3-4 because subsoiled areas are expected to reach full recovery within the short-term. Restoration treatments, such as subsoiling, are designed to promote maintenance or enhancement of soil quality, and these conservation practices are consistent with LRMP interpretations of standards and guidelines SL-3 and SL-4 (Final Interpretations, Document 96-01, Soil Productivity, 1996) and Regional policy (FSM 2520, R-6 Supplement No. 2500-98-1).

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

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

**Alternative 3 – Direct and Indirect Effects**

The proposed management activities are identified in the Alternative Descriptions (DEIS, Chapter 2). The objective for Alternative 3 is to implement only the restoration activities; reforestation, road closures and decommissioning treatments that were previously described for Alternative 2. Under this alternative, there would be no salvage timber harvest or other mechanical treatments that would disturb soil properties or affect the amount and composition of snags and down woody debris.

**Indicator #1: Detrimental Soil Disturbance**

Under Alternative 3, the extent of detrimental soil conditions would not increase above existing levels in any of the proposed activity areas because no additional land would be removed from production to build roads or logging facilities. As previously described for Alternative 1 (No Action), disturbed soils caused by the effects of the fire and past management would continue to recover through natural processes. Currently, there is a temporary public closure in the fire area to prevent soil disturbance from inappropriate access off of the classified road system. Livestock grazing has been postponed to allow the recovery of understory vegetation. Except for road decommissioning treatments that would slightly reduce the amount of compacted soil within two of the proposed activity areas, the current extent of detrimental soil compaction would likely remain unchanged for an extended period of time.

Reforestation would be accomplished by using hand tools to plant tree seedlings. Shallow excavations and scalping to prepare sites for planting would not disturb large enough areas to qualify as a detrimental soil condition. As previously described under “Important Interactions” and Alternative 2, the localized effects of installing fence posts and devices used for seedling protection would have a negligible effect on overall site productivity within the proposed activity areas. These tree plantations will increase soil permeability as root systems develop, and they would also provide some additional cover to intercept raindrop impacts in localized areas of exposed mineral soil.

Road decommissioning treatments would include subsoiling to alleviate compacted road surfaces on about seven miles of local system road which are recommended for removal from the transportation system. Approximately 3.3 miles of these road segments cross through portions of two activity areas (Units 1 and 3). Due to the size of these activity areas and the relatively small amount of surface area that would actually be reclaimed, the reductions in detrimental soil conditions would be minor. The percentage of detrimental soil conditions within Unit 1 would remain at 2 percent and the percentage within Unit 3 would be reduced from the current 2 percent to 1 percent of the unit area. The remaining 3.7 miles (5.6 acres) of road decommissioning occur outside of the proposed activity areas, but these activities would help improve soil quality in other portions of the project area.

**Indicator #2: Coarse Woody Debris (CWD) and Surface Organic Matter**

As previously described for Alternative 1 (No Action), the immediate effects of this alternative would have little influence on the amount and composition of CWD and surface organic matter. Adequate soil cover currently exists to control erosion on the dominant soils and landforms affected by the fire. Unlike Alternative 2, there would be no mechanical harvest that would accelerate the recruitment of woody materials through felling and skidding operations. The benefits of additional surface cover and the initiation of decomposition processes that affect nutrient cycling would be deferred until dead trees begin to fall to the ground under natural conditions. Although some dead trees would be felled to protect a fence line around 640 acres of planted tree seedlings in Unit 1, only localized sites would receive any immediate sources of woody debris within this large activity area.

In the short-term, some of the fire-killed trees and other sources of organic matter would be available for maintaining the soils ability to retain moisture and recycle nutrients. Some of this downfall would likely damage some of tree seedlings that would be planted beneath standing dead trees. Increases in available nutrients will benefit the recovery of ground cover vegetation that will provide new sources of surface organic matter. The establishment of herbaceous vegetation is expected to take two to three growing seasons, whereas the recovery of deep-rooted shrubs and conifers may take five years or longer. The accumulation of small woody material from shrub and tree branches, annual needle fall, and the decomposition of grass and forb plant materials will provide short-term nutrient supplies.

In the long-term, it is expected that the majority of fire-killed trees will become heavy fuel loadings that increase the risk for future wildfires to an unacceptable level. Established tree seedlings would be especially vulnerable to damage from falling trees and potential re-burns of high burn severity. Post-fire sampling estimates indicate that potential biomass from down woody debris could range from 40 to 60 tons per acre within areas affected by stand-replacement fire (Plot Sampling, 2003). Future reburns of these down woody materials and forest litter would adversely affect ground cover conditions and the ability to maintain long-term soil productivity.

### **Indicator #3: Project Design Criteria and Mitigation**

Under Alternative 3, there would be no cumulative increases in detrimental soil conditions from ground-based salvage and yarding operations. The localized effects of hand-planting trees, fence building and other devices used for seedling protection would not detrimentally disturb the soil. Therefore, implementation of project design criteria and mitigation measures would not be necessary.

## **Alternative 1 – Cumulative Effects**

### **Indicator #1: Detrimental Soil Disturbance**

Under Alternative 1 (No Action), the extent of detrimental soil conditions would not increase above existing levels because no additional land would be removed from production to build management facilities. The effects of the fire and past management disturbances were previously described under Existing Condition of the Soil Resource. There would be no cumulative soil impacts associated with the salvage removal of hazard trees along primary access roads because these roadside corridors are excluded from all of the activity areas analyzed for this project. Disturbed soils would continue to recover through natural processes. Livestock would not resume grazing until the fall of 2005. Table 3-2 displays existing sources and amounts of detrimental soil conditions in acres and percentages. Due to the size of the activity areas and the relatively minor amount of past disturbance, the existing percentages of detrimental soil conditions range from less than one to three percent of the unit areas.

### **Indicator #2: Coarse Woody Debris (CWD) and Surface Organic Matter**

Under Alternative 1, the amount of coarse woody debris and surface organic matter will gradually increase over time. In the long term, the accumulation of CWD and forest litter would increase the risk for wild land fires.

### **Indicator #3: Project Design Criteria and Mitigation**

Under Alternative 1, implementation of project design criteria and mitigation of project-related impacts would not be necessary.

## **Alternative 2 – Cumulative Effects**

### **Indicator #1: Detrimental Soil Disturbance**

Alternative 2 would cause some new soil disturbances where ground-based equipment is used for mechanical harvest and whole tree yarding of salvaged trees. There would be no cumulative soil impacts associated with hazard tree removal along primary access roads because these roadside corridors are excluded from all of the proposed activity areas. The combined effects of current soil disturbances and those anticipated from implementing the proposed actions were previously addressed in the discussion of direct and indirect effects above. Soils in the proposed activity areas were not severely burned, and post-fire erosion rates are not expected to have any long-term adverse effects to soil productivity. It is expected that the use of modern, ground-based equipment and designated skid trail systems would result in similar effects to those monitored in unburned areas with similar ash-influenced soils. The majority of project-related soil impacts would be confined to known locations in

heavy use areas (such as roads, log landings, and main skid trails) that can be reclaimed through soil restoration treatments. Estimates of existing and predicted amounts of detrimental soil conditions were previously displayed in Table 3-4. Based on these disturbed area estimates, the percentages of detrimental soil conditions would increase above existing conditions by approximately 8 to 11 percent in all eight activity areas. None of these activity areas would exceed Regional policy and the LRMP standard of 20 percent detrimental soil conditions following implementation of project and restoration activities.

Project design criteria, including operational guidelines for equipment use, would minimize the extent of detrimentally disturbed soil from mechanical harvesters between skid trails and away from log landings. The primary factor that would reduce the potential for soil compaction is the limited amount of equipment traffic off designated logging facilities. The relatively minor extent of these incidental soil disturbances is likely included in the conservative estimates used to account for logging facilities that would be developed in each of the proposed activity areas.

Fuel reductions would be accomplished by whole tree yarding and most of the logging slash would be machine piled and burned on log landings. This management practice would not cause cumulative increases in soil impacts because burning would occur on previously disturbed soils that already have detrimental conditions. Subsoiling treatments would be implemented to reduce the amount of detrimentally disturbed soil committed to log landings following these post-harvest activities. The proposed actions do not include prescribed burning or hand treatments for reducing and/or rearranging activity-created fuels.

Subsoiling treatments would be implemented on specific roads and logging facilities to reduce cumulative amounts of detrimentally compacted soil within all eight of the proposed activity areas. These restoration treatments are designed to promote maintenance or enhancement of soil quality.

#### **Indicator #2: Coarse Woody Debris (CWD) and Surface Organic Matter**

As previously described for direct and indirect effects, it is expected that enough fallen trees and other sources of organic materials would be available to protect mineral soil from erosion and provide nutrient supplies for both short and long-term maintenance of soil productivity.

In the short-term, the combined amount of existing and activity-created woody debris would provide adequate conditions for surface cover, biological activity, and nutrient cycling for maintaining soil productivity and promoting the recovery of native vegetation. In the long-term, the larger residual trees (greater than 10 inch diameter) that remain following harvest would become future sources of CWD over time. The amount of down woody debris after salvage is predicted to average 15 to 20 tons per acre within the next 10 to 20 years. Although this amount of woody debris would slightly exceed recommended guidelines for maintaining soil productivity on dry ponderosa pine sites, these fuel loadings are not expected to increase the future risk for intense wildfires to an unacceptable level.

#### **Indicator #3: Project Design Criteria and Mitigation**

The management requirements, project design criteria and Best Management Practices (BMPs) included for Alternative 2 are all designed to avoid or minimize potentially adverse soil impacts from project implementation. Soil restoration treatments would be applied to reduce the cumulative amount of compacted soil dedicated to temporary roads and logging facilities.

All reasonable BMPs would be applied to minimize the effects of road systems and timber management activities on the soil resource. The BMPs are tiered to the Soil and Water Conservation

Practices Handbook (FSH 2509.22), which contains conservation practices that have proven effective in protecting and maintaining soil and water resource values.

### **Alternative 3 – Cumulative Effects**

#### **Indicator #1: Detrimental Soil Disturbance**

Under Alternative 3, there would be no cumulative increases in detrimental soil conditions because there would be no development and use of management facilities within any of the proposed activity areas. The combined effects of current soil disturbances and those anticipated from implementing the proposed actions were previously addressed in the discussion of direct and indirect effects above. The localized effects of hand-planting tree seedlings, fence building and other devices used for seedling protection would not cause detrimental changes to soil properties. There would be no cumulative soil impacts associated with hazard tree removal along primary access roads because these roadside corridors are excluded from all of the proposed activity areas. Except for road decommissioning (obliteration) treatments that would slightly reduce the existing amount of compacted soil within two activity areas, the current extent of detrimental soil conditions would likely remain unchanged.

#### **Indicator #2: Coarse Woody Debris (CWD) and Surface Organic Matter**

Under Alternative 3, the amount of coarse woody debris and forest litter will gradually increase as dead trees fall to the ground over time and established vegetation provides new sources of organic matter. The immediate effects of this alternative would have little influence on the amount and composition of CWD and surface organic matter. In the long-term, the accumulation of dead trees on the forest floor would increase the risk for future wildfires to an unacceptable level.

#### **Indicator #3: Project Design Criteria and Mitigation**

Under Alternative 3, implementation of project design criteria and mitigation of project-related impacts would not be necessary because there would be no cumulative increases in detrimental soil conditions from ground-disturbing management activities.

### **Foreseeable Actions Common to All Alternatives**

Future management activities are assumed to occur as planned in the schedule of projects for the Deschutes National Forest. No ground-disturbing management activities are currently scheduled within the project area boundaries. The 18 Fire burned approximately 3,500 acres that were originally included in the Kelsey Vegetation Management planning area, but these affected acres were removed from the Kelsey proposal and included in the 18 Fire Recovery Project. Since there is no overlap of proposed activity areas with these two projects, there would be no cumulative increase in the extent of detrimental soil conditions beyond the predicted levels displayed for each of the proposed activity areas in Table 3-4.

During the spring of 2004, reforestation study plots would be established using hand tools on north-facing slopes of Bessie and Luna Buttes. Two plots, approximately 0.15 acres per plot totaling 0.6 acres or less, would be planted with sugar pine seedlings on each of these buttes. Shallow excavations and scalping to prepare sites for planting would not disturb large enough areas to qualify as a detrimental soil condition (FSM 2520, R-6 Supplement). Protective tubing and mulch mats would be used to prevent animal damage and reduce plant competition around the planted seedlings. These devices would have a negligible effect on site productivity around individual tree seedlings. Residual standing dead trees would be felled to prevent them from falling and damaging the study seedlings. This would accelerate the accumulation of woody debris in localized areas where these materials are currently lacking. Beneficial effects include additional soil cover that reduces the potential for surface erosion, and immediate input of organic materials to initiate decay processes for maintaining the soils

ability to retain moisture and provide nutrient supplies for the growth of vegetation. The locations for these study plots are outside of the planned activity areas; so there would be no positive or negative cumulative effects to soils in the areas analyzed for this project.

Other foreseeable future activities include continued recreation use, the resumption of livestock grazing in the fall of 2005, and standard road maintenance.

The effects of recreation use and livestock grazing would be similar to those described for Existing Condition of the Soil Resource. Future soil disturbances would be confined mainly to small concentration areas that have a relatively minor effect on overall site productivity. With the exception a few major arterial roads that cross through the project area, access roads would be closed to the public during the recovery period of two to three years. Future impacts from dispersed camping and incidental use by hikers and mountain bikers are expected to have a negligible effect on site productivity within the activity areas. Livestock grazing would resume following the recovery of herbaceous vegetation. Appropriate stocking levels, rotation of grazing use, and periodic rest would ensure adequate ground cover that effectively minimizes erosion and adverse effects to the soil resource. There are no major soil-related concerns associated with the combined effects of these future activities.

Road maintenance activities would reduce accelerated erosion rates where improvements are necessary to correct drainage problems on specific segments of existing road. Surface erosion can usually be controlled by implementing appropriate Best Management Practices (BMPs) that reduce the potential for indirect effects to soils in areas adjacent to roadways. Road maintenance activities would not be necessary on roads closed for access restriction because self-maintaining drainage structures would be installed, where appropriate, to protect the road surface from erosion. There are no major soil-related concerns associated with the combined effects of these future activities.

### **LRMP (Forest Plan) Consistency**

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

Soil restoration treatments would be applied to rectify impacts by reducing the amount of detrimentally compacted soil dedicated to specific management facilities within all eight of the proposed activity areas. Restoration treatments, such as subsoiling, are designed to promote maintenance or enhancement of soil quality. These conservation practices comply with LRMP interpretations of Forest-wide standards and guidelines SL-3 and SL-4 (Final Interpretations, Document 96-01, Soil Productivity, 1996), and Regional policy (FSM 2520, R-6 Supplement No. 2500-98-1) for planning and implementing management activities.



Under Alternative 2, the percentages of detrimental soil conditions would increase above existing conditions by approximately 8 to 11 percent in all eight activity areas. None of the activity areas would exceed the LRMP standard of 20 percent following implementation of project and restoration treatments. It is expected that enough fallen trees and other organic materials would be available after salvage activities to meet recommended guidelines for CWD retention in the short-term. Therefore, the proposed actions comply with Regional and LRMP standards and guidelines for maintaining soil productivity within all proposed activity areas.

Under Alternative 3, the extent of detrimental soil conditions would not increase above existing levels in any of the proposed activity areas. No additional land would be removed from production to build roads or logging facilities and there would be no mechanical treatments that would disturb soil properties. Road decommissioning treatments would slightly reduce the amount of compacted soil within two activity areas (Units 1 and 3), but the percentage reductions would be minor due to the size of these units and the small amount of surface area that would actually be reclaimed. Under natural conditions, it is expected that enough small diameter trees (less than 10 inches) and other sources of organic matter would be available to maintain the soils ability to retain moisture and recycle nutrients in the short-term.

The overall effects of the action alternatives combined with all past, present, and reasonably foreseeable management activities would be within allowable limits set by LRMP standards and guidelines for protecting and maintaining soil productivity.

### **Irreversible and Irretrievable Commitments**

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

The development and use of temporary roads and logging facilities is considered an irretrievable loss of soil productivity until their functions have been served and disturbed sites are returned back to a productive capacity. The action alternatives include soil restoration activities (subsoiling) that would improve the hydrologic function and productivity on detrimentally disturbed soils.

### **Short-Term Uses of the Human Environment and the Maintenance of Long-Term Productivity**

Project design, LRMP management requirements and mitigation measures built into the action alternatives ensure that long-term productivity will not be impaired by the application of short-term management practices. The action alternatives would improve soil productivity in specific areas where soil restoration treatments (subsoiling) are implemented on soils committed to roads and logging facilities.

### **Response to Soil-Related Concerns and Recommendations contained in the “Beschta Report” regarding Post-Fire Salvage Logging**

The interdisciplinary team considered the general principles and recommendations provided by Beschta et al. in their paper entitled “*Wildfire and Salvage Logging*” (Beschta et al., 1995). This

section provides responses to specific comments regarding soil-related concerns and recommendations contained in this document.

**Comment:** “Allow natural recovery and recognize the temporal scales involved with ecosystem evolution. Human intervention should not be permitted unless and until it is determined that natural recovery processes are not occurring”.

**Response:** Human intervention following wildfires does not always cause adverse impacts to resources. Although little can be done to control organic matter loss during wildfires, every opportunity must be taken to revegetate the site so that organic litter can be restored as quickly as possible (DeBano, 1991). Coarse woody debris and surface litter are currently deficient in some burned portions of the project area. Decaying wood and organic litter are critical for maintaining the soils ability to retain moisture and provide both short and long-term nutrient supplies for the growth of vegetation. Mycorrhizal fungi and soil organisms also depend upon the continuing input of woody debris and fine organic matter.

Human intervention is needed to expedite the establishment and restoration of ponderosa pine stands, reduce excessive fuel loadings and the potential for high-severity reburns, and improve the hydrologic function and productivity on compacted soils dedicated to specific roads and logging facilities that would no longer be needed for future management.

Under Alternative 2, salvage harvest operations would be expected to accelerate the accumulation of woody debris where these materials are currently lacking within portions of some activity areas. Enough fallen trees and other organic materials would likely be generated after salvage activities to meet recommended guidelines for maintaining soil productivity during the fire recovery period.

Salvage harvest and fuel reduction treatments would occur on gently sloping lava plains (0 to 15 percent slopes) that contain well-drained soils with low hazards for surface erosion. There are no sensitive soils with high erosion hazards, and sensitive areas with steep slopes (greater than 30 percent) were excluded from management consideration. The removal of fire-killed trees would have no affect on evapotranspiration rates and potential increases in overland flows of water. Logging slash and fallen dead trees would provide additional ground cover that would slow the velocity of any runoff water and improve the soils ability to resist erosion from precipitation events or snowmelt that occurs during the fire recovery period.

Over the next 20 years, it is expected that the majority of fire-killed trees will become heavy fuel loadings that increase the risk for future wildfires to an unacceptable level. Post-fire sampling estimates indicate that potential biomass from down woody debris could range from 40 to 60 tons per acre within areas affected by stand-replacement fire (Plot Sampling, 2003). High-to-extreme fire hazard and potential for excessive soil heating exists when downed woody debris exceeds 30 to 40 tons per acre (Brown et al., 2003). If a large amount of fuel is present during a future wildfire, soil temperatures can remain high for long duration and excessive soil heating would be expected to produce large changes in soil chemical, physical, and biological properties (DeBano, 1991). Under Alternative 2, fuel reductions would be accomplished by whole-tree yarding salvaged trees. Although this method removes potential sources of woody debris off-site, it would not cause additional soil impacts because burning would occur on previously disturbed sites that already have detrimental soil conditions. Soil restoration treatments would be implemented to reduce the amount of detrimentally disturbed soil following these post-harvest activities. Over time, the residual trees that remain after harvest will gradually fall to the ground, and it is estimated that future fuel loadings would be reduced to an acceptable average range of 15 to 20 tons per acre.

Under the action alternatives, soil restoration treatments would be applied with a winged subsoiler to reclaim and stabilize detrimentally compacted soil on certain management facilities. Restoration treatments, such as subsoiling, are designed to loosen compacted soil and improve the hydrologic function and productivity on disturbed sites. Subsoiled areas are expected to reach full recovery through natural recovery processes within the short-term.

**Comment:** “Protect Soils. No management activity should be undertaken which does not protect soil integrity”.

**Response:** The interdisciplinary team acknowledged the potential for adverse impacts to the soil resource and established design criteria to address this issue. The proposed management activities would occur on gently sloping lava plains that contain well-drained soils with high infiltration rates and low hazards for surface erosion. Due to the minor amount of severely burned soil and adequate amounts of existing soil cover, the effects of ground-disturbing management activities would likely be similar to those observed in unburned stands of live trees. The development and use of temporary roads, log landings, and skid trail systems are the primary sources of physical disturbance that would result in adverse changes to soil productivity. The majority of soil impacts would be confined to known locations in heavy-use areas that can be reclaimed when these facilities are no longer needed for future management.

The combined effects of current soil disturbances and those predicted from implementation of the proposed actions were addressed in the Environmental Effects section. The environmental effects of each of the alternatives are described and tracked by three issue indicators. One of these indicators addresses the probable success in project design and implementation of management requirements and mitigation measures that would be applied to minimize adverse impacts to soil productivity.

In order to protect or maintain soil conditions at acceptable levels, plans for projects must include provisions for mitigation of ground disturbances where activities are expected to cause resource damage. Mitigation measures are specific actions that could be taken to minimize, avoid or eliminate potentially significant impacts on the resources that would be affected by the alternatives, or rectifying the impact by restoring the affected environment (40 CFR 1508.02). Various research references and both Regional policy (FSM 2520, R-6 Supplement No. 2500-98-1) and LRMP direction were used as guidance in determining design elements and mitigation needs for this project proposal.

Under Alternative 2, the management requirements, mitigation measures and Best Management Practices (BMPs) listed for the soil resource (DEIS, Chapter 2) are incorporated into the project design to avoid or minimize potentially adverse impacts from ground-disturbing management activities. Operational guidelines are included in design elements that provide options for limiting the amount of surface area covered by logging facilities and controlling equipment operations to minimize the potential for detrimental soil disturbances in random locations of activity areas. The steep slopes on Bessie and Luna buttes were excluded from the proposed activity areas in order to avoid soil displacement and potential erosion damage on sensitive soils. Other examples of project design criteria include limiting the amount of traffic off designated areas or operating equipment over frozen ground or a sufficient amount of compacted snow. Soil restoration treatments, including road decommissioning, would be applied to rectify impacts by reducing the amount of detrimentally compacted soil committed to specific roads and logging facilities.

All reasonable Best Management Practices (BMPs) would be applied to minimize the effects of road systems and timber management activities on the soil resource. The BMPs are tiered to the Soil and

Water Conservation Practices Handbook (FSH 2509.22), which contains conservation practices that have proven effective in protecting and maintaining soil and water resource values. The Oregon Department of Forestry evaluated more than 3,000 individual practices and determined a 98 percent compliance rate for BMP implementation, with 5 percent of these practices exceeding forest practice rules (National Council for Air and Stream Improvement, 1999).

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

**Comment:** “Do not take actions which impede natural recovery of disturbed systems”.

**Response:** The 18 Fire burned in a classic mosaic pattern of moderate and lightly burned areas. Although the fire caused high mortality of overstory trees, ground-level heating was typically not elevated to temperatures capable of altering soil properties that affect site productivity. No measurable increase in surface erosion is expected from implementation of the planned restoration activities. Landforms have relatively gentle slopes and there are no sensitive soils with high erosion hazards. There are no natural or management-related landslides known to exist within the project area, and the hazard for debris flows is low. Sensitive soils with steep slopes (greater than 30 percent) were excluded from management consideration. Monitoring results of previous fires on the district indicate that overland flow of water and evidence of surface erosion is typically nonexistent in burned areas with gentle slopes. Although the 18 Fire killed vegetation and reduced evapotranspiration rates, most of the water yielded from affected acres is expected to be delivered to streams as subsurface flows that emerge at lower elevations outside the project area. The absence of stream channels within or adjacent to the project area assures that there is no potential for eroded sediments to reach any listed 303(d) water bodies or cause indirect, adverse effects to essential fish habitat (Walker, 2003).

At the present time, adequate soil cover currently exists within the proposed activity areas to control erosion rates within tolerable limits. Existing soil cover and the re-growth of sprouting shrubs and herbaceous vegetation will effectively slow the velocity of any overland flow that may occur during the recovery period. The re-establishment of live vegetative cover is already taking place in most of the burned areas. The post-fire soil environment likely maintained viable populations of soil biota which are capable of responding to nutrient increases and the natural recovery of vegetation.

Under Alternative 2, the proposed salvage harvest and fuel reduction treatments are not expected to cause accelerated erosion rates that would have any long-term adverse effects to soil productivity. Project design and the level of success in implementing the management requirements, mitigation measures and Best Management Practices (BMPs) determine the overall magnitude of soil disturbance within the individual activity areas proposed for these restoration treatments. All reasonable Best Management Practices (BMPs) for timber management and road systems would be applied to protect the soil resource and control erosion on roads and logging facilities that may be used during project implementation. Soil restoration treatments, including road decommissioning, would be applied to rectify impacts by reducing the amount of detrimentally compacted soil committed to specific roads and logging facilities.

**Comment:** Salvage logging should be prohibited in sensitive areas.

**Response:** Sensitive soils were considered to be those identified in the Deschutes LRMP. Sensitive soils within the project area include: 1) soils on slopes greater than 30 percent, 2) soils associated with frost pockets in cold air drainages, and 3) soils that occur in localized areas of rocky lava flows. There

are no potentially wet soils with high water tables or sensitive soils with high erosion hazard ratings that would require special mitigation.

As described in the previous responses (above), sensitive soils that could be adversely impacted by ground-disturbing management activities were excluded from management consideration. Modified harvest prescriptions or other, less intensive treatments are management options that do not apply to reforestation objectives in areas affected by stand-replacement wildfires.

**Comment:** On portions of the post-fire landscape determined to be suitable for salvage logging, limitations aimed at maintaining species and natural recovery processes should apply.

**Response:** The effects analysis for the soil resource addresses this issue by comparing post-fire existing conditions to the anticipated conditions which would likely result from implementing the action alternatives. As described in previous responses, soils in the proposed activity areas were not severely burned, and salvage logging would occur on gently sloping lava plains (0 to 15 percent slopes) that contain well-drained soils with low hazards for surface erosion. Sensitive soils that could be adversely affected by ground-based logging activities were excluded from all proposed activity areas. Adequate soil cover currently exists to slow the velocity of any runoff water and control erosion rates within tolerable limits. Monitoring of previous fires on similar soils and landforms has shown that overland flow of water and evidence of surface erosion is typically nonexistent within both logged and unlogged portions of burned areas. It is expected that the use of modern, ground-based equipment and designated skid trail systems would result in similar effects to those observed in unburned areas.

Under Alternative 2, the development and use of temporary roads, log landings, and skid trail systems are the primary sources of physical disturbance that would result in adverse changes to soil productivity. The majority of soil impacts would be confined to known locations in heavy-use areas that can be reclaimed when these facilities are no longer needed for future management. Best Management Practices (BMPs) would be applied to control erosion on and adjacent to roads and logging facilities that would be used during project implementation. The management requirements, mitigation measures and Best Management Practices (DEIS, Chapter 2) are incorporated into the project design to avoid or minimize potentially adverse impacts to the soil resource.

Salvage harvest operations would be expected to accelerate the accumulation of woody debris where these materials are currently lacking within portions of some activity areas. Enough fallen trees and other organic materials would likely be generated after salvage activities to meet recommended guidelines for maintaining soil productivity. This would expedite decomposition processes and input of organic materials into the soil surface.

**Comment:** Because of the wide range of chronic ecological effects associated with road building, the building of new roads in the burned landscape should be prohibited.

**Response:** There would be no new construction of roads that would be retained as part of the transportation system. Approximately 3.5 miles (total) of temporary road would be constructed to allow access to some activity areas, but these roads would be obliterated upon completion of salvage activities. All reasonable Best Management Practices (BMPs) for road systems would be applied to protect the soil resource and control erosion on roads that may be used as haul routes for this project.

**Comment:** Structural post-fire restoration is generally to be discouraged.

**Response:** Surface erosion by water is not a major concern on these coarse textured soils with high infiltration rates. There is no potential for overland flow of sediments to reach stream channels outside of the project area. Therefore, the Burned Area Emergency Response (BAER) team did not recommend any post-fire structural restoration projects.

**Comment:** Post-fire management will generally require reassessment of existing management.

**Response:** The interdisciplinary team conducted a roads analysis and identified several segments of local system road which are recommended for long-term closures and road decommissioning (obliteration) treatments. These recommendations are incorporated into the design of the action alternatives. In order to allow for adequate recovery of herbaceous vegetation, livestock would not resume grazing in the project area until the fall of 2005.

**Comment:** Continued research efforts are needed to help address ecological and operational issues.

**Response:** The interdisciplinary team acknowledges the value of continued research regarding post-fire activities. Within the Forest Service, only the research branch can conduct scientific research, therefore research projects are beyond the scope of this DEIS. Local monitoring would be conducted to evaluate whether adjustments in management practices may be necessary to achieve various resource objectives. Research studies were used to develop conservative recommendations for leaving sufficient coarse woody debris following management activities (Graham et al. 1994, Brown et al. 2003).

**Comment:** Fire suppression activities should be conducted only when absolutely necessary and with utmost care for the long-term integrity of the ecosystem and the protection of natural recovery processes.

**Response:** This recommendation is outside the scope of the analysis. Specific environmental effects of fire suppression activities are discussed under Existing Condition of the Soil Resource.

## Wildlife Habitat (Key Issue 2)

**Issue Statement:** The effects of the 18 Project proposed activities on deer winter range habitat and the availability of snags and down wood. Public comment and discourse (including Beschta et al, 1995).

**Background:** The following report meets the direction provided by the Forest Service Manual (FSM 2600), the Deschutes National Forest (DNF) Land and Resource Management Plan (LRMP; USDA, 1990), and the Environmental Assessment for the Continuation of Interim Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales (referenced as the “Eastside Screens”; USDA, 1995). It specifically addresses the 18 Fire Recovery Project effects upon Management Indicator Species (MIS) as designated by the LRMP, ecological indicator species and/or habitats as described in the FSM, and Species of Concern (SOC) or Sensitive (S) as respectively designated by the Fish and Wildlife Service (FWS; USDI, 2000) or the Oregon Department of Fish and Wildlife (ODFW, 1997). Species that are addressed by the Migratory Bird Treaty Act (MBTA) and the related Executive Order of 2001 (#13186; The White House, 2001) are also noted. The report does not address those species designated as threatened, endangered or proposed/candidate for federal listing under the Endangered Species Act. For these species and for those designated as Sensitive by the Forest Service Regional Office (Region 6; USDA, 2000) refer to the Biological Evaluation/Assessment (BE/BA) for this project.

### Indicators:

1. Amount of acres reforested.
2. Miles of open road density (miles/per/square mile).
3. Snag and down log levels, including display of effects of the alternatives using Decayed Wood Advisor for Managing Snags (snags per acre by diameter class), Partially Dead Trees, and Down Wood for Biodiversity (measured in percent) in Forests of Washington and Oregon, DecAID.

### **Landscape Overview**

The project area provided a low level of habitat diversity for wildlife prior to the fire. Dry, even-aged ponderosa pine forest dominated the area. The stands were classified as “black-bark”, which are generally 50 to 60 years old with one canopy layer. The relatively low elevation and limited precipitation of the area likely preclude the site capability to develop multi-stratum late and old structure (LOS) forest. However, it is capable of producing single-story LOS. There are no natural streams, springs, ponds, lakes or man-made guzzlers in the project area. Other than some minor lava outcrops there are also no special or unique habitats including cliffs, talus, caves, aspen, mountain mahogany, or extensive areas of forested lavas.

Approximately 96 percent of the salvage area (1,868 acres) within the fire is classified as big game winter range that is important to mule deer and elk. Mule deer are the dominant big game species and are distributed across the area throughout the year. Other medium and large mammal species potentially inhabiting this area include black bear, mountain lion, badger, coyote, and bobcat.

A variety of small mammals and birds were present in the project area prior to the wildfire. Refer to the following table for a partial listing of species. Species bolded and italicized will be evaluated to determine recommendations for the project.

Table 3-6: Selected Wildlife Species Summary

Species	Occurrence*	Management Indicator Species	FWS Species of Concern	ODFW Sensitive Species	Ecological Indicator Species**
Northern goshawk (NTMB, MBTA)	S	X	X	X	X (1)
Sharp-shinned hawk (NTMB, MBTA)	S	X			(4)
Red-tailed hawk (NTMB, MBTA)	C	X			(7-generalist)
Cooper's hawk (NTMB, MBTA)	S	X			
Golden eagle	U	X	BCC (BCR 9)		(6)
<b>Flammulated owl (NTMB, MBTA)</b>	U		BCC (BCR 9)	X	X (1, 2a, 4, 5-interspersed grassy openings and thickets)
Northern pygmy-owl (MBTA)	U			X	(2a, 7-open forests, edges)
<b>Lewis' woodpecker (NTMB, MBTA)</b>	U	X	BCC (BCR 9)		X (2a-large snags, 7-burns)
<b>White-headed woodpecker (MBTA)</b>	U (declining, local extirpation, BBS)	X	BCC (BCR 9)	X	X (1-PP, 2a, 2b, 7-sugar pine foraging, large LOS patches)
<b>Hairy woodpecker (MBTA)</b>	C				X (2a, 2b, 7-burns)
Black-backed woodpecker (MBTA)	R	X		X	X (1-LPP, 2a, 2b, 7-burns)
<b>Williamson's sapsucker (NTMB, MBTA)</b>	R (declining, BBS)	X	BCC (BCR 9)	X	X (2a-large snags, 2b, 7-higher elevations)
<b>Pygmy nuthatch (migratory, MBTA)</b>	U			X	X (1-PP, 2a, 2b, 7-large trees)
White-breasted nuthatch (migratory, MBTA)	U-C				X (1-PP, 2a, 2b)
Mountain chickadee (migratory, MBTA)	C				(1, 2a, 2b, 5)
<b>Green-tailed towhee (NTMB, MBTA)</b>	U				X (3)
<b>Olive-sided flycatcher (NTMB, MBTA)</b>	U-C (declining, BBS)		BCC (BCR 5)	X	X (1, 2a, 7-burns, clearings, edges w/ conifers)
Dusky flycatcher (MBTA)	U				X (3, 7-clearcuts)



Table 3-6 (continued)

Species	Occurrence*	Management Indicator Species	FWS Species of Concern	ODFW Sensitive Species	Ecological Indicator Species**
<i>Chipping sparrow</i> (NTMB, MBTA)	U (declining, BBS)				X (7- open understory w/regenerating pines)
<i>Mountain bluebird</i> (NTMB, MBTA)	U-C				X (2a, 7- burns, openings)
Rock wren (MBTA)	U				X (7-talus, rock, clear-cuts)
<i>Mule deer</i>	C	X			(7-shrubs winter range)
American marten	R	X		X	X (1-MC, LPP, 7-CWD concentrations)
<i>Yellow-pine chipmunk</i>	C				X (2a, 2b)
Townsend's big-eared bat (Pacific western)	S	X	X	X	(3-foraging, 6-caves)
Western small-footed myotis	S		X	X	(3-foraging, 6-cliffs, 7-bark of trees)
Long-eared myotis	S		X	X	(2a, 2b, 6, 7- open forest, bark of trees)
Long-legged myotis	S		X	X	(2a, 6, 7-bark of trees)
Palid bat	S			X	(6, 7-roosts in trees)
Silver-haired bat	S			X	(2a-cavities, 7-forages in forest, bark of trees)
Northern sagebrush lizard	S		X		X (2b, 3, 6-rock outcrops,
<i>Western fence lizard</i>	C				X (2b, 6-rocks)
Western skink	S				X (2b)
Western toad	U				X (2b)
Rubber boa	S				X (2b)

\***Note:** Relative abundance (18 Fire area only, pre-fire occupancy) codes: C = common, U = uncommon, R = rare, S = suspected but not confirmed, i.e. potential habitat available. \*\* Special habitat requirements codes: 1 = late and old successional forest (LOS), 2a = snags, 2b = logs, 3 = mature shrubs, 4 = dense conifers for nesting/foraging, 5 = meadows or grassy openings for foraging, 6 = special/unique habitats (rock, cliffs, caves, etc.), 7 = other, noted. Abbreviations: LPP = lodgepole pine, PP = ponderosa pine, MC = mixed conifer, CWD = coarse woody materials (logs and limbs > 3" in diameter), NTMB = neotropical migrant bird, MBTA = Migratory Bird Treaty Act listing. FWS Species of Concern includes species identified by the 2002 Birds of Conservation Concern (BCC) publication (USDI, 2000) with the applicable Bird Conservation Region (BCR; BCR5 is the Northern Pacific Forest and BCR9 is the Columbia Basin). Other references included: Guenther and Kucera, 1978, USDA, 1990 and 2000, ODFW, 1997, Csuti et al. 2001, Marshall et al. 2003, and USDI, 2001.

### Historic Range of Conditions

The historic population levels of wildlife species endemic to the 18 Fire Recovery Project area are unknown. It is likely those species associated with relatively dry, open ponderosa pine forest with frequent, low intensity wildfire were more common. Fire suppression, timber harvest, road

construction, and nearby development on private lands have impacted the wildlife populations of the local area. Species including the flammulated owl, white-headed woodpecker, pygmy nuthatch, Lewis' woodpecker, and olive-sided flycatcher are examples of species that were likely more common historically. Mule deer utilize the area year-around, and due to its low elevation it is particularly important as winter range. Deer numbers have declined from past levels in the North Paulina herd unit due to cumulative effects from elimination or degradation of their habitats.

Prior to the wildfire, the project area was dominated by a relatively young (that is "black-bark"), even-aged ponderosa pine stand. There was no late successional forest (LOS) present prior to the fire. The understory was also relatively simple with bitterbrush, green manzanita, and Idaho fescue being the dominate species. Openings allowed for greater shrub cover. A plantation of ponderosa pine created after the Bessie Butte Fire in 1996 is present in the northwestern portion of the area adjacent to the project boundary. Rocky outcrops with low tree stocking create some horizontal diversity. The area is very homogenous and the nearby Luna and Bessie buttes provided the only topographic diversity.

### **Existing Habitat Conditions**

The fire created a mosaic of burn intensities. Areas with low intensity and small areas of moderate and high intensities (such as tree crown mortality), as well as steep slopes, have been excluded from the project area (1,801 acres). Within the salvage area 100 percent of it is in the moderate/high category of burn intensity. At least 90 percent of moderate burn intensity trees and at least 95 percent of the high intensity trees are dead. The 1,801 acres of non-salvage has 11 percent in moderate/high intensity and 89 percent in low intensity. In total 2,420 acres (64 percent) of the gross area of the fire (3,810 acres) were in moderate/high intensity (such as stand replacement) regimes.

### **Big Game**

As previously noted, approximately 96 percent of the project salvage area is classified as winter range (such as LRMP Management Area 7, Deer Habitat). Both deer and elk use the area and are expected to continue post-fire, but it will take several years of recovery before use levels begin to increase. Bitterbrush, *Purshia tridentata*, and other shrubs sustained a high level of mortality from the fire, except in a few patches in openings. Bitterbrush and sagebrush, *Artemisia spp.*, are species that are easily killed by fire. In low intensity fires bitterbrush may sprout from root collar buds, but it is unlikely in high severe intensity fires. Sagebrush does not sprout. Rodent caches of bitterbrush seed may have survived the fire and assist in recovery. Grass species such as Idaho fescue, *Festuca idahoensis*, will likely recover very quickly. Herbaceous plants will be more valuable to wintering elk than mule deer, which prefer woody browse plants in the winter months. Areas over 600 feet from the remaining hiding/thermal cover around the fire perimeter will likely not be fully utilized by big game species (Thomas et al. 1979).

Coniferous hiding and thermal cover for big game has been eliminated by the fire. Some marginal vegetative cover still remains in those areas of lower intensity burn next to the project boundary. Topographic features and burnt snags provide some screening for big game. Unburned areas adjacent to the fire are dominated by single-story black-bark ponderosa pine which generally provides marginal cover at best. Previously designated deer movement corridors have also been eliminated by the fire (reference the analysis files).

### **Other Species**

There is a complex group of wildlife winners and losers post-fire. Those animals requiring dense or mature forest will be reduced or eliminated. Others favoring open habitats, snags, and grass dominated environments will be favored. Woodpeckers, sapsuckers, robins, juncos, red-tailed hawks, and gophers will all be present in the fire area in the near-term. There were no known raptor nest sites

within the project area prior to the fire. The relatively uniform black-bark pine habitat provided limited nesting habitat for sharp-shinned hawk, Cooper's hawk, and northern goshawk. Wildlife surveys had been previously done by the Fuzzy Project (implementation phase), which overlapped a minor amount of the project on the east side, and by the Kelsey Project (planning phase), which covers the majority of the 18 Fire area. Field reconnaissance was done post-fire but no formal surveys for any species were done.

### **Shrub Habitat**

Shrubs, primarily bitterbrush, provide critical mule deer winter forage. They also provide nesting and foraging habitat for shrub-associated species (such as yellow-pine chipmunk and golden-mantle ground squirrel), and neotropical migrant birds, such as green-tailed towhee (Paige and Ritter, 1999). Many of these species, particularly the seed-caching rodents, such as the yellow-pine chipmunk, serve an important ecological role in the regeneration of shrub species (Vander Wall, 1994). Refer to the section of the report on Indicator Species for more detailed information on species dependent upon shrub habitats.

### **Roads and Trails**

The area has a road density of 5.7 miles per square mile. There is one horse trail in the vicinity of Bessie Butte adjacent to the project area. Direct and indirect impacts to habitats from existing roads have been moderate to high depending on the class (that is width, level of use) of road, its location, and the season of use.

### **Late and Old Structure Habitat and Old Growth Management Areas**

There was no classified Late and Old Structure Habitat (LOS) present in the project area or designated Old Growth Management Areas (OGMA) (USDA, 1990). However, there is an OGMA about one mile west of the project.

### **Connectivity and Fragmentation**

Prior to the fire several connectivity areas had been designated and maintained through the project area for deer movement and OGMA/LOS connectivity. The fire has eliminated major portions of two corridors, which are not recoverable in the short-term. The southern corridor has been partially damaged. Fragmentation was low in the area and was primarily related to the effects of the adjacent Bessie Butte fire and roads. Past timber harvest had been selective cutting and not seed tree harvest or clear-cuts, which would fragment the landscape.

### **Snags, Green Trees, and Coarse Woody Debris (CWD) Habitats**

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

Desired conditions of snag and CWD habitat are based in part on management recommendations and standards and guidelines provided by the Deschutes National Forest Land and Resource Management Plan (USDA, 1990), Deschutes National Forest Wildlife Tree and Log (WLTL) Implementation Strategy (USDA, 1994), and the Revised Interim Management Direction (i.e. Eastside Screens; USDA, 1995).

The Proposed Decision for the Interior Columbia Basin Final Environmental Impact Statement (ICBEMP; USDA & USDI, 2000) and Draft Environmental Impact Statement (DEIS) for ICBEMP were also reviewed. Neither document was ever finalized or required direction, but they did summarize the best available scientific information at the time. Standard B-S29 of the Proposed Decision indicates that the tables in Appendix 12 (in Volume 2 of the Supplemental Draft EIS) were proposed to determine snag numbers and coarse woody debris levels whenever vegetation management is done. If adequate numbers of snags greater than 21 inches diameter-at-breast-height (dbh) are not available prior to vegetation management activities to meet the levels indicated in Appendix 12, then a mix of the largest snags available was suggested. The Supplemental Draft EIS direction (Appendix 12) recognized that the broad standards would require fine-tuning for more local ecological conditions. The ICBEMP snag and CWD guidelines were focused on maintaining snags and CWD >21 inches dbh and did not adequately address snags and CWD less than 21 inches dbh, or size and density by plant association group (PAG). Within the 18 Fire Recovery Project area, snags and CWD greater than 21 inches dbh are limited, which restricts the utility of using ICBEMP guidelines.

The DecAID Advisor (Marcot et al. 2003) was extensively utilized in the analysis of existing conditions and in the recommended desired conditions for snags and down wood cover, which are addressed in a following section. This reference is available at <http://www.notes.fs.fed.us:81/pnw/DecAID/DecAID.nsf>.

Other literature including the report by Beschta et al. 1995, was reviewed, but DecAid was concluded to be the most current scientific information on this topic. The following table summarizes the present levels of snags within the project area.

**Table 3-7: Existing Post-Fire Snag Levels**

Area	Diameter Mid-Point	Ht.	No. Per Acre	Notes
Salvage Units 1 to 8	6"	35'	14.6	50.3 tons of dead material per acre.
	9	55	19.1	Average of 3 green trees per acre.
	12	65	21.0	8.1 percent future CWD
	15	80	13.5	
	18	90	5.7	
	24	110	4.5	
Non fire salvage area	6"	35'	17.2	21.8 tons of dead material per acre.
	9	55	20.8	Average of 57 green trees per acre.
	12	65	10.8	4.1 percent future CWD
	15	80	6.4	
	18	90	1.0	
	24	110	1.0	

*Note: Source Jim Schlaich, Project Team Leader. Independent snag transects resulted in similar data, but it was noted that there were areas throughout the project area with openings and much lower snag levels. The above data represent averages of the plots taken. In summary, there are approximately: 30 snags/acre >8" dbh; 25 snags/acre >9" dbh; and 17 snags/acre >10" dbh in the salvage area.*

The fire consumed the majority of down logs and smaller coarse woody materials, so there was no data to collect on these habitat features. For reference, the pre-fire snag levels were averaged (5 inventory stands) as follows (all ponderosa pine): 12 inch to 24 inch diameter-at-breast-height (dbh) 3.1 snags per acre; 21”+ dbh less than .1 snag per acre (source P. Powers, project Silviculturist; FVS).

### Desired Future Conditions (Indicator Species)

The following table displays habitat and information for selected Management and Ecological Indicator Species from Table 3-6. Selected species reflect the capability of the project habitats. Short and long-term habitat objectives are displayed in the *Habitat Description* section. The territory and/or home range sizes will be used in the development of the spatial arrangement of habitat components.

**Table 3-8: General Objectives for Management and Ecological Indicator Species**

Species	Territory or Habitat Unit Size	Habitat Description
Mule deer	Patches 6+ acres of hiding/thermal cover	Establish coniferous trees for future hiding and/or thermal cover in patches no greater than 1200 feet apart on 40 percent of the planning area with a ratio of 10:30 hiding to thermal cover. Provide movement corridors of cover at least 600 feet wide no greater than ½ mile apart.
Flammulated owl	Home range 25 ac. Territory 15-30 acres.	Prefer open ponderosa pine or mixed conifer with limited understory and large trees. Forage in openings, meadows, along edges. Secondary cavity nester (22 to 28 inches dbh snags).
<i>*Lewis' woodpecker</i>	Territory 15 ac.	Open forests. Patches of burned forest. Target >50% of burns un-salvaged. Retain all snags >21” dbh and 50% of snags 12-21” in fire salvages. Overall, retain 25 snags per acre 9”+ dbh in burns. Usually secondary nester but may excavate (12”+ snags, with 26” mean).
Williamson's sapsucker	Territory 10-20 ac.	Prefer open ponderosa pine for nesting. Excavate soft, decayed wood (12” dbh minimum, with 21”+ preferred). 1.5 snags/ac.
Hairy woodpecker	Territory 25 ac.	Open forests along edges and in burned areas. Primary excavator (10” minimum, with 17”+ preferred). 1.3-1.9 snags/ac. (burns 41.8/ac.) Light to moderate decay.
<i>*White-headed woodpecker</i>	Home range 250-500 ac.; territory 20 ac.	Open old-growth ponderosa pine with large trees for foraging and snags for nesting. Pine seeds (ponderosa and sugar) are important forage in the winter. Will use short snags and tall stumps in open areas (averages 12% canopy cover). Target 10 trees per acre >21” dbh with >2 trees per acre >31” dbh; 10-40% canopy closure; 1.4 snags per acre >8” dbh with >50% >25” dbh, mean 18”. Burns 51.4 snags/ac.
<i>*Pygmy nuthatch</i>	Territory 2-4 ac.	Prefer older, mature ponderosa stands but will forage in young stands. Target 10+ trees per acre of 21” dbh+, including 2 trees per acre >31” dbh. Secondary nester or primary excavator in snags or dead portions of live trees (8” dbh minimum, prefer 16”+ dbh). 1.4 snags/ac.
Green-tailed towhee	Territory 25 ac.	Open ponderosa pine forest with vigorous, diverse shrub understories. Clearcuts used.
Olive-sided flycatcher	Territory 35-100 ac.	Open forests with scattered tall trees and snags, along edges (especially high contrast with mature forest). Burned areas are important.
<i>*Chipping sparrow</i>	Territory 3-7 ac.	Open forest with patches of regenerating trees or shrubs. Openings with forbs and grasses are important for foraging. Edges and clearcuts are utilized. Target 10 to 30 percent canopy cover, 20 to 60 percent shrub cover with >20% sapling cover, especially pines.
Mountain bluebird	Territory 5-15 ac.	Open forests, clear-cuts, edges of meadows, and burned areas. Secondary cavity nester (minimum 9” dbh). Burns 29.7 snags/ac.
Yellow-pine chipmunk	Home range <2.5-25 ac.	Open forests with shrub understories. Coarse woody debris is important, including stumps and logs, for nests (rocky areas also used). Seeds from trees and other plants are required. An important agent in the establishment of bitterbrush by caching seeds for food (Vander Wall, 1994).
Western fence lizard	Home range <2.5 ac.	Rocky rims, canyons, and hillsides with boulders. Require elevated perches and use stumps, logs, rocks, fences, etc. Great Basin subspecies in our area.

*Note: \*Focal Species for the Central Oregon Sub-province (Altman, 2000). Other principal references included Csuti et al. 2001; Johnson and O'Neil, 2001; Marshall et al. 2003; Thomas et al. 1979; and Marcot et al. 2003.*

### Habitat Components & Elements

The following sections describe the principal habitat elements that the selected Indicator Species will require. Specific Desired Conditions for each species/group that are necessary to maintain viable local populations in the long-term are described in the following component/elements descriptions.

### Snags/CWD Habitat Component

The following Table 3-9 was developed from the DecAID Advisor and shows future desired conditions for both large (150 years+) and small-medium ponderosa pine (40 to 150 years) structural stages. The former is provided for comparative information, and the latter will be the basis for specific Desired Conditions for the project area. The attainment period for both stages would be subject to a variety of variables including: 1) reforestation success rate; 2) tree density; 3) tree mortality or damage agents; 4) competition with other trees and vegetation (such as growth rates); and 5) climate (precipitation, drought).

**Table 3-9: DecAID General Desired Conditions for Snags and Down Wood**

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

Table 3-10 summarizes the individual elements for snags and coarse wood materials that can be reviewed for importance to individual indicator species. The summary after the table will provide specific Desired Future Conditions (DFC) that have unique numbers, such as DFC-1.

**Table 3-10: Snags/CWD Elements**

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

*Note: \*Italicized/bolded species are Focal Species (Altman, 2000). \*\*Rating codes—1 = required, 2 = used (not a critical parameter), 3 = indirect benefit (e.g. prey base uses), NA = not applicable. ? = no information \*\*\*DecAID data from the ponderosa pine/Douglas-fir Open Vegetation Condition.*

In summary, the snag/CWD habitat component is critical to a significant majority of the Indicator Species. The individual species territories are subject to both intra- and inter-species competition. Therefore, the arrangement and numbers of snags must be designed so as to reduce competition across the landscape. A combination of individual and patches of snags/logs is recommended. The DFC for snag/log patches are as follows:

- DFC-1: Provide a minimum of 3 snags per acre as averaged for all snags in each salvage unit. In addition, retain 34 snags (10 inches dbh) and/or recent blowdown per acre to meet the log cover element of 1.4 percent per acre. Do not include un-salvaged areas outside of the units in computing the averages.
- DFC-2: At least 50 percent of the snags should be 10 to 20 inches dbh and the balance of 50 percent of 21 inches dbh or greater. Logs should be a minimum of 10 inches in diameter and 40 feet long.
- DFC-3: Provide a mix of both individual snags and patches of snags across the salvage units. All snag/log patches and individuals should be no closer than 100 feet to an open, system road and be well distributed across each harvest unit. Patches can range in size from ½ to 15 acres, and distributed across the project area at a rate necessary to meet the total minimum. For example, if a total of 370 snags (30+340) are needed on 10 acres to meet DFC-1, then a ½ ac. patch with an average of 50 snags/ac. (reference Table 3-7) would need to be retained at the rate of 5 patches (2.5 acres) together with 120 snags/blowdown scattered across the remaining 8 acres. Patches with higher densities of suitable snags/blowdown would need less replication. The larger patches exceeding 5 acres should be strategically located.

Implementation of the DFC should take into consideration the observed distribution patterns of snags and logs that are cited in the DecAID Advisor. The recommended snag level as an example is an average derived from the various references. The data indicates that approximately 54 percent of the inventoried areas had no snags, while the balance of 46 percent had measurable snags greater than 10 inches dbh. Retaining snags in patches is supported by the data, but some species (such as Lewis' woodpecker) prefer individual snags in open areas. By having a mixed distribution of patches and individual snags meets more species' requirements. Species that utilize post-burn habitats have a higher snag requirement than they do in unburned forest. This is due to the lower levels of forage availability in recently burned areas. The snag levels indicated in Table 3-7 significantly exceed the level identified in the DFC for those species that prefer burned areas. The snags retained for future log inputs will provide adequate numbers for these species in the short-term. The effects analysis will also note the un-salvaged areas within the burn (that is 47 percent of the area) that will provide fully for these species.

Log retention also provides some flexibility. The referenced minimum of 34 logs in DFC-1 is for only the 10 inch diameter size class. Given that a 10 inch log covers .041 percent of the ground, a 15 inch log covers .086 percent, and a 20 inch covers .152 percent, there is an opportunity to meet the total minimum percentage (that is 1.4 percent) with fewer logs using larger sizes. For example, a 10 inch log covers ~18 square feet and it would require 33.8 of them to meet the 610 square foot minimum. Leaving logs of 15 inch diameter (@ 37 square feet of coverage each) would only require 16.5 logs per acre. Logs of 20 inch diameter (@ 66 square feet of coverage each) would only require

9.2 per acre. These percentages are based on a log length of 40 feet. Fewer logs would be needed in the salvage area, which has snags on average exceeding the 40 foot length.

**Green Tree Replacements Habitat Component**

The majority of the project no longer has any green trees due to high mortality from the effects of the fire. However, the recognition of the importance of providing future green trees to continue the cycle of snags and logs for dependent species is critical. The site capability to produce trees of adequate size for dependent species is important as related to the stand density and subsequent ability to produce trees and future snags within a reasonable time period. The area is below 5,000 feet in elevation and has low precipitation. The classified plant associations of the fire include in order of dominance: CP-S2-11 (ponderosa pine/bitterbrush/fescue) of moderate site productivity, CP-S2-17 (ponderosa pine/bitterbrush-manzanita/fescue) of poor site productivity, and CP-S2-13 (ponderosa pine/bitterbrush-manzanita/needlegrass) of low site productivity (Volland, 1988). The following DFC is designed to address meeting the long-term objectives for the green tree replacements (GTRs) habitat component (that is number of trees per acre for future snags and logs).

- **DFC-4:** Reforestation of the project area should provide and maintain 10 to 60 (average 35) large (that is greater than 21” dbh) ponderosa pine per acre in order to meet future snag and log habitats. The natural patchiness of ponderosa pine forest should be replicated. The retention of all remaining GTRs within the burned area will contribute to future snag recruitment goals.

**Big Game Habitat Component:** The most important elements for this habitat component are listed and rated for importance in the following Table 3-11.

**Table 3-11: Big Game Elements**

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

*Note: \* Rating codes— 1 = required by the LRMP, 2 = not required by the LRMP.*

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

- **DFC-5:** Provide hiding cover on at least 10 percent of the winter range area and 30 percent of the summer range area in the mid-term (15+ years) by planting coniferous trees in strategic patches that are a minimum of 6 acres in size and 400 feet in width. Cover patches should be located at least 400 feet from open, system roads if possible. A seedling spacing of 15 feet x 15 feet is recommended (200 trees per acre) or whatever is determined is necessary to meet hiding cover. Expected mortality, as an example, should be included in the density estimate. Hiding cover is defined as vegetation capable of hiding 90 percent of a deer at 200 feet. At a



minimum it must be at least 5 feet in height. No thinning would be done for at least 15 years. In addition plant trees along roadsides to provide screening cover.

- **DFC-6:** Develop thermal cover (40 percent canopy and 30 feet tall; minimum 30 percent canopy and 15’ tall) on at least 30 percent of the winter range area in the long-term (30+ years) by planting coniferous trees in strategic patches that are a minimum of 10 acres in size and 400 feet in width. Tree densities should be adjusted to account for mortality and costs. Thermal cover patches should be adjacent to forage areas and at least 400 feet from open, system roads.
- **DFC-7:** Develop travel corridors through the area where possible to reconnect with those adjacent to it from previous vegetation management projects. Plant coniferous trees in the designated corridors to attain hiding cover characteristics. The corridors must be a minimum of 600 feet in width. A seedling spacing of 15 feet x 15 feet is recommended (200 trees per acre). Higher densities may be needed if mortality is expected. No thinning would be done for at least 15 years. Acreages in corridors may be used to attain DFC-4 provided that good spatial distribution of hiding cover is attained.
- **DFC-8:** Promote or maintain high quality forage areas on 60 percent of the winter range area. The forage areas should emphasize bitterbrush and forbs. Availability can be promoted by closing or restricting motorized access to the area and by not allowing any impediments to access or movement by deer through the area (such as fencing). All forage areas (that is patch centers) should be within 1,200 feet of planned cover patches.
- **DFC-9:** Manage roads and motorized trails to meet the maximum allowable road densities in the respective portions of summer (2.5 mile per square mile) and winter ranges (1.0 to 2.5 mile per square mile). Restore decommissioned road prisms to native vegetation.

**Forest Structure and Arrangement Habitat Component:** The following Table 3-12 displays selected elements for this component and those Indicator Species that utilize them. The importance of each element is rated by species.

**Table 3-12: Forest Structure and Arrangement Elements (long-term)**

Indicator Species*	Element Ratings**						
	LOS Stage 6	LOS Stage 7	Large Trees/ Snags/ Logs	Open Canopy	Closed Canopy/ Dense conifers	Shrubs/ Herbaceous/ Openings	Edges/ Burns
Mule deer	3	2 (forage)	NA	2 (forage)	2 (cover)	1 (forage)	2/2
Flammulated owl	2	1	1 (nests)	1	1 (nests, roosts)	1 (forage)	1/?
<i>Lewis’ woodpecker</i>	3	1	1 (nests)	1	3	2 (forage)	2/1
Williamson’s sapsucker	2	2	1 (nests)	1	3	NA	3/?
Hairy woodpecker	1 (winter)	1 (winter)	1 (nests)	1	3	NA	3/1
<i>White-headed woodpecker</i>	3	1	1 (nests, forage)	1	3	2 (nests)	3/?

			green)				
<i>Pygmy nuthatch</i>	1	1	1 (nests, forage)	2	2	NA	2/?
Green-tailed towhee	NA	2	NA	1	NA	1	1/?
Olive-sided flycatcher	2 (edge)	1 (edge, gaps)	1 (dead tops)	1	NA	2 (migration)	1/1
<i>Chipping sparrow</i>	3	2	NA	1	3	1 (grass preferred)	1 (grass edges)?
Mountain bluebird	2 (juniper)	3	1 (secondary)	1	NA	1	1/1
Yellow-pine chipmunk	3	2	2 (logs)	2	3	1	1/?
Western fence lizard	3	3	2 (logs)	2	NA	2	1/?

*Notes: \*Italicized/bolded species are Focal Species for the Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains (Altman, 2000) for the ponderosa pine habitat type. \*\*Rating codes—1 = primary, 2 = secondary, 3 = casual use, NA = not applicable or negative relationship. Principal reference Marshall et al. 2003.*

In summary, the Indicator Species as a group require relatively open forest habitats. The majority require snags and several have a strong affinity to burned areas.

- **DFC-10:** Reforestation should mimic the natural patchiness of ponderosa pine forest and provide for future large tree habitat by keeping tree densities low. Dense patches should be strategically planned to meet the needs of mule deer, flammulated owls (nesting), and other species. The natural patch size in eastside ponderosa pine is 1.2 acres (Harrod et al. 1998). Openings should be frequent throughout the regenerated forest in order to provide herbaceous and shrub vegetation and vertical and horizontal diversity.
- **DFC-11:** Provide corridors via reforestation to reconnect Late and Old Structure Habitat (LOS) stands and Old Growth Management Areas (OGMA) around the project. Note: There is one OGMA about one mile west of the project area.

## Environmental Consequences (indirect, direct and cumulative)

### Introduction

Post-fire literature (e.g. McIver and Starr, 2000; Ambrose et al. 2003; Beschta et al. 1995) on salvage harvest was reviewed to further identify potential wildlife concerns for evaluation.

The following section on indirect and direct effects on the Indicator Species is based on these assumptions for Alternative 2: 1) the project areas will fence approximately 640 acres to exclude big game animals with one rectangular enclosure within Unit 1; 2) reforestation will provide winter range objectives of 40:60 cover to forage ratio on the larger salvage units (that is Units 1, 4, and 8); 3) reforestation in the non-cover areas will provide a tree density that will promote the growth of large individual trees at an average of 35 per acre in the long-term (excluding non-winter range areas, patches identified for future deer cover, the fenced enclosure, and snag/log retention patches); 4) post-project road closures will reduce densities; and 5) the desired conditions for snags and logs will be met.

**Indirect and Direct Effects**

The effects on indicator species are addressed in the following discussion. The selected indicators are listed first and then followed by the remaining LRMP management indicator species (MIS). Refer to the individual alternative worksheets (Tables A, B, and C) in the Wildlife Report in the Appendix E for supporting details. The biological information previously presented (that is Tables 3-6; 3-8; 3-10; 3-11; and 3-12) provides the foundation for the following determinations.

**Summary Discussion Relevant to the Issue Indicators****Mule deer (MIS):**

**Indicator #1: Amount of acres reforested.**

**Indicator #2: Miles of open road density (miles/per/square mile).**

**Alternative 1**

Overall a negative effect on deer because the area would reforest very slowly, which would be an undesirable rate of recovery of important hiding and thermal cover on winter range. The summer range portion of the project is small (68 acres) and the recovery of hiding cover less critical. Forage resources would be good as shrubs and forbs recovered, however the majority of forage areas are too far from existing cover for full utilization by deer (that is in excess of 600 feet; reference LRMP and Thomas et al. 1979). Retaining the existing road density would also be a negative effect on deer because the road density of 5.7 miles per square mile would reduce the solitude and ultimate utilization of the area by deer. This is particularly critical on the winter range portion of the project.

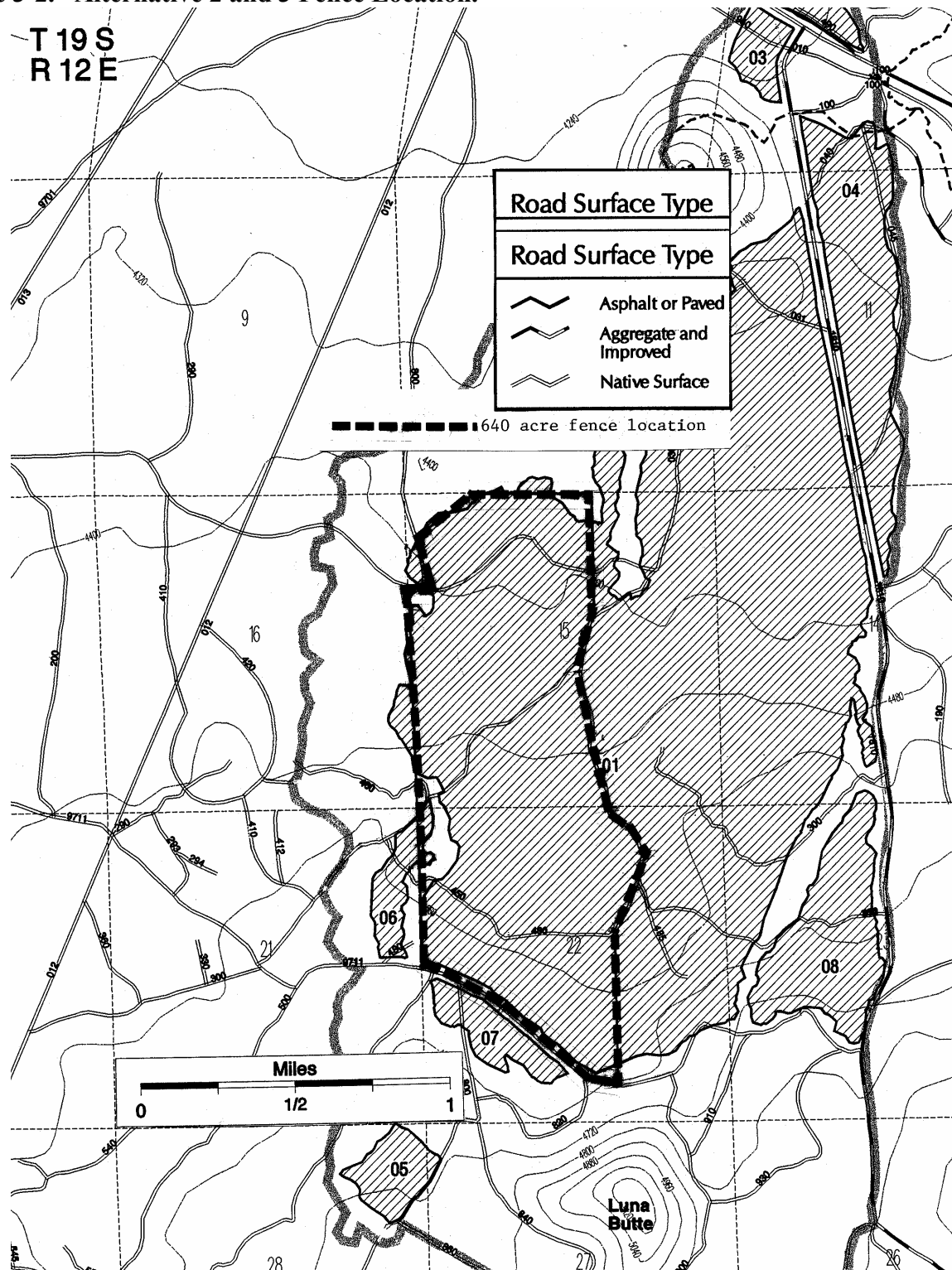
**Alternative 2**

This alternative would benefit mule deer, because the reforestation efforts would recover hiding and thermal cover more quickly. The strategic locations of cover patches and adjacent forage areas in Units 4 and 8 would also result in better utilization of the forage areas by deer. The fencing of a single block of 640 acres in Unit 1 to exclude deer and elk will enhance seedling survival. However, it would remove 17 percent of the area from foraging and somewhat restrict movement of animals through the area. The 200 trees per acre (530 acres) density will provide hiding cover and the 300 trees per acre density (179 acres) both hiding and thermal cover in the long-term (source P. Powers, project silviculturist, Forest Vegetation Simulator (FVS) data runs. The projected amounts of hiding cover in the mid- (hiding) to long-terms (thermal) are 34 percent for each in the project area (LRMP objectives of 10 percent hiding and 30 percent thermal cover). A total of 1,936 acres would be planted for hiding/thermal cover and forage areas. Removal of the dead material would facilitate deer movement through the area in the mid- to long-term (that is as the dead snags windthrow) and promote forage development and conifer seedling survival by allowing more light to reach the understory. Road density would be reduced to 3.6 miles per square mile from 5.7.

**Alternative 3** Effects from this alternative including fencing would be similar to the Alternative 2. Accumulations of windblown snags may impede deer movement through the area and reduce understory production.

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Figure 3-2. Alternative 2 and 3 Fence Location.



**Flammulated owl:**

**Alternative 1**

Development of an open forest structure would be significantly delayed without reforestation. Further, the development of future nesting snags (that is large size, unburned) would be retarded.

**Alternative 2**

Reforestation would promote a quicker recovery of forested habitats important to the owl, provided that an open forest canopy structure is attained. Patches of higher density canopy should be available (such as deer cover patches) for nesting. Salvage would not affect the owl as they are not known to use burned areas.

**Alternative 3**

Effects are similar to Alternative 2. Heavy accumulations of blowdown snags could adversely affect local areas by reducing conifer growth, which would have a minor adverse affect on long-term owl habitat.

**Indicator #3: Snags and CWD.**

The following table displays the number of snags per acre and future CWD (minimum of 5 inches in diameter and 40 feet long).

**Table 3-13: Estimated Alternative 2 Post-Salvage Snag and CWD Levels**

Area	Diameter Mid-Point	No. Per Acre	CWD Per Acre ****	Notes
Salvage units *(2009 acres)	6"	14.6	0	
	9	19.1	1.4	
	12	10.5	1.1	Total CWD 3.2 percent
	15	0.7	0.1	
	18	0.8	0.2	
	24	1.5	0.4	
Non fire salvage stand replacement area ** (411 acres)	6"	14.6	0	
	9	19.1	1.4	Total CWD 8.1 percent
	12	21.0	2.2	
	15	13.5	1.5	
	18	5.7	1.8	
	24	4.5	2.4	
Non fire salvage non stand replacement area *** (1,390 acres)	6"	17.2	0	
	9	20.8	1.5	
	12	10.8	1.1	Total CWD 4.1 percent
	15	6.4	1.0	
	18	1.0	0.2	
	24	1.0	0.3	

\* Includes 1,936 acres in Units 1 to 8 and 73 acres of Roadside Salvage completed in the winter of 2003 to 2004.

\*\* A total of 411 acres of stand replacement would not be salvaged under Alternative 2.

\*\*\* A total of 1390 acres of non stand replacement would not be salvaged under Alternative 2

\*\*\*\* Estimated CWD levels in year 2018.

**Lewis' woodpecker (MIS, Focal Species):**

**Alternative 1**

An abundance of burnt snags would be very favorable to this species. The delay in forest re-establishment (i.e. future snags) would be negative.

**Alternative 2**

Salvage harvest would reduce the number of snags below the level recommended by DecAID (that is Table 3-8), which is to retain greater than 50 percent of burns un-salvaged. The adjacent un-salvaged burnt forest is 1,801 acres or 47 percent of the fire area, which is very close to the DecAID

recommendation. The snag retention levels within unit (that is 17 snags/logs greater than 10 inches dbh per acre; source J. Schlaich, Project Team Leader) are less than the average recommended by DecAID (that is 25 snags per acre). Reforestation would be beneficial in the long-term, provided that an open canopied forest structure is attained.

### **Alternative 3**

Snag levels would be the same as Alternative 1, and reforestation the same as Alternative 2. This alternative would be the most favorable for this species.

### **Williamson's sapsucker (MIS):**

#### **Alternative 1**

Abundant snags would be a positive effect. The delay in forest re-establishment would be negative.

#### **Alternative 2**

Snag levels would be provided post-harvest at a level adequate for this species. Reforestation would be beneficial in the long-term, provided that an open canopied forest structure is attained.

#### **Alternative 3**

Effects are similar to Alternative 2, but snag levels would be higher.

### **Hairy woodpecker (MIS):**

#### **Alternative 1**

An abundance of snags would be very favorable to this species. The delay in forest re-establishment would be negative.

#### **Alternative 2**

Snag levels would be provided post-harvest at a level that is less (that is 17 snags/logs greater than 10 inches dbh per acre) than that recommended by DecAID (that is 41.8 snags per acre; Tables 3-8 and 3-10). The adjacent un-salvaged burnt forest (1801 acres; 47 percent of the fire area) together with the unit retention levels would, but exceed the DecAID recommendation when combined. Reforestation would be beneficial in the long-term, provided that an open canopied forest structure is attained.

#### **Alternative 3**

Effects are similar to Alternative 2, but snag levels would be higher. This alternative would be most favorable to this species. Note: this species has been observed within the project area post-burn.

### **White-headed woodpecker (MIS, Focal Species):**

#### **Alternative 1**

Abundant snags would be a positive effect. The delay in forest re-establishment would be negative and more pronounced for this species, which depends on green ponderosa pine for foraging.

#### **Alternative 2**

Snag levels would be provided post-harvest at a level (that is 17 snags/logs greater than 10 inches dbh per acre) that is less than that recommended by DecAID (that is 51.4 snags per acre; Tables 3-8 and 3-10). The adjacent un-salvaged burnt forest (1,801 acres; 47 percent of the fire area) together with the unit retention levels would mitigate the effects. Reforestation would be beneficial in the long-term, provided that an open canopied forest structure is attained.

#### **Alternative 3**

Effects are similar to Alternative 2, but snag levels would be higher. This alternative would be the most favorable for this species.

**Pygmy nuthatch (Focal Species):**

**Alternative 1**

Burnt snags may not be that beneficial, as this species primarily uses decayed green trees/soft snags that have existing cracks. The delay in forest re-establishment would be negative and more pronounced for this species, which depends on large, green ponderosa pine for foraging.

**Alternative 2**

Snag levels would be provided post-harvest at a level adequate for this species. Reforestation would be beneficial in the long-term, provided that an open canopied forest structure is attained (that is to promote large trees).

**Alternative 3**

Effects are similar to Alternative 2.

**Green-tailed towhee:**

**Alternative 1**

Not reforesting the area would be beneficial, because shrubs would develop more fully, which are important to this species.

**Alternative 2**

Reforestation would be negative in the long-term where stocking levels are high. Low stocking and open areas with shrubs provided in an open canopied forest structure should maintain adequate habitat.

**Alternative 3**

Effects are similar to Alternative 2. Accumulations of windblown snags may reduce the understory development.

**Olive-sided flycatcher:**

**Alternative 1**

Perches for foraging would be provided in excess from burnt snags. Delays in forest establishment could negatively affect forage (insect) availability and long-term perch availability (such as dead topped green trees).

**Alternative 2**

Snags (perches) would be adequate for this species post-salvage. Reforestation would be beneficial in the long-term, provided that an open canopied forest structure is attained.

**Alternative 3**

Effects are similar to Alternative 2, but snag levels would be in excess of needs.

**Chipping sparrow (Focal Species):**

**Alternative 1**

The delay in forest establishment would be negative in the short-term, but likely positive in the long-term for this species. The patchy, open canopied natural forest with extensive openings with shrubs and grasses would provide high quality habitat.

**Alternative 1**

Reforestation would establish suitable habitat sooner provided it incorporated an open canopied forest structure with openings.

**Alternative 2**

Effects similar to Alternative 2, but in the long-term the extensive blowdown of dead snags would likely reduce the understory productivity, which is important to this species.

**Mountain bluebird:****Alternative 1**

This species has a strong preference for open areas and burns. Snags would be in excess of needs.

**Alternative 2**

Snag levels would be provided post-harvest at a level (that is 17 snags/logs greater than 10 inches dbh per acre) that is less than that recommended by DecAID (that is 29.7 snags per acre; Tables 3-8 and 3-10). The adjacent un-salvaged burnt forest (1,801 acres; 47 percent of the fire area) would significantly contribute to snag levels. There would be generally positive effects in the short-term, but declining suitability as the forest is re-established. An open canopied forest structure with openings and snags would still likely provide some habitat value.

**Alternative 3**

Effects similar to Alternative 2, but snags would be in excess of needs.

**Yellow-pine chipmunk:****Alternative 1**

The habitat will slowly improve as forbs, grasses and shrubs become established. Logs will be provided in abundance but could negatively affect understory productivity (that is seeds) in the long-term.

**Alternative 2**

Reforestation that provides an open canopied forest structure with abundant logs will be beneficial to this species. An average of 14 logs 10 inches + diameter per acre would be left within the salvage units.

**Alternative 3**

Effects are similar to Alternative 2, except that heavy windthrow accumulations could reduce the understory productivity.

**Western fence lizard:****Alternative 1**

The habitat will slowly improve as forbs, grasses and shrubs become established. Logs will be provided in abundance but could negatively affect understory productivity (i.e. insects) in the long-term.

**Alternative 2**

Reforestation that provides an open canopied forest structure with abundant logs will be beneficial to this species. An average of 14 logs 10 inches + diameter per acre would be left within the salvage units. Maintaining open forest conditions near rock outcrops would be important to this species.



**Alternative 3**

Effects are similar to Alternative 2, except that heavy windthrow accumulations could reduce the understory productivity.

**Bald eagle (MIS):** Refer to the Biological Evaluation/Assessment for details.

**Northern spotted owl (MIS):** Refer to the Biological Evaluation/Assessment for details.

**Golden eagle (MIS):** No existing nesting habitat within the project area. Development of open canopied forest structure and large trees in the long-term may provide potential nesting habitat (Marshall et al. 2003). The action alternatives would promote reforestation and are, therefore, more beneficial than the no action alternative. Foraging habitat would exist for the short and mid-terms in all alternatives. Note: this species has been observed in the project area post-burn.

**Red-tailed hawk (MIS):** No existing nesting habitat within the project area. Development of open canopied forest structure and large trees in the long-term may provide potential nesting habitat (Marshall et al. 2003). The action alternatives would promote reforestation and are, therefore, more beneficial than the no action alternative. Foraging habitat would exist for the short and mid-terms in all alternatives.

**Osprey (MIS):** No habitat or occupancy in the project area. The nearest known use sites on national forest lands are on the Deschutes River south of Bend, which is about six miles west of the project. Osprey are also found at East and Paulina lakes approximately 12 miles south of the project.

**Northern goshawk (MIS):** No existing nesting or foraging habitat within the project area. Potential habitat identified by the Kelsey Project on Luna Butte has been seriously impacted by the fire. The nearest known nest site is about 1.5 miles southwest of the project. Development of LOS forest in the long-term may provide potential habitat (Marshall et al. 2003). The action alternatives would promote reforestation and are, therefore, more beneficial than the no action alternative. Refer to the Kelsey and Fuzzy Projects wildlife reports for details on pre-fire surveys in the vicinity.

**Cooper's hawk (MIS):** No existing nesting habitat within the project area. Potential habitat identified by the Kelsey Project on Luna Butte has been seriously impacted by the fire. Development of semi-open canopied (that is patchy) forest structure and medium sized trees in the long-term (50 to 80 years) may provide potential nesting habitat (Marshall et al. 2003). The action alternatives would promote reforestation and are more beneficial than the no action alternative. Foraging habitat would exist for the short and mid-terms in all alternatives, particularly after shrubs recover. Refer to the Kelsey and Fuzzy Projects wildlife reports for details on pre-fire surveys in the vicinity.

**Sharp-shinned hawk (MIS):** No existing nesting or foraging habitat within the project area. Potential habitat identified by the Kelsey Project on Luna Butte has been seriously impacted by the fire. Development of closed or semi-closed canopied forest structure with thickets of dense, young trees in the long-term may provide potential nesting habitat (Marshall et al. 2003). Foraging habitat would exist in the mid-term after a young forest is well established. The action alternatives would promote reforestation and are, therefore, more beneficial than the no action alternative for both nesting and foraging habitats. Refer to the Kelsey and Fuzzy Projects wildlife reports for details on pre-fire surveys in the vicinity.

**Great gray owl (MIS):** No habitat or occupancy in the project area. This species depends upon lodgepole pine forest habitat in proximity to meadows and other forest openings with good pocket gopher populations (Marshall et al. 2003).

**Great blue heron (MIS):** No habitat or occupancy in the project area. The nearest potential habitat on national forest lands is the Deschutes River approximately 6 miles west of the project.

**Woodpeckers (MIS):** Addressed by the previous ecological indicator species. The following are species not utilized as indicators, but included in the LRMP MIS category:

**Black-backed woodpecker**—this species has been observed in the project area post-fire. However, it is an opportunist and seeks out burned areas. Its normal habitat is closely associated with lodgepole pine with a preference for LOS stands. The Proposed Action alternative would have insignificant effects on the population viability of this species, because large numbers of snags would be retained, including substantial patches. The scale of the project is small in relation to the species' range. The other alternatives would be more beneficial, due to greater snag retention. Ponderosa pine is not their preferred habitat type (Marshall et al. 2003; Altman, 2000), but will be utilized after a stand replacement wildfire.

**Northern three-toed woodpecker**—this species is associated with higher elevation (over 4500 feet on the DNF) mixed conifer and lodgepole pine stands. It is closely associated with bark beetles (Marshall et al. 2003). The action alternatives would have no effect on this species, because it is normally absent from the area. Any future occupancy would likely be incidental and short-term in the pursuit of insects attracted to the area.

**Pileated woodpecker**—the pileated woodpecker is closely associated with higher elevation, dense, mesic mixed conifer stands and requires large diameter logs and snags (Marshall et al. 2003). The action alternatives would have no effect on this species, because it is normally absent from the area. It rarely uses pure ponderosa pine habitats. Any future occupancy would likely be incidental and short-term in the pursuit of insects attracted to the area.

**Northern flicker**—this species is a generalist that utilizes a wide variety of habitat types with a preference for open canopied forest and edges (Marshall et al. 2003). It is not dependent upon burns and would be adequately provided for by the snag retention measures in the Proposed Action alternative provided that some large diameter snags are retained.

**Waterfowl (MIS):** No habitat or occupancy in the project area. The nearest habitat on national forest lands is the Deschutes River about 6 miles west of the project.

**Peregrine falcon (MIS):** Refer to the Biological Evaluation/Assessment for details.

**Wolverine (MIS):** Refer to the Biological Evaluation/Assessment for details.

**Elk (MIS):**

**Alternative 1**

Effects are similar to mule deer, except that dominance by grass species would be more beneficial.

**Alternative 2**

Effects are similar to mule deer. Elk generally require larger cover patches and will benefit from the fenced reforested area after they regain access. The area is much more important to deer, as elk use is incidental.

**Alternative 3**

Effects are similar to mule deer.

**Pine (American) marten (MIS):** No habitat or occupancy in the project area. There are no recorded observations sites in or near the project for marten. Marten generally use higher elevation lodgepole pine and mixed conifer habitat types with a preference for mesic, late successional forests. Heavy canopy cover is also important in marten habitat (Ruggiero et al. 1994). Alternatives 1 and 3 could potentially provide marginal marten habitat (that is movement habitat) in the long-term as windthrown snags create heavy ground cover and the forest recovers.

**Townsend's big-eared bat (MIS):** No roosting or maternity habitat (that is caves or lava tubes) in the project area. The nearest occupied site is Skeleton cave about 3.5 miles northeast of the project. There is some potential for foraging (flying insects) in areas of shrubs (such as bitterbrush). Few shrubs survived the fire, and there are extensive shrub patches adjacent to the project boundary. Alternative 1 provides more shrubs in the long-term due to delays in reforestation.

**Species Associated with Logs and Down Woody Debris (MIS):** Addressed by the previous indicator species.

**Species Associated with Various Plant Communities and Successional Stages (MIS):** Addressed by the previous indicator species.

**Species with Special or Unique Habitats (MIS):** No special or unique habitats (such as caves, riparian zones, cliffs, talus, etc.) within the project area.

**Summary for Alternative 1**

The indicator species that prefer large, open areas with dominate coverage by grasses and shrubs will be positively affected by this alternative. The winter range and its dependent mule deer would have ample forage, but the recovery of hiding and thermal cover would be slow. Species dependent upon more extensive forest cover or old growth forest structure would be negatively affected. This is due to the very slow development of the forest post-fire without reforestation. None of the indicator species would have their population viability affected by the No Action Alternative. The project area represents a very small proportion of the range of the indicator species, and it does not provide any critical resources for their overall survival.

**Summary for Alternative 2**

Those species requiring future LOS forest and open canopy forest conditions would be benefited by the reforestation actions in this alternative. The required levels of snags and logs will meet most species' needs. A few species that specialize in the use of burned areas with moderate to large volumes of dead (such as white-headed woodpecker, Lewis' woodpecker) would have less benefit due to the salvage removals. Non-salvaged areas outside of the project area (47 percent of the fire area with an average of 19.2 snags per acre) and inclusions within it (that is 5 percent of larger units plus scattered individual snags) would mitigate the reduction in snags. Within the moderate/high intensity burn areas (that is stand replacement), 411 acres (17 percent of the gross 2,420 acres) would not be salvaged. The literature cited in the strategy for east-slope landbirds, clearly documents that the

primary limitation to the white-headed woodpecker is the loss of LOS ponderosa pine habitat, not access to burned areas. The primary impact on the Lewis' woodpecker on the east-slope has been the suppression of low intensity wildfires and the loss of single-story LOS stands that were created and maintained by fire.

It should also be noted that leaving extensive areas of burnt snags may negatively affect some species. Haggard and Gaines (2001) documented that salvage projects which retained a moderate level of snags (that is 5.8 to 13.5 per acre) had the highest abundance, species richness, and nesting population of cavity nesters. The planned retention level for snags/logs in this alternative is 17 per acre, which is equivalent to the "high" level assessed in the above study (that is 14.2 to 30.8 per acre). The Proposed Action alternative would have a mix of individual and patches of snags, which should provide for a moderate level of snag dependent species abundance and richness. As snags blow down the habitat should become increasing more open, which would further enhance its value to more species. None of the indicator species would have their population viability affected by the Proposed Action alternative. The project area represents a very small proportion of the range of the indicator species, and it does not provide any critical resources for their overall survival.

The construction and use of temporary roads (that is ~1 mile of existing and 2.5 miles of new) would not adversely affect any species other than by short-term displacement. Re-vegetation of the roads with native species would eliminate any mid- or long-term impacts. Connectivity would be restored in the long-term by reforestation. Fragmentation would be also be reduced by reforestation. The salvage of dead trees and retention of green within and adjacent to the project would not significantly increase fragmentation. The destruction of the green forested canopy by the fire has already caused the fragmentation.

This alternative would generally have positive effects on the winter range, because the long-term objective of providing a 40:60 cover to forage ratio would be attained more quickly than in the other alternatives. The use of fencing to exclude deer and elk from the 640 acre plantation in Unit 1 would have a short-term negative affect, because the animals would be denied access to potential forage areas. The trade-off is that the elimination of browsing on seedlings will enhance their survival and growth rates.

### **Summary for Alternative 3**

The effects are beneficial for those species requiring both high numbers of snags and an open canopied forest structure. The Lewis', white-headed and hairy woodpeckers for example would benefit from these conditions. Other species dependent upon an open, productive understory of forbs, grasses and shrubs could be negatively affected in the long-term as heavy accumulations of windthrown snags cover the ground. In the case of mule deer, their movements could be restricted. None of the indicator species would have their population viability affected by the Rehabilitation Action alternative. The project area represents a very small proportion of the range of the indicator species, and it does not provide any critical resources for their overall survival.

## **Cumulative Effects**

### **Alternative 1**

Cumulative effects of the No Action alternative include: 1) Additional stand replacement fire acreage when totaled with the other fires in the vicinity (that is Horse Butte, Bessie Butte, Sundance, Cabin, Horse Ridge, Evans West, and Skeleton). These are likely significant impacts on local mule deer herds because of the additional reduction of forage, hiding and thermal cover on winter range. In addition, the long recovery period for areas that are not fully reforested (such as Skeleton Fire) will

further delay the attainment of LOS forest habitats over a large area; and 2) The eventual accumulation of large amounts of down and dead material in the area may be a risk to future high intensity wildfires, which could potentially seriously impact the soil resources (that is heavy log sized fuels on the ground) and further delay the establishment of a functioning forest.

### **Alternative 2**

The Proposed Action alternative would mitigate the loss of deer cover in the area by reforestation. However, the benefits would at best be in the mid-term (that is 15+ years). Deer thermal cover in the area is below management objectives (Keown and Webb, 2004). Road closures would contribute to reducing the cumulative effects from roads in this general area, which are in excess of desired conditions as specified by the LRMP. Reducing the volume of woody debris by salvaging would reduce the probability of future high intensity wildfires, which could impact an area much larger than the project. It would also facilitate the movement of deer and elk through the area. The salvage logging would whole tree yard all the harvest trees which would greatly reduce potential post-logging fuel accumulations.

The cumulative effects of the Proposed Action on MIS are as follows: 1) those species requiring open canopied forest structure would benefit because the forest would be re-established more quickly. Further, maintaining 60 percent of the area in relatively low tree densities (that is deer forage areas) would also benefit this group; 2) species requiring heavy canopied, multi-stratum LOS habitat would not be adversely affected, because the low site productivity of the area likely precludes developing this type of habitat; and 3) cavity dependent species would be provided for by the planned retention levels of snags. Lewis', hairy and white-headed woodpeckers which utilize burned areas, would have sufficient snag levels post-salvage with the combination of un-salvaged areas of the fire (that is 47 percent) and within unit snag/log retention levels. The size of the project is very small compared to the regional distribution of all of the indicator species, so the effects are primarily local. Further, it is not the preferred habitat type of several MIS (such as black-backed woodpecker), which may use the area temporarily. Indicator species with declining populations have a number of factors affecting them. The Proposed Action mitigates potential adverse effects to the indicators and has positive effects through reforestation actions. The long-term impacts of the fire will cause a deficit in snag habitat for all dependent species within approximately 25 years, because the existing snags will have fallen prior to recruitment from the re-established forest (Harrod et al. 1998). The Proposed Action would reduce the time period of the deficit. This effect is aggravated by the low snags levels common in the surrounding un-burnt forest area (Keown and Webb, 2004).

### **Alternative 3**

The Rehabilitation Action alternative would have affects in common to both previous alternatives including the accumulation of large amounts of down and dead material (negative), the restoration of forested habitats (positive), and road closures (positive). The reforestation investments could potentially be lost to future catastrophic wildfire due to heavy fuels accumulations, which would further delay providing open canopied forested habitats for many indicator species.

### **Cumulative and Future Effects Common to all the Alternatives include:**

- Increased natural fuel loadings and risk of future wildfire. The duration of this risk is unknown, but likely extends to the long-term (that is 50+ years).
- Increased probability of insect attacks on residual and adjacent green trees due to the attraction to standing and down snags. The magnitude and duration of this effect are unknown.
- Past prescribed burns, wildfires, and timber harvest areas (10 to 20 years old) where bitterbrush and deer cover have not fully recovered.

- The Fuzzy Project (implementation) has affected deer cover and movement corridors, forage (that is bitterbrush), forested habitats and road densities. There is a minor overlap of the two projects. Most negative effects from the Fuzzy Project were mitigated via the environmental assessment, but it was predicted that the North Paulina deer herd would be reduced (Becker, 2000).
- The future Kelsey Project will be affecting deer cover and movement corridors, forage, forested habitats, road densities, etc., and it overlaps most of the salvage project. The environmental assessment is currently being revised to account for the cumulative affects of the 18 Fire and planned Kelsey activities. The 18 Fire Recovery Project does not add to the effects on deer hiding/thermal cover or raptor habitat as examples, because the fire eliminated these habitats. In fact, alternatives that include reforestation will facilitate the recovery of these habitats.
- The cumulative effects (that is hiding and thermal cover) of past (Fuzzy) and future (Opine, Kelsey, 18 Fire Recovery, and Aspen) projects on Deer Habitat Management Area (MA 7) overlapping the North Paulina Deer Herd area are as follows: Kelsey hiding at 23 percent, thermal at 24 percent; Fuzzy hiding at 11 percent, thermal at 4 percent; Opine at 9.6 percent hiding, 2.5 percent thermal; and 18 Fire Recovery at 0 percent hiding, 0 percent thermal. Collectively the projects will result in 11 percent hiding cover (LRMP objective of 10 percent) and 8 percent thermal cover (LRMP objective of 30 percent) across MA 7 for the North Paulina deer herd.
- The 18 Fire Road Salvage Project removed snags from a narrow strip along the major roads through the fire area (73 acres). It is not expected to contribute to cumulative effects on snag dependent species due to the limited area impacted. A minimum of 3 snags per acre and all live trees were retained to mitigate the salvage effects on indicator species.
- Existing roads, motorized trails, gas line corridor, and gravel pits for example are throughout the surrounding area. The Proposed Action alternative will only add temporary road impacts, which will be of short duration and of minor magnitude to the wildlife resources of the project area. Post-project road closures will reduce the current density of 3.6 to 1.9 miles per square mile.
- All alternatives would retain all live trees for GTR's.

There are no private lands or BLM administered lands adjacent to the project area that would have a significant contribution to the cumulative effects of this project. There is no current active livestock grazing in the project area that would contribute to cumulative effects. Active grazing by sheep and goats may occur within two years. Cumulative effects from the grazing are not expected, provided that utilization standards are met.

## Project Analysis Conclusions

The 18 Fire Recovery Project offers opportunities to restore the area more quickly to provide habitats for a variety of species. Open canopied forest structure that provides large ponderosa pine and a productive understory of herbaceous and shrub species would emulate the historic habitat type found in the area. Frequent, low intensity fires of the past created a patchy, mosaic of trees and openings that were favorable to most of the indicator species assessed by this report. The past processes also provided a steady recruitment of large diameter snags. Fire suppression has altered the natural occurrence of frequent, low intensity fires, which has resulted in stand replacement fires such as the 18 Fire. Pulses of snags post-crown fire eventually fall (that is within 40 years and most down in 25 years), and the replacement forest will have had inadequate time to recruit snags (that is 80 to 110 years is needed), other than small diameter ones (Harrod et al. 1998). Modeling (source P. Powers, project silviculturist) and monitoring of similar fires (source J. Schlaich, project team leader) suggests

that only 1.2 to 1.7 snags (greater than 12 inches dbh) per acre or less will still be standing in 2025. The re-establishment of the forest by planting would decrease the time gap for snag recruitment as well as provide forested habitats for other species sooner. However, establishing a uniform, dense plantation of trees over a large area would not be conducive to meeting the requirements of the indicator species assessed in this report.

Research has suggested that for cavity nesters that forage primarily on standing trees, that logging practices that remove a large portion of standing fire-killed trees may have particularly detrimental effects. Such effects are not likely to be mitigated simply by leaving a few trees as nesting substrates. Most tree-foraging cavity nesters are excavators that create nest holes used by other species. Their low numbers may ultimately contribute to lower densities of non-excavating species (Caton, 1996). The combination of leaving individual snags, patches of snags, and large areas of un-salvaged burn should provide for the variety of individual species needs. Further, fire damaged green trees that will not be salvaged, have a relatively high probability of dying later from drought, insect or disease. These trees will also contribute to future wildlife needs.

The effects on mule deer cover by the Proposed Action have been modeled through time (source P. Powers, project silviculturist). It is estimated that tree plantings of 200 trees per acre will provide about 16 percent crown cover in 40 years and 34 percent in 100 years. Plantings of 300 trees per acre would provide about 21 percent crown cover in 40 years and 36 percent in 100 years. Of the 1,868 acres of winter range within the salvaged portion of the fire, 530 acres (Units 1, 5 and 7) would be planted at 200 trees per acre and 179 acres (Units 1, 4 and 8) would be planted at 300 trees per acre. Units 1, 4 and 8 are within winter range and 5 and 7 in General Forest (that is summer range). Thus, the modeling would suggest that thermal cover would be developed on approximately 641 acres (30 percent + canopy cover) of winter range or 34 percent of the area after about 100 years. Assuming that both tree planting densities would provide hiding cover would give the same percentage on winter range, and 100 percent on the two summer range units. However, hiding cover is transitory and diminishes as the trees grow in height and branches on the lower bole die back. The remainder of the plantings on 1,227 acres (Units 1, 2, 3, 4, 6, and 8, which are 66 percent of the winter range) would be at 50 trees per acre. This would not provide any hiding or thermal cover, but should provide high quality forage areas. The above acreages are gross and include the 5 percent of Units 1, 4 and 8 (gross acreage 1,789 acres; net 89 acres) retained for snag/log patches that would not be planted. In summary, the winter range objective of 40:60 cover to forage ratio with 10 percent hiding cover and 30 percent thermal cover should nearly be met in the long-term. The spatial distribution could be better, but planting with fencing should be more successful and economical than other methods.

Allowing the area to naturally recover has some advantages, but also some negative effects as documented in the analysis. Providing dense snag patches to those species that favor burned forest is probably the most significant challenge for the project. The combination of within unit retention patches, individual retention snags, and the adjacent un-salvaged burnt areas, which are 47 percent of the fire area, should adequately provide for most species.

### **Knutsen-Vandenberg (K-V) Projects**

The following K-V projects are planned for the project area depending on funding: Reforestation including fencing to exclude big game species; Road closures (barriers, native plantings); and Road decommissioning (ripping, native planting)

These activities will not adversely affect the wildlife species analyzed in this report and should be of benefit to them provided that applicable Management Requirements and Mitigation Measures are met.

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## Air Quality

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### Management Direction

#### The 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 can be in the air. A State Implementation Plan (SIP) considers local geography and industry to further define how provisions of the CAA will be implemented. The Oregon Clean Air Act Implementation Plan was developed by the Department of Environmental Quality in 1989 under ORS 468A.035. Further delineated, pollution prevention measures are implemented under 40 CFR § 81.219 Central Oregon Air Quality Control Region (as defined in section 302(f) of the Clean Air Act, 42 U.S.C.1857h(f)).

As of July 1997 the Environmental Protection Agency (EPA) revised the particulate matter standards. While particulate matter 10 micrometers (PM10) will still be monitored and regulated, particulate matter 2.5 micrometers (PM 2.5) and smaller will be also be included. With this additional parameter the effects on air quality may be significant. This change was brought about after scientific study found a link between PM 2.5 and public health problems. The constraints this may place on forest burning are unknown. The Forest Service will achieve strict compliance to all aspects of the Clean Air Act by working in conjunction with the Oregon Department of Forestry to adhere to Oregon Smoke Management Plan. Any planned variance from the daily burning instructions will be discussed and approved by the Smoke Management Duty Forecaster.

The Clean Air Act, and associated measures listed above, states that federal land managers will attempt to "protect and enhance the quality of the nation's air resources so as to promote the public health and welfare..."

### Environmental Consequences

#### Effects Common to All Alternatives

##### Wildland Fire Activity

The potential for future wildland fire within the 18 Fire area exists regardless of the alternative selected, but would be greater under Alternative 1 No Action and Alternative 3 in the absence of fuels reduction activities. The No Action Alternative and Alternative 3 does not provide any opportunities to reduce existing forest fuels and the hazard they pose in the future on wildland fires. In the event of a wildfire, air quality degradation could exceed federal and state standards. Heavier fuel loading in the event of future wildland fire could result in greater smoke and debris emissions, which would adversely affect health and visibility.

##### Alternative 2 Effects Prescribed Fire

Air quality would be affected primarily by smoke produced during pile burning proposed in Alternatives 2.

*Table 3-13*, below, displays the type of burning proposed and an estimate of smoke emissions using an average of 15 tons per acre of fuel consumed during the burning operations.



Effects of the alternatives on smoke emissions are primarily related to the amount and type of fuels treatment proposed. *Table 3-14* displays the estimated smoke emissions for the alternatives.

**Table 3-14. Estimated Smoke Emmission by Alternative**

Alternative	Acres Treated	Total Tons PM<10	Total Tons PM<2.5
Alternative 1 – No Action	0	0	0
Alternative 2 – Proposed Action Pile and Burn	1,936	13.2	11.5
Alternative 3	0	0	0

### Emissions

All pile burning would be conducted under the State of Oregon Smoke Management System to track smoke produced and would be coordinated through Oregon Department of Forestry.

Pile burning would be conducted under favorable smoke dispersal conditions, avoiding impacts to the Three Sisters Wilderness Class I Airshed and the city of Bend Designated Area.

### Visual Effects

#### Class 1 Airshed

Class 1 designation does not allow human-caused activities outside the wilderness to adversely affect air quality within the wilderness. The closest Class 1 Airshed is the Three Sisters Wilderness, approximately 18 to 26 air miles west of the 18 Fire area. This airshed would be affected minimally since this airshed is much higher in elevation than the 18 Fire area. The prevailing wind patterns reflect a west or northwest flow, which would result in minimal potential for impacts because pile burning would only be conducted under these favorable weather conditions. The Oregon State Smoke Management Plan requires that all prescribed burning be conducted under conditions that minimize smoke intrusions into Designated Areas and Class 1 Airsheds.

### Dust

Dust would be created from proposed operations in Alternatives 2 and such as log haul on roads and operation of machinery within treatment units. Dust abatement and signing would be conducted on haul routes to minimize effects to public safety. Dust created during operations would be short-term.

### Cumulative Impacts

Deschutes National Forest policy dictates that prescribed burning be accomplished during periods of optimal smoke dispersion; however, there may still be some cumulative smoke impacts from concurrent Forest Service, and private prescribed burning operations.

The cumulative effects on air quality from the prescribed burning of landings piles are negligible. Burning of residues piles would only occur if existing and forecasted conditions assured that smoke would not enter any adjacent communities. A study of emissions in the Central Oregon area found slash burning to contribute less than 1 percent (.34 percent) of Particulate Matter (PM). The same study found that slash burning also produced less than 1 percent (.64 percent) of the carbon monoxide in Central Oregon (CAB, 1997).

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## Botanical Resources

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### Botanical Resources Introduction

The plant associations represented in the fire area include ponderosa pine/bitterbrush/fescue and ponderosa pine/bitterbrush-manzanita/fescue. Soils are mainly comprised of sandy volcanic ash over sandy to loamy buried soils, while in some areas in the middle and southern end, mixed with highly fractured lavas.

### Botanical Resources Existing Condition

Prior to the fire, roughly 30 percent of the area had been surveyed for Proposed, Endangered, Threatened, and Sensitive (PETS) plant species. No PETS species were found. Additionally, thousands of acres of similar habitat were surveyed within the past dozen years, with no PETS species located. Generally speaking, this area of the Bend/Ft. Rock Ranger District contains a relatively low number of herbaceous plant species. Reasons for this are unknown, but speculation might point to the young volcanic soils, and the lack of variety of habitats within this zone which would offer niches for different kinds of plants (for example, there are no seeps, springs, creeks, or rivers here). It may be suggested that fire suppression also plays a role, but plant surveys of and visits to nearby fires in the seasons following those fires did not reveal a spike in plant species diversity, although many species were much larger and more vigorous and certain annual species were more prevalent than typical in the year or two following the fire.

### Effects of the 18 Fire on Botanical Resources

Existing vegetation has been altered, often markedly, as a result of the 18 Fire. Approximately 3,800 acres burned, at varying levels of intensity. A high percentage of shrubs, at least those detectable due to persistence of charred remains above ground, appear to be dead, although sprouting was noted in the early fall months after the fire in some currants, in those areas where fire severity was lower. Existing herbaceous vegetation appears to have been incinerated over most of the burned area, although again observations in the fall noted the grasses, mostly Idaho fescue, were resprouting from their root crowns. This is typical for fire recovery observed elsewhere in this area; it is rare for the bunchgrasses to be eliminated, except for perhaps in only the very hottest pockets of a fire.

The vegetation that existed prior to the fire performed important functions in the local ecosystem of which it was a part. Its macrostructure moderated local air temperatures, at all times of the year, promoted higher local humidity and the retention of moisture in the soil and downed wood. All rooted vegetative material, and the litter and humus and larger woody debris produced by it, reduced the erosive energy of water, both that falling from the sky and that subsequently moving along the soil surface. The existing vegetation also provided habitat for wildlife as it provided sources of food, and shelter from physical elements and predators.

### Proposed, Endangered, Threatened, Sensitive (PETS) Plant Species

There are no listed Threatened or Endangered plant species that are known to exist within or near the project area. Currently, Deschutes National Forest has a Sensitive Plant List that includes 25 species. Of these, only one, *Castilleja chlorotica* (green-tinged paintbrush) had any probability for occurrence, and that probability is low, and only in the northern portion of the fire. The probability of finding PETS plants in the south half of the project, where manzanita existed in the shrub layer, is essentially reduced to none. Plant surveys on the Bend/Ft. Rock Ranger District have never located PETS plants

within manzanita-dominated sites. The nearest green-tinged paintbrush population is roughly seven miles away from the project area.

Criteria for rating probability of occurrence are: 1) nature of habitat, 2) potential extent of this habitat within the project area, 3) geographic range of taxon and 4) nearest documented occurrence of the taxon. For the reasons discussed, no additional PETS plant surveys were completed for this project.

### **Botanical Resources Desired Future Condition**

Rare plant species would be well distributed within existing suitable habitats and be potentially able to disperse to unoccupied sites where suitable habitat exists or is newly developing. Connectivity of habitat and availability of vectors for spores, pollen, seeds or vegetative propagules would allow genetic exchange with populations outside of the project area and/or establishment of new populations beyond the borders of the project area. Local populations would be sufficiently robust and resilient to permit loss of some individuals or habitat, and natural disturbances would not threaten persistence of the species at other than a local scale within the project area.

The extent of non-native, invasive plant species would be on the decline. Direction within the existing Forest Invasive Plant Species EA would allow effective treatment of existing sites and prompt treatment of newly discovered sites. Forest staff, contractors and recreationists would be aware of the primary importance of prevention as a means of limiting the spread of invasive plant species.

### **Botanical Resources Environmental Consequences**

#### **Impacts Common to All Alternatives**

There will be no effects to Threatened, Endangered, Proposed or Sensitive Plant species. Implementation of the BAER Team recommendations, including physical soil stabilization measures, invasive plant species prevention and control, revegetation, and monitoring, will continue regardless of which alternative is selected. None of these activities should have significant direct effects on PETS species or their potential habitat, because no high probability habitat exists for them.

#### **Impacts of Alternative 1 - No Action**

Direct, Indirect, and Cumulative Effects: There are no expected direct, indirect, or cumulative effects if this alternative is implemented, because there were no known populations prior to the fire, nor are there any expected to establish post-fire. This expectation is based on many visits to the general area in which the fire occurred over the past 13 years by the author and other Forest Service botanists. Differing seral stages within this plant association and habitat type have been surveyed in the area, including visits to nearby fires that have occurred within the past 13 years (such as the Horse Butte Fire), and no PETS plants have ever been located there.

#### **Impacts of Alternative 2 and Alternative 3**

Direct, Indirect, and Cumulative Effects: As with the No Action alternative, the two action alternatives do not pose direct, indirect, or cumulative effects to PETS plant species if either of them are chosen, for the same reasons outlined in the discussion for the No Action alternative.

**Survey and Managed:**

There are a number of former Survey and Manage plant species—bryophytes, lichens, and fungi—currently under review to determine suitability for inclusion on the Regional Forester’s sensitive species list. Inclusion on this list would mean review of potential habitats within any project for these species. There is currently no requirement to survey for any of these species, but this could change quickly. (Dr. Rick Dewey, Assistant Forest Botanist and Survey and Manage taxa expert, pers. comm. 5/21/04).

Of these potential candidate species, only one, a lichen called *Leptogium burnettiae* var. *hirsutum*, had any potential to occur within the fire area prior to the fire; very little is known about it, other than it is known as a ground species from three sites, all in Oregon—two in the eastern Columbia Gorge and one in Northwest Oregon. With the information now available, it can’t be ruled out of most habitats; it could be located anywhere on the Deschutes National Forest. It is recognized by taxa experts that this species needs widespread inventory to further refine its habitat requirements (Dewey, pers. comm.).

It can be assumed, regardless of its habitat, that any lichen that is ground-dwelling wouldn’t fare well in a fire, especially where an underburn occurs, such as happened in most of the 18 Fire. Therefore, it is very unlikely to be present within the 18 Fire boundaries. It is unknown what effect fire salvage activities would have on this species, if it were present, nor the effect they would have on its habitat.

**Comparison of Alternatives**

There are no identifiable differences between alternatives as they relate to PETS plant species, because none were known to exist prior to the fire, nor are they expected to establish post-fire.

**Culturally Important Plants**

Many native plants are considered “sensitive” because local American Indian tribes consider the use of these plants, and the activities associated with them, a means of maintaining connections to their heritage and preservation of their cultural identity.

During scoping and cultural resource consultation with area American Indian tribes, we have not received any direct input on “sensitive” or traditional cultural plants. The groups that may have an interest in the project area include the Burns Paiute Tribe, the Confederated Tribes of the Warm Springs Reservation, and The Klamath Tribes. Patterns of native life have changed dramatically in the last 500 years, yet traditions remain that tie these peoples to the native plants found in the project area, whether there is modern use of them or not.

Native plants found today in the project area are representative of current environmental conditions. Since these conditions have been subject to change over time, so too, have the native plants changed. Trees, shrubs, forbs, root crops, sedges, and grasses supplied such needs as food, tobacco, chewing gum, seed sources, teas, medicine, insect repellants, dyes, and materials for basketry and other building needs. Limited information is available about native plant use in the past in project area.

**Environmental Consequences**

Based on the lack of input about continued cultural use of native plants by American Indian tribes and the nature of the project area and proposed action, no effects are anticipated.

## Noxious Weeds

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### Summary of Finding

The Proposed Action alternative for the 18 Fire Recovery Project has a HIGH risk of introducing noxious weeds into the project area. See below Risk Ranking for a discussion of ranking and Mitigation Measures to reduce the risk of noxious weed introduction.

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, 29 November 1995).

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 Appendix A, Noxious Weed Risk Assessment for 18 Fire Salvage Project located in the project record.

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 included in this assessment.

### Risk Ranking

Factors considered in determining the level of risk for the introduction or spread of noxious weeds are:

#### **X** **HIGH -- for all alternatives**

Has to be a combination of the following three factors:

1. Known weeds in/adjacent to project area.
2. Any of vectors\* #1-8 in project area.
3. Project operation in/adjacent to weed population.

#### **MODERATE**

1. Any of vectors #1-5 present in project area.

#### **LOW**

1. Any of vectors #6-8 present in project area.

OR

2. Known weeds in/adjacent to project area without vector presence.

**Vectors** (if contained in project proposal) ranked in order of weed introduction risk:

1. Heavy equipment (implied ground disturbance)
2. Importing soil/cinders/gravel
3. OHV's
4. Grazing (long-term disturbance)

5. Pack animals (short-term disturbance)
6. Plant restoration
7. Recreationists (hikers, mountain bikers)
8. Forest Service project vehicles

## Discussion of Ranking

### Alternative 1 (No Action)

This alternative was given a HIGH risk ranking because a spotted knapweed population exists in the seedbank along the 18 Road and dalmation toadflax populations occur at the western edge of the fire and project area. They are expected to spread into the project area as a result of fire suppression activities. Although no actions would occur as a result of this alternative being chosen, there will still be vectors present in association with ongoing activities, especially within the completed 73 acres of roadside hazard tree salvage, that elevates the concern of weed introductions and spread.

### Alternative 2 (Proposed Action) and Alternative 3

These alternatives were also given a HIGH risk ranking because of the known spotted knapweed and dalmation toadflax populations already mentioned above, combined with heavy equipment associated with timber harvest, road closures, and subsoiling.

## Effects

### Alternative 1 (No Action)

**Direct and Indirect Effects:** There are no identifiable direct or indirect effects as regards weeds if the project did not occur.

**Cumulative Effects:** Although no actions would occur as a result of this alternative being chosen, there will still be vectors present in association with ongoing activities, especially within the 73 acres of roadside hazard tree salvage that elevates the concern of weed introductions and spread.

### Alternative 2 (Proposed Action) and Alternative 3

**Direct Effects:** There are no identifiable direct effects under this alternative.

**Indirect and Cumulative Effects:** These alternatives pose a HIGH risk of weeds spreading or being introduced because of the known spotted knapweed and dalmation toadflax populations present, combined with heavy equipment associated with timber harvest, road closures, and subsoiling.

## Prevention Strategy

Prevention of noxious weeds is always the preferred strategy because it is most effective and least costly. All project design criteria contained herein are part of this strategy.

## Noxious Weeds of Concern for the Project Area

**Spotted knapweed** (*Centaurea maculosa*) is a very invasive plant that grows along most major highways in Central Oregon. It is a perennial plant in the sunflower family that lives for 3 to 5 years. It is very competitive on disturbed dry to mesic sites because it is able to germinate in a wide range of conditions and it grows early in spring before many native plants. Seeds may be dispersed on animals and humans, and by being caught up in vehicles. Distribution over large areas is linked to transportation systems.

**Dalmation toadflax** (*Linaria dalmatica*) looks like bright yellow snapdragons with leathery leaves clasping the stem and grows easily in dry rangeland sites, gravel pits, and along roadsides. It is a perennial plant and stands 2 to 4 feet tall. One plant can produce up to 500,000 seeds per year, and they remain viable in the soil for up to 10 years. Pulling this plant will usually result in more plants sprouting from its root system, unless all root parts are removed from the soil, which is often difficult to do.

### **Weed prevention Practices**

The following goals and guidelines, relative to timber harvest and fire management, are listed in the *USDA Forest Service Guide to Noxious Weed Prevention Practices*. This guide discusses weed prevention practices that support the 2/3/99 Executive Order on Invasive Species. Each of these items is followed by a description of what is being done relative to the 18 Fire Recovery Project.

### **Timber Harvest Operations**

Forest Veg 1. *Treat weeds on projects used by contractors, emphasizing treatment of weed infestations on existing landings, skid trails, and helibases before activities commence.*

Burned Area Emergency Rehabilitation (BAER) funding has been requested and received for noxious weed monitoring and treatment. Weeds will be pulled if they are found during monitoring. It is likely that the timing of weed monitoring and treatment will occur prior to the commencement of timber salvage activities.

Forest Veg 2. *Train contract administrators to identify noxious weeds and select lower risk sites for landings and skid trails.*

The contract administrators are aware of the noxious weed problem and what the most likely weeds look like, and take them into account when selecting landings and skid trails.

Forest Veg 3. *Encourage operators to maintain weed-free mill yards, equipment parking, and staging areas.*

Noxious weeds are discussed at pre-work meetings; most operators are aware of the problem.

Forest Veg 4. *Use standard timber sale contract provisions such WO-C/CT 6.36 to ensure appropriate equipment cleaning.*

This clause is used on all contracts.

Forest Veg 5. *Minimize soil disturbance to no more than needed to meet project objectives. Logging practices to reduce soil disturbance include, but are not limited to:*

- *Over-snow logging*

The intent is to salvage the trees before they lose economic value, so over-snow logging is not proposed for this project. However, because of the timing of the sell date (October 2004), logging may occur during a snow period, but it is not a requirement of this sale.

- *Skyline or helicopter logging*

There will be no skyline or helicopter logging because it is not economical or necessary to accomplish this project.

- *Reuse landings, skid trails and helibases when they are weed free.*

Landings and skid trails are routinely reused.

This salvage is removing a smaller quantity of trees compared to typical Bend/Fort Rock District salvages: 30 trees per acre are estimated in the proposed action, versus 100 to 300 trees per acre in a typical sale. This reduced amount will also reduce the amount of harvest operations and associated activities, which could introduce or spread weeds.

Another item to note is that the ground is flat in this sale, which reduces the amount of soil displacement during harvest operations, and thus the potential for weed spread or introduction.

Forest Veg 6. *Minimize period from end of logging to site preparation, revegetation, and contract closure.*

The 18 Fire sale will most likely have a two-year contract. The entire project, including harvest and post-sale operations, is estimated to take five years.

### **Road Management**

Road 1. *For timber sale purchaser road maintenance and decommissioning, use standard timber sale contract provisions such as WO-C/CT 6.36 to ensure appropriate equipment cleaning.*

This clause is used on all contracts.

Road 5. *Avoid acquiring water for dust abatement where access to the water is through weed-infested sites.*

There are four sites that are used as water sources for harvest activity in the 18 Fire area: Benham Falls; the irrigation canal east of town on Highway 20; from Avion water at the hydrant on China Hat Road; and Burgess Road in LaPine (Brian O'Reilly, personal communication). Of these, at least the latter two have known spotted knapweed populations present. All will be inspected in the summer of 2004 for weeds and measures taken to eliminate them. Only the Benham Falls site occurs on Forest Service land and it can be treated as soon as possible (manually) if something is found; however, the other three occur on other ownerships and the stewards of those sites will be notified if weeds are found. The Burgess Road weed site occurs on Deschutes County land, and the county weed supervisor was notified of this in 2003 and was to have treated it, but the Forest Service has not been back to monitor this site.

Road 8. *Treat weeds in road decommissioning and reclamation projects before roads are made impassable. Reinspect and follow-up based on initial inspection and documentation.*

The roads proposed for decommissioning within the 18 Fire Recovery Project area will be inventoried for weeds in the summer prior to the sale being put up for bid, and treated if found.

See Mitigation Measures for Noxious Weeds in Chapter 2.

### **Common to All Alternatives**

Suppression activities within the 18 Fire area include retardant drops, burnout operations, and dozer lines. Approximately 5.5 miles of dozer line was constructed and drop points, staging areas, safety zones, and turn-arounds/parking caused disturbance on approximately 7 acres. The dozer line and other disturbed areas created prime habitat for noxious weeds. There is a possibility that the amount of noxious weed sites and density will increase, especially on the rehabilitated dozer lines.



Noxious weed inventory and treatment has been occurring on the Deschutes National Forest in past years. Accurate documentation of noxious weed sites began in the early 1990s. After the Deschutes National Forest Noxious Weed Control Environmental Assessment was approved in 1998, chemical treatment was permitted on selected sites, including Road 18 in the 18 Fire area. Past treatment of noxious weeds has reduced the density of weeds on many sites. Treatments authorized by the 1998 Deschutes National Forest Weed EA have been implemented annually on weed sites in and adjacent to the 18 Fire Recovery Project area. Chemical treatment of spotted knapweed has occurred since 1999, within the fire perimeter, with dicamba applied at a rate of 32 ounces per acre (less than an acre treated) targeting the individual weed plants.

### **Alternative 1 (No Action)**

From a short-term cumulative perspective, this alternative would have the least risk of weed spread and introduction of new populations above present levels.

Insert Char urban interface write-up.

### **Alternatives 2 and 3**

Alternatives 2 and 3 propose ground disturbing activities on a total of approximately 1,936 acres in the project area. Alternative 2 proposes 3.5 miles of roads be temporarily constructed and 28 net miles of road closure or decommissioning. Mitigations including prevention, along with early detection and treatment would be used to help offset some of the risk associated with weed introduction and spread in the 18 Fire Project area. In looking at long-term objectives and risk, quicker recovery to a forested condition could lessen the ongoing risk of weed invasion from future vegetation management as well as recreation and the gathering of special forest products. Also, eventual implementation of the road closure recommendations from the Roads Analysis process will lessen the long-term risk.

## **Environmental Effects**

### **Alternative 1 (No Action)**

Direct and Indirect Effects: There are no identifiable direct or indirect effects as regards weeds if the project did not occur.

### **Cumulative Effects:**

The risk of weed invasion would remain high even though no actions would occur as a result of this alternative being chosen. There will still be vectors present in association with ongoing and recently completed activities, especially within the 73 acres of roadside hazard tree salvage, as well as on-road vehicles, off-road vehicles, horses, garbage dumping, dogs, hikers, and Forest Service contracts that elevates the concern of weed introductions and spread. The area is close to the city of Bend and receives high public use. These vectors would remain and can be expected to increase as time progresses.

Another consideration, which would also contribute to the high risk, is the potential for cattle or other livestock to be used for targeted fuels reduction projects, or in an extreme case, where grass is not available for cattle off-forest, in the allotment in which the 18 Fire is located (per the Cinderhill Environmental Assessment, 2004). At the earliest, this would occur in 2006, although use is not expected to occur based on the allotment's inactive status since 1990.

Cattle have been shown to be a major factor in increasing the vulnerability of plant communities to weed invasion (Belsky and Gelbard 2000). These authors cite selective grazing (choosing native forage over weeds, thus increasing the weeds), trampling, and hoof action as patterns which exacerbate weed introductions and spread. They cite studies that show that hoof action damages protective soil crusts, creates safe sites for weed seeds, increases soil nitrogen levels, creates competition-free patches of bare ground that are open to invasion, and may play a role in reducing mychorrhizae numbers in the soil. Cattle have also been shown to create “locally-enriched” areas of high nitrogen which favors weeds such as cheatgrass and medusahead (Belsky and Gelbard 2000).

The unknown is being able to state exactly how often cattle may come in contact with known weed populations, which are currently limited to roadsides and in the dozer line. There is also the potential for the cattle to bring in weeds from their previous pasturage.

There is also the potential for cattle trucks, water trucks, OHV’s used to tend fences and herd cattle, and other vehicles associated with the cattle operation to bring in weed seeds via tires and undercarriages.

Noxious weed inventory and treatment has been occurring on the Deschutes National Forest in past years. Accurate documentation of noxious weed sites began in the early 1990s. After the Deschutes National Forest Noxious Weed Control Environmental Assessment was approved in 1998, chemical treatment was permitted on selected sites, including Road 18 where it bisects the 18 Fire area. Past treatment of noxious weeds has reduced the density of weeds on many sites, including the 18 Road. Treatments authorized by the 1998 Deschutes National Forest Weed EA have been implemented annually on weed sites in and adjacent to the 18 Fire Recovery Project area. Chemical treatment of spotted knapweed has occurred along the 18 Road since 1999, including the area where the 18 Road bisects the fire area. The chemical used was Dicamba\*, applied at a rate of 32 ounces per acre. The area actually treated within the fire area is well less than one acre. The 18 Road (where it bisects National Forest land) is almost free of noxious weeds currently, although weeds certainly exist there in the form of a seedbank.

In 2004 there will be targeted chemical treatment, if necessary, with Dicamba. It is anticipated that in the following years, if chemical treatment for the knapweed is deemed necessary, it will be with the chemical Transline. An Environmental Impact Statement is currently being developed that will analyze the effects of this chemical on the local environment.

\*Dicamba is a benzoate auxin herbicide that mimics a plant hormone in broadleaf plants (Syracuse Environmental 2004 ). It causes a hormone imbalance resulting in abnormal growth in the plant to a degree that the plant life processes no longer work and the plant dies. The hormonal imbalance is specific to plants. Studies on toxicity to animals have found at high doses (above recommended application levels) the chemical can cause skin and eye irritations (Syracuse Environmental 2004). It does not bioaccumulate.

### **Alternative 2 (Proposed Action) and Alternative 3 (Reforestation)**

**Direct Effects:** There are no identifiable direct effects under this alternative.

**Indirect and Cumulative Effects:** These alternatives pose a HIGH risk of weeds spreading or being introduced because of the known spotted knapweed and dalmation toadflax populations present, combined with heavy equipment associated with timber harvest, road closures, and subsoiling. There is also a high risk because of ongoing human activity in this heavily-used urban interface area (on-road vehicles, off-road vehicles, horses, garbage dumping, dogs, hikers, and Forest Service contracts).

The other concern, contributing to the high risk, is the potential for cattle use. See the section under the No Action Alternative, Cumulative Effects, for discussion.

The discussion for chemical treatment remains the same for these alternatives as for the No Action alternative.

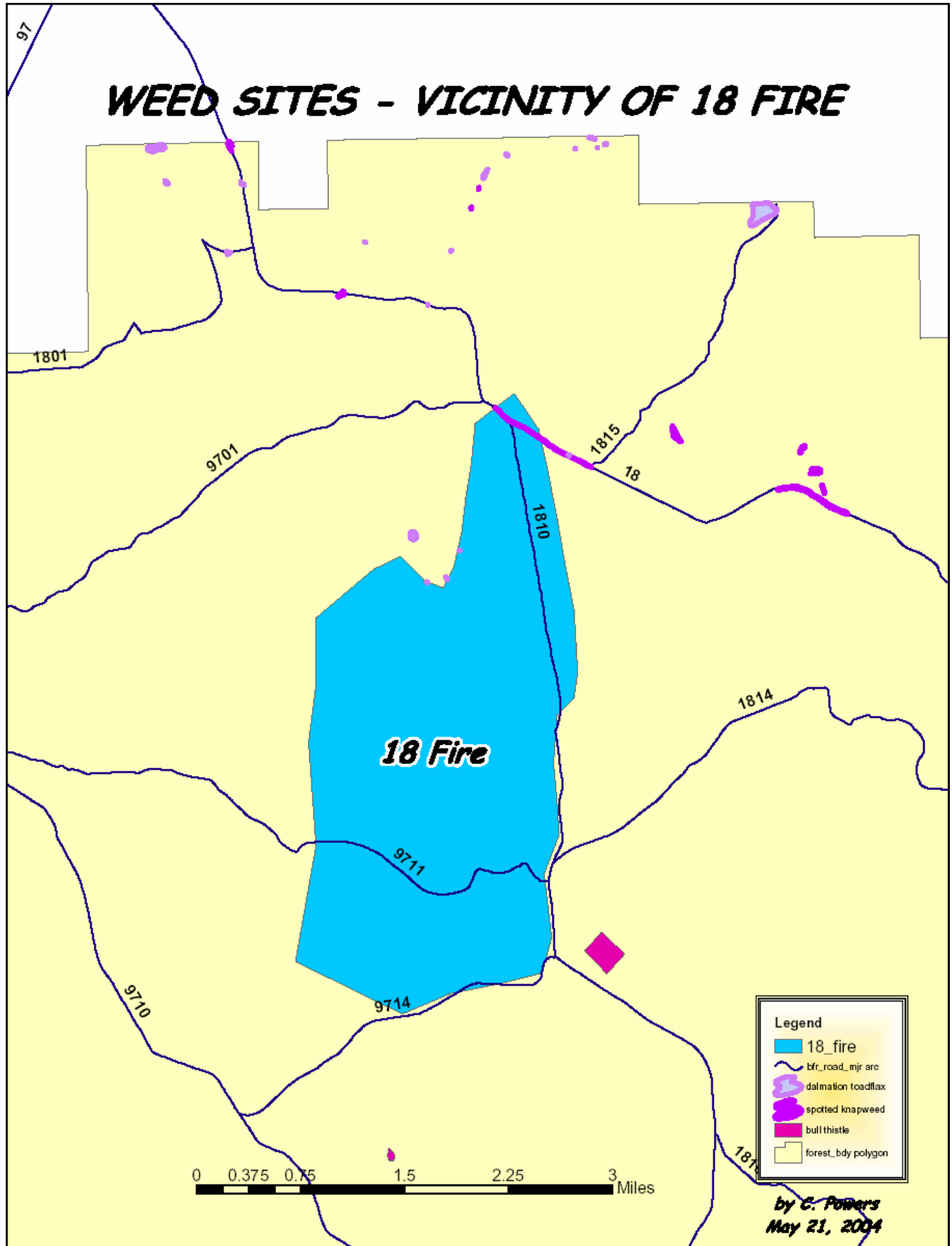
The weed map below displays the noxious weed populations within and adjacent to the 18 Fire. The overall trend of noxious weeds within this area has remained low.

**Present and Future Foreseeable Activities:**

Kelsey Vegetation Management EA, approximately 11,080 acres of vegetation management with a pending decision is adjacent to the 18 Fire area. There is a low potential that grazing would occur within the 18 Fire in the year 2006 at the very earliest. Both of these projects also have a risk assessment rating of “High” or “Moderate” for potential introduction or spread of noxious weeds.

To limit the spread of noxious weeds from recreationists, Roads 18 and 1810 are the only open roads within the 18 Fire area. Ongoing monitoring of noxious weeds would continue as specified by the BAER.

Figure 3- 3 Existing Weed Locations.



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## Cultural Resources

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### Cultural Resources Introduction

Archaeological resources are locations that contain evidence of previous human presence or activity, including areas or structures used for living, working, ceremonies, trade, transportation, conflict and recreation. The majority of known cultural resource sites in the Deschutes National Forest reflect historic use patterns prior to the 19<sup>th</sup> Century (such as stone tool detritus). More recent historic uses are related exploration, early settlement, ranching, and timbering.

This section will provide input to be used for the 18 Fire Recovery Project. It will describe the desired condition, existing condition, evaluate the effects of the alternatives, and describe any mitigation or monitoring that is recommended.

### Cultural Resources Existing Condition

#### Existing Condition

Management direction for cultural resources 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 to consider the effects on cultural resources when considering projects that fall within the Forest's jurisdiction. Further direction indicates that the Forest will determine what cultural resources are present on the forest, evaluate each resource for eligibility to the National Register of Historic Places (Register) and protect or mitigate effects to resources that are eligible.

In July of 2003 wildfire swept through the 18 Fire Recovery Project area consisting of 3,810 acres. Included in this area are historic sites associated with the Bessie Butte Logging Camp, owned and operated in the early part of the 1900s by the Brooks-Scanlon Company. Sometime in the 1950s the Forest Service acquired this land through a land exchange. The fire totally consumed the undergrowth, completely destroying or exposing cultural resources associated with this historic site. A GIS analysis for the project area was completed showing that 276 acres had been previously surveyed. An additional 474 acres were surveyed in the aftermath of the fire for a total of 756 acres being surveyed. Three historic sites associated with the logging camp were identified from previous surveys. No new sites were identified during the new survey. The three previously recorded sites were revisited and updated. Two of the sites were found to be not eligible for the National Register of Historic Places (NRHP). The remaining site has not been evaluated and is potentially eligible.

The 18 Fire project area is within ceded lands for the Burns-Paiute and Klamath Indian Tribes according to the Indian Treaty Boundary map of 1778-1883 (Royce Indian Land Cessions).

## Environmental Consequences

### Impacts Common to All Alternatives

The undertaking does not have the potential to impact the one unevaluated site because it has been avoided by layout design. The other two sites are considered not eligible and will need no further protection.

**Indirect/direct** impacts to cultural resources could occur because access to the site or visibility will be increased raising the potential for site vandalism or damage from illegal collecting or excavation activities.

All affected tribes were contacted. The Burns-Paiute Tribe responded and said they had no concerns. There is currently no known traditional use of the project area by tribes or tribal members and none of the alternatives would effect existing treaty rights or prevent the tribes from utilizing the area for traditional uses currently or at some future date. Although some roads would be closed under alternatives 2 and 3; vehicular access is still maintained to every section within the project area by roads proposed to remain open.

### Cumulative Impacts

Two sites were affected by the fire; one site was completely destroyed, and the other site was 80 percent destroyed by fire and dozer line. Management activities associated with the present undertaking would not impact cultural resources, however, post-fire erosion, or increased visibility due to loss of covering vegetation and duff have the potential to impact the one unevaluated site by illegal excavation and collection.

## Economic and Social Analysis

### Economic and Social Analysis Introduction

The importance of recovering economic value and restoring a ponderosa pine forest are the primary purposes of the 18 Fire Recovery Project. The economic gain from salvaging does not cover all the costs associated with restoring a ponderosa pine forest on the 1,936 acres of high mortality. This is due to the long timeline needed to implement the project, in relationship to the deterioration of the dead trees from insects, staining and checking, which has halved the commercial value of the dead trees; and the initial low economic value of the small diameter trees that were killed by the fire. There would be a positive cash flow if salvage logging is selected under Alternative 2, which would help to reduce the cost of reforestation. Overall, there would be a negative economic value, when considering all of the restoration treatments associated with either of the action alternatives.

Economic impact analysis of the activities proposed in the 18 Fire Recovery Project focuses on the makeup of the communities of Central Oregon, a comparison of recent local work and unemployment data to the state of Oregon as a whole, and a discussion of economic trends by industry.

Social factors important to Central Oregon, and specifically to land and forest management as a source of local income include: the region's rural setting and its history of a large wood products industry, farming, and ranching; the manner in which the local population utilizes resources for recreation; the collection of wood for fuel, fish and game for sport; and the effect of an increasing population on the region's job market and economy.

### Economic and Social Analysis Existing Condition

#### Demographics

Five Central and South Central Oregon counties; Jefferson, Crook, Klamath, Lake and Deschutes Counties, are considered in this analysis. The 18 Fire Recovery Project area is located within Deschutes County. The total population for the five county area during the 2000 Census totaled 224,735. Populations and change for the region and by each individual county are displayed in Table 3-15 below.

**Table 3-15. Central Oregon Population Growth**

	Population		Change	
	1990	2000	Actual	Percent
<b>Central and South Central Oregon</b>	167,623	224,735	57,112	34.1
<b>Jefferson County</b>	13,676	19,009	5,333	38.9
<b>Klamath County</b>	57,702	63,755	6,053	10.5
<b>Deschutes County</b>	74,958	115,367	40,409	53.9
<b>Crook County</b>	14,111	19,182	5,071	35.9
<b>Lake Co.</b>	7,176	7,422	245	3.4

The major population centers within the area are: Klamath Falls (19,462), Prineville (7,356), Bend (52,029), Redmond (13,481), Madras (5,078), and La Pine (5,799).

Future population projections mimic that of the past decade. Deschutes, Crook, and Jefferson Counties are expected to continue with aggressive growth.

As with the nation and Oregon as a whole, the population in the Central Oregon area is becoming both older and more diverse; but there are major differences within the area. For instance, the major cities, Bend, Redmond, Prineville, Madras, had lower median ages than Oregon, in fact Prineville's, Madras's, and Redmond's median age has actually decreased since 1990. Whereas more rural counties like northern Klamath County and unincorporated areas such as La Pine, are much older than the National or Oregon average and tend to be more retiree-heavy. Although racial diversity is increasing, with the Hispanic population increasing the fastest, Central Oregon, except for Jefferson County, is less racially diverse than Oregon as a whole. According to the 2000 census, Lake is 91 percent white with the Hispanic population increasing 50 percent, Crook is 93 percent white with the Hispanic population increasing 179 percent since the 1990 census, Deschutes is 95 percent white with the Hispanic population increasing 182 percent, Jefferson is 69 percent white with the Hispanic population increasing 133 percent. Klamath is 87 percent white with the Hispanic population increasing 66 percent. Oregon as a whole is 87 percent white with a Hispanic population increase of 144 percent.

The education attainment level, except for Deschutes County, within Central Oregon, is also lower than Oregon's as a whole. The percentage of population having graduated from high school is 47 percent in Crook, 56 percent in Deschutes, 44 percent in Jefferson and 49 percent in Klamath and Lake Counties. For Oregon as a whole it is 53 percent.

### **Employment**

According to the 2000 Census, estimated civilian labor force is: Crook, 7,525, up 12 percent since the 1990 census; Deschutes, 57,614, up 40 percent since the 1990 census, Jefferson, 8,570, up 31 percent since the 1990 census, Klamath, 28,753, up 6 percent since the 1990 census and Lake down 4 percent since the 1990 census. Where as the labor force in Oregon as a whole increased 18 percent. In Crook County the three largest sectors were trade (1,640), lumber and wood products (1,510), and government (1,180). In Deschutes County the three largest sectors were finance, insurance, real estate (14,170), trade (13,080), and government (6,900). In Jefferson County the three largest sectors were government (2,460), trade (1,250), and lumber and wood products (1,150). In Lake County the three largest sectors were government (940), trade (500), and lumber and wood products (290). In Klamath County the three largest sectors were finance, insurance, real estate government (5,580), trade (5,510), and government (5,400).

Unemployment rates in the individual counties were: Klamath 7.9 percent, Crook, 8.4 percent; Deschutes, 6.4 percent; Jefferson, 5.6 percent and Lake, 6.4 percent. The unemployment rate in Oregon as a whole was 5.7 percent.

The economies of Deschutes and Jefferson are the most robust in the Zone. In Deschutes County, although there has been an increase in the number of jobs created, the huge increase in the labor force (up 40 percent) has negated much of this success, at least in terms of the unemployment rate. But, due to their diversity, both economies are expected to remain very strong. On the other hand, in Crook, Lake and Klamath Counties, with their low overall economic diversity, dominated by either one manufacturing sector industry (lumber and wood products) or limited trade sectors (Les Schwab in



Crook County), have had their economies lag behind Oregon's as a whole. Future projections call for continued growth and diversification of their economies in these three counties.

### Income

Average annual wages in Central Oregon are displayed in Table 3-16 below.

**Table 3-16. Average Annual Wages in Central Oregon 1990 – 1999 \***

Industry	1990	1999	Change	Percent Change
All Industries	\$25,152	\$25,516	\$ 363	1.4
Private Coverage	24,089	24,617	527	2.2
Agriculture, Forest, and Fish	19,630	17,983	(1,647)	-8.4
Construction and Mining	29,156	28,532	(625)	-2.1
Manufacturing	30,633	30,807	174	0.6
Lumber and Wood Products	31,251	31,811	560	1.8
Other Manufacturing	29,028	29,547	520	1.8
Trans., Comm., and Utilities	33,963	35,231	1,267	3.7
Wholesale and Retail Trade	18,510	19,415	905	4.9
Fin., Ins., and Real Estate	26,286	28,468	2,181	8.3
Services	21,493	23,264	1,771	8.2
Government	30,760	30,485	(274)	-0.9

Note: \* Adjusted to 1999 \$  
Sources: Oregon Covered Employment & Payrolls by County and Industry  
Oregon Employment Department; US Bureau of Labor Statistics

Per capita personal income in 1999, as reported by the U.S. Department of Commerce, Bureau of Economic Analysis by county were as follows: Lake \$20,285; Klamath \$20,886; Crook, \$21,168; Deschutes, \$26,077; and Jefferson, \$18,808. Although the per capita income in the area is traditionally lower than Oregon's as a whole, there has been a widening of the gap mainly due to the loss of relatively high paying jobs in the lumber and wood products industries. Deschutes County's per capita income, which is the highest in the area and close to Oregon's as a whole, is attributable to a number of factors. The first being that although Deschutes County also lost significant jobs in the wood products industry they have been replaced by other high-paying manufacturing jobs. In addition, the increase of high-paying "high" tech jobs, and an influx of wealthy new comers have bolstered all income measures (per capita, total personal income, and medium family income) as compared to the other counties.

Although 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. In Crook County, 1,510 people were employed in the lumber and wood products industry. This accounts for 25 percent of all wage and salary employment in the county, and represents the third highest paying job in the county. In Deschutes County, 4,770 people were employed in the lumber and wood products industry. This accounts for 10 percent of all wage and salary employment, and represents the seventh highest paying job in the county. In Jefferson County, 1,150 people were employed in the lumber and wood products industry. This accounts for 19 percent of all wage and salary employment, and represents the third highest paying job in the county. In Klamath County, 3,180 people were employed in the lumber and wood products industry accounting for 19 percent of all wage and salary employment. In Lake County, 13 percent of all wage and salary employment was in the lumber and wood products industry.

Agricultural is an important use in Central Oregon. Leading crops include cattle, forage and hays. In Jefferson County there is also a substantial amount of seed and vegetable products. Total agricultural sales for each county in 2000 were as follows: Crook, \$34,604,000; Deschutes, \$21,855,000; Jefferson, \$46,431,000; Lake \$54,508,000; and Klamath \$128,806,000. Although farm income is a very small portion of total personal income in the area, the agriculture sector's role in the local economies is substantial in all but Deschutes County.

Employment and income statistical references do not specifically track recreation and tourism as a sector. Instead recreation and tourism contributes to several sectors, transportation, services (accommodations, eating and drinking, recreation), retail trade, and even government. The Oregon Tourism Commission publishes an annual report with estimates to total travel related spending in each County. Estimates for 1999 were 20.4 million in total travel spending in Crook, 414 million in Deschutes, 99.7 million in Klamath, 10.4 million in Lake, and 52.9 million in Jefferson. Estimated employments from these expenditures are as follows. In Crook, 380 people were employed in industries supporting recreation and tourism, representing 6.3 percent of all wage and salary employment in the county.

In Deschutes County, 5,160 people were employed in industries supporting recreation and tourism. This represents 10.5 percent of all wage and salary employment in the county. In Jefferson, 1,040 people were employed in industries supporting recreation and tourism. This represents 16.8 percent of all wage and salary employment in the county. In Lake, 170 people were employed in industries supporting recreation and tourism. This represents 7.7 percent of all wage and salary employment in the county. In Klamath 1,930 people were employed in industries supporting recreation and tourism. This represents 8.3 percent of all wage and salary employment in the county.

### **Social**

Surrounding physical and biological environments influences human social life. This is most evident in rural areas where the variety and quality of available natural resources often determines the chief means of economic livelihood and what leisure activities people are likely to pursue and, therefore, influence local preferences for the use of public lands. From a historical prospectus it is evident that all of the local community's cultures were natural resource based and to a certain degree, especially in the more rural less populated areas, still are. Livestock, agriculture and timber were the backbone of the economic structure and as a result strongly shaped the social fabric that still defines the communities today. Since most of the surrounding land is administered by federal agencies, chiefly the Ochoco, Deschutes, Winema, Fremont National Forests and the Prineville and Lakeview Districts of the BLM, changes in federal land use policies can impact the socioeconomic and socio-cultural way of life.

One needs to keep in mind that the various communities, and the individuals within them, contain a broad spectrum of perceptions and values related to the road system and use of resources on the surrounding national forests. These same communities and individuals also have interests that span multiple geographic and political scales simultaneously.

The following descriptions portray communities only in the most simplistic terms, and do not capture the full community richness.

Many of the communities (rural industrial, as defined in the Deschutes NF LRMP) within Central and South Central Oregon, such as Crescent and Gilchrist, are closely tied to the Forests in work, subsistence, and play, and are directly affected by what happens on the Forests. The relationship between the Forests and these communities is based in part on access to logs so that individuals can

make a living from their harvesting, manufacturing, and transportation businesses; and catering to tourists drawn to the area. People from these communities also use fuelwood, fish, and game for part of their subsistence and/or recreational activities. Recreation (often roaded and/or motorized) is also an important component of the life styles for many of the people living in these communities.

The Sunriver destination resort community is defined by recreation opportunities and amenities and recreation residences (rural recreation and residential, as defined in the Deschutes NF LRMP). Environmental and scenic amenities and nearby recreational opportunities plays the major role in its existence. Local service-oriented businesses are the major economic driver instead of extraction-based activities.

Bend (Central Oregon Urban Center, as defined in the Deschutes NF LRMP), is the dominant community in the Zone. It has a large industrial sector with wood products playing a major role, and a large service sector based on recreation and tourism. In addition its' financial, real estate sectors, and economy as whole has increased substantially as people have moved into the area because of the amenities the surrounding area provides, much of which is associated with the national forests. It is also the major shopping and service center for most of the communities within the area. Due to its population size and density, and economic and social diversity, the health of the wood products and service sectors of the economy, along with environmental and amenity values, play an important role in defining what is important to the Bend community.

Communities such as Prineville, Redmond, and Madras, from a historically perspective, better fit the "rural industrial" community described above. But with their exploding populations and diversifying economies, they are developing a more diverse set of interests more along the lines of Bend's. With the recent weakening of the economy, it is clear that these communities are still very much tied to the woods product industries both economically and culturally. Other communities within the Zone (such as Paulina, Silver Lake) can generally be defined as ranching or farming communities. These communities are closely tied to the Forests in work, subsistence, and play, and are directly affected by what happens on the Forests. These communities are linked more economically because of the need for summer forage for livestock, not timber, and to provide services for recreation and tourists. . These communities generally have no manufacturing based industries and have small, undiversified economies. Like "rural industrial communities", the people who reside in these communities also use fuelwood, fish, and game for part of their subsistence and/or recreational activities.

The one over-riding demographic trend in the area is that of rapid population increase through immigration. With the general gentrification that is occurring through the area and the influx of retirees, many of who are well to do, and professionals from many specialty areas, is resulting in rapid economic and social change.

## **Economic and Social Analysis Environmental Consequences**

### **Economic Efficiency**

Forest Service Handbooks 1909.17 and 2409.18 direct the evaluation of Economic Efficiency for proposed projects. To assess the economic efficiency of Alternative 2, the costs and anticipated timber volumes were entered into TEA.ECON (<http://www.fs.fed.us/rp/nr/fp/FPWebPage/ForestProducts/ForestProducts.htm>). The timber salvage sale was evaluated for the sale as a whole with a 4 percent discount rate. TEA.ECON uses the Transaction Evidence Appraisal (TEA) system to generate basic gross timber values and estimated advertised rates. Values for timber are generated using advertised rates in the appropriate geographic

area and appraisal zone. Rates were updated for the analysis and used the following cost file: version 04411, 12/31/2004.

The analysis can be used to compare alternatives, not to give an absolute number for the outputs. Numbers useful for comparing alternatives include a benefit/cost ratio, discounted benefits, discounted costs and present net value. Effects on the local economy include estimated number of jobs created or maintained.

### Value and Volume

Estimating value and volume loss of salvaged material is highly variable and dependent on species, diameter of trees, time since death, season of burn and deterioration agents in the area. Value loss in ponderosa pine is caused primarily by blue staining of the wood by fungi brought in by insects. Volume loss is caused by checking, decay, breakage and char (Lowell et.al. 1992). Revenues were adjusted by reducing ponderosa pine values by \$20 per CCF (hundreds of cubic feet or cunits) to reflect value loss and by using a minimum utilization specification of 12 inches dbh and an 8 inch top diameter to reflect volume loss.

Timber salvage volume estimates of 11,535 CCF (6.0 million board feet) of ponderosa pine sawtimber and 1,925 CCF (1.0 million board feet) of non-sawtimber ponderosa pine for Alternative 2 were calculated by establishing 1/20 acre fixed plots throughout the fire. Certified Region 6 timber cruisers were used to evaluate the plots. These estimates included deductions for non-salvage patches, 10 percent defect and breakage, and dead trees retained for wildlife.

When combined with 73 acres of roadside salvage, completed during the winter of 2003 to 2004, the following percentage of pre-fire trees by diameter class would remain after salvage within the perimeter of the 18 Fire:

<u>Diameter Class (dbh)</u>	<u>Total estimated Dead and Green Trees Remaining</u>
4.0-7.5"	100 percent
7.51-10.5"	99.8 percent
10.51-13.5"	75.2 percent
13.51-16.5"	57.5 percent
16.51-19.5"	58.3 percent
19.51"+	68.8 percent

### Costs

The 18 Fire Recovery Project salvage operation costs were developed for Alternative 2. The net sale value would depend on the market value of the timber when sold and the actual logging costs. These figures are based on the analysis discussed above. Logging costs include stump to truck (what it costs to get the trees from the harvest unit to the landing), haul (getting the trees from the landing to the mill), road maintenance, temporary road development and slash disposal. Cost assumptions are as follows:

- 2/3 of the zone average was used for both stump to truck and log haul due to short skidding distances, high production mechanized systems and mill vicinity
- zone averages were used for brush disposal, road maintenance, and temporary road development

Table 3-17. Expected Logging Costs of Alternative 2

System	Acres	Total Volume (ccf)	Stump-Truck (ccf)	Brush Disp. (ccf)	Road Road Maint. (ccf)	Temp. Road (ccf)	Haul (ccf)	Total Cost/ccf
Ground-based	1936	13,460	\$52.56	\$5.32	\$5.07	\$0.46	\$20.44	\$83.85

The logging costs by unit were added to the additional costs of activities needed to implement a timber salvage sale. These include:

- Weed treatment/monitoring of off-road equipment to reduce the potential of spreading nonnative plants
- Transportation planning (roads analysis) costs of \$3,400 (\$0.25/CCF)
- Sale Preparation costs of \$40,000 (\$3.00/CCF).
- Sale Administration costs of \$23,500 (\$1.75/CCF).
- DEIS planning and survey costs of \$160,000 (\$11.89/CCF)

Table 3-18. Alternative Financial Efficiency

Alternative	Estimated Volume CCF	Present Net Benefits (PNB)	Present Net Costs (PNC)	Present Net Value (PNV)	Benefit/cost Ratio (B/C)
Alternative 1	0	0	\$163,400	-\$163,400	0
Alternative 2	13,460	\$295,185	\$226,882	\$63,303	1.29
Alternative 3	0	0	\$163,400	-\$163,400	0

The negative PNV for alternatives 1 and 3 reflect planning and survey costs associated with the preparation of a roads analysis and DEIS.

Reforestation was considered in this analysis even though the fire and not timber salvage created the need for reforestation. Planting of trees and associated activities would occur to the same degree under Alternative 3; however, the net revenues generated by the sale of this timber would provide a potential additional source of funding for reforestation (KV receipts), albeit not the only source of funding under Alternative 2.

The costs of activities which are intended to expedite the restoration of a ponderosa pine forest under Alternatives 2 and 3 and not reflected in the table above include:

- Subsoiling of landings, main skid trails and temporary and inventoried roads to increase soil productivity and improve habitat conditions.
- Reforestation and protection from animal damage of 1936 acres by hand planting ponderosa pine.
- Reforestation and protection of 73 acres of roadside salvage accomplished in the winter of 2003 to 2004.

- The following table identifies the costs used which include overhead assessments for Alternatives 2 and 3.

All costs and activities are the same except for subsoiling. Alternative 2 would subsoil 7 miles of road obliterations and all logging facilities used for the salvage timber sale for a total of \$9,375 (62.5 acres). Alternative 3 would subsoil only the 7 miles of system road for a total of \$1,560 (10.4 acres).

**Table 3-19. Non salvage Related Projects and Costs**

Activity	Cost	Unit of measurement
Planning and survey	\$160,000	DEIS
Roads Analysis	\$3,850	Roads analysis
Weed Treatment	\$2,500	Project
Subsoiling	\$150	acre
Close 2.9 miles of road	\$2,000	Project
Plant, vexar, survey 73 acres	\$39,785	Project
Construct 640 acre fence	\$105,600	Project
Plant 1936 acres	\$334,925	Project
Reforestation surveys 2007-08	12,018	Project

### Direct and Indirect Effects of Alternative 1 - No Action

Selection of this alternative would result in no active management of the resources except for ongoing management activities such as future fire suppression, planting of 73 acres along roadsides, and roadside hazard tree felling. There would be no net sale value, and no additional jobs would be created or maintained. There would be no benefits to the local economy. This alternative may have negative impacts to the local economy because timber-related jobs would not be maintained.

Although Alternative 1 would generate no current revenues to return to the Treasury of the United States of America there is a cost resulting from the expenditure of planning monies. The PNV would be a negative \$163,400. Since there are no revenues predicted it is not possible to calculate a benefit/cost ratio.

### Direct and Indirect Effects of Alternative 2

The salvage harvest units under Alternative 2 have measurable economic recovery potential in terms of the volume of raw materials that could be recovered. Economic recovery is very time-dependent-the smaller the diameter of the trees to be salvaged, the less time the trees will have value. Most of the ponderosa pine less than 12 inches dbh has deteriorated to the point where they have marginal economic value. The remainder of the trees should retain some value up to three years from the date they were killed.

**Table 3-20. Comparison of Raw Material Recovery of the Alternatives**

Alternative	Volume CCF/MMBF
1	0/0
2	13,460/7.0
3	0

When the salvage related revenues and costs alone (including planning) are analyzed the PNV is \$63,303 with a benefit/cost ratio of 1.29. When combined with the non-salvage related discounted costs of 1936 acres of reforestation (subsoil, plant 1936 acres, browse protection, surveys) associated with this alternative, the total PNV is calculated at a negative \$361,328. The financial efficiency of this alternative, based on traditional measures, is the highest of the two action alternatives.

The net sale value is estimated to be \$301,000 of which some or all could be used to offset the costs of reforestation. An estimated 58 timber and timber-related jobs would be created or maintained. Timber could be logged in one year, and should be carried out as early as possible if this alternative is selected due to the continuing decrease in economic value from decay and insects. Indirect benefits from employment would contribute to the local economy.

The number of jobs maintained or created was calculated by using figures for the Deschutes National Forest from Appendix B-5 of the FY 1997 Timber Sale Program Annual Report. Excluding firewood from the volume harvested on the Deschutes National Forest in Fiscal Year 1997, an estimated 9.6 jobs per million board feet were maintained or created. Of the total estimated volume of 7 million board feet salvage harvested with Alternative 2, approximately 1 million board feet (1,925 CCF) is non-sawtimber. This material consists primarily of the tops of the sawtimber sized trees. This material was not used in the calculation of the total estimated number of jobs created or maintained with Alternative 2. Estimated employee income of \$1,845,038 is derived by multiplying the average 1999 salary of \$31,811 for lumber and wood products jobs and the number of jobs (58 jobs) created or maintained. These jobs would be in addition to the jobs discussed below under Alternative 3.

### **Direct and Indirect Effects of Alternative 3**

There would be some contributions to the local economy from planting 1936 acres, fencing 640 acres, closing 2.9 miles of road and obliterating 7.0 miles. Total estimated wages and materials, including overhead, is approximately \$460,000 over the next five years, in addition to the \$163,400 in planning costs, already expensed. Assuming planting and animal damage control installation (vexar) of 150 trees per person per day an estimated 6 to 7 jobs would be supported in addition to 3 to 4 jobs involved in fence construction and planning on a per year basis.

The PNV would be a negative \$581,984. Since there are no revenues predicted it is not possible to calculate a benefit/cost ratio.

### **Cumulative Effects**

The cumulative effects of all alternatives with regard to economic efficiency in the foreseeable future are based on costs and revenues. The cumulative effects on forest resources are discussed in other reports of this DEIS. All resources have a value, though many are difficult to identify in dollar terms.

In all alternatives the possibility of wildfire returning is high because of the location, weather and vegetation. What varies between alternatives in regards to fire is the fuels and future stand structure following implementation of the DEIS. The level of fuels remaining will contribute directly to the investment needed when fires return to the project area. The fuels accumulating in the next three decades may need treatments to protect the developing young ponderosa pine forest. These treatments may include prescribed fire or mechanical mowing of the shrub layer.

In Alternatives 1 and 3, no salvage would occur. Future fires within the perimeter of the 18 Fire would have the potential to be more difficult to control due to the high fuel loading. This potential could require more resources to control fire, create increased dangers to wild land fire fighters and increase costs to contain a fire. Future expenses to thin stands under Alternative 1 would not be needed and limited to higher density planting areas included with Alternative 3.

Alternative 2 includes salvage and reforestation and represents the only alternative that reduces future fuel loads. Resources required to control or manage fires could be substantially less than Alternatives 1 and 3. Identical to Alternative 3, future expenses to thin stands would be limited to the higher

density planting areas. This alternative has the best opportunity to accelerate the establishment and development of a large diameter ponderosa pine stand and provides the best assurance that the stand can develop past the age when small diameter trees are susceptible to ground fire mortality. Alternative 2 provides the most current and future opportunity for employment in the woods industry.

Approximately 330 MBF (667 CCF) was removed from 73 acres located adjacent to roads 18, 1810 and 9711 during the winter of 2003 to 2004. The contribution of this project (\$25,000 PVB) would be added to the effects on the local economy from the other alternatives and ongoing projects on the Deschutes National Forest. The PVC associated with reforestation of the 73 acres is \$38,255.

Over the last 10 years, an annual average of approximately 68.2 MMBF of timber has been sold from the Deschutes National Forest. In the near future, the amount of timber offered for sale is expected to be near this annual average. The Deschutes National Forest is expected to continue offering timber for sale and is expected to continue making contributions to the local economy as a result of timber harvest activities. If either Alternative 1 or 3 was chosen, the project area would not contribute any additional benefits to the local economy as a result of timber harvest. In this scenario, the projected amount of volume from Alternative 2 may or may not be provided to the local economy as it depends on the feasibility of substituting and implementing other ongoing planned projects.

### **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, 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 fire 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 Central Oregon communities.

### **Direct and Indirect Effects**

#### **Alternative 1 – No Action**

This alternative would continue the local economic situation as described above.

#### **Common to all Action Alternatives**

Within the social context presented above, the action alternatives developed for this project have the potential to bring in workers from the outside to perform logging, reforestation, mushroom harvesting, and related activities. 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. Some businesses may need to increase their employment, either by temporarily adding employees, or giving present employees more hours. This would likely result in increased local household incomes during implementation of project activities. Since these businesses have supported similar workforces in the past, capitol expansion would probably not be required.

Since reforestation activities are expected to span a period of several years and it is reasonable to expect a good proportion of the work will go to minority-based small businesses, as they have in the past. The vast majority of these businesses and their employees are based along the I-5 corridor, so again most of the disposable income from these activities would not flow into local communities. This is particularly true for the reforestation only Alternative 3.



A road closure order currently limits access for special forest products. Resources gathered for subsistence or of cultural importance are not likely affected by any federal action proposed within the fire area. Reducing the amount of dispersed, non-fee camping available in the project area may have a larger impact on lower income families; however, there are numerous other available locations in and near the 18 Fire area for free camping.

Recent research by the Center for Watershed and Community Health outline both the direct and indirect effects of wildfire on the health and welfare of impoverished individuals, families, and communities. Beside the direct impacts of the fire on potential jobs and income, there are also negative impacts to the value of property and other assets created by the public perception of risk created by local wildfires. The long-term effect of a decrease in a sustainable local timber supply for local mills combined with a short-term decrease in recreational opportunities can also affect major local employers and taxpayers. This means that the tax base decreases and the costs of sustaining local services cost more. Thus poor householders in local communities are especially vulnerable to the fallout of a wildfire like this on their local economy. They have limited financial ability to cope with the disruptive effects this may have on local economic activity and dependent social services. The effects discussed in this section, are very difficult to measure, but would tend to have a disproportional impact on local low income households. In contrast, minority groups from outside the immediate area would, whether harvesting forest products or helping in reforestation and restoration efforts, probably see fewer changes in income when compared to other groups.

## Fire and Fuels Accumulation

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### Fire and Fuels Accumulation Introduction

#### Existing Condition

The stand-replacing wildfire burned an estimated 2,420 acres at high intensity with tree mortality ranging from 95 to 99 percent. The majority of the high intensity burned area consisted of ponderosa pine and a bitterbrush understory. Presently, there are no surface fuels other than occasional patches of shrub, duff and litter that remain. The standing material consists of mainly scorched trees. The remainder of the burned area 1,390 acres burned at a low to moderate intensity, leaving brown needles in some cases with occasional surviving trees, creating a mosaic if you will across the landscape.

One objective in burned areas is to reduce fuels so that they more closely approximate historic dead and down woody fuel loads. At lower and middle elevations, this is an important ecological concept because fuel loads can significantly contribute to the effects of a fire disturbance but often exist in levels above pre-European settlement (Brown 2000; Everett et al 2000). It is generally accepted that fire suppression and past large-tree harvesting operations have contributed to excess tree densities and fuel loads in ecosystems that developed with relatively short fire intervals (Brown 2000).

In many places in the western United States, organic matter is produced at a higher rate than it can be cycled by decay. The accumulation of this woody material may increase the likelihood of severe stand replacing wildfires (DeBano et al 1998). “Fuel buildups continue and become more continuous in distribution. As a consequence, subsequent occurrence of high-severity fire results in generally greater changes in plant compositions and structure than would occur if the communities had been subjected to more frequent low-intensity fires” (DeBano et al 1998). Uncharacteristically high fuel levels create the potential for fires that are uncharacteristically intense (Franklin and Agee 2003). If lower and mid-elevation ecosystems are to experience a disturbance regime similar to that which they are adapted, the fuels must first be reduced to keep fire effects within an historic range. One goal of this project is to manage future fuel loads and fuel arrangement to be within a manageable range for both fire control and ecosystem processes.

The 18 Fire and surrounding areas have a fire occurrence rate of 9 to 10 fires per year. All the 18 Fire area is classified as Fire Regime I. Between 1987 to present, this area has the highest occurrence of large fires (100 acres or larger) on the district (Evans West, Skeleton, and Bessie Butte). With increasing recreational use and close proximity to the city of Bend, human caused fires are predicted to increase.

A fire regime is a generalized description of fire’s role within an ecosystem – characterized by fire frequency, predictability, seasonality, intensity, duration and scale (USDA/USDI 2002). Condition class is a landscape-level attribute which characterizes the degree of departure of vegetation composition and structure, and fire frequency and severity that currently exist inside the fire regime.

The national fire regime scheme has been modified for use within the Central Oregon Area (Central Oregon Fire Management Plan, USFS 2003e). Prior to the fire the condition class for the 18 Fire area was classified as a Class III. Condition Class III is defined as a fire regime that has been significantly altered from its historical range with a high risk of losing key ecosystem components. The other fire regime groups are shown in the table below for information only.

Table 3-21. Fire Regimes

Fire Regime Group	Fire Frequency	Fire Severity	Plant Association Group
I	0 – 35 years	Low	Ponderosa Pine
II	0 – 35 years	Stand Replacement	Non-forest grass
IIIa	< 50 years	Low/Mixed	Mixed Conifer Dry
IVa	35 – 100 years	Stand Replacement	Lodgepole Wet
IVc	100 – 200 years	Stand Replacement	Lodgepole Dry
V	200 – 400 years	Stand Replacement	Western Hemlock Dry

**Fuel Loading and Arrangement**

Fuel levels and risk of damage from wildfires is a component of the purpose and need for the 18 Fire Recovery Project. Components are described below.

Bringing fuel load levels and fuel arrangement to conditions that reduce the likelihood of stand-replacement fire in regenerated stands, particularly during the early stages of stand development, will promote the long-term survival and growth of new conifers.

Fuel loading will be described for the 18 Fire area. Fuel conditions resulting from the alternatives will have associated effects on fire behavior including potential fire intensity. The effect a fire may have on resources depends on fire intensity and the conditions of the environment, including vegetation, in which it burns.

Adjusting the fuel conditions within ponderosa pine stands to levels supporting the future use of prescribed fire. Salvage and fuel treatment in these stands would result in fuel characteristics reflective of Condition Class 1, where prescribed fire could be used for maintenance and the likelihood of damage to ponderosa pine from wildfire would be reduced.

Estimates of fire behavior under prescribed fire conditions are described. Low intensity prescribed fire applied within ponderosa pine stands would maintain stand density, species composition and structure to reflect the historic fire disturbance regime.

Over time the existing dead trees will fall and become down wood accumulating as surface fuels with the potential to increase fire intensity. It is recognized that down wood is an essential component of ecosystems within the 18 Fire area, providing wildlife habitat, soil protection and other important functions. Alternative CWD that provide essential function and levels which represent a potential for adverse impacts to soil productivity and other ecosystem components is analyzed.

Fire risk is elevated in areas of human development and along major roads within or near the wildland urban interface (city of Bend). There is a need to reduce fuel loadings to meet desired levels and reduce adverse impacts from future wildfires. Currently, it's estimated within 15 years fuel loads could range from 38 to 62 tons per acre inside the fire perimeter, meaning much of the fire killed trees would fall down resulting in a horizontal fuel bed, exceeding the desirable fuel load average of 5 to 20 tons per acre (Brown 2003).

## Environmental Consequences

### Alternative 1 (No Action)

The current fire hazard is low in the 18 Fire area, however without any salvage activities the hazard will be sure to increase overtime. Fire hazard generally refers to the difficulty of controlling potential wildfire. Under Alternative 1, no fuels reduction would occur, the existing dead trees would continue to fall and remain as part of the fuel bed making it more difficult to plant, grow and manage these stands in the future. The more snags left onsite increases the availability of a horizontal fuel loading. Fire hazard including resistance-to-control and fire behavior reach high ratings when large fuels exceed about 25 to 30 tons per acre in combination with small woody fuels of 5 ton per acre or less (Brown 2003). Excessive soil heating is likely at approximately 40 tons per acre and higher. Thus, generally high to extreme fire hazard potential exists when downed coarse woody debris (CWD) exceeds 30 to 40 tons per acre. Consideration of the positive and negative aspects indicates that the optimum quantity of CWD is about 5 to 20 tons per acre for warm dry ponderosa pine (Brown 2003). Higher loadings of CWD are acceptable where larger pieces dominate. Unfortunately, the relationship between quantity and size of CWD and the various measures of fire hazard is undefined (Brown 2003).

Over the next 10 to 20 years as the snags fall and accumulate over the burn area, brush will be the dominate fuel type in the area. Trees and brush will grow through the fallen snags creating a receptive fuel bed. Any fire that starts under these conditions would become a high intensity, ground fire through the existing grass, brush, and down trees. Control efforts would be hampered by the amount of down woody material eliminating some suppression options in order to reduce the risk of entrapment and injury to firefighters. For example, the emphasis would likely be on using heavy equipment (such as dozers) for constructing fireline verses ground forces building handline.

Fuel loading under alternative 1 is predicted to average approximately 50.3 tons per acre with a range of 38 tons per acre to over 60 tons per acre on the 2,347 acres (2420 acres minus 73 acres of road side salvage completed in the winter of 2003 to 2004) of stand replacement wildfire. Over the short-term (0 to 10 years) high severity fire is unlikely in the fire area because the initial fire burn with such intensity it consumed most if not all grasses and shrub. Large woody fuels would still be accumulating on the forest floor, but there would not be enough fuel to sustain a fire if one was to start.

Over the medium-term (10 to 30 years) depending on the site and the moisture content, downed CWD would exhibit some decay. A duff layer would not be well established and would be unable to contribute to soil heating. High burn severity would primarily occur

where large woody material was lying on or near the soil surface (Brown 2003). A wildfire that started under these conditions would be confined to the areas with heavy concentration increasing suppression options and controllability.

Over the long-term (30 to 60 years) large woody pieces would probably exhibit considerable decay, and the forest floor would be well established with duff, litter, coarse woody debris, and shrubs. A wildfire under these conditions would become a high intensity, high severity, running ground fire. Control efforts would be hampered by the amount of down woody material on the ground. These conditions delay firefighter access, increase risk to firefighter safety, limit effectiveness of hand tools for wildfire suppression, and require mechanical fireline construction. Under this alternative, any fire starting within the burned area would increase resistance to control due to the amount of snags left on site, more costly to contain and the effects on soil would be severe.

#### **Alternative 2 (Proposed Action)**

The proposed action would salvage fire-killed trees on approximately 1,936 of the 3,810 acres. Whole-Tree-Yard or Leave-Tops-Attached (LTA) to the last log would be used on most salvage acres to help relocate fuels to the landings. The predicted fuelbed in the harvested areas would be broken-up and the overall fuel load would be reduced from an estimated range of 38 to 60 tons per acre to a desired 17.2 tons per acre within a range of 15 to 20 tons per acre.

All salvage units would be reforested after harvest with variable stocking levels to meet wildlife and silviculture objectives. Under Alternative 2 approximately 640 acres would be fenced in Unit 1 (refer to map in Chapter 3, Wildlife section) to accelerate the development of hiding and thermal cover in the deer winter range at the least cost to government. Approximately 1,801 acres would not be salvaged. These acres include areas that burned at a lower intensity and acres that meet wildlife habitat needs. The effects are similar to the Alternative 1 (No Action), fuel loadings would continue to build on the forest floor as snags continue to fall. This in conjunction with shrubs and needle cast creates a potential fire hazard. These conditions increase resistance to control, limits the effectiveness of hand tools for wildfire suppression and delay firefighter access. The juxtaposition of salvage and non salvage areas would ensure that no large areas of continuous fuel loads would occur within the project area.

Based on field inspections by a Timber Sale Administrator (O'Reilly, personal communications) there would be approximately 142 landings with a total of approximately 2,130 tons of fuel, consisting of the limbs and tops of harvested dead trees. Utilization of fuel in landings piles would be an option for disposal depending on markets and economics. Burning of landing piles would be the treatment used if utilization does not occur. If burning occurs, there would be approximately 13.2 tons of Particulate Matter 10 microns and less in size (PM 10) produced. Brush disposal or appropriated funds would be collected from salvage sale to dispose of the landings and pay smoke management fees. Oregon Department of Forestry Smoke Management will be the guidance for prescribed burning.

This alternative would do the most to ensure that future high intensity fires are reduced. The fire area would be salvaged and total future fuel loadings per acre would be reduced to 20 tons or less per acre. This would allow for future management options (such as prescribed fire) in the ponderosa pine plant association group. Furthermore, this will mimic historical conditions where pockets of mortality and fuels occurred thus, were subsequently reduced through frequent fire return (Agee 1993).

### **Alternative 3**

Alternative 3 is similar to the no action alternative.

Under Alternative 3 approximately 640 acres would be reforested and fenced in Unit 1 to accelerate the development of hiding and thermal cover in the deer winter range at the least cost to government. Outside of felling trees to deter any damage to the fenced area, all remaining trees would be left onsite to fall through natural succession.

This alternative offers nothing to protect the investment of reforestation. The increased snag retention will eventually increase the fuel loading. A wildfire through the area would be expected to produce intense heat closer to the soil surface due to the fuel type and arrangement killing any regeneration that would be occurring. This would adversely affect the acceleration of thermal and hiding cover, and reduce suppression options.

### **Cumulative Effects**

The action alternatives include fuel treatments that would reduce or dispose of residues created by salvaging of dead trees. A total of 3,810 acres burned in the 18 Fire, approximately 2,009 acres would be salvaged under the Alternative 2 in combination with the Decision Memo for the 18 Fire Roadside Salvage Categorical Exclusion. A total of 1,801 acres would not be salvaged to meet wildlife objectives under all the alternatives.

Approximately 1,390 acres of the 1,801 acres were classified as non-stand replacement, meaning the stand burned at varying degrees resulting in limited mortality. Approximately 411 acres of the 1,801 acres were classified as stand-replacing meaning, 5 percent or less of the trees survived. Over the next 10 to 20 years it's estimated that the 1,390 acres would average 21.8 tons per acre of fuel (Plot Sampling Data, 2003).

The fire hazard including resistance-to-control and fire behavior would remain high when large fuels exceed about 25 to 30 tons per acre in combination with small woody fuels of 5 tons per acre or less (Brown 2003).

Over the next 10 to 20 years it's estimated that the 411 acres would average 50.3 tons per acre of fuel. Approximately 94 of the 411 acres are located in Units (1= 80ac, 4 = 8ac, 8 = 6ac), which under the action Alternative 2 would be harvested so, these heavy concentrations would be located around rock out-crops and other natural features to serve as wildlife leave areas. The remaining 311 acres of stand-replacement is located around Bessie Butte or within the fire perimeter, therefore, keeping the increase in fuel loading to limited areas. Excessive soil heating is likely at approximately 40 tons per acre and higher. Thus, generally high to extreme fire hazard potential exists when downed coarse woody debris (CWD) exceeds 30 to

40 tons per acre (Brown 2003). Adequate fuel treatments that dispose of the residues created by the future management activities would mitigate any cumulative effects. Overall, there would be a downward trend in the amount of fuel loading and fire risk if the action alternative is implemented.

The 18 Fire area is surrounded by the Kelsey and Fuzzy Project areas. On going fuel treatments with the Fuzzy Project area, located on the east side of the 18 Fire, have focused on thinning and under burning. The effect of these treatments on the behavior of the 18 Fire was responsible for stopping the spread of the fire east of the 1810 Road. The fire was spreading southeast when it burned to the edge of a ponderosa pine stand that had been thinned and under burned the previous year. This caused the fire to turn away from the Fuzzy Project area.

The Kelsey EA's preferred alternative would treat many of the stands on the west side of the 18 Fire with an emphasis on thinning and under burning to protect the urban interface of Bend and maintain and restore ponderosa pine stands. On-going and proposed fuels treatments would reduce the probability of a stand replacement wildfire within and adjacent to the 18 Fire and the city of Bend.

### **Reburn Potential**

There is no universally accepted view on the potential for an area to burn again after a major fire similar to the 18 Fire. Some references cite that the occurrence of a high intensity fire does not increase the potential for a reburn (Beschta, et al 1995), while others (Brown et al, 2003) suggest that site-specific conditions may play a role for an area to burn again after a large intense fire.

In order to assess a portion of this question an assumption could be made that the probability of ignition remains unchanged in the post-fire environment; that is human activity continues as it has historically, and natural ignitions (lightning) also remain unchanged. This would result in the fire occurrence rate remaining constant and at historic levels for the future. Would there be any change in the potential for the area to burn based on fuel and vegetation characteristics under the alternatives proposed here? There may be effects of the alternatives that affect the potential spread rate, intensity, and resistance to control should a wildfire be ignited. Fast moving fires may involve more area before sufficient suppression forces are able to respond and contain the spread. Higher intensity fires and fires burning in heavy fuels may require additional resources or a different type of suppression equipment in order to contain the spread.

In effect the question might be are there site specific effects of the alternatives that would potentially result in a wildfire involving more area based on potential fire behavior, and resistance to control of suppression resources.

## Forest Vegetation and Timber Management \_\_\_\_\_

### Forest Vegetation and Timber Management Introduction

This section provides an overview of the vegetative component within the 18 Fire Recovery Project. Management direction, historical activities, potential natural vegetation, structural stages of stands, the expected vegetative response following the fire and the tools used to conduct the analysis of fuels and vegetative response. The alternatives and effects of alternatives to the area affected by the 18 Fire follows the existing condition report.

### Forest Vegetation and Timber Management Existing Condition

#### Forest Types Affected by the Fire Management Direction

The Deschutes National Forest Management Plan gives management direction for the 18 Fire area. There are three Management Areas for the fire area: Deer Habitat (MA7); General Forest (MA8); and Scenic Views (MA9). These management emphasis areas do not preclude managing for other resource objectives, which are common throughout forest lands yet they do give direction for the desired outputs and conditions for areas through the forest.

**Table 3-22. LRMP Allocation**

Management Area	Acres	Percent Area
MA 7 Deer Habitat	2,887	76 %
MA 8 General Forest	901	24%
MA 9 Scenic Views	22	Less than 1%

#### Desired Future Condition

##### Deer Winter Range

The desired future condition of the 18 Fire area within Deer Winter Range are ponderosa pine stands providing 30 percent thermal cover and 10 percent hiding cover spread throughout the area adjacent to forage. Variable spacing providing openings for forage, closed stands for cover and large diameter trees for various wildlife.

##### General Forest

The desired future condition of the 18 Fire area within General Forest is to emphasize timber production while providing for other resource values.

##### History of the Area

The 18 Fire area was stocked with young stands of ponderosa pine following harvest by private ownership in the 1920s. Scattered overstory trees remained as a seed source. This area was later acquired by the Forest Service in the 1950s. Heavy stocking in the area developed during these past decades. Following acquisition by the Forest Service, fire suppression in the area allowed for the development of a mature brush layer, low branching on trees, and a thick surface of pine needles and brush on the ground.



### Past Activities

Prior to the 18 Fire stand ages tended to be 60 to 70 years old with scattered remnant trees 110 to 130 years old. These developed as dense stands and fires were suppressed through the area. A few fires, such as the Bessie Butte (1996), Horse Butte, and Evans West fires were stand replacement events. Some of the stands in the 18 Fire area had received intermediate treatments involving precommercial thinning of small diameter trees of the stands to promote growth and yield to meet management direction and reduce loss to insect attacks. Most of the thinning occurred in the 1970s and 1980s and was of material smaller than six inches in diameter. This material was small enough and green enough to decompose within a couple decades. There is no record of fuels treatments. Some planting had occurred in a few areas in the vicinity of Bessie Butte. A small portion of this was done following the Bessie Butte Fire and the subsequent salvage of that fire area. This included portions of Bessie Butte and the flat area to the south of the butte. Other reforestation followed a 1968 harvest to the south of Bessie Butte, which removed trees in all size groups and was followed by reforestation using mechanical scarification and hand planting of ponderosa pine. Little of this stand remains since it did not survive the foraging from deer and elk. Past harvests cover less than 200 acres southwest of the Bessie Butte area. There has been a commercial thin of 25 acres in the southeast portion of the fire area. There was a small area that had shelterwood treatments on the western middle portion of the fire area. This area removed the overstory following stand establishment in the late 1970s.

### Fire Activities

Of the 18 Fire's 3,810 acres that burned, an estimated 2,420 acres had stand replacement mortality. This area has little stand survival with high scorching and consumption of the tree crowns. Many different conditions were in place for this to happen including the brush size, density and species, lower crown levels and needle accumulations. Dryness, wind, and low humidity allowed this fire to progress and volatilize the aerial retardant applications on other than the flanks of the fire. Evening humidity, temperatures and a drop in the wind allowed back burns and burn outs (burning of fuels between fire line and the active fire) to control the front of the fire. Areas where some tree survival occurred was the result of adjacent smaller trees and the crowns were open, less fire intensity along the flanks, and where ground fire from burning out underburned islands along the line was able to burn at a slower less intense rate. The southern quarter of the fire area had low intensity fire and was mostly an underburn (burning of the understory and surface fuels) with a few areas of higher intensity with crown consumption in small areas ten acres and less. Luna Butte had some crown fire activity due to its aspect and slope (slope facilitates heat transfer and thus crown fires)

Following the fire, rehabilitation of the line was done with slash and water bars being placed in control lines and some seeding of native fescue on top of Bessie Butte in a safety area (larger area where fuels are removed) constructed during fire suppression efforts. Salvage logging along the 1810 and 9711 roads was done to reduce the hazard to publics by removing dead trees leaning towards the roads.

**Table 3-23. Fire Intensity**

Post Fire Stand status	Estimated Acres	Percent Area
Stand Replacement	2420	63%
Mixed Lethal	1390	37%

### Potential Natural Vegetation

Potential natural vegetation is the vegetation that would be expected to be established on a given site in the absence of disturbance. Field mapping of the potential natural vegetation to the plant association level was done according to Volland (1985) for the stand exams within the area. Plant associations are then grouped by climax species, site potential, temperature and moisture similarities

into Plant Association Groups. Plant association groups are used to identify sustainable levels of vegetation management which impacts the amount of vegetation and biomass, which is sustainable in an area and further assists in identifying the fire regime of an area.

The 18 Fire is identified as a Plant Association Group ponderosa pine dry. This plant association group has developed historically as a fire-climax stand structure. This develops from frequent low intensity fire return intervals less than 35 years (Agee 1993). With frequent fires the dominant brush species (bitterbrush, ceanothus) historically did not develop into continuous high brush stands. Frequent fires retard the development of bitterbrush since in this area little sprouting following fire occurs seed in the soil seed bank following multiple fires is not replaced (Brown & Smith eds. 2000). Frequent fires thus kept brush populations at low to sparse levels. Ceanothus is found mostly on the north side of the buttes in this area. Following fire ceanothus will show increase in population levels from seed scarified, receptive seed bed and root shoots. Following subsequent fires ceanothus shows a reduction in population for the same reasons found with bitterbrush (Brown & Smith 2000). Both these brush species rely on seed caching from rodents to survive well following fires. Following fires the largest increasers are rabbitbrush, grasses and forbs (Franklin 1973, Volland 1985).

The condition prior to the 18 Fire was outside the historic range of variability (Agee 1993, Franklin 1973). Continuous acreage of young single structure ponderosa pine was uncommon on the landscape since ponderosa pine stands tended to have small areas of mortality following any light fire and so small areas of regeneration or openings with mostly stands of larger diameter stems and little brush or fuels in the understory dominated the landscape (Arno 1995, Agee 1993, Agee 2002). Through evaluation of tree rings on trees, the 18 Fire area has not had fire through it for approximately 70 years or since the present stand was established, except for the Bessie Butte Fire. As documented in many places (Beschta 1995, Agee 1993, Franklin 1995, Arno 1995) these stands had developed structure and fuels outside the historic range of variability, burnt with mortality levels outside the historic range of fires and now have a pulse of snags and fuels outside the historic range (Agee 2002, Brown 2003). Historically in ponderosa pine types few stand replacing fires occurred though pockets of mortality would occur due to fire or insects. When stand replacement fires did occur the stand would be replaced, but scattered remnant trees would remain through the stand as seed sources thus allowing the reestablishment of ponderosa pine on the sites (Arno 1995). With the 18 Fire there is over 2,400 acres with high mortality.

### **Vegetative Response**

The natural vegetation response through the moderate and high intensity fire areas where high mortality occurred will be grasses and brush. In the high lethal area of the 18 Fire the vegetative response will depend largely on the seed bank remaining in the soil and the seed sources still alive and subsurface regenerative structures such as root crown buds, rhizomes, and bulbs. There are plenty of perennial forbs and grasses, which will quickly regenerate and occupy the site following the fire (Brown & Smith eds. 2000). Ceanothus has live root structures, which are plentiful on the north facing parts of Luna and Bessie buttes that will regenerate following the fire. As with other fires found in the area it is expected that initially grasses and forbs will be the first occupiers of the site. Grasses will be followed by some bitterbrush response where seed was cached by rodents. Rabbitbrush will seed in from adjacent areas possibly becoming second to the grasses and forbs as site occupiers (Volland 1985). Little natural reproduction of ponderosa pine is expected since the intensity of the fire killed the majority of trees in the middle of the fire covering a large expanse. Ponderosa pine has no regular periodicity of cone production and transient seed that is usually found on the surface of the duff was destroyed with the consumption of the duff layer (Brown & Smith eds. 2000). Seed fall may occur around the perimeter of the lethal fire area, but will not be carried far with low travel distances of ponderosa pine seed (Silvics Handbook of North American Trees). Some

regeneration will come in, but as with other fires in the area less than an average of 5 Trees Per Acre (TPA) can be expected within the next twenty years, even around the perimeter.

Within areas of mixed lethal fire, revegetation will depend on openness of the crowns and availability of seed. Ponderosa pine seed can not be expected, but seed crops may occur in the next few years which would allow establishment of seedlings where crown density is low for seedling establishment. This is true also for brush and grass species. Where the crown opens from tree mortality brush, grass, and forb revegetation from sub surface regenerative structures will occur and occupy the site soon following the fire (Volland 1985, Brown & Smith eds. 2000).

Fuels remaining will influence stand development. The plant associations within the fire area developed with fire and fire can be expected to return to the area multiple times within the next century. If the area is to be managed, which replicates natural development then fire should be reintroduced with in the next 5 decades. Any stand which develops in the next five decades will likely experience another stand replacing event if fire occurs when the fuels levels are higher than 25 tons per acre. The ability to reintroduce and manage fire in the area will require fuels levels to be around 15 tons per acre. These levels are considered sustainable in this plant association group (Agee 1995, Brown 2003).

Reforestation through natural regeneration in these plant association groups can not be expected to occur within the next two decades. Reforestation will require planting of ponderosa pine seedlings prior to heavy competing vegetation establishment and with protection from browse by deer. Deer browse and competing vegetation are primary causes for failed plantations and seedling mortality in the area (Bessie Butte 1968, Bessie Butte 1996). There are many methods and systems developed and studied for establishing seedlings (Cleary et al). This is to establish seedlings using the largest and healthiest trees as the best start. Protecting trees from browse damage is important to tree survival since each season the trees put most of their energy into the buds and growth, multiple years of losing this growth will cause tree mortality. Competing vegetation reduces the growth of seedlings though usually does not cause direct demise. Competing vegetation and subsequent growth loss leaves a seedling in a position to be browsed for more years thus more potential for mortality. To establish a stand of trees which meets the management goals it is essential to plant healthy stock well, control browse damage and reduce growth loss by controlling competing vegetation.

### **Insects and disease**

Diseases and insects within the 18 Fire area impacting trees include dwarf mistletoe, mountain pine beetles, western pine beetles and turpentine beetles. The insects were all observed in the fire area following the fire. Western pine beetles affect mostly the larger fire affected trees and the mountain pine beetles affect smaller diameter trees and lodgepole pine. Turpentine beetle, which rarely cause mortality are found at the base of trees under the bark. Mortality from mountain pine beetle and western pine beetle occurs when trees cannot pitch out enough to remove them and they get established, lay egg galleries and inoculate the sapwood with stain fungus. Dwarf mistletoe occurs in ponderosa pine and lodgepole pine. The ponderosa pine shows heavy infection of mistletoe in stands adjacent to and on the buttes.

Mortality from fires in ponderosa pine is directly correlated with the amount of crown scorch a tree receives (Lynch 1959). In years following a fire there is an attraction of insects, which impact trees that have experienced fire. These insects include wood borers and bark beetles. Mortality in the years after a fire from successful insect attacks on remaining live ponderosa pine is also correlated with crown scorch. The more of a tree's crown which has been killed will have increased chances of insect attack and mortality (Flanagan 2001). Within the moderate and high severity fire areas an average of

3 trees per acre were seen as still containing some green needle. These trees tend to be larger diameter (greater than 16 inches dbh) and have generally less than 10 percent live crown remaining. Studies have shown that trees with more than 40 percent crown scorch from wildfires have a high rate of mortality due to bark beetle infestation (Weatherby 1994). This or more mortality can be expected in the low fire severity areas of the 18 Fire and the remaining live trees within the moderate and high fire intensity area.

Dwarf mistletoe will remain in the stands adjacent to the buttes, but may have been decreased due to fire mortality of the understory trees, which had higher infection rates than larger diameter trees. Mortality from mistletoe and fire stress combined can be expected for the next decade. Reduction of diseased stands is not proposed and the location of these stands would not be practical for management objectives due to the locations and importance of the remaining trees on Luna and Bessie Buttes.

### **Data and Analysis of Stand Treatments**

The vegetative analysis of the 18 Fire estimates of stand conditions prior to the fire and following the fire were done using stand exam data from 1993, 1995 and 1997. This data was entered into the FVS provided by the forest service. The documentation, description, instructions, and software for this program are available on the internet at [www.fs.fed.us/fmssc/fvs](http://www.fs.fed.us/fmssc/fvs). The FVS, at its most basic level is a family of forest growth simulation models. Since its initial development in 1973, it has become a system of tightly linked analytical tools. These tools are based upon a growing body of scientific knowledge gleaned from decades of natural resources research is based on the Prognosis growth and yield model. Fire and Fuels Extension (FFE) to FVS simulates fuel dynamics and potential fire behavior over time and can be used to simulate and predict snag fall down rates, fuel loadings and parameters affecting fire behavior and fuels accumulation and decay. This model was used to compare alternative actions in the 18 Fire area including salvaging timber, treating fuels, reforestation by planting, and stand development over time. The model is based on studies measuring stand characteristics throughout the northwest and has specific adaptations for the central Oregon area.

Snag fall down rates and decomposition are based on ponderosa pine data collected on the eastern side of the Cascades (Marcot unpublished data). The decay and fall down rates of snags and fuels within the model vary depending on species, size class and decay status of trees. Snags as they are simulated breaking and falling are added to the surface fuels where further decay modeling happens. This compares better than most other models which are based on west cascade Douglas-fir snag information (Mellen & Agner). For snag retention and fall down rates the program models are based on data for different species and size classes. One variable not modeled but which affects fall down rates is micro topographic position of the snag location (Everett 1999). This is an important factor which affects the lag time between the last snags standing and the earliest recruitment of snags from the next stand. Out year predictions are not predictions for individual snags, but for a stand and its overall impacts. The fall down rates and subsequent fuels loadings are important to model to compare effects of removing fuels and not removing fuels in future stand management.

The FVS program models growth and stand characteristics such as stand height, crown closure and average diameter. This assists comparing alternatives and their effects in future stand development. Using the model levels of stocking, habitat conditions and possible management possibilities are developed. The FVS model uses stand density index (SDI) to estimate mortality rates in stands. The growth model in FVS depends on plant association groups to project growth and stocking limitations and has the ability to increase or decrease stand growth if growth data is included.

The stand exam data available for the 18 Fire restoration was covered many of the units proposed for the 18 Fire Recovery Project. The stands within the 18 Fire were uniform stands established following logging in the 1920s and 1930s. The exam data was analyzed together and used as an average for the treatments within the 18 Fire.

The stand exam data entered into FVS for the 18 fire area did not include periodic growth data. Therefore projections are made from average plant association productivity. The program probably is close to the productivity of the 18 Fire area since it is on ecotones, which should be average for the plant associations.

The estimates made using FVS for the 18 Fire area assumed natural regeneration of ponderosa pine to occur through most of the stands at a rate of 5 trees per acre at the start of the modeling. This rate is probably high since complete consumption of the duff layer and crowns in high intensity areas and crown mortality in moderate intensity areas eliminated any possible seed sources for 2003.

Simulation of trees left and fuels treatments used the salvage keyword in FVS. This does not allow the leaving of trees per acre but a percentage of the trees. After identifying the number of snags to be left for each stand, numerous runs were made to estimate the percentage which came close to the leave trees desired. This for most of the stands was found to be salvaging 90 percent of the trees 12 to 20 inches. This level of salvage modeling left an average tree numbers which were desired for snag retention (18 Fire Wildlife Report, Lowrie). This does not include the 5 percent of units, which will receive no treatment. For the tree growth simulation and snag simulation to 100 years following the fire no intermediate treatments were simulated. Artificial and natural regeneration scenarios were simulated though no intermediate treatments or fires were simulated in the intervening years. This then allows the comparison of snag recruitment and stand condition in the future to be compared without the variables becoming exponential.

### **Fuels and Snags**

Fuels and Snag levels following the 18 Fire are at higher than naturally found. This pulse of snags and fuels occurs in all levels of fire intensity; this is due to not the size of the 18 Fire, but to the level of mortality over the area. Historical fires in ponderosa pine types were large, but had low levels of mortality over the area (Arno 1995, Agee 1995). Fuels loadings from fire and insect attacks were pulses in small concentrations usually not more than a few acres.

The snag and fuels levels which can be expected to accumulate in the 18 Fire area were modeled using FVS with the FFE. The data for the analysis were from 1995 and 1998 stand exams in the fire area. Modeling shows a fall down rate within the first two decades of 100 percent of the snags less than 12 inches dbh, 85 percent of the snags between 12 and 20 inches dbh and 50 percent of the snags greater than 20 inches dbh. Modeling snags 40 years following the fire shows 1 percent of the snags in the 12 to 20 inches dbh group being left and 13 percent of the snags greater than 20 inches dbh left. Some of the snags modeled in the larger size groups represent trees, which the model did not originally kill in the fire simulation, but were shown as mortality one or two decades following the fire. This can be expected as large trees within the high mortality and high crown scorch areas are stressed from fire impacts and will be susceptible to the increased bark beetle populations and will not be as fit to pitchout attacking insects (Flanagan 2001). Modeling snags left following a salvage of the area shows by leaving the largest snags, leaving the few live trees and leaving a few per acre the numbers of snags present after 40 years is about the same. This model shows leaving some of the largest snags are important to longevity of snag retention in the area.

Surface fuels were modeled following the fire. With no treatment these fuels levels were highest at thirty to forty years following the fire. This is to be expected as larger snags fall and those that have fallen deteriorate at a slower rate than accumulation. The small diameter fuels culminate at twenty to thirty years following the fire, but still are high enough (above 5 tons per acre) to be a suppression problem following that time (Brown 2003). The forty year fuels in untreated stands and alternatives averaged twenty and were a maximum of thirty tons per acre. This level is considered a high resistance to control for fire suppression and too high to introduce fire into a stand without high mortality (Brown 2003, Brown & Smith eds. 2001). Modeling the fuels following a salvage show the fuel levels averaging 6.7 tons per acre and a maximum of 18.6 tons per acre. This level of fuels is considered within the optimal (5 to 20 tons/ acre) amount in warm dry forest types to provide acceptable risk of fire hazard and fire severity, while providing desirable quantities for soil productivity, soil protection, and wildlife needs (Brown 2003). With these levels of fuels prescribed fire could be used without high mortality to trees.

### Green Trees and Snag Recruitment

Modeling the growth of the stands, which grow into the moderate and high intensity fire areas where greater than 95 percent mortality of the overstory trees occurs was conducted with FVS modeling the crown canopy closure and stand diameters. Following reforestation large diameter trees greater than 16 inches dbh occurred after eight decades of growth. The highest numbers of trees in the large size group were in the simulation of planting at 300 trees per acre (with an estimated 65 percent survival rate), though as a percentage there were more trees in this group with 50 TPA planted.

Modeling stand characteristics for different planting levels crown closure modeled shows 6 percent crown closure in 40 years where 50 TPA were planted, 16 percent where 200 TPA were planted and 21 percent where 300 TPA were planted. Thermal cover for wildlife in the dry ponderosa pine types is considered adequate when it is 30 percent. The stands when modeled out further reached 30 percent crown closure only on the areas where 200 or 300 TPA were planted. In the areas where planting was at 300 TPA the 30 percent crown closure occurred in 50 to 70 years. This 30 percent crown closure was reached in 70 to 90 years where 200 TPA were planted. In the areas modeled at 100 years and planted at 50 TPA the crown closure did not exceed 20 percent and in the areas not planted did not exceed 10 percent.

Based on modeling stand diameters of widely spaced trees, snag recruitment trees occurred at approximately 70 years to reach a diameter of 16 inches dbh and in more dense stands took longer than 70 years. Modeling shows a bell shaped curve of the reforested stand diameter through time so once trees start entering the larger diameter class there is a constant influx for the next four decades which allows the recruitment of trees for wildlife species requiring larger diameter trees and large diameter snags. This allows a long-term consistent supply of snags through many decades.

**Table 3-24. Forty Year Stand Structure**

40 Year Stand Structure				
Planting tpa	Crown Cover %	Stand avg. Height	Trees/ acre <16" dbh	Average dbh < 16"
0	2.33	41.03	3.63	8.09
50	5.88	27.09	33.02	6.13
200	15.65	24.83	144.05	5.62
300	20.70	24.72	184.17	5.48

Modeling from FVS using 65% survival of reforestation efforts and modeling of no animal damage.

### Passive versus Active Management (Recent Discussions)

Discussions of management practices in the public domain have a long history surrounding the Forest Service. Recently opinions and comments from scientists have been published and helped shape public opinion. These include comments by Beschta, Franklin, Agee and a thesis by Sexton. These comments are important in the setting for the Forest Service and help shape what is done. However it is difficult to use these in making prescriptive decisions since managers are charged with using current science which these are not. The Beschta recommendations are discussed in Appendix G while a few others are discussed here.

#### *Jerry Franklin's Comments on the Biscuit Fire DEIS*

Jerry Franklin is professor of Ecosystem analysis, College of Forest Resources from the University of Washington in Seattle. Professor Franklin was part of the Forest Ecosystem Management Assessment Team (FEMAT) in 1993 that ultimately was used in the drafting of the Northwest Forest Plan Record of Decision in 1994. Professor Franklin provided comments to the Biscuit Fire EIS on the Siskiyou and Rogue River National Forests.

The Biscuit Fire, located in southern Oregon and northern California, began on July 13, 2002 and reached 499,965 acres. Estimated to be one of Oregon's largest in recorded history, the Biscuit Fire encompassed most of the Kalmiopsis Wilderness. The boundary of the Biscuit Fire stretches from 10 miles east of the coastal community of Brookings, Oregon; south into northern California; east to the Illinois Valley; and north to within a few miles of the Rogue River.

The 18 Fire DEIS is a science-based analysis that accounts for this variability and (possibly) the best ecological path chosen for the Biscuit Fire may not be the best for the 18 Fire. To let natural processes proceed may not be as appropriate as acknowledged by Franklin. Agee recognized this point in his article in "Conservation Biology I Practice" Winter 2002 that passive management on the Eastside forest LSRs over a century had the potential to lose over half of the reserves in that time frame with no old growth characteristics left.

Franklin also acknowledges eastside and westside systems may function differently. In the fall edition of "Issues in Science and Technology Online", Agee and Franklin coauthored an article that quotes: "Uncharacteristic stand-replacement fires in dry forests can produce uncharacteristic levels of post-fire fuels, including standing dead and down trees. Removing portions of that particular biological legacy may be appropriate as part of an intelligent ecological restoration program, and not simply as salvage." They recommend that any management for fuels and ecosystems should be science based, which this analysis is. For example the 18 Fire salvage prescription would leave enough standing dead trees to provide future ground cover at 3.2 percent level (see Chapter 2, Table 2.3). This is above the design level of 1.4 percent for the 18 Fire salvage units (Chapter 2, page 27).

Two poignant points made in Agee's comments on passive management are as follows, "The hard lesson that we should take away from the last decade of fire management in drier forests, particularly in the North American West, is that a choice to do nothing is a choice of action, not always one with a desirable outcome." He also recommends, "In order of priority treatment should focus on surface fuel, ladder fuel and then crown fuel." (Agee 2002)

*Timothy Ogden Sexton's Masters Thesis "Effects of Post-wildfire Management Activities on Vegetation, Composition, Diversity, Biomass, and Growth and Survival of Pinus ponderosa and Purshia tridentata"*

Mr. Sexton, in pursuit of his Master of Science in Rangeland Resources for Oregon State University, presented this thesis in 1998 for a partial fulfillment of requirements. His conclusion is that salvage logging or active management on the post-fire landscape, retards the re-establishment and early growth of ponderosa pine (*Pinus ponderosa*) and bitterbrush (*Purshia tridentata*) as studied for the 1992 Lone Pine Wildfire on the Winema National Forest.

A follow up report was completed five years later compiled by Sarah Malaby (forest Botanist for the Fremont and Winema National Forests) on December 2002. This report summarizes data collected in 1999 in permanent plots established in the Lone Pine Fire study area and compares the 1999 results to prior years' results (Sexton, 1998). In Sexton's thesis, only tree height in 1994 was statistically greater in unplanted control plots compared to unplanted salvage plots. However, this had a p-value of 0.2 which does not provide enough evidence to reject the null hypothesis (Triola 1997) and should not be considered statistically significant. In addition, this data was preliminary because it only included 1 to 2 seasons of regrowth. Continued research on these same plots 6 to 7 years after the salvage show no statistical difference between control plots or treatment plots regardless of planting (Malaby 2002). However, when natural and planted control plots were compared to natural and planted salvage plots, tree density, height, and diameter were significantly greater (p 0.01 for diameter, p 0.1 for density and height) in planted plots than in naturally regenerated plots. This supports the Forest Service assumption that revegetating salvaged units with 3 to 4 year old conifers would give these areas a "head-start" on evapotranspiration recovery.

The effect of proposed salvage operations on cover values would be twofold. The use of ground-based machinery would disturb established vegetation on implemented skid trails and landings, the extent of which would be approximately 13 to 16 percent of an activity area. At the same time, the felling and yarding of material would move organic woody branches and smaller boles to the ground. Effective cover values would not be expected to change significantly as a result of these two effects. Disturbance resulting from these operations would also not be expected to slow the continued growth of vegetation established on the site. Cover values of shrubs (*Purshia tridentata* = 25%) and biomass production (herbaceous species = 387 kg/ha) on salvaged areas in the Lone Pine fire years were not statistically different than un-salvaged controls and had additional cover provided by planted and naturally regenerated conifers (Malaby 2000). Based on information from these studies, effective cover values on acres proposed for treatment would be of sufficient levels to meet LRMP Standards and Guidelines for Soil quality (SL-6) within two years following implementation of activities. The survival and growth of seedlings in open ground on the eastslope of the cascades has been monitored for some time. The root/stem interface at the soil surface is known for high heats in direct sun on reflective soils. To improve growth and survival a common practice not conducted in Sextons plots is to microsite seedlings to partially shade the tree stems at the soil surface. The 18 Fire salvage units would leave 10 times the number of trees per acre for microsities compared to Sextons study area.



## Reforestation

Table 3-25. Natural Regeneration Potential

Plant Association Code	Plant Composition	Natural Regeneration Potential
CPS211	Ponderosa / bitterbrush/ fescue	Natural regeneration common under shelterwood but difficult to establish without overstory protection. Planting requires scarification of fescue.
CPS213	Ponderosa/ bitterbrush- manzanita/ needlegrass	Natural regeneration occurs with snag patches and within shrub influence. Soil scarification and brush control necessary to plant trees.
CPS217	Ponderosa/ bitterbrush- manzanita/ fescue	Generally natural regeneration is difficult to establish due to fescue competition. Site scarification necessary for planting.

(Volland 1985)

Reforestation on the ponderosa pine plant associations is directed to achieve management goals for the areas (Deschutes LRMP) and to follow NFMA and Regional Office direction (Goodman. 2002). Minimum stocking levels for ponderosa pine sites are directed to be 120 TPA of free to grow seedlings (Draft Stocking Levels. 1994, Oregon State Forest Practices Act 2003). Though the state direction does not effect national forest management they have been used as guidelines. The Deschutes LRMP directs optimum stocking levels to be based on maximum cubic foot volume production unless other resource objectives are identified and documented. The minimum stocking level will include mortality predicted at 20 percent over the length of the rotation (Deschutes LRMP 1990). As has been documented prior in this document the deforestation, which occurred by fire is outside the historical range of variability in that historically there were no large stand replacement fires in the ponderosa pine plant associations (Brown & Smith. 2000) and the stand replacement fires, which did occur left some ponderosa pine trees with in the stands to disseminate seed (Arno. 1995). The fire which went through this area removed tree canopies over a large area and left no tree seed sources. Ponderosa pine seed is transitory and does not remain viable long after its initial year. Transient seed is typically found on the surface of the duff and was thus consumed when the duff was volatilized. Transient seed left on the site will be low. This seed includes many of the annual grasses and forbs as well as the coniferous trees. Persistent seed on these sites is expected to be mostly ceanothus, bitterbrush, and manzanita (Schopmeyer 1948, Brown & Smith 2000, Volland 1985). Revegetation is also expected from plants which have reproductive tissue in the soil including which includes perennial forbs and grasses including sedges and fescue. Ceanothus will tend to sprout from surviving root crowns especially on the buttes and upper slopes of the fire area. The revegetation of these species will reduce the ability of ponderosa pine to reforest the site (Volland 1985). Grass and brush can be expected to dominate the site for more than four or five decades with out artificial regeneration of ponderosa pine from locally adapted seed. Local seed is used in reforestation following guidelines for seed transfer rules within seed zones. Seed will be from collections within the Bend/Fort Rock Ranger District and within the breeding zone.

Modeling of stand characteristics using the FVS has shown that planting of ponderosa pine seedlings at 300 trees per acre with 65 percent survival and minimum in growth of natural trees the stands

would have crown closure over 21 percent within 40 years and average stand diameters of 6 to 9 inches dbh. Planting of ponderosa pine at 200 trees per acre with 65 percent survival and minimum in-growth of natural trees the stands would have crown closure of within 40 years with average stand diameters of 6 to 9 inches dbh. Modeling 50 trees per acre with the same mortality rate would show 6 percent crown cover in 40 years.

Natural regeneration may occur on perimeters where there is a seed source or where a few surviving trees which may produce seed occur in the high lethal areas. After reviewing previous fires in the area including the Horse Butte and Bessie fires no natural regeneration has occurred within those fire areas. An estimate of five trees per acre/per decade is high for the area, but was used for areas along the fire perimeters and within mixed lethal fire area. In other areas of previous disturbance no trees are found where there is no seed source within a couple hundred feet. Jerry Franklin in his comment on the Biscuit Recovery EIS mentioned that “establishment of dense, uniform stands is completely inappropriate in the Late Successional Reserves and on any Plant Association Group identified as fire regime types I and II” (Franklin 2004). Reforestation at rates of 200 trees per acre will not be developing an intermediate tree component until the average stand diameter is more than 8 inches dbh (Cochran 1994) at this time the average crown closure would be 30 percent. In these ecosystems establishing a stand later is much more difficult and expected to fail than modifying the density of an established stand. If meeting management objectives requires trees growing on these dry sites then reforestation will be needed. Even spacing of trees in these habitats does not tend to occur when planting lower levels of trees due to mortality, browse damage and microsite conditions for tree growth. Data from adjacent plantations shows plots ranging from 50 to 300 trees per acre following planting of 350 trees per acre (Deppmeier personal communication 2004)

Reforestation in ponderosa pine plant associations in deer winter range typically needs protection from large game and small mammal damage to be effective. These damages occur soon after planting and the following decade depending on the weather patterns, and animal population dynamics. Protection from big herbivorous animals will include fencing or application of vexar tubing. Protection from rodents if they start causing mortality can be accomplished by trapping or using poisoned baits applied in active tunnels. Protection from these animals is compounded by slow growth due to competing vegetation for typically 5 years. Seedlings growing slowly due to competition from brush and grass take more years to grow large enough to not be impacted by animals. The more damage to seedlings the less chance of survival.

Reducing the impact of competing vegetation due to moisture stress, is critical in the first few years of seedling establishment and can be reduced by planting healthy seedlings, establishing trees immediately following disturbance and controlling the grasses, forbs and brush with mulch mats. Open ground planting in Central Oregon allows trees to be exposed to high surface temperatures around the root/stem interface. Ponderosa pine is one of few coniferous tree species that can successfully colonize drought-prone sites with high soil surface temperatures, but there is a threshold temperature at the seedling stem surface, which will result in the death of seedlings (Kolb & Robberecht 1996). Sexton (1998) in his thesis found after wildfire comparing salvaged areas and unsalvaged areas, in a two year study, growth loss in the salvaged area. The salvage areas had reductions in overstory shade with only 4 trees per acre left. This reduction in overstory shade will naturally increase temperatures at the soil level. This phenomenon can decrease survival and growth of planted and natural regenerated seedlings (Cleary 1978, Kolb & Robberecht, 1996 Sexton, 1998). Further study of Sextons plots (unpublished data 2000) found that after five years the differences in tree growth were limited to the height of planted trees. The assumption is that microsite shading from fallen snags had more effect at shading than standing snags. Reducing soil temperatures impacting seedlings can be reduced through micro site planting of seedlings in the shade of remaining logs,

snags, stumps or other objects. All of these treatments can be used with each other to quickly establish a stand of fire adapted conifers on dry sites where otherwise a stocked stand will not be established within the next few decades.

Reforestation within the 18 Fire area is planned to meet the needs of wildlife and ecosystem needs and also meet LRMP requirements outside of deer winter range allocation. In the ponderosa pine plant association group it is planned to plant ponderosa pine at a level that will produce 170 to 200 trees per acre free to grow after 5 years in areas to meet 30 percent cover areas and in General Forest. Within the salvage units in Deer Winter Range and outside the cover areas it is planned to plant ponderosa pine, which will develop future stands of 10 to 60 trees per acre.

### Historic Condition

Historic condition or reference condition as used here describes vegetative conditions prior to being notably influenced by direct and indirect affects of European settlement. Historic records, fire-scarred stumps, tree ages, and other documented studies were used to gather information to estimate historic conditions.

Under the Regional Forester's Eastside Forest Plan Amendment, #2, 1995, five types of sales are not subject to the interim ecosystem standard, this includes salvage sales, with incidental green volume, located outside currently mapped old growth. The 18 Fire is located outside mapped old growth and will not have any associated green trees removed. The Historic Range of Variability (HRV) was calculated for the 18 Fire because of its impact on two adjacent planning project areas. These are the Fuzzy and Kelsey planning project areas.

Use of historic conditions as a basis for comparison assumes vegetative and wildlife populations were viable and sustainable across the landscape. While such an approach and assumptions may not be perfect, this approach was chosen to approximate past conditions, to compare historic and present conditions, and to estimate the desired conditions that might reasonably be expected to maintain a sustainable, viable ecosystem.

The following is a brief description of structural stages used for analyzing HRV and comparing existing conditions with historic conditions

**Table 3-26. Structural Stage Description**

Structural Stage	Description
Stand Initiation	One canopy stratum (may be broken or continuous), on dominant cohort of seedlings or saplings. Grass, forbs or shrubs may be present with seral trees.
Understory Re-initiation	The overstory canopy is discontinuous. Two or more canopy layers are present. Overstory trees may be poles or of small or medium diameter. Understory trees are seedlings or poles.
Stem Exclusion: Open Canopy	One discontinuous canopy stratum. One cohort of tree stems excluding competition. Trees may be poles of small or medium diameter. Understory shrubs, grasses, or forbs may be present.
Stem Exclusion: Closed Canopy	Canopy layer is closed and continuous. One or more canopy strata may be present. Lower canopy strata, if present, is the same age as

Structural Stage	Description
	the upper stratum. Trees may be poles or small or medium diameter. Understory shrubs, grasses, or forbs may be present.
Multi-stratum without Large Trees	The overstory canopy is discontinuous. Two or more canopy layers are present. Large trees are uncommon in the overstory. Horizontal and vertical stand structure and tree sizes are diverse. The stand may be a mix of seedlings, saplings, poles, or small or medium diameter trees.
Multi-stratum with Large Trees	The overstory is broken or discontinuous. Two or more canopy layers are present. Medium and large sized trees dominate the overstory. Trees of all sizes may be present. Horizontal and vertical stand structure and tree sizes are diverse.
Single Stratum with Large Trees	The single dominant stratum consists of medium sized or large trees. One or more cohort of trees may be present. An understory may be absent or consist of sparse or clumpy seedlings or saplings. Grasses, forbs, or shrubs may be present.

**Table 3-27. Historic Range of Variability of Ponderosa Pine on the Bend/Fort Rock District**

Structural Stage	Historic Condition	Post fire Condition		Within HRV
		Acres	Percent	Yes / No
Stand Initiation	0-15%	2420	63%	No
Understory Re-initiation	10-30%	1390	37%	No
Stem Exclusion: Closed Canopy	0-20%			Yes
Multi Stratum without Large Trees	0-30%			Yes
Multi Stratum with Large Trees	10-35%			No
Single Stratum with Large Trees	20-55%			No

Historic condition was conducted on the Kelsey planning area and documentation of methodology can be found in the silviculturist report for that project (Silviculturist revised report for Kelsey planning area 2004). The basis for classification was the stand condition classified in the cadastral land survey conducted in the mid 1880s.

The post-fire condition was identified as stand initiation where high stand mortality occurred in moderate and high intensity fire areas. Where low intensity fire occurred in the south of the fire understory mortality was observed as high, holes in the continuous canopy are present yet there is an overstory present. There are no stands where large diameter trees are common in the low intensity fire area. This area was classified as understory re-initiation.

## Forest Vegetation Environmental Consequences

**Table 3-28. Comparison of Treatments**

Down Fuels Tons / Acre	Salvage Area			Non Salvage Area		
	0-6"	6-12"	>12"	0-6"	6-12"	>12"
Average Fuels tons/acre estimated @2045	3	6	3.5	3	10.5	7
<b>Future Percent Crown Cover @ 2045</b>	<b>Crown Cover %</b>					
unplanted area	2%					
Planted at 50 tpa	6%					
Planted at 200 tpa	16%					
Planted at 300 tpa	21%					

## Effects of Alternatives

### Alternative 1 (No Action)

#### Direct and Indirect Effects

This alternative will not accelerate recovery of cover and dispersal habitat for wildlife. Modeling stand within the moderate and high fire intensity areas shows no cover occurring within the next century. Cover in adjacent areas of low fire intensity may seed in from overstory trees and provide cover within the next forty years if a seed crop in the ponderosa pine occurs before the establishment of the grass and brush species. Adjacent sites where removal or opening of the crowns has not had ponderosa pine establish naturally in the past two decades.

This alternative will not develop a stand of trees in areas of moderate and high fire intensity within the foreseeable future. Current levels of snags will fall within the next four decades with little or no trees growing to replace them. This will develop into brush and grass dominated open area with high levels of fuels. The stands which burnt in low intensity fire will be thinned from fire mortality and insect attacks in the next decade. These areas will be the same as action alternatives and will provide long-term snags through the remaining trees as they die and add to the snag levels in the future.

In this area no naturally regenerated stands of dry ponderosa pine type have become established since lethal fires and it is not expected in this case either. The same effect can be expected following the 18 Fire. The current stands developed through reforestation with a few overstory trees for seed. It is not known what conditions allowed for successful establishment of these stands.

Alternative 1 will not reduce fuels loadings to allow future introduction of prescribed fire. Except for the fuels reduction due to roadside hazard tree removal there will not be any fuels reduction on the 18 Fire. Fuels loadings are expected to culminate in thirty to forty years when the surface fuels of brush and grass form continuous fine fuels to carry fire through the area. This will not allow the reintroduction of prescribed fire, maintenance of the stand present and natural processes until the fuels are consumed below a sustainable level (Brown 2003).

Alternative 1 will not generate any economic return to assist offsetting the costs restoration of the 18 Fire area. Except for the trees removed as roadside hazard this alternative will not generate economic return.

Alternative 1 would leave a have high levels of standing snags, and stocking of high mortality areas of the 18 Fire with brush and grasses. Little regeneration of conifer species would occur in these areas. There would be an increase in insect populations due to leaving dead trees.

Leaving high levels of dead trees where the 18 Fire caused high mortality will increase the fuels loading to an extreme level rating of resistance to control (Brown 2003). This increased level will continue for the next century unless interim fuels treatments are conducted. Downed wood will decay at slower rates due to being elevated by other pieces on the ground. This may also hinder big game travel through the area. Low levels of regeneration of ponderosa pine may occur and grow though susceptibility to fire will persist in the area through the next century. The lag time between the last large snag falling and the next snags recruited will be longer than in planted stands by at least 50 years and could take up to 100 years longer (Sessions. 2003. Everett. 1999). Fire will be able to carry through the area after 10 to 15 years at which time the ability to control a fire in the heavy fuels present will be very difficult and costly (Brown. 2003).

It is not expected that any intermediate management treatments will be conducted since there will not be a manageable stand. Thinning will not occur due to the lack of trees and where dense enough stands occur it would not be practical since there would be no way to protect the stands from wildfire when it returns.

This alternative will not provide thermal or long-term hiding cover for wintering deer herds.

### **Cumulative Effects**

Large diameter trees will not be available for snag recruitment for more than two centuries. Due to low numbers of trees per acre that survived the fire, trees available for snag recruitment will be for less than a century. The naturally established stands will be low stocked, which will not provide continuous on-site snag availability over the multiple centuries as occurs with in most of the other stocked stands in the area (Everret. 1999)

Fire suppression in the area will be mostly ineffective for any fire, which starts in annual dry conditions until it burns into managed fuels areas. Brush fields and associated species will dominate the site into the next century with only scattered trees becoming established under the brush.

Under this alternative it is not anticipated that habitat conditions of old growth or those with conditions for long-term structural components will develop until it is replaced with an early seral stand, which is resistant to fires after fuels are reduced. There are three ways fuels can be reduced: they can be removed, decay or burnt. Until one of these occurs developing stands for long-term management objective will not happen.

In the surrounding watershed into the foreseeable future treatment of stands with thinning, fuels treatments and timber sales will continue and will be conducted to meet management objectives. These treatments will be conducted in the near future with completion of treatments prescribed in the Fuzzy and Kelsey Environmental Assessments. Past fires have impacted 14,000 acres with in the vicinity (five mile radius) in the past quarter century. These fire areas have mostly had stand replacement fires and presently have variable stocking, many acres are not stocked and will not

provide for large diameter tree wildlife habitat any time soon. The 18 Fire in this alternative will add to the grass fields, which accumulates to 16 percent of the area. The stand replacement fire events can be expected to continue to be expected in the foreseeable future with increased hazard within the non-salvaged 18 Fire fires in the next three to six decades can be expected to be larger, harder to control and more intense with fuels loadings predicted to occur. Young stand conditions and open grass and brush can be expected to dominate and increase in the 18 Fire surrounding area.

## **Elements Common to Alternative 2 and Alternative 3**

### **Direct and Indirect Effects**

Alternative 2 and 3 will accelerate recovery of cover and dispersal habitat for wildlife. On areas planted for cover at 200 to 300 TPA will tend towards crown cover over 32 percent of the stand replacement fire area. Crown cover where this reforestation will occur will reach 30 percent cover in 60 to 90 years. Areas planted at 50 TPA will not qualify as cover for large game, but will provide tree structure for other wildlife over 50 percent of the stand replacement fire area. This will allow the stands to be open with an average of 33 TPA. This will not allow the recruitment of many snags per acre over a long time, but it will allow for some stand structure to develop and will move the stands to a multi-layered stand as regeneration eventually occurs.

Alternative 2 and 3 will tend towards developing a healthy stand, which will provide for future forest needs including large diameter trees for wildlife habitat and large snag recruitment. These alternatives, where reforestation occurs, will leave snags in leave areas, low intensity fire area, and scattered across the salvage units. Current levels of snags will fall within the next four decades these will be replaced in areas of reforestation at the 200 to 300 TPA reforestation areas within six to nine decades and will allow for long-term continuous snag recruitment (Brown & Smith eds. 2001). The lag time between current snags being gone and snags being recruited will typically be three decades. In areas where low reforestation occurs at 50 TPA large diameter trees will be present, but will not have enough numbers to recruit continuously as snags and keep stand structure. In areas which receive no reforestation, snags will fall within the next four decades with little or no trees growing to replace them. This will develop into brush and grass dominated open areas. The stands which burnt in low intensity fire will be thinned from fire mortality and insect attacks in the next decade. These areas will be the same as the No Action Alternative and will provide long-term snags through the remaining trees as they die and add to the snag levels in the future.

## **Alternative 2**

### **Direct and Indirect Effects**

Alternative 2 will develop fire adapted species stands through reforesting at variable levels with ponderosa pine seedlings over 80 percent of the moderate and high intensity fire area. Ponderosa pine is considered a highly adapted fire resistant species (Flanagan 2001). Fire can be reintroduced into young stands of ponderosa pine with low mortality where fuels have been reduced to levels below 15 tons per acre. This will be an opportunity over the 50 percent of the total fire area where salvage reduces the snags and subsequent fuels.

Alternative 2 will reduce fuels loadings to allow future introduction of prescribed fire. Within this alternative 50 percent of the total fire are will be salvaged and reduce the average fuels loadings, which are expected to culminate at levels below 15 tons per acre. This will allow the reintroduction of prescribed fire and future management options to mimic natural processes. This will also allow for less high levels of resistance to fire suppression when wildfires occur in the area. Fuels will be higher in areas not salvaged within the treatment units. Outside the units fuels will also be high where the units do not extend. Fuel levels in the stands where low intensity fire occurred will be highly variable and fire in these stands will be difficult to control in small patches. This will mimic historical

conditions where pockets of mortality and fuels occurred and were subsequently reduced through frequent fire return (Agee 1993). This will also provide habitat for species which require high levels of snags in proximity to green tree stands (Saab & others 2002). This will also open stand canopies in areas and the possibility of natural seeding following disturbance in small openings will mimic the development of the original ponderosa pine stands of Central Oregon (Arno 1995).

Alternative 2 direct effects would be moderate fire hazard through the treated areas in the next four to seven decades and then decrease through decay of the fuels. There would be moderate levels of fuels in the 1,390 acres of the 18 Fire area which receive no fuels treatments and 5 percent of the treatment units which are not salvaged. Fires will have little chance of surface spread for the first decade due to the lack of fine fuels accumulation (Brown, 2003).

In Alternative 2 the regenerated stands may need intermediate treatments depending on resource objectives. With active management and restoration of ponderosa pine stands in conjunction with fuels treatments management activities in the third and following decades can be expected (such as precommercial thinning and underburning). These treatments will be needed to meet other future objectives of the area. Thinning will be used to develop faster growing large trees at various densities. Along perimeters of the fire and units adjacent to mixed severity fire areas stocking levels may have favorable conditions for regeneration and thus may need stocking reduction, this is not anticipated. When the dominant trees in the stands average 12 inches dbh (40 to 50 years) prescribed fire should be used to manage fuels levels and mimic frequent low intensity fires. This may be conducted in conjunction with thinning some stands or following older thinning to varying densities to promote large diameter trees. Mortality to shrub layers can be expected to begin as crown closure rises to 30 percent (5th decade) this will assist in the use of prescribed fire and increase the hazard to wildfire. Over the landscape there will be various stand characteristics with areas, which have received no salvage treatment will mostly be brush and grass fields, various thinned areas, and areas which receive prescribed fire treatments and show various levels of mortality and growth differentiation (Brown, 1995). Jerry Franklin in his comments to the Biscuit Recovery EIS mentioned that “establishment of dense, uniform stands is completely inappropriate in the Late Successional Reserves and on any Plant Association Group identified as fire regime types I and II” (Franklin 2004). Reforestation at rates of 200 trees per acre is not considered dense since regenerated stands will not be developing an intermediate tree component until the average stand diameter is more than 8 inches dbh (Cochran 1994). Reforestation in this alternative reforests less than 50 percent of the area. Variability through the area at a landscape level will be high due to non-salvaged areas and areas of mixed lethal fire and variable planting densities below 100 trees per acre through the majority of the area reforested. Through the moderate and high fire intensity area it is not expected to have large uniformly stocked stands. Variability will occur with differing planting densities, variable planting survival, and untreated areas. Establishing trees soon after disturbance is not difficult or expensive and is more successful than waiting even a few years. Once brush and grasses are established it will be very difficult to establish trees, which are early seral, fire resistant, and long lived species.

Fire may be used at varying frequencies in the regenerated units of ponderosa pine plant associations, to meet fuels and wildlife objectives of developing ponderosa pine and fire dependent ecosystems. Wildfires which begin in the 18 Fire area will be suppressed. Fires which occur where fuels treatments or salvage did not occur will be very difficult to suppress and will need to be controlled from safer locations such as stands where fuels have been managed. These fires will be high mortality fires, which can cause stand replacement events, but in smaller areas than occurred in the 18 Fire of 2003. Wildfires which occur in ponderosa pine stands where salvage and fuels treatments have reduced fire hazard will be light fires which cause light mortality in areas, but do not have a high resistance to control. Jerry Franklin in comments to the Biscuit fire recovery made points that “one



might question the appropriateness of allowing natural recovery processes to proceed if stand-replacement fire behavior with the resulting high levels of fuels were not characteristic of the Late Successional Reserves” (Franklin 2004). As has been mentioned the ponderosa pine plant associations within the 18 Fire are not within the historical range of variability for fuel loading. Beschta in his recommendations (1995) used general guidelines for salvage crossing all ecosystems. The interior west in dry ponderosa pine types are not the same as west side ecosystems. To leave a percentage of the dead trees following a fire is not the same. Fuels loadings in ponderosa pine types are lower for numerous reasons and will retard restoration following future fires.

Sexton (1998) in his thesis found after wildfire comparing salvaged areas and unsalvaged areas, in a two year study, growth loss in the salvaged area. The salvage areas had reductions in overstory shade with only 4 trees per acre left. This reduction in overstory shade will naturally increase temperatures at the soil level. This phenomenon can decrease survival and growth of planted and natural regenerated seedlings (Cleary 1978, Kolb & Robberecht, 1996 Sexton, 1998). Further study of Sextons plots (unpublished data 2000) found that after five years the differences in tree growth were limited to the height of planted trees. The assumption is that microsite shading from fallen snags had more effect at shading than standing snags. Reducing soil temperatures impacting seedlings will be reduced through microsite planting of seedlings in the shade of remaining logs, stumps or other objects. This alternative will leave an estimated 40 trees per acre still standing following salvage.

### **Cumulative Effects**

The area where salvage and reforestation occur will provide continuous on-site snag availability over the multiple centuries as occurs with in most of the other stocked stands in the area (Everret. 1999).

Fire suppression in the area will be effective for any fire which starts in annual dry conditions as it burns in managed fuels areas. Treated stands will have prescribed fire introduced to manage fuels and reestablish natural processes.

Under this alternative it is anticipated that habitat conditions of old growth or those with conditions for long term structural components will develop as the treated stands will be seral stands where fires will be low intensity non lethal fires. There are three ways fuels can be reduced: they can be removed, decay or burnt. This alternative removes a major burden of the future fuels on the site, which allows management meeting desired objectives.

In the surrounding watershed into the foreseeable future treatment of stands with thinning, fuels treatments and timber sales will continue and will be conducted to meet management objectives. These treatments will be conducted in the near future with completion of treatments prescribed in the Fuzzy and Kelsey Environmental Assessments. The 18 Fire with past fires have impacted 14,000 acres within the vicinity (five mile radius) in the past quarter century. These fire areas have mostly been stand replacement fires and presently have variable stocking, many acres are not stocked and will not provide for large diameter tree wildlife habitat in the foreseeable future. The 18 Fire in this alternative will add to the stands growing towards open stocked condition. The stand replacement fire events can be expected to continue to occur in the foreseeable future with increased hazard within the non-salvaged areas. Within the treatment units of the 18 Fire, change in future fire behavior compared to the surrounding area can be expected. Fires in the next three to six decades can be expected to be easier and lighter to control with lighter fuels loadings predicted to occur. Young stand conditions can be expected to dominate and increase in the 18 Fire surrounding area.

### **Alternative 3**

#### **Direct and Indirect Effects**

Alternative 3 will develop fire adapted species stands, through reforestation at variable levels with ponderosa pine seedlings over 80 percent of the moderate and high intensity fire area. Ponderosa pine is considered a highly adapted fire resistant species (Flanagan 2001). Fire can be reintroduced into young stands of ponderosa pine with low mortality where fuels have been reduced to levels below 15 tons per acre. There will not be an opportunity over the fire area to accomplish this except for small areas where there were few trees prior to the fire. Fuels accumulation through time in this alternative will leave stands which were burnt with low, moderate, and high fire intensity at a high level of resistance to control with fuels levels averaging greater than 20 tons per acre for the next five decades. When fire returns to this stand in the next five decades loss of the stand and larger area covered than the original can be expected.

Alternative 3 will not reduce fuels loadings to allow future introduction of prescribed fire. Except for the fuels reduction due to roadside hazard tree removal there will not be any fuels reduction on the 18 Fire. Fuels loadings are expected to culminate in thirty to forty years when the surface fuels of brush and grass form continuous fine fuels to carry fire through the area. This includes the entire 18 Fire area where low, moderate, and high fire intensity occurred. This will not allow the reintroduction of prescribed fire, maintenance of the stand present and natural processes until the fuels are consumed below a sustainable level (Brown 2003).

The effects of not removing dead and down would be to have high level of standing snags, stocking of high mortality areas of the 18 Fire with brush and grasses. Little regeneration of conifer species would occur in these areas. Insect populations will increase due to leaving dead trees. Trees will stock the treated area of the fire (53 percent) with regeneration at variable spacing. Six hundred and forty acres will be encompassed by a fence, which will exclude deer and elk to provide protection to planted seedlings. The fenced area will allow the establishment and the development of seedlings and forage species without impacts from deer and elk the next two decades needed to establish the trees to a level above that impacted by deer and elk. The remaining area planted outside of the enclosure will have protection from browse provided by Vexar tubing.

Leaving high levels of dead trees where the 18 Fire caused high mortality will increase the fuels loading to an extreme level rating of resistance to control (Brown 2003). This increased level will continue for the next century unless interim fuels treatments are conducted. Downed wood will decay at slower rates due to being elevated by other pieces on the ground. This may also hinder big game travel through the area. The lag time between the last large snag falling and the next snags recruited will be the same as in Alternative 2 (Everett. 1999). Fire will be able to carry through the area after 10 to 15 years at which time the ability to control a fire in the heavy fuels present will be very difficult and costly (Brown. 2003).

Thinning will not occur due to the lack protection of the investment where stands occur it would not be practical since there would be no way to protect the stands from wildfire when it returns. It is not expected to reintroduce of prescribed fire and natural processes within the area with the high fuels levels for the next eight decades.

Alternative 3 will not generate some economic return to assist offsetting the costs of reforestation and restoration of the 18 Fire area. Except for the trees removed as roadside hazard this alternative will not generate economic return. This alternative will cost for reforestation and protection of the reforestation investment. The cost of reforestation has a high probability of being lost when fire returns to the stand in the 18 Fire area.

### Cumulative Effects

Large diameter trees will not be available for snag recruitment within about 70 years. The trees planted will be distributed in variable spacing. Stocking of trees will not occur on about 400 acres of the high lethal areas of the fire area not salvaged and not planted. The naturally established stands will have low stocking, which will not provide continuous on-site snag availability over the multiple centuries as occurs with in most of the other stocked stands in the area (Everret. 1999)

Fire suppression in the area will be mostly ineffective for any fire starting in annual dry conditions until it burns into managed fuels areas.

In the surrounding watershed into the foreseeable future treatment of stands with thinning, fuels treatments and timber sales will continue and will be conducted to meet management objectives. These treatments will be conducted in the near future with completion of treatments prescribed in the Fuzzy and Kelsey Environmental Assessments. Fires have impacted 14,000 acres within the vicinity (five mile radius) in the past quarter century. These fire areas have mostly had stand replacement fires and presently have variable stocking, many acres are not stocked and will not provide for large diameter tree wildlife habitat. The stand replacement fire events can be expected to continue in the foreseeable future with increased hazard within the non-salvaged 18 Fire area. Fires in the next three to six decades can be expected to be larger, harder to control and more intense with predicted fuel loadings. Young stand conditions can be expected to dominate and increase in the 18 Fire surrounding area except where effective fuels treatments are conducted.

## Insects and Decay

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### Insects and Decay Introduction

After a wildfire, there is typically a large increase in the populations of certain forest insects. Recently dead wood is colonized by a wide variety of wood boring insects and bark beetles that sometimes come from great distances to take advantage of a new and abundant food source. These insects introduce various fungi into the wood that they infest and the fungi begin the decay process that eventually leads to the recycling of the dead material and the release of nutrients back into the system. Many of the same insects, particularly the bark beetles, will also infest trees that are not yet dead but that have been sufficiently wounded by the fire to have their defense systems impaired. In subsequent years, typically two to four years after the fire, the populations of bark beetles may become quite large and may move beyond the perimeter of the fire and infest trees that did not sustain any damage in the original fire event.

### Management Direction

#### Guidelines for the assessment of tree survival

One of the many challenges that arise after a wildfire is making an assessment of the level of fire damage sustained by trees and judging how that damage relates to subsequent tree survival. These criteria give the decision-maker a baseline from which to judge the number of currently live trees that may soon die and to incorporate that information into long-term planning. In the case of the 18 Fire, all of these damaged trees will be left on site to serve as “green tree replacements” for existing snags once those snags fall over.

Due to controversy over the guidelines for the assessment of tree survival all damaged live trees will be left in the 18 Fire. Only dead trees, without green needles, would be harvested under Alternative 2.

### Insects and Decay Existing Condition

According to aerial detection survey maps, beetle populations have fluctuated greatly from one year to another in response to changes in climatic factors and the activities of other disturbance agents. For example, the drought period of the early to mid-1990s led to a substantial increase in populations of the mountain pine beetle and western pine beetle across the forest. Pandora moths, that defoliate ponderosa pine trees, also had the high point of their natural cycle during this drier period. The defoliation caused by the Pandora moth, when combined with the bark beetle level, contributed to increased levels of mortality within the ponderosa pine stands located in the Bend and Sunriver areas. At this time, bark beetles and Pandora moths have been functioning at endemic levels within the area surrounding the 18 Fire.

#### Significant insects related to the 18 Fire

Dead wood from burned and damaged trees provide a food source for beetles and other insects. Generally, insects quickly colonize freshly available burned trees and introduce various fungi into the wood that they infest, which begins the decay process that eventually leads to the recycling of the dead material and the release of nutrients back into the system. Insects utilize trees whose cambial tissue is intact to support developing larvae. Many of the same insects, particularly the bark beetles, will also infest trees that are not yet dead but that have been sufficiently wounded by the fire to have their defense systems impaired.

Of particular concern are wood boring insects. Wood borers are the primary reason for the sense of urgency that accompanies the salvage of fire-killed wood. All wood borers appear to have a strong association with fungi. Some of these associations may be passive (insects creating holes for fungi to enter the wood) while others are active (vectoring of a symbiotic fungus into the wood). These associated fungi are ones that produce stains and decays. It has been recognized that wood infested by woodborers decays considerably faster than uninfested wood.

The wood-boring insects are also the main reason that woodpecker populations increase dramatically in a forest after a wildfire occurs. Table 3-29 provides a detailed explanation of each insect species found within the 18 Fire project area, including suitable habitat and behavior within burned, damaged, and adjacent stands.

**Table 3-29. 18 Fire Insects by Species, Habitat, and Behavior**

<b>Significant Insects related to the 18Fire</b>		
<b>Species</b>	<b>Habitat</b>	<b>Behavior</b>
<b>Western pine beetle,</b> <i>Dendroctonus brevicomis</i>	Most commonly associated with large-diameter ponderosa pine. Primary mortality agent in trees that have lost more than half their crown from wildfire.	Will colonize trees that were killed in fire but still have their cambium intact to support developing beetle broods.  Ability to complete two generations in one year when food source is available.  In years 3 and 4 following a fire, may infest weakened pines that still retain live crown, fairly healthy trees outside fire perimeter or those left for green-tree replacement.
<b>Mountain pine beetle,</b> <i>Dendroctonus ponderosae</i>	Most commonly associated with second-growth ponderosa pine; commonly found on fire-damaged trees.	Will colonize damaged trees with cambial tissue intact, often responds shortly after a fire and may actually be attracted by odors emanating from burned trees.  Infested trees are easily recognized by the thumbnail-sized globs of pitch on the bole where each point of attack has occurred.
<b>Pine engraver,</b> <i>Ips pini</i>	Typically small diameter ponderosa pine.	Prefer colonizing damaged trees with cambial tissue to support the developing larvae.  May infest and kill the tops of larger trees, producing a spike top.  Trees within the fire perimeter with a significant level of fire damage are vulnerable to infestation.  Outbreaks have been known to occur in green stands shortly after the fire, but are usually confined to dense stands of pole-sized trees
<b>Red turpentine beetle,</b> <i>Dendroctonus valens</i>	Exclusively pine associations; usually confined to the basal portion of the boles of host.	The turpentine beetle is a good indicator that the host may be vulnerable for colonization by other more aggressive bark beetles.  The presence of pitch tubes resulting from turpentine beetle attack is an indicator that the host tree has been sufficiently wounded to produce pitch flow which serves as an attractant to these bark beetles.
<b>Coleoptera:</b>	Recently dead wood	Wood borers*; feed on the cambial tissue between the

Significant Insects related to the 18Fire		
Species	Habitat	Behavior
<p><i>Cerambycidae</i> (longhorned beetle)</p> <p><i>Coleoptera:</i> <i>Buprestidae</i> (flat-headed beetle)</p> <p><i>Hymenoptera: Siricidae</i> (woodwasps, horntails)</p>	<p>of varying species.</p>	<p>bark and the wood before entering the sapwood.</p> <p>The majority of wood borers usually infest trees within the first year after tree death.</p> <p>Roles as primary decomposers: strong association with fungi which produce stains and considerably faster rates of decay.</p>
<p>Note: * Wood-boring insects are the main reason that woodpecker populations increase dramatically in a forest after a wildfire occurs. The larvae of all wood borers are a highly prized food source for woodpeckers; their feeding can be a diagnostic tool for recognizing infested wood.</p>		

## Insects and Decay Environmental Consequences

### Desired Condition for insect populations

Many of the forest insects such as wood borers and bark beetles are important agents in nutrient cycling, in producing the disturbances that are critical to the diversity of the forest, and in providing a food source for other organisms. As such, it is important to achieve a balance that allows for these ecological processes to continue, but that still limits insect populations to less than epidemic levels. The populations of all of these insects are ultimately regulated by the amount of habitat (food source) that is available to them.

### Opportunities and objectives regarding insect populations

A disturbance such as a large wildfire temporarily disrupts the balance of insect populations in the forest and can lead to even greater imbalance without some directed effort at reducing current and potential insect habitat. Salvage harvest of recently dead trees can reduce insect habitat, and to some extent the insect populations themselves, by targeting those trees that are infested at the time of the harvest, and those that would likely be the next to be infested. However, it is important to note that we do not have the ability to entirely eliminate the possibility of insect outbreaks through salvage activity because timing is critical and large areas of potential bark beetle habitat would remain untreated in the 18 Fire Recovery Project area.

It is difficult to prove that salvage logging reduces bark beetle epidemics, and as such, no claim is made in the DEIS that says an outbreak will be averted by the proposed action. However, the opportunity does exist to dampen the effect of an outbreak that may occur by removing the type of material that harbors bark beetles and enables them to build larger populations. The trees to be harvested are ones that are dead (suitable for bark beetles). As far as we know, there is no evidence that removing dead or dying host material would increase bark beetle populations.

### Impacts Common to All Alternatives

The relationships between forest insects and the issues are described as follows:

The effect of forest insects on soils is indirect. Trees that are killed by bark beetles will eventually fall over and baring a future fire, be incorporated into the soil.

The relationship between forest insects and wildlife habitat is more direct. As key disturbance agents, the bark beetles create gaps in the forest by infesting and killing certain species, ages and sizes of trees that represent the most appropriate host for each beetle species. As such, insects are directly responsible for snag levels within the forest and for their temporal and spatial arrangement. Wildlife habitat can be affected by insects in either positive or negative ways, depending on the species under consideration. The conversion of live trees to dead trees may be positive for some species (such as woodpeckers), but extensive mortality can lead to loss of cover that might be important for other species such as big game.

Bark beetles and wood borers introduce fungi into the wood they colonize and thus influence the rate at which dead wood decays and becomes usable by other organisms, either as food or as habitat.

### **Effects Specific to Alternative 2**

Even though the manager has limited ability to avoid outbreak populations of bark beetles (the greatest forest insect-related concern that arises after a wildfire), there are some limited opportunities. The removal of infested trees and soon-to-be-infested host material helps to limit bark beetle populations to a certain degree. The greatest gains are with the largest infested trees; removal of small infested trees, or trees colonized two years previously have no relevance to reducing bark beetle populations from within the fire area.

The greater the salvage of currently infested or soon-to-be-infested trees, the greater will be the potential benefit to live surrounding stands. This alternative is the only alternative that would harvest any dead trees. Since, it is limited to only trees with no green needles the overall effect of salvage harvesting on beetle populations would be minor.

### **Cumulative Effects Common to All Alternatives**

In the short-term, wood-boring insects will colonize most of the trees killed in the fire. In the larval form, the wood borers will provide a nutritious food source for woodpeckers that congregate in the burned area. The colonized wood will begin to decompose quickly through the action of decay fungi brought in by the woodborers. In the medium to long-term, these insects will be replaced by others such as carpenter ants that utilize wood in a more advanced state of decay. In general, the significance of these wood-boring insects will be confined to recently dead wood and will decrease as time goes on.

The bark beetles in ponderosa pine will be important as tree mortality agents in the short to mid-term, causing the death at first of trees severely damaged by the fire and then subsequently infesting trees less severely damaged. Within three to four years small infestations may develop in stands outside the perimeter of the 18 Fire if weather conditions favor the buildup of these insect populations within the fire-damaged trees. Larger trees in surrounding stands may be infested and killed by bark beetles from the 18 Fire; although the level of this mortality would be extremely difficult to predict due to the many environmental factors that influence population dynamics and tree mortality.

## Recreation Resources

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### Recreation Resources Introduction

Recreation in the 18 Fire Recovery Project area consists of dispersed recreation (activities like hunting, dispersed camping, hiking, and driving for pleasure due to the proximity to Bend). The area of most concentrated recreation use is in the vicinity of Bessie Butte trail. The types of vegetation management activities will have little effect on the type of recreation use this area receives. Change in road status (closure), will have little effect on dispersed recreational activities because it will only limit access within the fire area and reduce vehicle travel in the deer winter range. There will still be open road access to the Bessie Butte trail.

### Recreation Resources Existing Condition

As a whole, people use federal lands and roads to access areas and sites that will provide some form of leisure opportunities or recreation. In general, higher standard roads would access sites which lead to more developed recreation sites, such as campgrounds and resorts. Access to primitive areas, such as Wilderness, is normally through trailheads, accessed by Highway Safety Act roads. Lower standard roads typically lead to more dispersed types of recreation such as primitive camping, fishing, hiking, caving, collecting forest products and simply driving for pleasure or exploration.

#### Activities and Facilities

The recreational activities currently existing include dispersed camping, hunting, hiking, mountain biking, horseback riding, snowmobiling, OHV use, sight-seeing, watching wildlife, nature study, driving for pleasure.

There are no designated trails within the project area, however the Bessie Butte trail was totally burned over in the fire. The trail is outside of proposed harvest activity areas.

Much of the recreation use in the project area is of a dispersed nature. Approximately 5 dispersed campsites were burned over within the fire. No structures of any consequence were affected.

The use of OHV's is often associated with dispersed camping. There are a number of user created OHV trails within the project area many of which come from adjacent private lands. There is some evidence that OHV use and trails are proliferating in burned areas now bare of vegetation. A post-fire closure order is now in place restricting motorized use to (posted closed) open numbered roads.

Recreational or commercial mushroom collecting can increase in the short-term as a result of fire, but the vegetation type is not conducive to quality mushroom habitat.

#### Lands and Minerals

The only designated mineral site within the analysis area is Luna Bess pit. This site uses the rock for administrative purposes.



**Effects of the 18 Fire**

The landscape has been drastically changed and the visiting public will find that over much of the project area conditions no longer meet their expectations. Five dispersed campsites were burned over by high intensity fire. All living vegetation, shade and screening have been destroyed. Most of these campsites will no longer be used by the public until the vegetation grows back. The landscape character in and around Bessie Butte was also modified by the fire. It is expected that use attributed to the dispersed campsites will be displaced to other locations. Future use of these campsites and others within the fire area is dependent on road access to the sites. It is reasonable to expect that new campsites will be created where long-term road access is provided. It is also expected that due to fire blackened ground and vegetation that use will be non-existent in the short-term and will gradually increase in the long-term.

**Recreation Resources Desired Future Condition****Recreation Opportunity Spectrum (ROS)**

The majority of the project area (roaded from past logging) falls within the ROS of Roaded Modified. The experience goal is to provide visitors with an opportunity to get away from the sights and sounds of other people, but in an area with easy access. Visitors provided with some opportunity to practice self-reliance in building their own campsite and in the use of motorized equipment. This experience offers feelings of independence and freedom, but there is little risk and challenge. The environment is substantially modified except in the campsite itself. The immediate foreground in the campsite should be in a natural appearing state.

The primary vantage point of this area visually is from Bessie Butte, which receives moderate horse and hiker use.

The 18 Fire area has modified the scenic value of the area and increased the sight distance, by burning vegetation at eye level. The long range goal from a recreation standpoint will be to revegetate the area as quick as possible, providing greenery and screening. The area will gradually increase in use as greenup occurs over the years, returning to pre-fire use patterns. Long-term use will mimic pre-fire use levels. Long-term uses would include such activities as hiking, horseback riding, mountain biking, and driving for pleasure.

**Recreation Resources Environmental Consequences****Alternative 1 - No Action****Direct and Indirect Effects**

Under the “No Action Alternative” there would be no impacts on recreationists and forest recreation settings from salvage activities, post-harvest activities and slash treatment (smoke and visuals). There would be no timber hauling from national forest lands to conflict with recreational traffic. An area closure restricting motor vehicle use to designated open roads is in place and would likely continue to be in effect for 2 years. Use would be light in general for the short-term due to the blackened area and lack of vegetation. Due to the easily accessible area, there may be an increase in motorized use, which would have the potential to do significant resource damage to existing vegetation and soils. The existing closure to motorized use would help protect the area.

**Effects Common to All Action Alternatives**

Forest reforestation activities in both action alternatives are predicted to improve the aesthetic value of the area over time. Road closure and obliteration would improve the quality of solitude in the area for

hikers and horseback riders while at the same time providing for motorized access to every section within the 18 Fire area.

### **Alternative 2**

#### **Direct and Indirect Effects**

Alternative 2 would remove approximately 7.0 million board feet of salvage timber, reforesting 1,936 acres, and 12.6 miles of road closures. Short-term negative impacts, such as displacement from forest settings during treatments, dust and noise from equipment, smoke from burning and conflicts with timber hauling along forest roads would be greatest under Alternative 2. The difference as perceived by the public would be proportionate to the acres treated.

Alternative 2 could potentially have the shortest turnaround in returning the treated acres to the DFC. This assumption is based on KV collections and removal of burned fuels. Salvaging a greater volume generally results in higher KV collections. These collections would allow for more reforestation and fuel treatments. Landscape fuel reduction and forest restoration activities are predicted to reduce the risk of severe wildfire disturbances, improve thermal cover and in the long-term, create an aesthetic background for recreation activities.

### **Alternative 3**

#### **Direct and Indirect Effects**

Alternative 3 would reforest approximately 1,936 acres. No salvage harvesting would occur under this alternative. Short-term negative impacts would be noise and dust from reforestation crews and vehicles. The difference as perceived by the public would be proportionate to the acres treated.

#### **Cumulative Effects**

Closing access to areas during vegetation management activities does have a short-term effect on recreationists. Harvest and post-harvest activities have the longest duration effect. They may prevent recreationists from visiting certain areas while these activities occur and can displace them in the short-term. Displacement during implementation of the activity might be from one day to several weeks.

In addition to displacing recreationists, trucks hauling timber along forest roads can also affect visitors by increasing the perceived hazard of sharing the narrow roads with log trucks. Vegetation management activities occurring during seasons other than summer generally impacts fewer recreationists. The timing of the timber haul might have less effect upon local residences though they may prefer weekdays in the off season.

Fuel reduction and removal of hazard trees has a positive effect on both the actual and perceived safety of recreation sites and travel routes. Timber salvage on flat ground can increase the temptation to drive off roads even though it may be illegal to do so.

There have also been multiple fires over recent years in this general area and recreation use has been curtailed by area closures (fire related) and fences. This has caused some displacement of use and this fire closure would result in the same. There have been fewer and fewer acres to recreate in within this general area. There will be added pressure and recreation use in adjacent open areas as the use will continue and grow.

## Roads and Transportation

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### Roads and Transportation Introduction

The 18 Fire Recovery project covers 3,810 acres and is accessed by 21.4 miles of road. All of the roads and project area are under Forest Service jurisdiction. The existing Forest road system includes 7.6 miles of arterial and collector roads and 13.8 miles of open local roads.

A Roads Analysis Report was completed for the Kelsey EA that includes the 18 Fire Recovery Project area. Site specific road resource management recommendations are contained in the Kelsey Roads Analysis Report. The Interdisciplinary Team (ID Team) reviewed all the roads within the project area and identified opportunities for road management actions based on future needs and the Roads Analysis Report.

### Transportation System Existing Condition

Arterial Road 18 and collector Roads 1810, 9711 and 9714 provide the primary access into the 18 Fire Recovery project area. Road 18 is a Highway Safety Act road, suitable for mixed traffic including passenger vehicles. Road 18 is accessed from Knott Road and connects to Oregon State Highway 97 south of Bend, Oregon. Collector roads 1810, 9711, and 9714 provide secondary access to the project area. National Forest System Roads (NFSR) provide access to National Forest lands, and are classified as either arterial, collector, or local.

- An arterial road provides service to large land areas and connects with other arterials or public highways.
- A collector road serves smaller land areas than arterials and connects arterials to local roads.
- A local road is generally a single purpose facility and connects terminal facilities with collectors and/or arterials.

Most Forest roads in this area are currently open year-around to both motorized vehicles and non-motorized uses. Present uses include, but are not limited to, driving for pleasure, horse back riding, biking, running, cross country skiing, hunting, off-highway vehicle use (ATVs, motorcycles, 4WD, snowmobiles), special use access, and Forest Service resource management. None of the roads are maintained during the winter and use is limited in most years from mid-December to mid-March, depending on snow depth.

### Desired Future Condition of Transportation System

Most of the road systems are currently in good condition structurally as far as having a maintainable surface to support timber haul. The native surface portion of road 9711, from road 1810 to the project area boundary has rocks protruding from the surface and needs spot surfacing with crushed aggregate to provide smoother access and timber haul.

Many of the local forest system roads in the project area need some minor maintenance. This work typically involves grading and the addition of a few drain-dips or water-bars to improve surface drainage. None of the roads require any road reconstruction.

## Roads and Transportation Environmental Consequences

### Effects Common to All Alternatives

The Kelsey Roads Analysis and road management activities, as amended by the ID team, could be implemented in a separate environmental document, regardless of the 18 Fire Recovery Project alternative chosen. For this reason, the largest determining factor relating to proposed management activities could be the potential use of Forest roads for hauling of salvaged timber and reforestation access.

The 18 Fire Recovery project includes three alternatives: Alternative 1 would not directly affect the transportation system; however, road restoration, monitoring and hazard tree activities could be accomplished separately with the implementation of a Roads Management EA. Alternative 2 would provide for the greatest economic return by salvaging merchantable timber. Alternative 3 focuses on ecological restoration issues and does not harvest dead timber. All action alternatives include identified road closures and obliterations. These project activities are summarized in Table 3-30.

### Alternative 1 - No Action

#### Direct and Indirect Effects

There would be no changes to the current Forest road transportation system under Alternative 1 (No Action). Consequently, there would be no improvements to the roads or the drainage systems of the roads in this alternative. There would be no increase in log truck traffic on county and Forest roads. Activities affecting the road system under separate NEPA projects could proceed regardless. These could include 7.0 miles of road decommissioning (obliteration) and 2.9 miles of road closures identified with the Kelsey Roads Analysis.

### Effects Common to All Action Alternatives

Figure 3-30. Project Effects on Total Transportation System

Project Activity	Alt. 1 – No Action (miles)	Alt. 2 – Proposed Action (miles)	Alt. 3 – Action Alternative (miles)
Existing “National Forest System Roads” in the Project Area (NFSR)	21.4	11.5	11.5
New Road Construction	0.0	0.0	0.0
Road Reconstruction	0.0	0.0	0.0
Project Maintenance	0.0	6.0	0.0
Temporary Road	0.0	3.5	0.0
Road Closures	0.0	2.9	2.9
Road Decommission	0.0	7.0	7.0
NFSR Density	3.6 mi./sq. mi.	1.9 mi./sq. mi.	1.9 mi./sq. mi.

The following roads would be decommissioned or closed.

**Decommission roads:** 1810-010, 030, 031, 032, 033, 036, 038; 9701-950; 9711-460, 484, 486, 488, 860, and 910.

**Closed roads:** 1800-030; 1810-300, 330; 9711-600, 820.

## **Alternative 2**

### **Direct and Indirect Effects**

Selection of Alternative 2 would result in changes to the transportation system by closing and decommissioning roads. An estimated 6 miles of roads in Alternative 2 would receive some pre and post haul road maintenance associated with this project tying into County Road 18. All hazardous trees along the haul route have been previously removed. The county roads are all designed to handle log truck traffic. The total number of log trucks on county and state roads in Central Oregon would remain the same. The 18 fire haul volume would offset or defer a comparable amount of volume from other approved sales to coming years. Road 9711 would receive spot surfacing with crushed aggregate rock. The crushed aggregate surfacing material needed for Road 9711 would likely be obtained from a commercial rock source located outside of the project area on private land.

An estimated 3.5 miles, including 1 mile of existing non system roads (project record), of short temporary roads would be required to provide access to timber harvest locations. None of the temporary roads would cross any ephemeral, intermittent or perennial streams because there are none in the project area. Temporary road locations would not require culverts, endhauling of material or surfacing as all of them are located on flat ground (less than 15 percent) with little or no sideslopes. Following timber harvest operations, the temporary access routes would be obliterated and reconditioned to a natural state.

## **Alternative 3**

### **Direct and Indirect Effects**

The effects of the selection of Alternative 3 on the transportation system would be similar to Alternative 2. Since this alternative would not salvage any dead trees, the 6 miles of road maintenance, spot surfacing of Road 9711 and 3.5 miles of temporary roads would not be needed.

## **Cumulative Effects**

Implementing either of the action alternatives would result in a reduction in the overall transportation system mileage. Combining the 7.06 miles of decommissioning with ongoing road closures and 67.69 miles decommissioning included with the Kelsey Roads Analysis, a total of 74.75 miles of Level 1, 2, and 3 roads may be closed. This would reduce the overall open road density from an estimated 3.99 miles per square mile within the Kelsey Project Area to 2.94 miles of open road per square mile. The 18 Fire is included in the Kelsey Project Area.

## Scenic Quality

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### Existing Scenic Condition

The second growth black bark ponderosa pine forest found within the 18 Fire area has been highly scorched. An estimate of 2,420 acres burned at moderate to high intensities with tree mortality ranging from 95 to 99 percent.

The 18 Fire also scorched part of Bessie Butte to the north and Luna Butte to the south. These are two prominent buttes that can be seen from part of the city of Bend. Trees along both sides of Forest Road 18 (China Hat Road) and Forest Road 1810 corridors have been lightly to highly burned.

The fire intensity has highly altered the existing landscape character, scenic quality and integrity level. The 18 Fire Recovery Project area because of the fire currently does not meet the Landscape Character Goals and the Desired Future Scenic Conditions as specified under the LRMP for Management Area 9, Scenic Views.

### Social and Human Ecology Cultural Values and Scenic Resources

The USDA Forest Service established a Handbook for Scenery Management System (SMS--USDA FS 1995) use to protect and enhance scenic resources, which may be diminished by human activities, such as vegetation management, recreation, and/or administrative facility development.

The Scenery Management System will be used in conjunction with the LRMP. The analysis will take into consideration the balance between Social and Ecological needs within the study area.

The Forest Service implementing regulations, currently establish a variety of **Scenic Quality Standards** (SQO's for MA-9). These standards include:

1. Natural Appearing Landscape with High Scenic Integrity Level (formerly Retention, SV-1 allocation),
2. Slightly Altered Landscape with Medium Scenic Integrity Level (formerly Partial Retention, SV-2 allocation),
3. Altered Landscape with Low Scenic Integrity Level (formerly Modification or General Forest, GFO allocation).

### Scenic View Allocations

Within the 18 Fire Recovery Project area, only a small segment (about 22 acres), part of Trail 63, has been allocated as part of a Scenic View corridor by the LRMP with Natural Appearing Landscape with High Scenic Integrity Level (formerly Retention, SV-1 allocation).

Forest Road 18 (China Hat Road), 1810, 9711, and Forest Road 9714 and the rest of the 18 Fire area is within Altered Landscape with Low Scenic Integrity Level (formerly Modification or General Forest MA 8, GFO) allocation.

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**Desired Future Scenic Condition (Landscape Character Goals and Scenic Quality Objectives)****Landscape Character Goals**

The landscape Character goal for 18 Fire Recover Project is to achieve a natural appearing landscape, such as open park-like stands, where management directions, the desired future conditions, social and ecological framework of the Management Area are met (LRMP MA-9 and MA-19 through MA-28).

Scenic quality for the 18 Fire Recover Project would be natural appearing character where various line, form, color, and texture elements can be found within the landscape. Human alterations, in general, would be subordinate and conform to natural appearing landscape characteristics. Character trees, snags, and small openings, to highlight special features within the landscape, are desirable and encouraged. Where biologically feasible, diversity in vegetation species, age and size classes would be encouraged (Deschutes NF LRMP MA-9).

**Scenic Quality Objectives**

Ponderosa pine in Foreground Scenic Views will be managed to maintain or create a visual mosaic of numerous, large diameter, yellow-barked trees with stands of younger trees offering scenic diversity as seen from sensitive viewer locations, such as from a travel corridor. A mosaic of even-aged and uneven-aged stands and small natural-appearing openings of various sizes (less than ½ acre) are desirable.

**Environmental Consequences****Affect on Scenery**

The existing landscape character, scenic quality, and scenic integrity level have been highly altered by the 18 Fire. The area's landscape currently does not meet the desired scenic conditions as specified under the Deschutes National Forest LRMP for Management Area 9, Scenic Views. The proposed management activities are expected to have additional effect(s) on the area's scenery, including direct effect(s) on landscape character, scenic quality, and scenic integrity level.

**Effects Common to All Alternatives**

There would be no management activities within the Scenic Views Management Area. This area would be left to naturally regenerate over time.

**Alternative 1 (No Action)****Direct and Indirect Effects**

Under this alternative, an estimated of up to 3,810 acres (100 percent) of the existing vegetation community within the 18 Fire Recovery Project (analysis area) would not be managed or altered by any management activity. The natural and ecological processes, such as insects, diseases, lateral and vertical fuels build up, that may lead to even more severe catastrophic wildfire, wind thrown, snow damage/break, dead and down trees, would be allowed to continue unmanaged.

The current management actions would continue as is (such as management of recreation use and services, fire suppression, hazard trees, standard road maintenance, and re-closure of breached roads). No action would be taken to salvage and recover wood fiber to benefit social and ecological needs.

The current vegetation condition within the 18 Fire, would continue to degrade and thus could eventually affect long-term scenic quality, forest health, and also public safety--as related to access and travel management.

The area's landscape character, scenic quality and integrity level would remain essentially the same during the short-term period. The long-term scenic quality, scenic integrity level, and landscape character are expected to be highly altered through time as the fire killed trees over time fall down.

Under this alternative, the LRMP (MA-9 S & G's) directions, the DFC for Scenic Views within the 18 Fire Recovery Project is not expected to be met as originally intended.

### **Alternative 2 (Proposed Action)**

#### **Direct and Indirect Effects**

Under this alternative, an estimated of 1,936 acres within Altered Landscape with Low Scenic Integrity Level (formerly Modification or General Forest MA 8, GFO) allocation would be managed by the proposed management activities.

- The proposed harvest units, including Unit 1 through Unit 8 within the 18 Fire Recovery Project, are expected to further alter the existing landscape character, scenic quality, and scenic integrity level during the short-term (landscape term of 0 to 5 years).
- The long-term (5 years and beyond) trend is expected to be more beneficial to scenery as rehabilitation and regeneration of new forest took affect. Vegetation age and size classes are expected to diversify and thus help enhance scenery, while moving closer toward the Desired Future Scenic Conditions.

With proper design guidelines in place, including effective mitigation measures to help minimize soil impact, protecting residual trees, keeping cut stumps under 12 inches, and timely slash treatments, the effect(s) on landscape character, scenic quality, and scenic integrity level is expected to be minimized.

### **Alternative 3 (Reforestation)**

#### **Direct and Indirect Effects**

Under this alternative, the effect(s) on landscape character, scenic quality, and scenic integrity level during the short-term duration (0 to 5 years) is expected to be very minimal due to no salvage activity being proposed. The current vegetation condition after the 18 Fire would continue to degrade and thus could potentially affect long-term scenic quality, forest health, and also public safety--as related to access and travel management.

The area's current landscape character, scenic quality, and scenic integrity level (post burn condition) would remain essentially the same during the short-term period. The long-term scenic quality, scenic integrity level, and landscape character are expected to be highly altered through time as the dead trees fall down. This could lead to a potential heavy fuel loading hazard that could pose a serious threat to long-term scenic quality.

The increase emphasis on road closure and reforestation under this alternative is expected to help enhance both short and long-term scenery.

Under this alternative, the LRMP (MA-9 S & G's) directions, the DFC for Scenic Views within the 18 Fire Recovery Project is expected to be only "partially" met as originally intended.



## Range Allotment

### Introduction

The following addresses the 18 Fire Recovery Projects affects on overlapping grazing allotments. Refer to Chapter 1 of this Draft Environmental Impact Statement (DEIS) document for a complete description of the project.

### Range Overview

The 18 Fire Recovery Project area overlaps the Bessie Grazing Allotment (Table 3-31). Livestock grazing was historically a common use of the 18 Fire Recovery Project area. Official Forest Service records document that grazing occurred as early as the 1930s and has continued up to 1990.

The present Allotment Management Plan for the Bessie Allotment was adopted in 2004. Range standards and guidelines in the LRMP were used to develop the Allotment Management Plan. Forage utilization by livestock is maintained at a level such that sufficient forage is available to support the desired number of deer. Grazing systems, stocking levels, forage use standards and range improvement projects are designed to be compatible with or complementary to the deer habitat objectives (M7-8, page 4-114).

**Table 3-31 Bessie Grazing Allotment.**

Allotment	Total Allotment Acres	Permitted Livestock Type	Last Year Actively Grazed/Status	Acres of Allotment Within Project Area
Bessie	24,257	Cattle, sheep, and goats	1990/Active	3,717

### Existing Allotment Condition

Utilization of forage is within the LRMP Standards and Guidelines {RG-13 (D), page 4-50}, which suggest a maximum utilization of 50 percent. Allotment Management Plans and the Condition and Trend Analysis Plots indicate that the forage condition on the allotment is generally good, and the vegetative trend stable. Monitoring has shown that areas where resource damage appears to have been caused by livestock are water set locations, water haul roads, and resting or bedding areas. These areas contain compacted soils and less diverse plant communities (occasionally, dominated by cheatgrass). Impacted areas are estimated to be less than 0.03 percent of the total analysis area and these areas have had thirteen years of rest (no use by livestock).

Livestock grazing in the 18 Fire Recovery Project area has provided an economic resource for local communities for many decades. The 2004 Allotment Management Plan allows for periodic-use utilizing a four-pasture rotation grazing system that permits individually or in combination up to 1) 200 cow/calf pairs to be grazed from May 15th through September 15th (periodically, but not annually); and 2) 700 sheep or 500 goats to be grazed from May 15th through July 31st (periodically, but not annually). The East and West pastures allow for use by cattle, sheep, or goats, but do not allow for concurrent use by different types of livestock at the same time. The North and South pastures are sheep and goat only pastures.

The 2003, 18 Fire burned in portions of the North, West, and South pastures of the Bessie Allotment. Fire impacts were greatest in the West and South pastures. The fire burned 56 acres in the North Pasture, 2,563 acres in the West Pasture, and 1,098 acres in the South Pasture. The Bessie Allotment has not been grazed since 1990 and is not currently active. Approximately  $\frac{3}{4}$  mile of existing pasture fence was heavily impacted by the 18 Fire and will need to be rebuilt prior to reintroduction of cattle. Sheep or goats do not require fencing as they can be controlled by humans or dogs and as such can use any or all four pastures.

## Environmental Consequences

### Alternative 1 (No Action)

#### Direct and Indirect Effects

In the spring of 1997 cheatgrass flourished along the 18 Road corridor as a result of the 1996 Skeleton Fire and good spring moisture, but not within the 18 Fire project area. The same scenario could occur along main roads within the project area. Cheatgrass begins growth much earlier than most native grasses and is best managed with early season grazing. In the case of sheep and goats, livestock grazing could begin in May/June of 2006. If needed sheep and goats could be used to treat exotics and noxious weeds such as cheatgrass along the road corridors of roads 1800, 9711, and 1810 within the hazard tree reduction corridor (approximately 100 feet on either side of the roadway) within the project area. A small number of animals would be used for up to two weeks to accomplish this task. The animals would need to be intensively managed to keep them within the corridor.

Sheep and goats could use the West and East pastures of the Bessie Allotment on a periodic basis beginning in the fall of 2006 for general fuel treatments.

After a vegetation recovery period, from approximately the summer of 2004 to the spring of 2006 vegetation conditions in the project area would be optimized for forage production. Forage production would be optimized for up to 20 years due to the initial response of grasses and forbs to nutrient release by the 18 Fire and reduced competition from trees and shrubs. Optimal site conditions would exist for livestock production, especially cattle. Resting the burn area for two grazing seasons would provide for natural recovery of vegetation while increasing the competition from native plants against noxious weeds and other exotics. Without the reforestation efforts across the project area, livestock would have few restrictions on access. Regarding livestock, this area is delineated for two purposes: 1) use livestock to reduce fuel loads on a periodic basis and 2) provide for a forage reserve.

Under this alternative cattle grazing in the project area will be allowed beginning in late summer of 2006, provided all improvements specified in the Cinder Hill Environmental Assessment had been constructed and the  $\frac{3}{4}$  of a mile of fence damaged in the 18 Fire and partially removed in the spring of 2004 had been reconstructed.

This alternative would have the least impact to the grazing program as harvest activities and most importantly reforestation activities would not be implemented. Exclusion of livestock from plantations for up to ten years would not be an issue.

Livestock may have effects on the 73 acres adjacent to roads 18, 9711, and Road 1810 that will be replanted under *Additional Resource Recovery Projects, Chapter I*. Using short wooden stakes (less than 18 inches tall) with vexar tubes around planted trees will minimize any impacts. With these measures in place the greatest threat will be trampling of tubes and stakes by livestock.

Dead trees from the 18 Fire pose a minor threat to livestock and permittee(s) within the project area. Continued road/area closures would reduce disturbance to livestock from vehicles. Closures would also restrict vehicle access by permittees. When fire killed trees fall to the ground and down fall is substantial (estimated to be the case in 10 to 20 years) livestock may have difficulty reaching and foraging in some areas and distribution patterns will change.

Water set locations are perhaps the highest area of impact for livestock operations on dry upland allotments. Soil compaction from water trucks and livestock has been measured to significant levels to include up to 1 acre of disturbance. Livestock create a trail system to access the watering area and often lounge around after having taken a drink. Due to such site disturbance and their attraction to vehicle use, water sets are optimum locations for the introduction of noxious weeds; although there are few locations where this has actually occurred on the Forest. For these reasons it is best if once established, that water set locations are not changed and their occurrence on the allotment is minimized. Water set location would remain as they are.

When not in use or after some period of rest, water sets are often used by the public as camping or parking locations. They seem especially attractive to hunters during the fall months. OHV users also select these sites and a concern arises that they may use livestock trails accessing the water sets as OHV trails. Appropriate laws enforcement would be needed to control such use.

### **Effects Common to Alternatives 2 (Proposed Action) and Alternative 3 (Reforestation) Direct and Indirect Effects**

Within the 18 Fire 2,009 acres would be planted to trees (73 acres along roads). Under these alternatives cattle grazing would be excluded from plantations for up to ten years. Plantations would be evaluated and allow for reintroduction of cattle if reforestation objectives have been met. Exclusion would be accomplished by either hard fencing of plantations or by the use of temporary electric fences.

The North and South pastures are not a concern as sheep and goats could easily avoid plantations and may even be used in them to treat competing vegetation. No fences would be needed in these pastures. The East Pasture is outside the fire and is not an issue for exclusion. The West Pasture is open to cattle grazing and plantations would need protection if cattle were allowed to use this pasture during the "exclusion" period. Cattle could just be excluded from the pasture until reforestation objectives were met and it would not be available for a forage reserve.

Identical to Alternative 1, sheep and goats could be used to treat exotics and/or noxious weeds such as cheatgrass along the road corridors of roads 1800, 9711, and 1810 within the hazard tree reduction corridor (approximately 100 feet on either side of the roadway in the project area, if the need arises).

Under these alternatives cattle grazing in the project area, outside the 2,009 acres, could be allowed beginning in late summer of 2006, provided all improvements specified in the Cinder Hill Environmental Assessment had been constructed and the  $\frac{3}{4}$  of a mile of fence damaged in the 18 Fire and partially removed in the spring of 2004 had been reconstructed.

Silviculture plans to construct a deer fence around 640 acres of plantations to exclude native ungulates. This area will be unavailable to livestock until reforestation objectives are met and the fence is removed. Livestock could be used under intensely managed conditions to control competing vegetation inside the fence. The 640 acre fence will be located in Unit 1, which lies in the West Pasture that could be grazed using cattle, sheep, or goats.

In summary, as a result of the 18 Fire, grazing of livestock within the burn area would be delayed until 2006. Resting the burn area for two grazing seasons would provide for natural recovery of vegetation while increasing the competition from native plants against noxious weeds and other exotics. Grazing would continue outside the burn area for sheep and goats beginning in 2005. Cattle grazing would be allowed in the East Pasture unaffected by the 18 Fire. Cattle grazing in the West Pasture would be allowed in the fall of 2005. However, reforestation planting in the West Pasture would require exclusion of cattle from plantations for up to ten years after all planting is completed or longer depending on reforestation success.

Reforestation planting would reduce the number of acres available for grazing by sheep, goats, and cattle for up to ten years after completion of planting in the North, West, and South Pastures. How many acres and how long they would be unavailable for grazing would depend on the type of livestock used, the number of years it takes to complete planting the fire, plantation success, use of hard fencing around plantation for native ungulate exclusion in conjunction with the placement of the fences, and the use of livestock for the control of competing vegetation in plantations.

Livestock can add to erosion problems as they often choose the roads as travel routes for ease of travel and because roads often lead to watershed locations. Roads are also used to trail livestock from pasture to pasture and from the allotment. The changes in road status and the resultant changes in access will impact the permittees by reducing vehicle access into some areas. This will be offset by the permittees using alternative modes of transportation such as horses.

### **Alternative 2**

#### **Direct and Indirect Effects**

Alternative 2 would treat 62.5 acres of subsoiling that includes roads and logging facilities. Livestock can have difficulty when traveling through subsoiled areas for up to eight months after the soil has been treated. There are no records of cattle or horses becoming trapped or injured in these areas, but the possibility is present. There would be little threat, once the soil has had time to “settle”.

Under the proposed action alternative the opportunity exists for potential KV projects. Range proposes to: 1) reconstruct  $\frac{3}{4}$  of a mile of 3-strand wire fence in Unit 3 where the old fence was destroyed by the fire; and 2) remove the cattle guard on Road 18 just west of the 18 and 1810 Road intersections.

### **Alternative 3 (Reforestation)**

#### **Direct and Indirect Effects**

No timber salvage or associated road building activities will occur. This is a reduction of 1,936 acres of treatment. Range improvements would not need protection from salvage activities.

Potential KV dollars would not be generated and therefore a possible source of funding for rebuilding the fence destroyed in the 18 Fire and removal of the road 18 cattle guard will not be available.

Alternative 3 would treat 10.4 acres of subsoiling that includes roads and logging facilities. There would be little threat to livestock once the soil has had time to “settle”.

### **Foreseeable Actions**

Foreseeable management activities are assumed to occur as planned in the schedule of projects for the Deschutes National Forest. Cinder Hill (Cluster I) Environmental Assessment was completed in 2004. This range analysis authorized grazing on the Coyote, Cinder Hill, and Pine Mountain Allotments. Grazing by sheep and goats could begin as early as the spring of 2006 within the 18 Fire

area. Grazing by cattle could begin as early as August 15, 2006. Some ground disturbing activities such as water set use, development of new water sets, and fence construction are anticipated under the action alternative for this range analysis and would need to be completed prior to any cattle use in the Bessie Allotment.

No out year timber sales are currently scheduled within the project area boundary. The Kelsey Project Environmental Assessment is near decision. This project will implement management actions outside the 18 Fire Recovery Project area. The Kelsey Project proposes to change the status of some roads within the project area and those decisions were incorporated into the 18 Fire decision.

### **Irreversible and Irretrievable Commitments**

Alternative 2 or 3 are not expected to create any impacts that would causes irreversible or irretrievable damage to range resources.

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## Other Disclosures

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### Short-term Uses and Long-term Productivity

NEPA requires consideration of the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity (40 CFR 1502.16). As declared by Congress, this includes using all practicable means and measures 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 present and future generations of Americans (NEPA Section 101).

An examination of productivity or long-term productivity in relation to both Forest Vegetation and Soil Quality, as well as some aspects of Wildlife Habitat, is presented in Chapter 3. An examination of short-term uses, as they pertain to the products that would be made available by the proposals is included in the Economics and Social Analysis section of Chapter 3. Specifically, economic returns to society from possible future management activity are presented under the subheading Economic and Social Analysis.

### Unavoidable Adverse Effects

Several expected adverse effects, including some that are minimal and/or short term, were identified during the analysis. Resource protections measures or mitigations were identified and considered for each of these as a means to lessen or eliminate such effects of specific resources. See Chapter 2, Mitigation and Management Requirements. Resource areas determined to have potential adverse effects (resulting from any of the alternatives – including No Action and the Action Alternatives) are documented within the appropriate Environmental Consequences sections of each resource in Chapter 3.

### Irreversible and Irretrievable Commitment of Resources

NEPA requires that environmental analysis include identification of “. . . any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.” Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations.

- Irreversible effects primarily result from use or destruction of a specific resource (such as minerals) that cannot be replaced within a reasonable time frame.
- Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (such as disturbance of wildlife habitat); or is lost as a result of inaction (such as failure to monitor and treat forest vegetation to prevent infestation of insects).

The proposed fire salvage project would result in few direct and indirect commitments of resources; these would be related mainly to timber harvest operations.

For the proposed alternatives, most resource commitments are neither irreversible nor irretrievable. Most impacts are short term, temporary, and are being mitigated as outlined in project design criteria and best management practices. Others that may have a longer effect can be reduced through appropriate measures. Those resources that may have a possible irreversible or irretrievable commitment are discussed below.

The 18 Fire Recovery Project proposes no activities that would result in irreversible commitments of resources.

With the implementation of any of the alternatives (including No Action), a variable portion of one primary resource (standing dead trees) would be irretrievably lost to use either as a natural resource for the harvest of commercial forest products or as a component of wildlife habitat, particularly cavity dependent species. These tradeoffs, as they relate to each of the alternatives, are explored in discussions of one of the Key Issues, Wildlife Habitat.

See *Economic and Social Analysis* and *Wildlife Habitat: Existing Condition and Environmental Consequences: Cavity Excavators/Down Woody Material* in Chapter 3 of this document. The analysis revealed no significant irreversible or irretrievable commitment of resources associated with implementing the alternatives that are not already identified in the LRMP EIS or the Regional FEIS for Managing Competing and Unwanted Vegetation.

### **Consistency with the Regional Forester's Eastside Forest Plan Amendment #2 (Eastside Screens)**

All of the 18 Fire is within the Eastside Screens boundary.

#### **Interim Riparian Standard**

There are no ephemeral, intermittent, or perennial streams, rivers, riparian areas, wetlands, lakes, or reservoirs within or adjacent to the 18 Fire Recovery Project area.

#### **Interim Ecosystem Standard**

A Historical Range of Variation (HRV) analysis was completed. No live trees are proposed for harvest, therefore the HRV would not change from the current structural stage level.

#### **Interim Wildlife Standard - Scenario A**

- 1) and 2)** There would be no harvest of live trees, therefore no change to LOS conditions.
- 3)** Sufficient connectivity is provided by the unharvested portions including stands that experienced non-lethal wildfire.
- 4)** No live trees would be harvested, therefore the 21 inch diameter limit does not apply. The action alternatives are designed to meet the 100 Maximum Population Potential for MR species. Action alternatives do not propose to remove down logs existing before the fire and down log recruitment is expected to exceed specified levels (reference the wildlife and fire and fuels section). There are no known goshawk nests in the area and the habitat most likely to be used for nesting is not proposed for harvest.

### **Human Health and Safety**

The existing level of hazard tree management consists of a conservative approach to removal of hazard trees on approximately 73 acres adjacent to roads 18, 1810, and 9711. Remaining standing dead trees that do not lean towards the roadway, particularly in areas where the fire intensity burned moderate to severe, have increasing potential to fall on the roadway compounded through time as wood deteriorates and storm events occur. Approximately 21.4 miles of roads are currently available for use post-fire if the closure order was lifted.

A roads analysis for the area has been completed and recommendations include a net reduction of 9.9 miles of access. This has been carried forward into the design of the action alternatives. A copy of this analysis can be found in the project record at the Bend/Fort Rock Ranger District.

Health effects are limited in scope and duration. This analysis summarizes the human health and safety effects described in other sections of the document.

### **Alternative 1 (No Action) and 3**

These alternatives would present greatest potential for hazards to the visiting public from falling dead trees along roads. Although hazard tree management has been accomplished along major travelways, a decline in user safety would be expected for at least the first decade while standing trees begin to fall at an accelerated rate. In order to maintain public safety, some roads would be closed to motorized travel.

In both of these alternatives, custodial activities such as removal of trees that fall on the roadway would occur. Road closures along major roads could occur for periods ranging from a day to several weeks depending upon the severity of the event. Public access along less traveled roads could be restricted for at least a decade until the potential hazard is lessened and road maintenance could accommodate motorized use.

High levels of downed material are likely to affect future wildfire suppression actions. High levels of dead and down material and resistance to suppression efforts (control) would likely result in a higher potential to become extremely hazardous for fire fighters and visitors. Some suppression strategies would be eliminated due to lack of adequate escape routes and safety zones.

### **Alternatives 2**

Implementation of Alternative 2 would increase the potential for encounters on roadways between equipment associated with logging, other restoration activities and visitors. This elevated level of risk would be present for the short-term (approximately 6 months). All other proposed activities would not expose the public to an elevated risk of injury above hazards associated with routine forest practices that are regulated by the Oregon Occupational Safety and Health Division.



Over the long-term, Alternative 2 would have greatest reduction in hazards associated with remaining trees along roads after salvage activities have concluded.

Worker health effects and safety from all phases of logging operations would potentially occur. The work environment would be physically demanding and hazardous.

The Clean Air Act lists 189 hazardous air pollutants to be regulated. Some components of smoke, such as polycyclic aromatic hydrocarbons (PAH) are known to be carcinogenic. Probably the most carcinogenic is benzo-a-pyrene BaP. Other components, such as aldehydes, are acute irritants. Primary air toxins that are presently being assessed relative to the exposure to humans to smoke from prescribed and wildfires are as follows:

**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 and nasopharyngeal 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 carcinogenic. Benzene causes anemia, liver and kidney damage, and cancer.

The closest Designated Area to the project area is the city of Bend, Oregon. The greatest risk of exposure to respiratory particulates would be to firefighters and forest workers implementing prescribed burning of the landing piles. It is unlikely the general public would be exposed to levels adverse to human health during implementation of prescribed burning operations because of the prescriptions designed to lessen the release of particulate matter. Those that suffer from breathing ailments may experience some difficulty during periods of prescribed burning and 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.

## Prime Lands

The Secretary of Agriculture issued memorandum 1827 which is intended to protect prime farm lands and rangelands. The project area does not contain any prime farmlands or rangelands. Prime forestland is not applicable to lands within the National Forest System. National Forest System lands would be managed with consideration of the impacts on adjacent private lands. Prime forestlands on adjacent private lands would benefit indirectly from a decreased risk of impacts from wildfire. There would be no direct, indirect, or cumulative adverse effects to these resources and thus are in compliance with the Farmland Protection Act and Departmental Regulation 9500-3, “Land Use Policy”.

## Compatibility with State and Local Laws

Implementation of all alternatives would be consistent with State and local laws, land use, and environmental policies.

Action alternatives follow State of Oregon requirements in accordance with the Clean Water Act for protection of waters including application of BMPs.

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Senator Gordon Smith  
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Bend Department of Public Works  
Bend Fire Department  
City of Bend

**Oregon State Government**

Oregon Dept. of Geology and Mineral Industries  
Governor's Natural Resource Policy Director  
Governor's Forest Advisor  
Oregon State Economist, Executive Department  
Oregon State University, Area Extension Forester  
Economic and Community Development  
Department of Land Conservation and Development  
Division of State Lands  
State of Oregon Water Resources Department  
Parks and Recreation Dept., Resource Management and Planning Div.  
Oregon Department of Fish and Wildlife  
Oregon Department of Forestry  
Oregon Department of Environmental Quality, Eastern Region  
Oregon Department of Transportation

**Federal Agencies**

Advisory Council on Historic Preservation, Western Office of Review  
Environmental Protection Agency  
Federal Aviation Administration, Northwest Mountain Region  
Federal Highway Administration, Western Resource Center  
Northwest Power Planning Council  
Bonneville Power Administration  
U.S. Dept. of Agriculture  
    Policy and Planning Division  
    Natural Resource Conservation Service  
    National Agricultural Library Acquisitions and Serials Branch  
    Animal and Plant Health Inspection Service  
    Forest Service, Pacific Northwest Regional Office  
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 Office of Environmental Compliance  
 U.S. Department of Commerce  
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**Organizations**

American Forest Resource Council	Bend Recreation
Blue Mountains Biodiversity Project	Bend Clean Air Committee
Cascadia Wildlands Project	Action for Animals
Central Oregon Running Club	Deschutes Basin Land Trust
COMAC Motorcycle Club	Central Oregon Community College
E. Oregon Forest Protection Organization	Deschutes County 4-Wheelers
Earthjustice Legal Defense Fund	Emerald Trail Riders Association
Hi-Desert Four Wheelers	Forest Conservation Council
High Desert Museum	Four Runners
Klamath Forest Alliance	John Muir
Motorcycle Riders Association	Native Plant Society
Natural Resources Defense Council	Northwest Environmental Defense Council
Northwest Land Management	OHA – Bend Chapter
OMSI Science Camps	PROWL
Oregon Natural Resources Council	Sierra Club, Juniper Group
Portland State University	The Wilderness Society
Redmond Four Bangers	Sunriver Owners Association
Sunriver Environmental	Sunriver Fire
Sunset View Estates Homeowners Association	Woodside Ranch Homeowners Association

**Businesses**

Ace Discount Motorsports	Ochoco Lumber Company
Action Motorsports	Power Trip Motorsports
Boise Cascade Corporation	Prineville Power Sports
Cascade Yamaha-SkiDoo	7 <sup>th</sup> Mountain Management

Cascade Motorsports	Sun Country Tours
Cycle Sports	The Bend Bulletin
DR Johnson Lumber Co.	Tom's World of Wheels
KLE Enterprises	Tye Cattle Co.
KTVZ	Wanderlust Tours, Inc.
Midstate Power Products	

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## APPENDIX C: GLOSSARY OF ABBREVIATIONS AND TERMS

### Abbreviations

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<b>ATV</b>	All Terrain Vehicle
<b>BE</b>	Biological Evaluation
<b>BAER</b>	Burned Area Emergency Rehabilitation
<b>BMP</b>	Best Management Practice
<b>CCF</b>	100 Cubic Feet
<b>CE</b>	Categorical Exclusion
<b>CFR</b>	Code of Federal Regulations
<b>CWD</b>	Coarse Woody Debris
<b>DBH</b>	Diameter Breast Height
<b>DEIS</b>	Draft Environmental Impact Statement
<b>DFC</b>	Desired Future Condition
<b>DNF</b>	Deschutes National Forest
<b>EA</b>	Environmental Assessment
<b>EIS</b>	Environmental Impact Statement
<b>ESA</b>	Endangered Species Act
<b>FFE</b>	Fire and Fuels Extension
<b>FSEIS</b>	Final Supplement Environmental Impact Statement
<b>FSH</b>	Forest Service Handbook
<b>FSM</b>	Forest Service Manual
<b>FVS</b>	Forest Vegetation Simulator
<b>GIS</b>	Geographic Information System
<b>GRT</b>	Green Replacement Trees
<b>HRV</b>	Historic Range of Variability
<b>ICBEMP</b>	Interior Columbia Basin Final Environmental Impact Statement
<b>IDT</b>	Interdisciplinary Team
<b>KV</b>	Knutson-Vandenberg Act
<b>LOS</b>	Late Old Structure
<b>LRMP</b>	Land Resource Management Plan
<b>MMBF</b>	Million Board Feet
<b>MIS</b>	Management Indicator Species
<b>MOU</b>	Memorandum of Understanding
<b>NEPA</b>	National Environmental Policy Act
<b>NF</b>	National Forest
<b>NFMA</b>	National Forest Management Act
<b>ODFW</b>	Oregon Department of Fish and Wildlife
<b>OHV</b>	Off Highway Vehicle
<b>PAG</b>	Plant Association Group

## 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.

**Age class** - An interval, usually 10 to 20 years, into which the age ranges of vegetation are divided for classification or use.

**Age group distribution** - Age class distribution; the location and/or proportionate representation of different age classes in a forest.

**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.

**Allowable Sale Quantity (ASQ)** - The quantity of timber that may be sold, from the area of suitable land covered by the Forest Plan, for a time period specified by the Plan. This quantity is usually expressed on an annual basis as the “average annual allowable sale quantity.”

**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).

**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.



**B**

**Background** - In visual management terminology, refers to the visible terrain beyond the foreground and middleground where individual trees are not visible, but are blended into the total fabric of the stand. Also a portion of a view beyond three to five miles from the observer, and as far as the eye can detect objects.

**Bark Beetle** – An insect that bores through the bark of forest trees to eat the inner bark and lay its eggs.

**Benchmark** - The analytical basis from which the alternatives were developed; the use of assessed land capability as a basis from which to estimate the effects of alternative patterns of management on the land.

**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 nonpoint 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, elk, antelope, and bear.

**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.

**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**

**Canopy** - The more-or-less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth.

**Cavity** - The hollow excavated in trees by birds or other natural phenomena, used for roosting and reproduction by many birds and mammals.

**Class 1 Area** - As defined in the Clean Air Act, the following areas that were in existence as of August 7, 1977: national parks over 6,000 acres, national wilderness areas and national memorial parks over 5,000 acres.

**Class 2 Area** - All areas outside of class 1 areas in the state of Oregon.

**Clearcutting** - The cutting method that describes the silviculture system in which the old crop is cleared over a considerable area at one time. Regeneration then occurs from (a) natural seeding from adjacent stands, (b) seed contained in the slash or logging debris, (c) advance growth, or (d) planting or direct seeding. An even-aged forest usually results.

**Closure** - An administrative order restricting either location, timing, or type of use in a specific area.

**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 Thinning** - Any type of tree thinning that produces merchantable material at least equal in value to the direct costs of harvesting.

**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.

**Cost Efficiency** - The usefulness of specified inputs (costs) to produce specified outputs (benefits). In measuring cost efficiency, some outputs, including environmental, economic, or social impacts, are not assigned monetary values, but are achieved at specified levels in the least costly manner. Cost efficiency is usually measured using present net value, although use of benefit-cost ratios and internal rate-of-return may be appropriate.

**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.

**Crown** – The part of a tree, or other woody plant, bearing live branches and foliage.

**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.

## 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](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 whose social, economic, or political life would change in important respects if market or non-market outputs from the National Forests were substantially decreased.

**Diameter at Breast Height (dbh)** - The diameter of a tree measured 4 feet 6 inches above the ground on the high side of the tree.

**Discount rate** - An interest rate that represents the cost or time value of money in determining the present value of future costs and benefits.

**Discounting** - An adjustment, using a discount rate, for the value of money over time so that costs and benefits occurring in the future are reduced to a common time, usually the present, for comparison.

**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.

**Disturbance (Ecosystem)** – Refers to events (either natural or human caused) that alter the structure, composition, or function of terrestrial or aquatic habitats.

**Diversity** - The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

**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

**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.

**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 DEIS 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** - A drainage-way that conveys surface water for short periods of time in direct response to snowmelt or rainfall runoff.

**Erosion (rill)** - An erosion process in which numerous small channels less than 4 inches deep and 6 inches wide are formed.

**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 exercises 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 Regime** - A fire regime is defined as the fire frequency or interval: “the average number of years between fires” (Hardy et al, 2001)

**Fire Severity or Burn Severity** - Severity 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 (e.g., 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.

**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 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.

**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 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.

**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.

**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.

**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.

**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.

**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.

**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.

**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.

**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**

**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.

**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 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, to be met in accomplishing 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.

**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 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.

**Modification** - See Visual quality objective.

**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.

**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 regeneration** - Reforestation of a site by natural seeding from the surrounding trees. Natural regeneration may or may not be preceded by site preparation.

**No Action Alternative (Alternative 1)** - This alternative is the “No Action” alternative required by the National Environmental Policy Act. It analyzes the effects of continuing management under direction established by the Deschutes National Forest’s 1991 Land and Resource Management Plan.

**Noxious Weeds** – 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.

**Old-Growth Habitat** – Habitat for certain wildlife that is characterized by overmature 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.

**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).

**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).

**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.

**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 harvest activities and regeneration methods.

**Present net value (PNV)** - The value of the estimated flow of present and future monetary benefits after subtracting present and future monetary costs.

**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.

**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.

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**R**

**Raptors** - Predatory birds, such as falcons, hawks, eagles, or owls.

**Reburn** – Reburn results when falldown of the old burned forest contributes significantly to the fire behavior and fire effects of the next fire (Brown 2003).

**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.

**Reforestation** - The natural or artificial restocking of an area with forest trees.

**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.

**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 Forest Plan that outlined the activities and projects for a particular resource element independently of considerations for other resources. Such Plans are superseded by the Forest Plan.

**Responsible Official** - The Forest Service employee who has been delegated the authority to carry out a specific planning action.

**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.

**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.

**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.

**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.

**Silvicultural examination** – The process used to gather the detailed in-place field data needed to determine management opportunities and direction for the timber resource within a small subdivision of a Forest area, such as a stand.

**Silviculture** – The art and science of controlling the established, composition, and growth of forests.

**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.

**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.

**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 Examination Surveys** - Procedures to collect data on Forest stands.

**Standards and Guidelines** - Principles specifying conditions or levels of environmental quality to be achieved.

**Subsoiling** - The tillage of subsurface soil, without inversion, for the purpose of breaking up dense layers that restrict water movement and root penetration. (Soil Conservation Society of America, 1976).

**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.

**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.

## T

**Temporary Roads** - 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 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.

**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.

**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.

## U

**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.

**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.

**Utilization Standards** - Standards guiding the projection of timber yields and the use and removal of timber. The standards are described in terms of minimum diameter at breast height, minimum length, and percent soundness of the wood, as appropriate.

## V

**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 Quality Objective (VQO)** - Categories of acceptable landscape alteration measured in degrees of deviation from the natural-appearing landscape.

Preservation (P) - Ecological changes only.

Retention (R) - Management activities should not be evident to the casual Forest visitor.

Partial Retention (PR) - Management activities remain visually subordinate to the characteristic landscape.

Modification (M) - Management activities may dominate the characteristic landscape but must, at the same time, follow naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground.

Maximum Modification (MM) - Human activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.

Enhancement - A short-term management alternative that is done with the express purpose of increasing positive visual variety where little variety now exists.

## 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.

**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.

## X, Y, Z

**Yarding** - Hauling timber from the stump to a collection point.

**18 Fire Salvage Project**  
**Biological Evaluation/Assessment**  
Bend-Ft. Rock Ranger District  
Deschutes National Forest  
*Jim Lowrie, District Wildlife Biologist*

### **Introduction**

It is Forest Service policy to avoid all adverse impacts on threatened and endangered species and their habitats except when it is possible to compensate adverse effects totally through alternatives identified in a biological opinion rendered by the Fish and Wildlife Service. Measures are to be identified and prescribed to prevent adverse modification or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened, and proposed species (Forest Service Manual, FSM 2670.31). Through the biological evaluation process (FSM 2672.4), actions and programs authorized, funded, or carried out by the Forest Service are to be reviewed to determine their potential for effect on threatened and endangered species and species proposed for listing (FSM 2670.31). Species classified as sensitive by the Forest Service are to be considered through the National Environmental Policy Act process by conducting biological evaluations to determine the potential effect of all programs and activities on these species (FSM 2670.32). No impacts may be allowed on sensitive species that would result in loss of population viability or create significant trends toward Federal listing. The findings of biological evaluations are to be documented in a decision notice or, if applicable, in official files.

The following biological evaluation/assessment evaluates the effects of all proposed alternatives for the 18 Fire Salvage Project including the No Action alternative. For species other than those classified as Proposed, Endangered, Threatened or Sensitive (PETS) refer to the Wildlife Report for the project. A Biological Assessment is prepared for the 18 Fire Salvage Project, because it is a major federal construction project that requires an environmental impact statement.

Effects of the project are evaluated for those PETS species that are documented or suspected to occur within the 18 Fire Salvage Project area. Existing management direction is found in the Deschutes National Forest Land and Resource Management Plan (LRMP; USDA, 1990), as modified by the Regional Forester's Forest Plan Amendment #2 ("Eastside Screens," USDA, 1995). Projects proposed in occupied or potential habitat of any proposed, candidate, threatened, or endangered species on the Forest must be consistent with the Project Design Criteria (PDC) for the Joint Aquatic and Terrestrial Programmatic Biological Assessment (BA) for Fiscal Years 2003-06 (USDA et al., 2003), hereafter referred to as the Programmatic BA. Project's that affect the species addressed by the document, and do not meet the applicable PDCs, must initiate the appropriate level of consultation with the Fish and Wildlife Service.

### **Project Location and Description**

The 18 Fire Salvage Project is located approximately four miles southeast of Bend, Oregon within the administrative boundaries of the Bend-Ft. Rock Ranger District on the Deschutes National Forest. It encompasses 2030 acres of the gross 3810 acre fire area. The elevation averages about 4400 feet and the topography is nearly flat. However, several buttes which were involved in the fire but excluded from the project area are nearby.

The project area provided a low level of habitat diversity for wildlife prior to the fire. Dry, even-aged ponderosa pine forest dominated the area. The stands were classified as "black-bark" which are generally 50-60 years old with one canopy layer. The relatively low elevation and limited precipitation of the area likely preclude the site's ability to develop multi-stratum late and old structure (LOS) forest. However, it is capable of producing single-story LOS. There are no natural streams, springs, ponds, lakes or man-made guzzlers in the project's area. Other than some minor lava outcrops there are also no special or unique habitats including cliffs, talus, caves, aspen, mountain mahogany, or extensive areas of forested lavas.

Approximately 95% of the project area is classified as big game winter range that is important to mule deer and elk. Mule deer are the dominant big game species and are distributed across the area throughout the year. Other medium and large mammal species potentially inhabiting this area include black bear, mountain lion, badger, coyote, and bobcat.

A variety of small mammals and birds were present in the project area prior to the wildfire. Refer to the summary table in the Wildlife Report for a partial listing of species. There are no known records of any PETS species occupying the project area. Reference the District files for the Fuzzy and Kelsey Projects which conducted surveys throughout the project area and in an extensive area around the project.

**Historic Range of Conditions**

The historic population levels of wildlife species endemic to the 18 Fire Salvage Project area are unknown. It is likely those species associated with relatively dry, open ponderosa pine forest with frequent, low intensity wildfire were more common. Fire suppression, timber harvest, road construction, and nearby development on private lands have impacted the wildlife populations of the local area. Species including the flammulated owl, white-headed woodpecker, pygmy nuthatch, Lewis’ woodpecker, and olive-sided flycatcher are examples of species that were likely more common historically. Mule deer utilize the area year-around, and due to its low elevation it is particularly important as winter range. Deer numbers have declined from past levels in the North Paulina herd unit due to cumulative effects from elimination or degradation of their habitats.

There was no late successional forest (LOS) present prior to the fire. The understory in the uniform black-bark forest was relatively simple with bitterbrush and Idaho fescue being the dominate species. Openings allowed for greater shrub cover. A plantation of ponderosa pine created after the Bessie Butte Fire in 1996 is present in the northwestern portion of the area adjacent to the project boundary. Rocky outcrops with low tree stocking create some horizontal diversity. In general the area was very homogenous and the nearby buttes (i.e. Luna and Bessie) provided the only topographic diversity.

**Existing Habitat Conditions**

The fire created a mosaic of burn intensities. Areas with low intensity and small areas of moderate and high intensities, as well as steep slopes have been excluded from the project area (~1800 acres). Burn intensities (i.e. tree crown mortality) within the project include: low at 0% and moderate/high at 100%. At least 90% of moderate burn intensity trees and at least 95% of the high intensity trees are dead. The remainder of the fire (i.e. 1780 acres of non-salvage) has 89% in low intensity and 11% in moderate/high intensity.

**Species and Habitats Evaluated**

The following species and their habitats were considered in the preparation of this document. Those with bolded type are known, suspected or have some potential to occur within the project boundary. There are no known current sites occupied, no known historic sites, and no current or potential habitats for those species that have not been designated.

**SPECIES**

**CLASSIFICATION**

<i><b>Haliaeetus leucocephalus</b></i>	<b>Northern bald eagle</b>	<b>T, OR/T</b>
<i>Strix occidentalis caurina</i>	Northern spotted owl	T
<i>Felis lynx canadensis</i>	Canada lynx	T
<i>Rana pretiosa</i>	Spotted frog	C, OR/S
<i>Histrionicus histrionicus</i>	Harlequin duck	S, SOC
<i>Podiceps auritus</i>	Horned grebe	S

<i>Podiceps grisegena</i>	Red-necked grebe	S, OR/S
<i>Bucephala albeola</i>	Bufflehead	S
<i>Coturnicops noveboracensis</i>	Yellow rail	S
<i>Agelaius tricolor</i>	Tricolored blackbird	S
<b><i>Centrocercus urophasianus</i></b>	<b>Greater or Western sage-grouse</b>	<b>S, SOC, OR/S**</b>
<b><i>Buteo regalis</i></b>	<b>American peregrine falcon</b>	<b>SOC*, S, OR/E</b>
<b><i>Accipiter gentiles</i></b>	<b>Northern goshawk</b>	<b>SOC*, OR/S</b>
<i>Buteo regalis</i>	Ferruginous hawk	SOC, OR/S,
<b><i>Corynorhinus townsendii townsendii</i></b>	<b>Pacific western big-eared bat</b>	<b>SOC, OR/S</b>
<i>Gulo gulo luteus</i>	California wolverine	S, SOC, OR/T
<i>Martes pennanti pacifica</i>	Pacific fisher	S, SOC, OR/S
<i>Sorex preblei</i>	Preble’s shrew	SOC
<b><i>Sylvilagus idahoensis</i></b>	<b>Pygmy rabbit</b>	<b>S, SOC, OR/S</b>

Note: E=Endangered, T=Threatened, C=Candidate for Federal listing, P=Proposed for Federal listing, SOC=USFWS Species of Concern, \* = Birds of Conservation Concern (USDI 2002) , S=USFS Region 6 Sensitive, OR/T,E,S = State of Oregon status. \*\*Petitioned for listing but found to not be warranted by the USFWS (USDI 2003).

The following species are concluded to not be in or near the project, however the information provided will assist in clarification of the conclusions. The project area is at least 20 miles from nearest known **spotted owl** site, and there is no current or potential habitat in the project area. There is no classified habitat or any other evidence of **Canada lynx** on the Deschutes National Forest. Habitat for **wolverine** and **fisher** is not found in or near the project area. Fish including the **bull trout** and mid-Columbia basin (Deschutes River basin) **steelhead** have no habitat in or proximate to the project. Nor will the project affect any water resources connected to their habitats.

The **northern goshawk** and **Pacific western big-eared bat** are addressed by the Wildlife Report for this project. Neither species has USFS Region 6 Sensitive status, however the goshawk has been petitioned in the past for federal listing, and the big-eared bat is a former Sensitive species. The following species are included in this assessment because each has a remote possibility of being in the projects area (e.g. migration, accidental).

**American peregrine falcon:** The only potential nesting habitat (Cutsi et al., 2001; Johnson and O’Neil, 2001) in the area is 19 miles to the east on the cliffs on the southwest flank of Pine Mountain. However, the cliffs are likely not high enough or sheer enough for adequate security for peregrines to nest. Generally, they nest within one mile of water (Marshall et al., 2003), which is lacking in the project’s area and at least 6 miles away. Further, there are no potential foraging areas (e.g. riparian zones, marshes) with high numbers of birds in the vicinity of the project. There have been no known observations of peregrine falcons within the project area, however there is the potential for migrating birds to pass through the area.

**Pygmy rabbit:** This species may occur on the eastern fringe of the District which is 4-5 miles from the project. Pygmy rabbits require relatively tall, dense clumps of sagebrush (i.e. Great Basin or big sage; Gabler et al., 2000) on deep, friable soils (Csuti et al., 2001; Johnson and O’Neilk 2001). Studies suggest that a high canopy cover of sage is required (i.e. 21-36%, Utah Div. of Wildlife, 2003). The volcanic pumice soils of the projects area are loose and not conducive to supporting the tunnels built by pygmy rabbits. Further, the area is dominated by bitterbrush and has very little sagebrush. The fire eliminated almost all of the shrubs.

**Greater or Western sage-grouse:** Sage-grouse are closely associated with big sagebrush habitat types and are commonly referred to as “sagebrush obligates” (USDI, 2000; Marshall et al., 2003). During the spring and summer months they may use the fringes of open forest habitat types with good herbaceous understories (Connelly et al., 2000). In winter they depend upon low elevation big sagebrush habitats for survival. There are no known lek sites (i.e. breeding/display grounds) on Forest Service lands, however there is a site near Evans Well approximately 11 miles east of the project boundary that is on BLM lands. There are also no known winter or brood rearing grouse habitats within the vicinity of the project (USDI, 1995).

**Northern bald eagle:** The nearest bald eagle sites are approximately 11 miles to East Lake and 31 miles to the Flat Top site. Bald eagles require an adequate supply of fish, nearby nest site (usually large trees within a kilometer of water), and solitude during nesting (Johnsgard, 1990). There is currently no nesting or roosting habitat in the project area, and there was none prior to the fire either. However there is a remote potential for bald eagles to forage on deer or other carrion in the area.

### **Environmental Consequences**

**Alternative Descriptions** - Refer to the project's environmental assessment for a complete description of the alternatives and the environmental consequences. Post-fire literature (e.g. McIver and Starr, 2000; Ambrose et al., 2003; Beschta et al., 1995) on salvage harvest was reviewed to further identify issues for evaluation.

**Alternative 1 No Action:** This alternative would leave the project area as it is post-fire. There would be no salvage harvest, reforestation plantings, or road closures. The area would be allowed to naturally restore itself. The establishment of coniferous trees would be slow and uneven. Grasses, forbs, and some shrub species should recover relatively quickly. However, they would compete with the natural conifer seedlings, and further extend the time of reforestation. Large amounts of dead and down trees would accumulate through time. This may benefit some species but potentially negatively affect some others, e.g. deer movement.

**Alternative 2 Proposed Action:** The proposed action would salvage harvest within a 2030 acre area of the fire, which had a gross acreage of 3810 acres. Approximately 8.5 million board feet of logs would be removed from 8 individual harvest units. Existing and temporary roads would be used in removing the material. No new, permanent roads would be constructed. After harvest, road/area closures to motorized vehicles would be implemented that would reduce the current density. The area would be reforested after harvest with variable densities of tree planting with dense planting in pre-identified locations for deer cover, movement corridors, and roadside screens.

**Alternative 3 Rehabilitation Action:** This alternative would not do any salvage harvest. Reforestation would be done in the same way as for the Proposed Action. Road/area closures would also be identical to the Proposed Action.

### **Direct, Indirect, and Cumulative Effects**

**Alternative 1 (No Action):** There would be no indirect or direct adverse effects or impacts on any of the known or suspected species in the preceding list, because the area would naturally recover and not be salvage logged. None of the assessed Sensitive species are dependent upon ponderosa pine forest and therefore, it's recovery rate is not an issue. The northern bald eagle uses ponderosa pine forest for nesting and roosting, but as stated earlier it was not used prior to fire, and the area is totally unsuitable now. The delay in the establishment of forest in this alternative will likely not affect bald eagles.

### **Alternatives 2 and 3:**

**Peregrine falcon**—There are no known indirect or direct negative impacts on this species by the action alternatives of this project. This determination is based upon: 1) no known occupancy; 2) no cliff habitats (i.e. nesting) are present; and 3) no suitable foraging habitats within the project's area (existing or potential).

**Pygmy rabbit**—There are no known indirect or direct negative impacts on this species by the action alternatives of this project. This determination is based upon: 1) no probability of any pygmy rabbits occupying the project area due to unsuitable soil types; and 2) no sagebrush dominated plant associations are present (existing or potential).

**Greater sage-grouse**— There are no known indirect or direct negative impacts on this species by the action alternatives of this project. This determination is based upon no known occupancy and no suitable (existing or potential) habitats within the project area.

**Northern bald eagle**— There are no known indirect or direct negative impacts on this species by the action alternatives of this project. This determination is based upon the fact that the potential nesting and roosting habitat has been eliminated by the fire. Further, the project would not affect their access to forage resources (i.e. big game carrion).

**Cumulative Effects**— Cumulative effects on habitats by the No Action alternative include: 1) Additional stand replacement fire acreage when totaled with the other fires in the vicinity (i.e. Evans West and Skeleton). In addition, the long recovery period for areas that are not reforested (e.g. Skeleton fire) will further delay the attainment of LOS forest habitats over a large area. 2) The eventual accumulation of large amounts of down and dead material in the area may be a risk to future catastrophic fires, which could potentially seriously impact the soil resources (i.e. heavy log sized fuels on the ground) and further delay the establishment of a functioning forest.

The Proposed Action alternative would mitigate the loss of coniferous habitat in the area by reforestation. However, the benefits would at best be in the mid-term (i.e. 15+ years). Road closures would contribute to reducing the cumulative effects from roads in this general area (i.e. loss of solitude). Reducing the volume of woody debris by salvaging would reduce the probability of future catastrophic wildfires which could impact an area much larger than the project. It would also facilitate the movement of some species through the area. The salvage logging would whole tree yard all the harvested trees which would greatly reduce potential post-logging fuel accumulations.

The cumulative effects of the Proposed Action on species common to ponderosa pine forest habitat are as follows: 1) those species requiring open canopied forest structure would benefit because the forest would be re-established more quickly. Further, maintaining 60% of the area in relatively low tree densities (i.e. deer forage areas) would also benefit this group; 2) species requiring heavy canopied, multi-stratum LOS habitat would not be adversely affected because the low site productivity of the area likely precludes growing this type of habitat; and 3) cavity dependent species would be provided for by the retention levels of snags, however several species would have insufficient snag levels post-salvage (Marcot et al, 2003). The magnitude of this adverse effect is not significant at the population level of these species. This is because the project area is very small compared to their home ranges. Within unit mitigation patches and the non-salvaged areas adjacent to the project would help mitigate these effects.

The Rehabilitation Action alternative would have affects in common to both previous alternatives including the accumulation of large amounts of down and dead material (generally negative), the restoration of forested habitats (positive), and road closures (positive). The reforestation investments could potentially be lost to future catastrophic wildfire due to heavy fuels accumulations, which would further delay providing open canopied forested habitats for many species.

Cumulative and future effects common to all the alternatives include:

- Increased natural fuel loadings and risk of future wildfire. The magnitude and duration of this risk are unknown, but likely extend to the long-term (i.e. 50+ years).
- Increased probability of insect attacks on residual and adjacent green trees due to the attraction to standing and down snags. The magnitude and duration of this effect are unknown.
- The adjacent (east, southeast) Fuzzy Project has affected the habitats for a variety of species. There is a minor overlap of the two projects. Negative effects from the Fuzzy Project were mitigated via the environmental assessment.
- The overlapping Kelsey Project will be affecting habitats. The environmental assessment is currently being revised to account for the cumulative affects of the 18 Fire and planned Kelsey activities. The 18 Fire Salvage Project does not add to the effects on coniferous forest habitat, because the fire eliminated these habitats. In fact, alternatives that include reforestation will facilitate the recovery of forested habitats.

- The current 18 Fire Road Salvage Project is removing snags from a narrow strip along the major roads through the fire's area. It is not expected to contribute to cumulative effects on snag dependent species due to the limited area impacted.
- Existing road, motorized trails, gas line corridors, gravel pits, etc. are found throughout the surrounding area. The Proposed Action alternative will only add temporary road impacts, which will be of short duration and of minor magnitude to the wildlife resources of the project area.

There are no adjacent private lands or BLM administered lands to the project area that would have a significant contribution to the cumulative effects of this project. Development on private lands as an example, often totally eliminates habitat. But the 18 Fire Project action alternatives will restore it. There is no current active livestock grazing in the project area that would contribute to cumulative effects.

In conclusion, there are no known adverse cumulative effects from the 18 Fire Salvage Project on any PETS species. This determination is based upon: 1) there is no known occupancy by any PETS species within the project area or within the local vicinity; 2) the project effects will not eliminate or degrade any existing or potential PETS species' habitats; and 3) there are no known or expected PETS species' migration or temporary uses of the area, because the area does not have any essential suitable habitat presently, nor any significant future potential. This includes the northern bald eagle, because they prefer to nest near water bodies with good fish populations for foraging (Marshall et. al, 2003). Winter foraging on big game carrion by bald eagles has not been observed in this area, and it is not an important source site for them. The nearest known area where bald eagles forage on big game carrion (i.e. road kills) is along State highway 31 southeast of La Pine, Oregon, which is over 30 miles distance.

#### **Compliance with Project Design Criteria (PDCs)**

All potentially applicable PDCs from the Programmatic BA species were reviewed. Compliance is not a question for the project given that the only potential species for consideration are the greater sage-grouse, which is not present or a potential occupant of the project area, and the northern bald eagle, which has a very low probability of using the area and would not be affected by any alternative of the project.

#### **Conclusions**

For Region 6 Sensitive Species:

**American peregrine falcon**— No Impact

**Pygmy rabbit**— No Impact

**Greater sage-grouse**— No Impact

For species with federal status:

**Northern bald eagle**— No Effect.

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**18 Fire Salvage Project**  
**Wildlife Report**  
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**Bend-Ft. Rock Ranger District**  
**Deschutes National Forest**  
*Version 1.0*

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Appendix

**Introduction**

The following report meets the direction provided by the Forest Service Manual (FSM 2600), the Deschutes National Forest (DNF) Land and Resource Management Plan (LRMP), and the Environmental Assessment for the Continuation of Interim Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales (referenced as the “Eastside Screens”). It specifically addresses the 18 Fire Salvage Project’s effects upon Management Indicator Species (MIS) as designated by the LRMP, ecological indicator species and/or habitats as described in the FSM, and Species of Concern (SOC) or Sensitive (S) as respectively designated by the Fish and Wildlife Service (FWS) or the Oregon Department of Fish and Wildlife (ODFW). Species that are addressed by the Migratory Bird Treaty Act (MBTA) and the related Executive Order of 2001 (#13186) are also noted. The report does not address those species designated as threatened, endangered or proposed/candidate for federal listing under the Endangered Species Act. For these species and for those designated as Sensitive by the Forest Service Regional Office (Region 6) refer to the Biological Evaluation/Assessment (BE/BA) for this project.

**Landscape Overview**

The 18 Fire Salvage Project is located approximately four miles southeast of Bend, Oregon within the administrative boundaries of the Bend-Ft. Rock Ranger District on the Deschutes National Forest. It encompasses the gross 3810 acre fire area but only proposes to treat 2030 acres within it. The elevation averages about 4400 feet and the topography is nearly flat. However, several buttes which were involved in the fire but excluded from the project area are nearby.

The project area provided a low level of habitat diversity for wildlife prior to the fire. Dry, even-aged ponderosa pine forest dominated the area. The stands were classified as “black-bark” which are generally 50-60 years old with one canopy layer. The relatively low elevation and limited precipitation of the area likely preclude the site’s ability to develop multi-stratum late and old structure (LOS) forest. However, it is capable of producing single-story LOS. There are no natural streams, springs, ponds, lakes or man-made guzzlers in the project’s area. Other than some minor lava outcrops there are also no special or unique habitats including cliffs, talus, caves, aspen, mountain mahogany, or extensive areas of forested lavas.

Approximately 95% of the project area is classified as big game winter range that is important to mule deer and elk. Mule deer are the dominant big game species and are distributed across the area throughout the year. Other medium and large mammal species potentially inhabiting this area include black bear, mountain lion, badger, coyote, and bobcat.

A variety of small mammals and birds were present in the project area prior to the wildfire. Refer to the following table for a partial listing of species. Species bolded and italicized will be evaluated to determine recommendations for the project.

***Table 1: Selected Wildlife Species Summary***

<b>Species</b>	<b>Occur- rence*</b>	<b>Management Indicator Species</b>	<b>FWS Species of Concern</b>	<b>ODFW Sensitive Species</b>	<b>Ecological Indicator Species**</b>
Northern goshawk (NTMB, MBTA)	S	X	X	X	X (1)
Sharp-shinned hawk (NTMB, MBTA)	S	X			(4)

Table 1 continued

Species	Occurrence*	Management Indicator Species	FWS Species of Concern	ODFW Sensitive Species	Ecological Indicator Species**
Red-tailed hawk (NTMB, MBTA)	C	X			(7-generalist)
Cooper's hawk (NTMB, MBTA)	S	X			
Golden eagle	U	X	BCC (BCR 9)		(6)
<i>Flammulated owl</i> (NTMB, MBTA)	U		BCC (BCR 9)	X	X (1, 2a, 4, 5- interspersed grassy openings and thickets)
Northern pygmy- owl (MBTA)	U			X	(2a, 7-open forests, edges)
<i>Lewis' woodpecker</i> (NTMB, MBTA)	U	X	BCC (BCR 9)		X (2a-large snags, 7-burns)
<i>White-headed woodpecker</i> (MBTA)	U (declining, local extirpation, BBS)	X	BCC (BCR 9)	X	X (1-PP, 2a, 2b, 7-sugar pine foraging, large LOS patches)
<i>Hairy woodpecker</i> (MBTA)	C				X (2a, 2b, 7-burns)
Black-backed woodpecker (MBTA)	R	X		X	X (1-LPP, 2a, 2b, 7-burns)
<i>Williamson's sapsucker</i> (NTMB, MBTA)	R (declining, BBS)	X	BCC (BCR 9)	X	X (2a-large snags, 2b, 7-higher elevations)
<i>Pygmy nuthatch</i> (migratory, MBTA)	U			X	X (1-PP, 2a, 2b, 7-large trees)
White-breasted nuthatch (migratory, MBTA)	U-C				X (1-PP, 2a, 2b)
Mountain chickadee (migratory, MBTA)	C				(1, 2a, 2b, 5)
<i>Green-tailed towhee</i> (NTMB, MBTA)	U				X (3)
<i>Olive-sided flycatcher</i> (NTMB, MBTA)	U-C (declining, BBS)		BCC (BCR 5)	X	X (1, 2a, 7-burns, clearings, edges w/ conifers)
Dusky flycatcher (MBTA)	U				X (3, 7- clear-cuts)
<i>Chipping sparrow</i> (NTMB, MBTA)	U (declining, BBS)				X (7- open understory w/regenerating pines)
<i>Mountain bluebird</i> (NTMB, MBTA)	U-C				X (2a, 7- burns, openings)
Rock wren (MBTA)	U				X (7-talus, rock, clear-cuts)
<i>Mule deer</i>	C	X			(7-shrubs winter range)

American marten	R	X		X	X (1-MC, LPP, 7-CWM concentrations)
<i>Yellow-pine chipmunk</i>	C				X (2a, 2b)
Townsend's big-eared bat (Pacific western)	S	X	X	X	(3-foraging, 6-caves)
Western small-footed myotis	S		X	X	(3-foraging, 6-cliffs, 7-bark of trees)
Long-eared myotis	S		X	X	(2a, 2b, 6, 7-open forest, bark of trees)
Long-legged myotis	S		X	X	(2a, 6, 7-bark of trees)
Palid bat	S			X	(6, 7-roosts in trees)
Silver-haired bat	S			X	(2a-cavities, 7-forages in forest, bark of trees)
Northern sagebrush lizard	S		X		X (2b, 3, 6-rock outcrops,
<i>Western fence lizard</i>	C				X (2b, 6-rocks)
Western skink	S				X (2b)
Western toad	U				X (2b)
Rubber boa	S				X (2b)

*\*Note: Relative abundance (18 Fire area only, pre-fire occupancy) codes: C = common, U = uncommon, R = rare, S = suspected but not confirmed, i.e. potential habitat available. \*\* Special habitat requirements codes: 1 = late and old successional forest (LOS), 2a = snags, 2b = logs, 3 = mature shrubs, 4 = dense conifers for nesting/foraging, 5 = meadows or grassy openings for foraging, 6 = special/unique habitats (rock, cliffs, caves, etc.), 7 = other, noted. Abbreviations: LPP = lodgepole pine, PP = ponderosa pine, MC = mixed conifer, CWM = coarse woody materials (logs and limbs > 3" in diameter), NTMB = neotropical migrant bird, MBTA = Migratory Bird Treaty Act listing FWS Species of Concern includes species identified by the 2002 Birds of Conservation Concern (BCC) publication (USDI, 2000) with the applicable Bird Conservation Region (BCR; BCR5 is the Northern Pacific Forest and BCR9 is the Columbia Basin). Other references included Guenther and Kucera, 1978, USDA, 1990 and 2000, ODFW 1997, Csuti et al. 2001, Marshall et al., 2003, and USDI, FWS, 2001.*

### Historic Range of Conditions

The historic population levels of wildlife species endemic to the 18 Fire Salvage Project area are unknown. It is likely those species associated with relatively dry, open ponderosa pine forest with frequent, low intensity wildfire were more common. Fire suppression, timber harvest, road construction, and nearby development on private lands have impacted the wildlife populations of the local area. Species including the flammulated owl, white-headed woodpecker, pygmy nuthatch, Lewis' woodpecker, and olive-sided flycatcher are examples of species that were likely more common historically. Mule deer utilize the area year-around, and due to its low elevation it is particularly important as winter range. Deer numbers have declined from past levels in the North Paulina herd unit due to cumulative effects from elimination or degradation of their habitats.

Prior to the wildfire, the project area was dominated by a relatively young (i.e. "black-bark"), even-aged ponderosa pine stand. There was no late successional forest (LOS) present prior to the fire. The understory

was also relatively simple with bitterbrush and Idaho fescue being the dominate species. Openings allowed for greater shrub cover. A plantation of ponderosa pine created after the Bessie Butte Fire in 1996 is present in the northwestern portion of the area adjacent to the project's boundary. Rocky outcrops with low tree stocking create some horizontal diversity. In general the area was very homogenous and the nearby buttes (i.e. Luna and Bessie) provided the only topographic diversity.

### **Existing Habitat Conditions**

The fire created a mosaic of burn intensities. Areas with low intensity and small areas of moderate and high intensities, as well as steep slopes have been excluded from the project area (~1800 acres). Burn intensities (i.e. tree crown mortality) within the project include: low at 0% and moderate/high at 100%. At least 90% of moderate burn intensity trees and at least 95% of the high intensity trees are dead. The remainder of the fire (i.e. 1780 acres of non-salvage) has 11% in moderate/high intensity and 89% in low intensity.

**Big Game**— As previously noted, approximately 95% of the area is classified as winter range (i.e. LRMP Management Area 7, Deer Habitat). Both deer and elk use the area and are expected to continue post-fire, however it will take several years of recovery before use levels begin to increase. Bitterbrush, *Purshia tridentata*, and other shrubs sustained a high level of mortality from the fire, except in a few patches in openings. Bitterbrush and sagebrush, *Artemisia spp.*, are species that are easily killed by fire. In low intensity fires bitterbrush may sprout from root collar buds, but it is unlikely in more severe intensity fires. Sagebrush does not sprout. Rodent caches of bitterbrush seed may have survived the fire and assist in recovery. Grass species such as Idaho fescue, *Festuca idahoensis*, will likely recover very quickly. Herbaceous plants will be more valuable to wintering elk than mule deer, which prefer woody browse plants in the winter months. Areas over 600 feet from the remaining hiding/thermal cover around the fire's perimeter will likely not be fully utilized by big game species (Thomas et al., 1979).

Hiding and thermal cover for big game has been eliminated by the fire. Some marginal cover still remains in those areas of lower intensity burn near the project boundary. Unburned areas adjacent to the fire are dominated by single-story black-bark ponderosa pine which generally provides marginal cover at best. Previously designated deer movement corridors have also been eliminated by the fire (reference the analysis files).

**Other Species**— There is a complex group of wildlife winners and losers post-fire. Those animals requiring dense or mature forest will be reduced or eliminated. Others favoring open habitats, snags, and grass dominated environments will be favored. Woodpeckers, sapsuckers, robins, juncos, red-tailed hawks, and gophers will all be present in the fire's area in the near-term. There were no known raptor nest sites within the project area prior to the fire. The relatively uniform black-bark pine habitat provided limited nesting habitat for sharp-shinned hawk, Cooper's hawk, and northern goshawk. Surveys had been previously done by the Fuzzy Project (implementation phase), which overlapped a minor amount of the project on the east side, and by the Kelsey Project (planning phase), which covers the majority of the 18 Fire area. Field reconnaissance was done post-fire but no formal surveys for any species were done.

**Shrub Habitat**— Shrubs, primarily bitterbrush, provide critical mule deer winter forage. They also provide nesting and foraging habitat for shrub-associated species (e.g. yellow-pine chipmunk and golden-mantle ground squirrel), and neotropical migrant birds, such as Brewer's sparrow and green-tailed towhee (Paige and Ritter, 1999). Many of these species, particularly the seed-caching rodents, i.e. the yellow-pine chipmunk, serve an important ecological role in the regeneration of shrub species (Vander Wall, 1994). Refer to the report's section on Indicator Species for more detailed information on species dependent upon shrub habitats.

**Roads and Trails**— The area has a road density of 4.5 miles per square mile. There is one horse trail in the vicinity of Bessie Butte adjacent to the project area. Direct and indirect impacts to habitats from existing roads have been low to moderate depending on the class (i.e. width, level of use) of road.

**Late and Old Structure Habitat (LOS)/Old Growth Management Areas (OGMA)**— There was no classified LOS present in the project area or designated OGMA (Forest Service 1990, LRMP). However, there are several OGMA west of the project.

**Connectivity and Fragmentation**— Prior to the fire several connectivity areas had been designated and maintained through the project area for deer movement and OGMA/LOS connectivity. The fire has eliminated major portions of the corridors, which are not recoverable in the short-term. Fragmentation was low in the area and was primarily related to the effects of the adjacent Bessie Butte fire and roads. Past timber harvest had been selective cutting and not seed tree harvest or clear-cuts, which would fragment the landscape.

**Snags, Green Trees and Coarse Woody Materials (CWM) Habitats**— A snag is defined as a dead or partly dead tree (or stump per Johnson and O'Neil 2001) that is over 4 inches in DBH and taller than 6 feet (Thomas et al., 1979). Coarse woody material (CWM) or woody debris is the accumulation of dead woody material on the forest floor including limbs and logs (Thomas et al., 1979). Numerous species of animals use snags and CWM for foraging, nesting, denning, roosting and resting. The most notable of the wood-using wildlife species are the primary cavity nesters including woodpeckers and nuthatches that excavate nest cavities in decayed wood in standing trees. Vacated cavities are subsequently used by many other birds and small mammals (i.e. secondary cavity users). Selected wildlife species known or suspected to occur in the pre-fire project area that utilize these habitats include the flammulated owl, northern pygmy owl, white-headed woodpecker, Williamson's sapsucker, pygmy nuthatch, white-breasted nuthatch, mountain bluebird, western small-footed myotis, long-eared myotis, long-legged myotis, pallid bat, and silver-haired bat. Refer to Table 1 for individual species' management status and occurrence within the project area.

Desired conditions of snag and CWM habitat are based in part on management recommendations and standards and guidelines provided by the Deschutes National Forest Land and Resource Management Plan (USDA 1990), Deschutes National Forest Wildlife Tree and Log (WLTL) Implementation Strategy (USDA, 1994), and the Revised Interim Management Direction (Eastside Screens; USDA 1995).

The Proposed Decision for the Interior Columbia Basin Final Environmental Impact Statement (ICBEMP 2000) and Draft Environmental Impact Statement (EIS) for ICBEMP were also reviewed for new management guidelines related to these habitats. Standard B-S29 of the Proposed Decision indicates that the tables in Appendix 12 (in Volume 2 of the Supplemental Draft EIS) shall be used to determine snag numbers and coarse woody debris levels whenever vegetation management is done. If adequate numbers of snags greater than 21 inches diameter at breast height are not available prior to vegetation management activities to meet the levels indicated in Appendix 12, then a mix of the largest snags available shall be substituted. The Supplemental Draft EIS direction (Appendix 12) recognized that the broad standards may require fine-tuning for more local ecological conditions. The ICBEMP snag and CWM guidelines were focused on maintaining snags and CWM >21 inches DBH and did not address snags and CWM less than 21 inches DBH, or size and density by plant association group (PAG). Within the 18 Fire Salvage Project area, snags and CWM greater than 21 inches DBH are limited, which restricts the utility of using the ICBEMP guidelines.

The DecAID Advisor (Marcot et al., 2003) was extensively utilized in the analysis of existing conditions and in the recommended desired conditions for snags and down wood cover, which are addressed in a following section. This reference is available via the internet at <http://www.notes.fs.fed.us:81/pnw/DecAID/DecAID.nsf>. Other literature including the report by Beschta, et al., 1995, was reviewed, but DecAid was concluded to be the most current scientific information on this topic. The following table summarizes the present levels of snags within the projects area (refer to the map in the Appendix for unit locations).

Table 2: Existing Snag Levels

Unit	Diameter Mid-Point	Height	No. Per Acre	Notes
1	6	35	15.8	Total of 49.7 tons of material per acre.
	9	55	18.8	
	12	65	17.8	
	15	80	13.1	
	18	90	4.9	
	24	110	5.3	
2/3	6	“ “	28.6	Total of 48.4 tons of material per acre.
	9		14.3	
	12		17.1	
	15		10.0	
	18		11.4	
	24		2.9	
4	6	“ “	4.7	Total of 71.8 tons of material per acre.
	9		16.5	
	12		35.3	
	15		22.4	
	18		8.2	
	24		5.9	
5	6	“ “	8.9	Total of 32.8 tons of material per acre.
	9		11.1	
	12		37.8	
	15		8.9	
	18		2.2	
	24		0	
6/7	6	“ “	11.1	Total of 61.2 tons of material per acre.
	9		14.4	
	12		11.1	
	15		14.4	
	18		12.2	
	24		6.7	
8	6	“ “	12.0	Total of 46.0 tons of material per acre.
	9		30.0	
	12		30.7	
	15		14.7	
	18		4.0	
	24		1.3	

*Note: Source Jim Schlaich, Project Team Leader. Independent snag transects resulted in similar data, but it was noted that there were areas throughout the project area with openings and much lower snag levels. The above data represent averages of the plots taken.*

The fire consumed the majority of down logs and smaller coarse woody materials, so there was no data to collect on these habitat features. For reference, the pre-fire snag levels were averaged (5 inventory stands) as follows (all ponderosa pine): 12”-24” diameter-at-breast-height (dbh) 3.1 snags per acre; 21”+ dbh <.1 snag per acre (source P. Powers, project silviculturist; FVS data runs).

#### **Desired Future Conditions**

**Indicator Species** - The following table displays habitat and information for selected Management and Ecological Indicator Species from Table 1. Selected species reflect the site capability of the project site. Both short-term and long-term habitat objectives are displayed in the Habitat Description section. The territory and/or home range sizes will be used in the development of the spatial arrangement of habitat components.

**Table 3: General Objectives for Management and Ecological Indicator Species**

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



*Note: \*Focal Species for the Central Oregon Sub-province (Altman 2000). Other principal references include Csuti et al., 2001; Johnson and O'Neil, 2001; Marshall et al., 2003; Thomas et al., 1979; and Marcot et al., 2003).*

**Habitat Components & Elements** - The following sections describe the principal habitat elements that the selected Indicator Species will require. Specific Desired Conditions for each species/group that are necessary to maintain viable local populations in the long-term are described in the section following each component/elements descriptions.

**Snags/CWM Habitat Component:** The following table was developed from the DecAID Advisor and shows future desired conditions for both large (i.e. 150 years+) and small-medium ponderosa pin (i.e. 40-150 years) structural stages. The former is provided for comparative information, and the latter will be the basis for specific Desired Conditions for the project area. The attainment period for both stages would be subject to a variety of variables including: 1) reforestation success rate; 2) tree density; 3) tree mortality or damage agents; 4) competition with other trees and vegetation (i.e. growth rates); and 5) climate (precipitation, drought).

**Table 4: DecAID General Desired Conditions for Snags and Down Wood**

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

Table 5 summarizes the individual elements for snags and coarse wood materials that can be rated for importance to individual indicator species. The summary after the table will provide specific Desired Conditions that have unique numbers, e.g., DC#1. Each element will receive an attainment rating for each of the project's alternatives in the Environmental Consequences section.

**Table 5: Snags/CWM Elements**

Indicator Species* (territory size)	Element Ratings**			
	Snag Density (minimum #/ac./DecAID data @ 50% level)/DecAID data @ 50% Post-fire***	Snag Size (minimum/mean dbh)***	Snag Arrangement (clumped, individual or mix)	Log Cover (minimum DecAID data for 1.4% per acre)
Flammulated owl (15-30 ac.)	1 (??/?)	1 (22"/24")	2 (mix)	3
<i>Lewis' woodpecker</i> (15 ac.)	1 (??/24.8 burns)	1 (12"/26")	1 (clumped)	2
Williamson's sapsucker (15 ac.)	1 (1.5/?/?)	1 (12"/21")	2 (mix)	2
Hairy woodpecker (25 ac.)	1 (1.6/?/41.8)	1 (10"/17")	2 (mix, edges)	2
<i>White-headed woodpecker</i> (20 ac.)	1 (1.4/6.4/51.4)	1 (8"/26")	2 (individual)	2

<b><i>Pygmy nuthatch</i></b> (3 ac.)	1 (1.4/?/?)	1 (8"/18")	2 (mix)	2
Mountain bluebird (5-15 ac.)	1 (??/29.7)	1 (9")	1 (individual)	NA
Yellow-pine chipmunk	2	2	2 (individual)	2
Western fence lizard	NA	NA	NA	2

*Note: \*Italicized/bolded species are Focal Species (Altman, 2000). \*\*Rating codes—1 = required, 2 = used (not a critical parameter), 3 = indirect benefit (e.g. prey base uses), NA = not applicable. \*\*\*DecAID data from the ponderosa pine/Douglas-fir Open Vegetation Condition.*

In summary, the snag/cwm habitat component is critical to a significant majority of the Indicator Species. The individual species territories are subject to both intra- and inter-species competition. Therefore, the arrangement and numbers of snags must be designed so as to reduce competition across the landscape. A combination of individual and patches of snags/logs is recommended. The Desired Conditions for snag/log patches are as follows:

**DC#1**—Provide a minimum of 3 snags per acre as averaged for all snags in the unit. In addition, provide 34 snags (10" dbh) and/or recent blowdown per acre to meet the log cover element of 1.4% per acre.

**DC#2**—At least 60% of the snags should be 10"-20" dbh and the balance of 40% of 21" dbh or greater. Logs should be a minimum of 10" in diameter and 40' long.

**DC#3**—Provide a mix of both individual snags and patches of snags across the harvest units. All snag/log patches and individuals should be no closer than 100 feet to an open, system road. Patches can range in size from ½-5 acres, and distributed across the project area at a rate necessary to meet the total minimum. For example, if a total of 370 snags (30+340) are needed on 10 acres to meet DC#1, then a ½ ac. patch with an average of 50 snags/ac. (reference Table 2) would need to be retained at the rate of 5 patches (2.5 acres) together with 120 snags/blowdown scattered across the remaining 8 acres. Patches with higher densities of suitable snags/blowdown would need less replication.

Implementation of the Desired Conditions should take into consideration the observed distribution patterns of snags and logs that are cited in the DecAID Advisor. The recommended snag level as an example is an average derived from the various references. The data indicates that approximately 54% of the inventoried areas had no snags, while the balance of 46% had measurable snags >10" dbh. Therefore, retaining snags in patches is supported by the data. However, some species (e.g. Lewis' woodpecker) prefer individual snags in open areas, so having a mixed distribution of patches and individual snags meets more species' requirements. Species that utilize post-burn habitats have a higher snag requirement than they do in unburned forest. This is due to the lower levels of forage availability in recently burned areas. The snag levels indicated in Table 5 significantly exceed the level identified in the Desired Conditions for those species that prefer burned areas. However, the snags retained for future log inputs will provide adequate numbers for these species in the short-term. Further, the effects analysis will note the contributions of un-salvaged areas within the burn that will provide fully for these species.

Log retention also provides some flexibility. The referenced minimum of 34 logs in DC#1 is for only the 10" diameter size class. Given that a 10" log covers .041% of the ground, a 15" log covers .086%, and a 20" covers .152%, there is an opportunity to meet the total minimum percentage (i.e. 1.4%) with fewer logs using larger sizes. For example, a 10" log covers ~18 square feet and it would require 33.8 of them to meet the 610 square foot minimum. Leaving logs of 15" diameter (@ 37 square feet of coverage each) would only require 16.5 logs per acre. Logs of 20" diameter (@66 square feet of coverage each) would only require 9.2 per acre.

**Green Tree Replacements (GTRs) Habitat Component:** The majority of the project no longer has any green trees due to high mortality from the effects of the fire. However, the recognition of the importance of providing future green trees to continue the cycle of snags and logs for dependent species is critical. The site's capability to produce trees of adequate size for dependent species is important as related to the stand's density and subsequent ability to produce trees and future snags within a reasonable time period. The area is below 5000 feet in elevation and has low precipitation. The fire's area classified plant

association is CPS\_ \_ (Volland 1988), which is..... The following Desired Condition is designed to address meeting the long-term objectives for the GTR element (i.e. number of trees per acre for future snags and logs).

**DC#4**—Reforestation of the project area should provide and maintain 10-60 large (i.e. >21” dbh) ponderosa pine per acre in order to meet future snag and log habitats. The natural patchiness of ponderosa pine forest should be replicated. The retention of all remaining green trees (GTRs) within the burned area will contribute to future snag recruitment goals.

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

**Table 6: Big Game Elements**

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

*Note: \* Rating codes— 1 = required by the LRMP, 2 = not required by the LRMP.*

In summary, the described elements are critical for the maintenance of the mule deer population in the area. The LRMP and other agreements with the Oregon Department of Fish and Wildlife also direct that habitat for mule deer, and winter range in particular, will be maintained and enhanced where possible to meet specific herd objectives.

**DC#5**—Provide hiding cover on at least 10% of the winter range area and 30% of the summer range area in the mid-term (15+ years) by planting coniferous trees in strategic patches that are a minimum of 6 acres in size and 600 feet in width. Cover patches should be located at least 400 feet from open, system roads if possible. A seedling spacing of 15’ x15’ is recommended (200 trees/acre) or whatever is determined is necessary to meet hiding cover. Expected mortality, as an example, should be included in the density estimate. Hiding cover is defined as vegetation capable of hiding 90% of a deer at 90 feet. At a minimum it must be at least 5 feet in height. No thinning would be done for at least 15 years. In addition plant trees along roadsides to provide screening cover.

**DC#6**—Develop thermal cover (40% canopy and 30 feet tall; minimum 30% canopy and 15’ tall) 3) on at least 30% of the winter range area in the long-term (30+ years) by planting coniferous trees in strategic patches that are a minimum of 10 acres in size and 600 feet in width. Tree densities should be adjusted to account for mortality, costs, etc. Thermal cover patches should be adjacent to forage areas and not bisected by open, system roads if possible and at least 400’ from open, system roads.

**DC#7**—Develop travel corridors through the area to reconnect with those adjacent to it from previous vegetation management projects. Plant coniferous trees in the designated corridors to attain hiding cover characteristics. The corridors must be a minimum of 600 feet in width. A seedling spacing of 15’x15’ is recommended (200 trees/ac.). Higher densities may be needed if mortality is expected. No thinning would be done for at least 15 years. Acreages in corridors may be used to attain DC#4 provided that good spatial distribution of hiding cover is attained.

**DC#8**—Promote or maintain high quality forage areas on 60% of the winter range area. The forage areas should emphasize bitterbrush and forbs. Availability can be promoted by closing or restricting motorized access to the area and by not allowing any impediments to access or movement by deer through the area. All forage areas (i.e. patch centers) should be within 1200’ of planned cover patches.

**DC#9**—Manage roads and motorized trails to meet the maximum allowable road densities in the respective portions of summer (2.5 mile per square mile) and winter ranges (1.0-2.5 mile per square mile). Restore decommissioned road prisms to native vegetation.

**Forest Structure and Arrangement Habitat Component:** The following table displays selected elements for this component and those Indicator Species that utilize them. The importance of each element is rated by species.

**Table 7: Forest Structure and Arrangement Elements (long-term)**

Indicator Species*	Element Ratings**						
	LOS Stage 6	LOS Stage 7	Large Trees/ Snags/ Logs	Open Canopy	Closed Canopy/ Dense conifers	Shrubs/ Herb-aceous/ Openings	Edges/ Burns
Mule deer	3	2 (forage)	NA	2 (forage)	2 (cover)	1 (forage)	2/2
Flammulated owl	2	1	1 (nests)	1	1 (nests, roosts)	1 (forage)	1/?
<b>Lewis' woodpecker</b>	3	1	1 (nests)	1	3	2 (forage)	2/1
Williamson's sapsucker	2	2	1 (nests)	1	3	NA	3/?
Hairy woodpecker	1 (winter)	1 (winter)	1 (nests)	1	3	NA	3/1
<b>White-headed woodpecker</b>	3	1	1 (nests, forage green)	1	3	2 (nests)	3/?
<b>Pygmy nuthatch</b>	1	1	1 (nests, forage)	2	2	NA	2/?
Green-tailed towhee	NA	2	NA	1	NA	1	1/?
Olive-sided flycatcher	2 (edge)	1 (edge, gaps)	1 (dead tops)	1	NA	2 (migration)	1/1
<b>Chipping sparrow</b>	3	2	NA	1	3	1 (grass preferred)	1 (grass edges)?
Mountain bluebird	2 (juniper)	3	1 (secondary)	1	NA	1	1/1
Yellow-pine chipmunk	3	2	2 (logs)	2	3	1	1/?
Western fence lizard	3	3	2 (logs)	2	NA	2	1/?

**Notes:** \**Italicized/bolded* species are Focal Species (Altman 2000) for the ponderosa pine habitat type.

\*\*Rating codes—1 = primary, 2 = secondary, 3 = casual use, NA = not applicable or negative relationship. Principal reference Marshall et al., 2003.

In summary, the Indicator Species as a group require relatively open forest habitats. The majority require snags and several have a strong affinity to burned areas.

**DC#10**—Reforestation should mimic the natural patchiness of ponderosa pine forest and provide for future large tree habitat by keeping tree densities low. Dense patches should be strategically planned to meet the needs of mule deer, flammulated owls, and other species. The natural patch size in eastside ponderosa pine is 1.2 acres (Harrod et al, 1998). Openings should be frequent throughout the regenerated forest in order to provide herbaceous and shrub vegetation and vertical and horizontal diversity.

**DC#11**—Provide corridors to reconnect LOS/OGMAs around the project.

**Environmental Consequences (indirect, direct and cumulative)**

**Alternative Descriptions**— Refer to the project's environmental assessment for a complete description of the alternatives and the environmental consequences. Post-fire literature (e.g. McIver and Starr, 2000; Ambrose et al., 2003; Beschta et al., 1995) on salvage harvest was reviewed to further identify issues for evaluation.

**Alternative 1 No Action:** This alternative would leave the project area as it is post-fire. There would be no salvage harvest, reforestation plantings, or road closures. The area would be allowed to naturally restore itself. The establishment of coniferous trees would be slow and uneven. Grasses, forbs, and some shrub species should recover relatively quickly. However, they would compete with the natural conifer seedlings, and further extend the time of reforestation. Large amounts of dead and down trees would accumulate through time. This may benefit some species but potentially negatively affect some others, e.g. deer movement.

**Alternative 2 Proposed Action:** The proposed action would salvage harvest within a 2030 acre area of the fire, which had a gross acreage of approximately 3810 acres. Approximately 8.5 million board feet of logs would be removed from 8 individual harvest units (refer to the Appendix map). Existing and temporary roads would be used in removing the material. No new, permanent roads would be constructed. After harvest, road/area closures to motorized vehicles would be implemented that would reduce the current density. The area would be reforested after harvest with variable densities of tree planting with dense planting in pre-identified locations for deer cover, movement corridors, and roadside screens.

The following section on indirect and direct effects on the Indicator Species is based on these assumptions for Alternative 2: 1) the project areas will not be fenced to exclude big game animals; 2) reforestation will provide a pattern of planting to achieve the winter range objectives of 40:60 cover to forage ratio and the summer range objective of 30:70 cover to forage ratio; 3) reforestation in the non-cover areas will provide a tree density that will promote the growth of large individual trees at a minimum of 10 per acre and a maximum of 60 per acre in the long-term (excluding non-winter range areas and patches identified for future deer cover); 4) post-project road closures will attain the LRMP standard and guideline of no more than 2.5 miles per square mile of open road; and 5) the desired conditions for snags and logs will be met.

**Alternative 3 Rehabilitation Action:** This alternative would not do any salvage harvest. Reforestation would be done in the same way as for the Proposed Action. Road closures would also be identical to the Proposed Action.

**Indirect and Direct Effects**— The effects on indicator species are addressed in the following discussion. The selected indicators are listed first and then followed by the remaining LRMP management indicator species (MIS). Refer to the individual alternative Worksheets (Tables A, B, and C) in the Appendix for supporting details. The biological information previously presented (i.e. Tables 1, 3, 5, 6, and 7) provide the foundation for the following determinations.

**Mule deer (MIS):**

Alt. 1—Overall a negative effect on deer because the area would reforest very slowly, which would be an unacceptable rate of recovery of important hiding and thermal cover on winter range. The summer range portion of the project is small and the recovery of hiding cover less critical. Forage resources would be good as shrubs and forbs recovered, however the majority of forage areas are too far from existing cover for full utilization by deer (i.e. in excess of 600'; reference LRMP and Thomas et al., 1979). Retaining the existing road density would also be a negative effect on deer because the road density of 4.5 miles per square mile would reduce the solitude and ultimate utilization of the area by deer. This is particularly critical on the winter range portion of the project.

Alt. 2—This alternative would benefit mule deer, because the reforestation efforts would recover hiding and thermal cover more quickly. Planning the locations of cover patches and adjacent forage areas would also result in better utilization of the forage areas by deer. Removal of the dead material would facilitate deer movement through the area in the mid- to long-term (i.e. as the dead snags windthrow) and promote forage development and conifer seedling survival by allowing more light to reach the understory.

Alt. 3—Effects from this alternative would be similar to the Alternative 2. Accumulations of windblown snags may impede deer movement through the area and reduce understory production.

**Flammulated owl:**

Alt. 1—Development of an open forest structure would be significantly delayed without reforestation.

Further, the development of future nesting snags (i.e. large size, unburned) would be retarded.

Alt. 2—Reforestation would promote a quicker recovery of forested habitats important to the owl, provided that an open forest canopy structure is attained. Patches of higher density canopy should be available (e.g. deer cover patches) for nesting. Salvage would not affect the owl as they are not known to use burned areas.

Alt. 3—Effects are similar to Alternative 2. Heavy accumulations of blowdown snags could adversely affect local areas by reducing conifer growth, which would have a minor adverse affect on long-term owl habitat.

**Lewis' woodpecker (MIS):**

Alt. 1—An abundance of burnt snags would be very favorable to this species. The delay in forest re-establishment (i.e. future snags) would delay full habitat development.

Alt. 2—Salvage harvest would reduce the number of snags below the level recommended by DecAID (i.e. Table 5). The adjacent un-salvaged burnt forest (1800 acres) and the within unit snag retention patches should mitigate the negative effects, which are local in scale. Reforestation would be beneficial in the long-term, provided that an open canopied forest structure is attained.

Alt. 3—Snag levels would be the same as Alternative 1, and reforestation the same as Alternative 2. This alternative would be the most favorable for this species.

**Williamson's sapsucker (MIS):**

Alt. 1—Abundant snags would be a positive effect. The delay in forest re-establishment would be negative, as full habitat development would be delayed.

Alt. 2—Snag levels would be provided post-harvest at a level adequate for this species. Reforestation would be beneficial in the long-term, provided that an open canopied forest structure is attained.

Alt. 3—Effects are similar to Alternative 2, however snag levels would be higher.

**Hairy woodpecker (MIS):**

Alt. 1- An abundance snags would be very favorable to this species. The delay in forest re-establishment would be negative.

Alt. 2- Snag levels would be provided post-harvest at a level that is less than that recommended by DecAID (i.e. Table 5). Reforestation would be beneficial in the long-term, provided that an open canopied forest structure is attained.

Alt. 3 - Effects are similar to Alternative 2, however snag levels would be higher. This alternative would be most favorable to this species. Note: this species has been observed within the project area post-burn.

**White-headed woodpecker (MIS):**

Alt. 1—Abundant snags would be a positive effect. The delay in forest re-establishment would be negative and more pronounced for this species, which depends on green ponderosa pine for foraging.

Alt. 2—Snag levels would be provided post-harvest at a level that is less than that recommended by DecAID (i.e. Table 5). The adjacent un-salvaged burnt forest and within unit retention patches should mitigate the negative effects, which are local in scale. Reforestation would be beneficial in the long-term, provided that an open canopied forest structure is attained.

Alt. 3—Effects are similar to Alternative 2, however snag levels would be higher. This alternative would be the most favorable for this species.

**Pygmy nuthatch:**

Alt. 1—Burnt snags may not be that beneficial, as this species primarily uses decayed green trees/soft snags that have existing cracks. The delay in forest re-establishment would be negative and more pronounced for this species, which depends on large, green ponderosa pine for foraging.

Alt. 2—Snag levels would be provided post-harvest at a level adequate for this species. Reforestation would be beneficial in the long-term, provided that an open canopied forest structure is attained (i.e. to promote large trees).

Alt. 3—Effects are similar to Alternative 2.

**Green-tailed towhee:**

Alt. 1—Not reforesting the area would be beneficial, because shrubs would develop more fully, which are important to this species.

Alt. 2—Reforestation would be negative in the long-term where stocking levels are high. Low stocking and open areas with shrubs provided in an open canopied forest structure should maintain adequate habitat.

Alt. 3—Effects are similar to Alternative 2. Accumulations of windblown snags may reduce the understory development.

**Olive-sided flycatcher:**

Alt. 1—Perches for foraging would be provided in excess from burnt snags. Delays in forest establishment could negatively affect forage (insect) availability and long-term perch availability (e.g. dead topped green trees).

Alt. 2—Snags (perches) would be adequate for this species post-salvage. Reforestation would be beneficial in the long-term, provided that an open canopied forest structure is attained.

Alt. 3—Effects are similar to Alternative 2, but snag levels would be in excess of needs.

**Chipping sparrow:**

Alt. 1—The delay in forest establishment would be negative in the short-term but likely positive in the long-term for this species. The patchy, open canopied natural forest with extensive openings with shrubs and grasses would provide high quality habitat.

Alt. 2—Reforestation would establish suitable habitat sooner provided it incorporated an open canopied forest structure with openings.

Alt. 3—Effects similar to Alternative 2, but in the long-term the extensive blowdown of dead snags would likely reduce the understory productivity, which is important to this species.

**Mountain bluebird:**

Alt. 1—This species has a strong preference for open areas and burns. Snags would be in excess of needs.

Alt. 2— Snag levels would be provided post-harvest at a level that is less than that recommended by DecAID (i.e. Table 5). Otherwise, there would be generally positive effects in the short-term, but declining suitability as the forest is re-established. An open canopied forest structure with openings and snags would still likely provide some habitat value.

Alt. 3—Effects similar to Alternative 2, but snags would be in excess of needs.

**Yellow-pine chipmunk:**

Alt. 1—The habitat will slowly improve as forbs, grasses and shrubs become established. Logs will be provided in abundance but could negatively affect understory productivity (i.e. seeds) in the long-term.

Alt. 2—Reforestation that provides an open canopied forest structure with abundant logs will be beneficial to this species.

Alt. 3—Effects similar to Alternative 2, except that heavy windthrow accumulations could reduce the understory productivity.

**Western fence lizard:**

Alt. 1—The habitat will slowly improve as forbs, grasses and shrubs become established. Logs will be provided in abundance but could negatively affect understory productivity (i.e. insects) in the long-term.

Alt. 2—Reforestation that provides an open canopied forest structure with abundant logs will be beneficial to this species. Maintaining open forest conditions near rock outcrops would be important to this species.

Alt. 3—Effects similar to Alternative 2, except that heavy windthrow accumulations could reduce the understory productivity.

**Bald eagle (MIS):** No habitat or occupancy in the project area. Refer to the project's Biological Evaluation for details.

**Northern spotted owl (MIS):** No habitat or occupancy in the project area. Refer to the project's Biological Evaluation for details.

**Golden eagle (MIS):** No existing nesting habitat within the project area. Development of open canopied forest structure and large trees in the long-term may provide potential nesting habitat (Marshall et al. 2003). The action alternatives would promote reforestation and are, therefore, more beneficial than the no action alternative. Foraging habitat would exist for the short and mid-terms in all alternatives. Note: this species has been observed in the project area post-burn.

**Red-tailed hawk (MIS):** No existing nesting habitat within the project area. Development of open canopied forest structure and large trees in the long-term may provide potential nesting habitat (Marshall et al. 2003). The action alternatives would promote reforestation and are, therefore, more beneficial than the no action alternative. Foraging habitat would exist for the short and mid-terms in all alternatives.

**Osprey (MIS):** No habitat or occupancy in the project area. The nearest known use sites on national forest lands are on the Deschutes river south of Bend, which is about six miles west of the project. Osprey are also found at East and Paulina lakes approximately 12 miles south of the project.

**Northern goshawk (MIS):** No existing nesting or foraging habitat within the project area. Development of LOS forest in the long-term may provide potential habitat (Marshall et al., 2003). The action alternatives would promote reforestation and are, therefore, more beneficial than the no action alternative. Refer to the Kelsey and Fuzzy Projects wildlife reports for details on pre-fire surveys in the vicinity.

**Cooper's hawk (MIS):** No existing nesting habitat within the project area. Development of semi-open canopied (i.e. patchy) forest structure and medium sized trees in the long-term (i.e. 50-80 years) may provide potential nesting habitat (Marshall et al., 2003). The action alternatives would promote reforestation and are, therefore, more beneficial than the no action alternative. Foraging habitat would exist for the short and mid-terms in all alternatives, particularly after shrubs recover. Refer to the Kelsey and Fuzzy Projects wildlife reports for details on pre-fire surveys in the vicinity.

**Sharp-shinned hawk (MIS):** No existing nesting or foraging habitat within the project area. Development of closed or semi-closed canopied forest structure with thickets of dense, young trees in the long-term may provide potential nesting habitat (Marshall et al., 2003). Foraging habitat would exist in the mid-term after a young forest is well established. The action alternatives would promote reforestation and are, therefore, more beneficial than the no action alternative for both nesting and foraging habitats. Refer to the Kelsey and Fuzzy Projects wildlife reports for details on pre-fire surveys in the vicinity.

**Great gray owl (MIS):** No habitat or occupancy in the project area. This species depends upon lodgepole pine forest habitat in proximity to meadows and other forest openings with good pocket gopher populations (Marshall et al., 2003).

**Great blue heron (MIS):** No habitat or occupancy in the project area. The nearest potential habitat on national forest lands is the Deschutes River approximately 6 miles west of the project.

**Woodpeckers (MIS):** Addressed by the previous indicator species. The following are species not utilized as indicators, but included in this category:

**Black-backed woodpecker**—this species has been observed in the project area post-fire. However, it is an opportunist and seeks out burned areas. Its normal habitat is closely associated with lodgepole pine with a preference for LOS stands. The Proposed Action alternatives would have insignificant effects on the population viability of this species, because large numbers of snags would be retained. Additionally, the scale of the project is small in relation to the species' range. However, the other alternatives would be more beneficial, due to heavy snag retention. Ponderosa pine is not their preferred habitat type (Marshall et al., 2003; Altman 2000) but will be utilized after a stand replacement wildfire.



**Northern three-toed woodpecker**—this species is associated with higher elevation (over 4500' on the Deschutes) mixed conifer and lodgepole pine stands. It is closely associated with bark beetles (Marshall et al, 2003). The action alternatives would have no effect on this species, because it is normally absent from the area. Any future occupancy would likely be incidental and short-term in the pursuit of insects attracted to the area.

**Pileated woodpecker**—this species is closely associated with higher elevation, dense, mesic mixed conifer stands and requires large diameter logs and snags (Marshall et al., 2003). The action alternatives would have no effect on this species, because it is normally absent from the area. It rarely uses pure ponderosa pine habitats. Any future occupancy would likely be incidental and short-term in the pursuit of insects attracted to the area.

**Northern flicker**—this species is a generalist that utilizes a wide variety of habitat types with a preference for open canopied forest and edges (Marshall et al., 2003). It is not dependent upon burns and would be adequately provided for by the snag retention measures in the Proposed Action alternative provided that some large diameter snags are retained.

**Waterfowl (MIS):** No habitat or occupancy in the project area. The nearest habitat on national forest lands is the Deschutes River about 6 miles west of the project.

**Peregrine falcon (MIS):** No habitat or occupancy in the project area. Refer to the project's Biological Evaluation for details.

**Wolverine (MIS):** No habitat or occupancy in the project area. Refer to the project's Biological Evaluation for details.

**Elk (MIS):**

Alt. 1—Effects similar to mule deer, except that dominance by grass species would be more beneficial.  
Alt. 2—Effects similar to mule deer, except that elk generally require larger cover patches than those planned for reforestation. However, the area is much more important to deer, as elk use is incidental.  
Alt. 3—Effects similar to mule deer, except that elk generally require larger cover patches than those planned for reforestation.

**Pine (American) marten (MIS):** No habitat or occupancy in the project area. There are no recorded observations sites in or near the project for marten. Marten generally use higher elevation lodgepole pine and mixed conifer habitat types with a preference for mesic, late successional forests. Heavy canopy cover is also important in marten habitat (Ruggiero ed., et al. 1994). Alternatives 1 and 3 could potentially provide marginal marten habitat (i.e. movement habitat) in the long-term as windthrown snags create heavy ground cover and the forest recovers.

**Townsend's big-eared bat (MIS):** No roosting or maternity habitat (i.e. caves or lava tubes) in the project area. The nearest occupied site is Skeleton cave about 3.5 miles northeast of the project. There is some potential for foraging (flying insects) in areas of shrubs (e.g. bitterbrush). However, few shrubs survived the fire, and there are extensive shrub patches adjacent to the project boundary. Alternative 1 provides more shrubs in the long-term due to delays in reforestation.

**Species Associated with Logs and Down Woody Debris (MIS):** Addressed by the previous indicator species.

**Species Associated with Various Plant Communities and Successional Stages (MIS):** Addressed by the previous indicator species.

**Species with Special or Unique Habitats (MIS):** No special or unique habitats (e.g. caves, riparian zones, cliffs, talus, etc.) within the project area.

In summary for Alternative 1, the indicator species that prefer large, open areas with dominate coverage by grasses and shrubs will be positively affected by the this alternative. Species dependent upon more extensive forest cover and/or old growth forest structure would be negatively affected. This is due to the very slow development of the forest post-fire without reforestation. None of the indicator species would have their population viability affected by the

No Action alternative. The project area represents a very small proportion of the range of the indicator species, and it does not provide any critical resources for their overall survival.

In summary for Alternative 2, those species requiring future LOS forest and open canopy forest conditions would be benefited by the reforestation actions in this alternative. The required levels of snags and logs will meet most species' needs. However, a few that specialize in the use of burned areas with large volumes of dead (e.g. Lewis' woodpecker) would have less benefit due to the salvage removals. Non-salvaged areas outside of the project area or inclusions within it would mitigate this reduction in benefit from the No Action alternative. It should also be noted that leaving extensive areas of burnt snags may negatively affect some species. Haggard and Gaines (2001) documented that salvage projects which retained a moderate level of snags (i.e. 5.8 to 13.5 per acre) had the highest abundance, species richness, and nesting population of cavity nesters. The recommended retention level for snags/logs in this alternative is 37 per acre, which is equivalent to the "high" level assessed in the above study which was 14.2 to 30.8 per acre. The Proposed Action alternative would have a mix of individual and patches of snags which should provide for at least a moderate level of snag dependent species abundance and richness. As snags blow down the habitat should become increasing more open, which would further enhance its value to more species.

The construction and use of temporary roads would not adversely affect any species other than by short-term displacement. Re-vegetation of the roads with native species would eliminate any mid- or long-term impacts. Connectivity would be restored in the long-term by reforestation. Fragmentation would be also be reduced by reforestation. The salvage of dead trees and retention of green within and adjacent to the project would not significantly increase fragmentation. The destruction of the green forested canopy by the fire has already caused the fragmentation. None of the indicator species would have their population viability affected by the Preferred Action alternative. The project area represents a very small proportion of the range of the indicator species, and it does not provide any critical resources for their overall survival.

In summary for Alternative 3, the effects are beneficial for those species requiring both high numbers of snags and an open canopied forest structure. The Lewis', white-headed and hairy woodpeckers for example would benefit from these conditions. Other species dependent upon an open, productive understory of forbs, grasses and shrubs could be negatively affected in the long-term as heavy accumulations of windthrown snags cover the ground. None of the indicator species would have their population viability affected by the Rehabilitation Action alternative. The project area represents a very small proportion of the range of the indicator species, and it does not provide any critical resources for their overall survival.

**Cumulative Effects**— Cumulative effects of the No Action alternative include: 1) Additional stand replacement fire acreage when totaled with the other fires in the vicinity (i.e. Evans West and Skeleton). This is likely a significant impact on local mule deer herds because of the additional reduction of hiding and thermal cover on winter range. In addition, the long recovery period for areas that are not reforested (e.g. Skeleton fire) will further delay the attainment of LOS forest habitats over a large area. 2) The eventual accumulation of large amounts of down and dead material in the area may be a risk to future catastrophic fires, which could potentially seriously impact the soil resources (i.e. heavy log sized fuels on the ground) and further delay the establishment of a functioning forest.

The Proposed Action alternative would mitigate the loss of deer cover in the area by reforestation. However, the benefits would at best be in the mid-term (i.e. 15+ years). Road closures would contribute to reducing the cumulative effects from roads in this general area, which are generally in excess of desired conditions as specified by the LRMP. Reducing the volume of woody debris by salvaging would reduce

the probability of future catastrophic wildfires which could impact an area much larger than the project. It would also facilitate the movement of deer and elk through the area. The salvage logging would whole tree yard all the harvest trees which would greatly reduce potential post-logging fuel accumulations.

The cumulative effects of the Proposed Action on MIS are as follows: 1) those species requiring open canopied forest structure would benefit because the forest would be re-established more quickly. Further, maintaining 60% of the area in relatively low tree densities (i.e. deer forage areas) would also benefit this group; 2) species requiring heavy canopied, multi-stratum LOS habitat would not be adversely affected because the low site productivity of the area likely precludes growing this type of habitat; and 3) cavity dependent species would be provided for by the retention levels of snags, however several species would have insufficient snag levels post-salvage. The magnitude of this adverse effect is not significant at the population level of these species. This is because the project area is very small compared to their home ranges. Further, the area is on the periphery of the habitat used by the Lewis' woodpecker, which is the most dependent species on burnt forest habitat. Within unit mitigation patches and the non-salvaged areas adjacent to the project would help mitigate these effects. The long-term impacts of the fire will cause a deficit in snag habitat for all dependent species within approximately 25 years, because the existing snags will have fallen prior to recruitment from the re-established forest (Harrod et al., 1998). The Proposed Action would reduce the time period of the deficit.

The Rehabilitation Action alternative would have affects in common to both previous alternatives including the accumulation of large amounts of down and dead material (negative), the restoration of forested habitats (positive), and road closures (positive). The reforestation investments could potentially be lost to future catastrophic wildfire due to heavy fuels accumulations, which would further delay providing open canopied forested habitats for many indicator species.

Cumulative and future effects common to all the alternatives include:

- Increased natural fuel loadings and risk of future wildfire. The magnitude and duration of this risk are unknown, but likely extend to the long-term (i.e. 50+ years).
- Increased probability of insect attacks on residual and adjacent green trees due to the attraction to standing and down snags. The magnitude and duration of this effect are unknown.
- The adjacent (east, southeast) Fuzzy Project has affected deer cover and movement corridors, forage (i.e. bitterbrush), forested habitats, road densities, etc. There is a minor overlap of the two projects. Negative effects from the Fuzzy Project were mitigated via the environmental assessment.
- The overlapping Kelsey Project will be affecting deer cover and movement corridors, forage, forested habitats, road densities, etc. The environmental assessment is currently being revised to account for the cumulative affects of the 18 Fire and planned Kelsey activities. The 18 Fire Project does not add to the effects on deer hiding/thermal cover as an example, because the fire eliminated these habitats. In fact, alternatives that include reforestation will facilitate the recovery of cover as previously noted.
- The current 18 Fire Road Salvage Project is removing snags from a narrow strip along the major roads through the fire's area. It is not expected to contribute to cumulative effects on snag dependent species due to the limited area impacted.
- Existing road, motorized trails, gas line corridors, gravel pits, etc. are found throughout the surrounding area. The Proposed Action alternative will only add temporary road impacts, which will be of short duration and of minor magnitude to the wildlife resources of the project area.

There are no adjacent private lands or BLM administered lands to the project area that would have a significant contribution to the cumulative effects of this project. Development on private lands as an example, often totally eliminates habitat. But the 18 Fire Project action alternatives will restore it. There is no current active livestock grazing in the project area that would contribute to cumulative effects. Active grazing by sheep and goats may occur within two years. Cumulative effects from the grazing are not expected, provided that utilization standards are met.

**Summary of Applicable Project Design Criteria (PDC) and Mitigation Measures (MM)**

The following items are recommended in order to meet existing direction and/or to meet the previously described Desired Conditions. Reference the environmental impact statement for the final determinations.

**PDCs**— Project Design Criteria represent LRMP Standards and Guidelines (S&Gs) and Eastside Screens standards including updates of the technical criteria due to more current scientific information. Desired Conditions (DCs) that would be met by the PDCs will be referenced in brackets.

**Management Area 7 (Deer Habitat):**

**PDC 1:** Vegetation will be managed to provide optimum habitat considering the inherent productivity of the land. ...with cover making up 40 percent of the land area. Approximately three-quarters of cover areas should be thermal cover with the remainder in hiding areas (theme and objectives). [DC #5, #6]

**PDC 2:** Habitat management will be designed to provide a mosaic of forested conditions which incorporates the concepts of escape and hiding cover, thermal cover, travel corridors, visual screens, and harassment potential. (M7-10). DC #5, #6, #7]

**PDC 3:** Forage conditions will be maintained or improved with emphasis on increasing the variety of plants available for forage and a mixture of age classes of shrubs (M7-14). [DC #8]

**PDC 4:** Target open road densities shall average 1.0-2.5 miles per square mile in each Implementation Unit...(M7-22). [DC #9]

**Forest-Wide Standards and Guidelines/Eastside Screens Standards:**

**PDC 5:** Biological diversity is considered of primary importance to wildlife species. Deer, elk, woodpeckers, and songbirds are species which can serve as indicators of the maintenance of biological diversity. Management activities should be tailored to provide habitat diversity including horizontal, vertical and vegetative species diversity necessary for the maintenance of these wildlife species at the appropriate population levels established in the standards/guidelines (TM-55). [DC #10]

**PDC 6:** Horizontal diversity is of primary importance to deer and elk. Forage/cover ratios are one measure of this diversity (TM-57). [DC #5, #6, #10]

**PDC 7:** Vertical diversity is of primary importance to cavity dependent wildlife species as well as songbirds which require a variety of tree sizes for nesting, perching, and feeding. Vertical structural diversity can best be maintained with uneven-aged management and it is the preferred prescription to meet this objective (TM-62). [DC #10]

**PDC 8:** Active nest sites (golden eagles, redtail hawk, Cooper's hawk, sharp-shinned hawk) should be protected from disturbing activities within ¼ mile of the nest by restricting site disturbing operations during the period of: February 1-July 31: Golden eagle, March 1-August 31: Redtail hawk, April 15-August 31: Cooper's and Sharp-shinned hawks (WL-3, 19, 28).

**PDC 9:** In coniferous forest, sufficient snags will be maintained to provide 40 percent of potential population levels of cavity nesting species...live replacement trees (i.e. GTRs) will be left during any harvest to assure 60 percent of cavity nesting potential. Specific guidelines will be provided by the Deschutes National Forest Wildlife Tree Implementation Plan (WL-37, 38). The Eastside Screens specify that 100 percent of cavity nesting potential will be provided with snags and green tree retention (however, "salvage" sales are exempted). Reference the preceding Desired Conditions which incorporate the latest scientific findings, which require a minimum of 3 snags per acre and retention of the remaining green trees. [DC #1, #2, #3]

**PDC 10:** Deer summer range—Target open road densities are 2.5 miles per square mile... (WL-53). [DC #9]

**PDC 11:** Deer summer range—Hiding areas must be present over at least 30 percent of National Forest land in each implementation unit. Six acres or larger stand with an average height of 6 feet and which has not been thinned in 15 years (WL-54). [DC #5]

**PDC 12:** Deer summer range—Travel corridors will be provided.... (WL-56). [DC #7]

**PDC 13:** Deer summer range—If possible, a narrow strip of trees should be left along roads to reduce view distances (WL-58). [DC #5]

**PDC 14:** Fallen trees and other woody debris will be retained in sufficient quantity, distribution, and physical characteristics to provide habitat for viable populations of dependent wildlife species over time (WL-72, 73). The Eastside Screens require 3-6 logs of 12" diameter (small end) per acre (however, "salvage" sales are exempted). Reference the preceding Desired Conditions which incorporate the latest scientific findings, which require a minimum of 34 logs per acre. [DC #1, #2, #3]

**PDC 15:** Diversity will be provided by having various successional stages represented in an area through time. Large homogeneous areas of the same species and/or successional stages will be avoided (WL-74). [DC #10]

**PDC 16:** Provide connectivity between LOS stands and designated Old Growth Management Areas (Eastside Screens standard). [DC #11]

**PDC 17:** Maintain open, parklike stand conditions where this condition occurred historically. Manipulate vegetation in a manner to encourage the development of large diameter, open canopy structure (Eastside Screens standard). [DC #10]

**PDC 18:** In preferred forest types, concentrations of down woody material (logging slash, cull logs, fallen trees, etc.) will be left at an average rate of approximately one per acre after any timber harvest (WL-63, 73). [DC #1, #3]

**MMs**— Mitigation measures are those that are recommended to the interdisciplinary team and line officer that are necessary to maintain or protect wildlife resources. They are site specific and may exceed or augment the PDCs.

**MM1:** Harvest, road building, hauling and other disturbing activities within the deer winter range area are prohibited from December 1-March 31 each year.

**MM2:** Restrict motorized vehicle access (including OHVs and snowmobiles) to designated routes year-around. Prohibit all off-road travel in the project area.

**MM3:** Reforestation will plant ponderosa pine within pre-determined deer hiding/thermal cover patches, movement corridors, and roadside screens to meet the long-term Desired Conditions. A maximum of 40% of the winter range area would be planted for this objective. Cover patches of at least 6 acres and no greater than 10 acres in size should be at least 400' from open, system roads and no further than 1200' apart. Vexar tubes and/or vegetation matting may be employed within cover, corridor and screen patches to promote survival and growth.

**MM4:** Reforestation will plant ponderosa pine on deer forage areas (i.e 60% of project area) in a variable spacing of individual trees, patches of trees, and openings. The objective is to emulate a natural mosaic of open canopied pine forest and produce and maintain 10-60 large diameter (i.e. 21"+ dbh) ponderosa pine trees per acre. Patch size should average 1.2 acres (Harrod et al., 1998). The estimated number of trees achieve these objectives should be determined by considering site factors of productivity, vegetation competition, and other factors. The use of vexar tubes to reduce animal damage is acceptable. Vegetation control matting or herbicides may also be used on 50% these trees to promote growth rates. The other trees above the minimum objectives should not have vegetation control in order to produce a stand with variable canopy heights.

**MM5:** Animal damage control, including gopher baiting/trapping, will be done only on a local-scale as needed to achieve the preceding reforestation objectives. Treatment area locations, timing, and methodology would be coordinated between wildlife and silviculture operations personnel. Coordinated monitoring will be done to document the results and needs for any future actions.

**MM6:** Fencing done in the winter range area will be done in a manner that will maintain access to at least minimal forage resources by deer and elk and to allow free movement of animals through the winter range.

**MM7:** Established cover patches will not be thinned for a minimum of 15 years. Patches will be monitored 5 years after planting and replanted as necessary to meet cover objectives.

**MM8:** Retain all non-commercial trees (including whips) that do exceed the maximum allowable amounts of fuels in order to provide some hiding cover for deer

*MM9*: Re-vegetate closed/decommissioned road beds with native shrubs, forbs, grasses and trees.

*MM10*: Restrict salvage logging activities (falling) during the nesting season of migratory birds from March 15-July 30. A waiver could be granted provided that a nesting survey of the area was conducted which confirmed that would no significant adverse impacts on migratory birds.

### **Project Analysis Conclusions**

The 18 Fire Salvage Project offers some opportunities to restore the area more quickly to provide habitats for a variety of species. Open canopied forest structure that provides large ponderosa pine and a productive understory of herbaceous and shrub species would emulate the historic habitat type found in the area. Frequent, low intensity fires of the past created a patchy, mosaic of trees and openings that were favorable to most of the indicator species assessed by this report. The past processes also provided a steady recruitment of large diameter snags. Fire suppression has altered the natural occurrence of frequent, low intensity fires, which has resulted in stand replacement fires such as the 18 fire. Pulses of snags post-crown fire eventually fall (i.e. within 40 years with most down in 25 years), and the replacement forest will have had inadequate time to recruit snags (i.e. 80-110 years is needed), other than small diameter ones (Harrod et al., 1998). Thus, the re-establishment of the forest by planting would decrease the time gap for snag recruitment as well as provide forested habitats for other species sooner. However, establishing a uniform, dense plantation of trees would not be conducive to meeting the requirements of the indicator species assessed in this report.

Allowing the area to naturally recover has some advantages but also some negative effects as documented in the analysis. Providing dense snag patches to those species that favor burned forest is probably the most significant challenge for the project. The combination of within unit retention patches, individual retention snags and the adjacent un-salvaged burnt areas should adequately provide for these species.

### **Monitoring Recommendations**

Both implementation and effectiveness monitoring are recommended for the Proposed Action and Restoration alternatives for this project. The following objectives are suggested:

- Monitor the snag longevity by size class and site location (i.e. individual or patch).
- Document the mortality of planted trees by falling snags, gophers, browsing, etc.
- Determine the snag use by wildlife post-salvage for at least 2 years (Bate, 1995).
- Monitor the success of road/area motorized vehicle closures, including the effectiveness of enforcement actions. Adjust tactics in a timely fashion to address problems.
- Install strategically located photo points to document the area's recovery.

For the No Action alternative:

- Monitor the area's use by mule deer.
- Install strategically located photo points to document the area's recovery.

### **Knutsen-Vandenberg Projects**

The following K-V projects are planned for the project area:

- Reforestation
- Road closures (barriers, native plantings)
- Road decommissioning (ripping, native planting)

These activities will not adversely affect the wildlife species analyzed in this report and should be of benefit to them.

## Appendix

Table A: No Action Effects (Worksheet)

Indicator Species	Effects on Habitat Elements*							Notes
	Snags/Lo gs	Soli- tude	LOS	Large Trees	Open Canopy	Closed Canopy	Openings /Edges	
Mule deer	NA	-	0	NA	+	--	+	Cover would establish very slowly.
Flammulated owl	+	NA	-	-	+	-	+	
Lewis' woodpecker	++	NA	-	-	+	NA	+	Prefers burns.
Williamson's sapsucker	+	NA	-	0	+	NA	NA	
Hairy woodpecker	+	NA	-	0	+	NA	+	Uses burns.
White-headed woodpecker	+	NA	--	--	+	NA	+	
Pygmy nuthatch	+	NA	-	--	-	-	NA	
Green-tailed towhee	NA	NA	NA	NA	+	NA	++	
Olive-sided flycatcher	+	NA	-	-	+	NA	+	Uses burns.
Chipping sparrow	NA	NA	-	NA	+	0	++	
Mountain bluebird	+	NA	NA	0	+	NA	+	Uses burns.
Yellow-pine chipmunk	+	NA	NA	-	+	NA	++	
Western fence lizard	+	NA	NA	-	+	NA	+	

Note: Effects ratings as follows: ++ very positive, + positive, 0 neutral, - negative, -- very negative, NA not applicable or unknown.

Table B: Proposed Action Effects (Worksheet)

Indicator Species	Effects on Habitat Elements*							Notes
	Snags/Lo gs	Soli- tude	LOS	Large Trees	Open Canopy	Closed Canopy	Openings /Edges	
Mule deer	NA	+	+(SS7)	NA	+(forage areas)	+(cover areas)	+(forage, within 600' of cover)	Cover would be established in the mid-term.
Flammulated owl	+	NA	+	+	+	+(nesting patches)	+(forage areas)	
Lewis' woodpecker	- to +	NA	+	+	+	NA	+(forage areas)	Prefers burns.
Williamson's sapsucker	+	NA	+	0	+	NA	na	
Hairy woodpecker	+	NA	+	0	+	NA	+	Uses burns.
White-headed woodpecker	+	NA	+	+	+	NA	+	
Pygmy nuthatch	+	NA	+	+	+	+	NA	
Green-tailed towhee	NA	NA	NA	NA	+	NA	++	
Olive-sided flycatcher	+	NA	+	+	+	NA	+	Uses burns.
Chipping sparrow	NA	NA	+	NA	+	0	+	
Mountain bluebird	+	NA	NA	0	+	NA	+	Uses burns.
Yellow-pine chipmunk	+	NA	NA	+	+	NA	+	
Western fence lizard	+	NA	NA	+	+	NA	+	

Note: Effects ratings as follows: ++ very positive, + positive, 0 neutral, - negative, -- very negative, na not applicable or unknown.

Table C: Rehabilitation Action Effects (Worksheet)

Indicator Species	Effects on Habitat Elements*							Notes
	Snags/Lo gs	Soli- tude	LOS	Large Trees	Open Canopy	Closed Canopy	Openings /Edges	
Mule deer	NA	+	+(SS7)	NA	+(forage areas)	+(cover areas)	+(forage, within 600' of cover)	Cover would be established in the mid- term.
Flammulated owl	+	NA	+	+	+	+(nesting patches)	+(forage areas)	
Lewis' woodpecker	++	NA	+	+	+	NA	+(forage areas)	Prefers burns.
Williamson's sapsucker	+	NA	+	0	+	NA	NA	
Hairy woodpecker	+	NA	+	0	+	NA	+	Uses burns.
White-headed woodpecker	+	NA	+	+	+	NA	+	
Pygmy nuthatch	+	NA	+	+	+	+	NA	
Green-tailed towhee	NA	NA	NA	NA	+	NA	++	
Olive-sided flycatcher	+	NA	+	+	+	NA	+	Uses burns.
Chipping sparrow	NA	NA	+	NA	+	0	+	
Mountain bluebird	+	NA	NA	0	+	NA	+	Uses burns.
Yellow-pine chipmunk	+	NA	NA	+	+	NA	+	
Western fence lizard	+	NA	NA	+	+	NA	+	

*Note: Effects ratings as follows: ++ very positive, + positive, 0 neutral, - negative, -- very negative, na not applicable or unknown.*



Biological Evaluation  
Threatened, Endangered, Proposed, and Sensitive Plants

**18 FIRE SALVAGE PROJECT**

Charmane Powers  
Ecologist

Bend/Ft. Rock Ranger District, Deschutes National Forest

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**SUMMARY OF FINDINGS**

The analysis of effects on species viability found the following:

**For the No Action alternative:**

*There are no expected impacts to PETS plant species with the implementation of this alternative.*

**For the two action alternatives:**

*There are no expected impacts to PETS plant species with the implementation of this alternative.*

## **INTRODUCTION**

This Biological Evaluation documents the review and review findings of Forest Service planned programs and activities for possible effects on species (1) listed or proposed for listing by the USDI Fish and Wildlife Service (USFWS) as Endangered or Threatened; (2) designated by the Pacific Northwest Regional Forester as Sensitive. It is prepared in compliance with the requirements of Forest Service Manual (FSM) 2630.3, FSM 2672.4, FSM 10/89 R-6 Supplement 47 2670.44, and the Endangered Species Act (ESA) of 1973 (Subpart B; 402.12, Section 7 Consultation).

Proposed, Endangered, Threatened, or Sensitive (PETS) species considered in this evaluation are those listed in FSM 2670.4 Region 6 list dated April 1999 as suspected or documented to occur on the Deschutes National Forest. Listed plant species and their listing status are in Appendix A.

This document is organized as follows:

1. PROPOSED ACTION AND ALTERNATIVES--Description of the project and its alternatives
2. EVALUATION--Evaluation of effects on listed plant species
3. RECOMMENDATIONS--Recommendations to minimize minor effects on non-Federally listed Sensitive species viability
4. COMMUNICATION--Communication with personnel during the evaluation
5. REFERENCES--Documents referred to during the evaluation
6. APPENDICES--Appendices of sensitive species that are suspected to occur on the Bend/Ft. Rock Ranger District, and habitat descriptions of species suspected to occur within the project area

## **NO ACTION ALTERNATIVE**

Under the No Action alternative, current management plans would continue to guide management of the project area. Separate resource recovery projects (#1: Hazard tree and salvage removal from 73 acres adjacent to the 18, 9711 & 1810 roads at a 100-foot distance from the road. Fifty trees or less may eventually fall after this roadside salvage; #2: Road management –the area will be closed to the public for an indefinite period of time [typically two-three years] except for the 18, 1810 roads; #3: Reforestation of the 73 acres adjacent to the roads within the roadside removal; #4: Weed treatment -- the Burned Area Emergency Rehabilitation report identified the need to monitor & treat noxious weeds) would not be affected with the selection of this (or any other) alternative.

### **Salvage Harvest – No Action Alternative**

No salvage activities or timber harvest would result from this alternative.

### **Hazard trees – No Action Alternative**

Trees that pose a hazard to public safety on open roads would continue to be monitored and felled when identified as a hazard according to the Region Six Hazard Tree standard (Harvey, Jr. & Hessburg, Sr., 1992). Utilization of felled trees for commercial use would not occur under this alternative.

### **Snags and Down Wood – No Action Alternative**

Under the No Action alternative existing snag levels would remain. No treatments are planned that would affect snags or down wood.

**Table 2.5-1 Existing dead tree numbers for the 2420 acres of stand replacement**

Size Class (diameter in inches-dbh)	Existing Dead Trees/Acre	Future Percent Cover Down Wood (>10" large end diameter)
4-7.5"	14.6	0
7.51-10.5"	19.1	1.4
10.51-13.5"	21.0	2.2
13.51-16.5"	13.5	2.0
16.51-19.50"	5.7	1.1
19.51"+	4.5	1.4
Total	78.4	8.1 percent

**Forest Roads – No Action Alternative**

No new roads would be constructed. The existing open road density for the 3,810-acre fire area would remain at 5.73 miles per square mile. Of this total, 4.44 miles of open road per square mile is comprised of tertiary roads and 1.29 miles per square mile consists of arterial and collector roads such as roads 18, 1810, 9711, 9714.

**Reforestation – No Action Alternative**

Reforestation would be limited to 73 acres previously approved, adjacent to roads 18, 1810 and 9711.

**Subsoiling – No Action Alternative**

No subsoiling would occur under this alternative.

**PROPOSED ACTION (Alternative 2)**

**Objective – Proposed Action Alternative**

This alternative is the proposed action. Proposed activities were designed to meet the purpose of and need for action as described in Chapter 1 and are consistent with existing Forest Plan direction. Map 1, at the end of this chapter, displays proposed timber harvest.

**Salvage harvest - Proposed Action Alternative**

With the implementation of Alternative 2, salvage would remove dead trees on approximately 1,936 acres. Minimum diameter of salvaged trees would generally be 12 inches for ponderosa pine. Only dead trees with no green needles would be removed. An estimated total volume of 8.5 million board feet (MMBF) would be salvaged under this alternative (*Table 2.6-1*) with ground based harvest systems.

Table 2.6-1 Alternative 2 salvage acres by LRMP Management Area

Unit Number	Acres Salvaged Alternative 2	LRMP Management Area	Percent of LRMP Management Area in fire Salvaged
1	1539	Deer Habitat	53
2	27	Deer Habitat	1
3	23	Deer Habitat	1
4	142	Deer Habitat	5
5	34	General Forest	3
6	29	Deer Habitat	1
7	34	General Forest	3
8	108	Deer Habitat	4

**Hazard trees - Proposed Action Alternative**

Trees that pose a hazard to public safety on open roads would continue to be monitored and felled when identified as a hazard according to the R6 Hazard Tree standard (Harvey, Jr. & Hessburg, Sr., 1992). Utilization of felled trees for commercial use would not occur under this alternative.

**Snags and Down Wood - Proposed Action Alternative**

Alternative 2 includes design elements to leave dead trees (snags) and down wood at levels derived from DECAID as shown in *Table 2.6-2*. A total weighted average of 23 dead trees per acre  $\geq$  10 inches dbh would be retained on the 2,420 acres of stand replacement wildfire and 17 dead trees per acre  $\geq$  10 inches dbh within the 1,936 acres of fire salvage. Future percent cover of down wood would occur by the year 2013 as existing dead standing trees transition to dead, down wood.

**Table 2.6-2 Post-salvage dead tree numbers for 2,420 acres of stand replacement**

Size Class (diameter in inches-dbh)	Existing Dead Trees/Acre	Future Percent Cover Down Wood (>10" large end diameter)
4-7.5"	14.6	0
7.51-10.5"	19.1	1.4
10.51-13.5"	12.6	1.3
13.51-16.5"	3.3	0.5
16.51-19.50"	1.8	0.4
19.51"+	2.1	0.6
Total	53.5	4.2 percent

**Forest Roads - Proposed Action Alternative**

Access to designated units for harvest and hauling of logs would predominately be on existing forest roads. An estimated 3.5 miles of temporary road construction would be required to access harvest units. Existing roads used to clearcut harvest the area in the 1920s comprise the majority of the temporary roads to be reopened. Temporary roads would be closed after purchaser use. After completion of identified road closures, the existing open road density for the 3,810-acre fire area would be lowered from 5.73 miles per square mile to 3.62 miles per square mile. Of this total, 2.33 miles of open road per square mile is comprised of tertiary roads and 1.29 miles per square mile consists of arterial and collector roads 18, 1810, 9711, 9714.

**Reforestation - Proposed Action Alternative**

Reforestation would occur on 1,936 acres, not including the 73 acres previously approved adjacent to roads 18, 1810 and 9711.

**Subsoiling – Proposed Action Alternative**

Subsoiling would occur on about 57 acres of landings and roads within units, about 5 acres of roads outside units, and about 7 miles (~10 acres) of road closures.

**Alternative 3**

**Objective – Alternative 3**

The objective of this alternative is to implement only the reforestation and road closure activities described in Alternative 2.

**Salvage harvest – Alternative 3**

No salvage activities or timber harvest would result from this alternative.

**Hazard trees – Alternative 3**

Trees that pose a hazard to public safety on open roads would continue to be monitored and felled when identified as a hazard according to the R6 Hazard Tree standard (Harvey, Jr. & Hessburg, Sr., 1992). Utilization of felled trees for commercial use would not occur under this alternative.

**Snags and Down Wood – Alternative 3**

Under this alternative existing snag levels would remain. No treatments are planned that would affect snags or down wood.

**Table 2.7-1 Existing dead tree numbers for the 2,420 acres of stand replacement**

<b>Size Class (diameter in inches-dbh)</b>	<b>Existing Dead Trees/Acre</b>	<b>Future Percent Cover Down Wood (&gt;10" large end diameter)</b>
4-7.5"	14.6	0
7.51-10.5"	19.1	1.4
10.51-13.5"	21.0	2.2
13.51-16.5"	13.5	2.0
16.51-19.50"	5.7	1.1
19.51"+	4.5	1.4
<b>Total</b>	<b>78.4</b>	<b>8.1 percent</b>

**Forest Roads – Alternative 3**

Access to designated units for reforestation would be on existing forest roads. After completion of identified road closures, the existing open road density for the 3,810-acre fire area would be lowered from 5.73 miles per square mile to 3.62 miles per square mile. Of this total, 2.33 miles of open road per square mile is comprised of tertiary roads and 1.29 miles per square mile consists of arterial and collector roads 18, 1810, 9711, 9714.

**Reforestation – Alternative 3**

Reforestation would occur on 1,936 acres, not including the 73 acres previously approved, adjacent to roads 18, 1810 and 9711.

**Subsoiling –Alternative 3**

Subsoiling would occur on about 5 acres of roads within units, about 5 acres of roads outside units, and about 7 miles (~10 acres) of road closures.

*EVALUATION*

This evaluation of the project area includes:

- X A pre-field review
- X A field survey
- X An effects analysis
- X Management recommendations (if a sensitive plant population exists).

**PREFIELD REVIEW - METHODS AND RESULTS**

Project area description: Soils within the 18 Fire project area are mainly comprised of sandy volcanic ash over sandy to loamy buried soils, while in some areas in the middle and southern end, mixed with highly fractured lavas.

The plant associations that dominate the 18 Fire project area are ponderosa pine/bitterbrush/fescue roughly in the north half, and ponderosa pine/bitterbrush-manzanita/fescue in the south half.

Elevations within the project area range from about 4200’ at the north end of the project to about 4700’ at the south end of the project. Average annual precipitation ranges from approximately 15-20”.

The potential for sensitive plant species’ habitat to occur in the project area was evaluated using the preceding information, as well as the following resources: aerial photo interpretation, vegetation map information, as well as personal knowledge of the project area.

Based on the preceding information, a comparison with the habitat requirements of Bend/Ft. Rock Ranger District potential sensitive species indicates that there is no likely habitat for PETS species within the project area; only one species is suspected but was unlikely to exist there either prior to or in the years after fire recovery.

<u>Species</u>	<u>Probability</u>
<i>Castilleja chlorotica</i> (Green-tinged paintbrush, or CACH)	Low

**FIELD RECONNAISSANCE**

Proposed, Endangered, Threatened, and Sensitive (PETS) plant surveys had been conducted over roughly 30% of the project area prior to the 18 Fire, within the past 13 years, for various thinning, mowing, and special uses projects. Additionally, thousands of acres in the vicinity, in similar habitats as the project area, have also been surveyed within the same time frame.

**SURVEY RESULTS**

None of the surveys found any PETS plant species.

**PROJECT EFFECTS**

This section discusses what effects may occur as a result of the proposed project and what risks the effects may have on the viability of proposed, threatened, endangered, and sensitive species.

**No Action Alternative Direct, Indirect, and Cumulative Effects:**

There are no expected direct, indirect, or cumulative effects if this alternative is implemented, because there were no known populations prior to the fire, nor are there any expected to establish post-fire. This expectation is based on many visits to the general area in which the fire occurred over the past 13 years by the author and other Forest Service botanists. Differing seral stages within this plant association and habitat type have been surveyed in the area, including visits to nearby fires that have occurred within the past 13 years (such as the Horse Butte Fire), and no PETS plants have ever been located there.

**Proposed Action and Alternative 3 Direct, Indirect, and Cumulative Effects:**

As with the No Action alternative, the two action alternatives do not pose direct, indirect, or cumulative effects to PETS plant species if either of them are chosen, for the same reasons outlined in the discussion for the No Action alternative.

**COMPARISON OF ALTERNATIVES**

There are no identifiable differences between alternatives as they relate to PETS plant species, because none were known to exist prior to the fire, nor are they expected to establish in the post-fire conditions.

**FINDINGS**

The analysis of effects on species viability found the following:

**For the No Action alternative:**

There are no expected impacts to PETS plant species with the implementation of this alternative.

**For the two action alternatives:**

There are no expected impacts to PETS plant species with the implementation of these alternatives.

**DESCHUTES NATIONAL FOREST – SENSITIVE PLANT CONTACTS**

Forest Botanist – Katie Grenier (388-5564)

Crescent District Plant Coordinator – Carolyn Close (433-3234)

Bend/Ft. Rock District Plant Coordinator – Charmane Powers (383-4730)

Sisters District Plant Coordinator – Maret Pajutee (549-7727)

**REFERENCES**

Bend/Ft. Rock Ranger District Sensitive Plant Sightings Atlas

Bend/Ft. Rock Ranger District Cleared Areas Atlas

Larsen, 1976. Deschutes National Forest Soil Resource Inventory.

**APPENDIX A**

**DESCHUTES NATIONAL FOREST SENSITIVE PLANT LIST**

Twenty-five plants are currently on the Regional Forester's Sensitive Species List (FSM 2670.44, 4/99) for the Deschutes National Forest, as follows (BFR = Bend/Fort Rock District, CRE = Crescent District, SIS = Sisters District):

Scientific Name	Common Name	LISTING STATUS	District		
			BFR	CRE	SIS
<i>Agoseris elata</i>	Tall agoseris	ONHP List 2	S	S	D
<i>Arabis suffrutescens</i> var. <i>horizontalis</i>	Crater Lake rockcress	Sp. Of Concern ONHP List 1	---	S	---
<i>Arnica viscosa</i>	Shasta arnica	ONHP List 2	D	S	S
<i>Artemisia ludoviciana</i> ssp. <i>estesii</i>	Estes' artemisia	Sp. Of Concern ONHP List 1	D	S	---
<i>Aster gormanii</i>	Gorman's aster	Sp. Of Concern ONHP List 1	S	S	S
<i>Astragalus peckii</i>	Peck's milk-vetch	Sp. Of Concern ONHP List 1	D	D	S
<i>Botrychium pumicola</i>	Pumice grape-fern	Sp. Of Concern ONHP List 1	D	D	---
<i>Calamagrostis breweri</i>	Brewer's reedgrass	ONHP List 2	S	S	S
<i>Calochortus longebarbatus</i> var. <i>longebarbatus</i>	Long-bearded mariposa lily	Sp. Of Concern ONHP List 1	S	S	S
<i>Carex hystricina</i>	Porcupine sedge	ONHP List 2	S	S	S
<i>Carex livida</i>	Pale sedge	ONHP List 2	S	S	S
<i>Castilleja chlorotica</i>	Green-tinged paintbrush	Sp. Of Concern ONHP List 1	D	S	S
<i>Cicuta bulbifera</i>	Bulb-bearing water-hemlock	ONHP List 2ex	S	S	S
<i>Collomia mazama</i>	Mt. Mazama collomia	Sp. Of Concern ONHP List 1	S	S	S
<i>Gentiana newberryi</i> var. <i>newberryi</i>	Newberry's gentian	ONHP List 2	D	S	D
<i>Lobelia dortmanna</i>	Water lobelia	ONHP List 2	S	S	D
<i>Lycopodiella inundata</i>	Bog club-moss	ONHP List 2	S	D	S
<i>Lycopodium complanatum</i>	Ground cedar	ONHP List 2	S	S	S
<i>Ophioglossum pusillum</i>	Adder's-tongue	ONHP List 2	S	S	S
<i>Penstemon peckii</i>	Peck's penstemon	Sp. Of Concern ONHP List 1	S	S	D
<i>Pilularia americana</i>	American pillwort	ONHP List 2	S	S	---
<i>Rorippa columbiae</i>	Columbia cress	Sp. Of Concern ONHP List 1	S	S	S
<i>Scheuchzeria palustris</i> var. <i>americana</i>	Scheuchzeria	ONHP List 2	D	S	S
<i>Scirpus subterminalis</i>	Water clubrush	ONHP List 3	S	D	S
<i>Thelypodium howellii</i> ssp. <i>howellii</i>	Howell's thelypody	ONHP List 2	S	S	S

\* CODES: D = Documented; S = Suspected; Species of Concern = Federal Designation; neither Endangered or Threatened; ONHP List 1 = Oregon Natural Heritage Program List: Contains species which are endangered or threatened throughout their range or which are presumed extinct; ONHP List 2 = Oregon Natural Heritage Program List: Contains species which are threatened, endangered or possibly extirpated from Oregon, but more common or stable elsewhere; ONHP List 3 = Oregon Natural Heritage Program List: Contains species for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range; ONHP List 4 = Oregon Natural Heritage Program List: Contains species of concern which are not currently threatened or endangered.



**APPENDIX B**  
**HABITAT DESCRIPTION FOR *Castilleja chlorotica***

CACH, or green-tinged paintbrush, is a perennial eastern Oregon endemic, known only from Deschutes, Lake, and Klamath Counties. It had been found at 4300' to 8200' elevation in open and forested ponderosa, lodgepole, and mixed conifer. It has also been found in nonforested sagebrush-bitterbrush types. Soils are often very poor and rocky.

An important life history factor to note about the *Castilleja* genus is that it is hemiparasitic, which means it contains chlorophyll and may or may not be able to complete its life cycle without a host species; hemiparasites primarily draw water and minerals from the host. It is not known which species is the host for CACH, although it is suspected to be a shrub (Dr. Richard Everett, pers. comm.). On the Fremont National Forest, upon which the majority of the known CACH population exists, the host is suspected to be sagebrush; on the Deschutes National Forest sites, it may be bitterbrush. Successful CACH reestablishment after a fire or other disturbance may depend upon the reestablishment of its host.

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## APPENDIX G: RESPONDING TO GENERAL PRINCIPLES AND RECOMMENDATIONS OF BESCHTA ET AL. (1995)

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The 18 Fire Recovery Project Interdisciplinary Team (IDT) considered the general principles and recommendations provided by Beschta et al in their paper “Wildfire and Salvage Logging”, 1995.

Based on considerable academic experience, the authors of Beschta et al provide their opinions on the issue of salvage following wildfires in the form of general principles and recommendations. The authors present their suggested policy principles and land management recommendations as generally applicable to federal lands throughout the western United States, or at least the interior Columbia and upper Missouri basins. The recommendations presented in the paper are not focused on the specific ecological, social, and economic characteristics of the post-fire conditions of the 18 Fire Recovery Project area. Additionally, the authors do not consider the multiple use goals, objectives and standards of the Deschutes Forest Plan. Thus, the IDT considered the authors’ suggested principles and recommendations in the context of specific post-fire conditions for the 18 Fire Area and Forest Plan management direction of the Deschutes National Forest.

The following is a summary of how the IDT and 18 Fire Recovery Project DEIS address the issues raised by Beschta et al (1995). All bold text is from the Beschta document.

**“Ongoing human activity and the residual effect of past activity continue to threaten watershed ecosystem integrity.**

**a. “The ability of ecosystems to recover has been substantially compromised.”**

**b. “Attempting to continue to manage fire and its consequences without altering or controlling other threats to ecosystems integrity, including logging, grazing, road building, and mining is scientifically and pragmatically unsound.”**

It is recognized by the team that the project area within which proposed salvage would occur have had some degraded conditions incurred as a result of past management activities. Existing conditions are summarized within the Affected Environment of the EIS. Although past management has caused some levels of environmental stress, land

management agencies have made significant progress toward a holistic ecosystem approach in recent years (Everett, 1995).

The effects of the proposed salvage and alternatives on wildlife, soils and other resources are described in Chapters 3 and 4 of the DEIS.

Analysis of post-fire conditions reveals cumulative effects as a result of the 18 Fire may have placed some of the ecosystem components at risk for degradation, specifically erosion susceptibility due to wind. The risks identified, however, are short-term when considering vegetative recovery following the fire. Field reconnaissance of burn severity and vegetative recovery has shown that re-growth has not been inhibited as a result of the fire and that the ability of this ecosystem to recover has not been substantially compromised.

Proposed activities are located on soils that are well-drained (pumice) and Best Management Practices would be employed. In a letter dated 11/25/2003, the District Wildlife Biologist states “A field reconnaissance of the 18 Fire Salvage Area on 11/20/03 did not locate any riparian, perennial, intermittent, or ephemeral stream channels in the project area. There would be no effects to riparian, water resources, ground water or fisheries from the proposed salvage of dead trees. There is no potential for overland flow of sediments into streams as a result of any proposed activities. Surface run-off is rare or nonexistent in the project area because of highly permeable volcanic soils. The nearest perennial stream channel is the Deschutes River approximately 6 miles west of the project area. There would be no effects to the hydrology of the Deschutes River as flows in the Deschutes are driven by groundwater and water storage practices in the Upper Deschutes basin. There would be no effects to any Oregon Department of Environmental Quality 303(d) listed waterbodies, and no effects to Essential Fish Habitat because none exists within the project area.”

The proposed salvage described in the 18 Fire Recovery Project EIS is one of several projects being considered in a larger context of fire restoration. A road analysis has been completed and a road management proposal has been developed which proposes to reduce the number of open roads within the fire area. Also common to all action alternatives is planting various levels of conifer regeneration. Burned Area Emergency Rehabilitation (BAER) projects such as monitoring for noxious weeds are ongoing within the fire perimeter.

**“Fires are an inherent part of the disturbance and recovery patterns to which native species have adapted.**

- a. **“Fires are part of the pattern of disturbance and recovery that provides a physical template for biological organization at all levels.” Fires reset temporal patterns and processes that, if allowed to proceed undisturbed by additional human impacts, provide dynamic and biologically critical contributions to ecosystems over long time frames.”**

In significantly altered ecosystems, natural disturbance processes may be no longer operating within historical ranges of variability (Agee 1994b, Hessburg et al. 1994), and their effects may be as foreign to the functioning of the ecosystem as human activities (Everett, 1995). The 18 Fire area was clearcut harvested in the 1920's. Subsequent fire suppression activities did not allow fire to operate within its role as a natural disturbance agent for the dry, ponderosa pine plant associations found within the 18 Fire Recovery project area. The area has missed several return intervals for fire due to effective fire suppression.

The action alternatives were developed in varying degrees to “reset” the stands to a point where the potential historical role of fire regimes can be used to retain the ecological benefits while responding to the needs of society and the goals of the Deschutes Forest Plan. This is especially true within the 18 Fire Recovery project area where frequent low intensity fires were the norm. Though fire is recognized as an important disturbance process within the 18 Fire Recovery Project area several points must be considered in the management of the area:

- The conditions present within the area prior to the fire reflected past management history including fire suppression. These conditions include the following vegetation trends:
  - Increased stand densities and shrub layers.
  - An increase in the amount and distribution of fuels.
  - Increased probability of a stand replacement disturbance
- Given that the pre-fire vegetation conditions were outside the historic ranges of variability, the fire itself was of such intensity and size that it also was outside the range of historic of variability.
- The design of the action alternatives in the 18 Fire Recovery Project DEIS includes actions that would restore vegetation and fuels to sustainable conditions within most of the fire area that currently do not provide the habitat for the white-headed woodpeckers and other species that prefer late and old ponderosa pine forests..

**b. “The ‘patchiness’ of fire is a desirable characteristic, and many species depend on the environmental influences that fires create.”**

It is important to discuss the fire recovery effort in the context of what is being retained. The area within the perimeter of the 18 Fire totals about 3,810 acres. Table C-1 displays burn intensity by areas retained where no salvage activity would occur by action alternative.

Table G-1:

**18 Fire Burn Intensity by Areas Where No Commercial Salvage Activities Will Occur**

Burn Intensity	Acres and Percent Within 18 Fire Perimeter	Acres and Percent of Fire Where All Dead Trees Are Retained by Alternative		
		Alt. 1	Alt. 2	Alt. 3
Non-Lethal	1390 36%	1,390 100%	1,390 100%	1,390 100%
Lethal (Stand Replacement)	2420 64%	2,347 97%	411 17%	2,347 97%
Total Acres	3,810	3,737	1,801	3,737

**“There is no ecological need for immediate intervention on the post-fire landscape.”**

Letting nature take its course may not be the best post-fire management approach. By the time we find that natural recovery processes are not functioning, significant ecosystem degradation could have occurred (Everett, 1995).

Future fire hazard is complex with or without wood removal. Current research and comments received from scoping suggests that salvage logging may actually create an elevated fire hazard. This is an assumption the 18 Fire team has adopted. However, compared to the areas where no biomass is removed, this is a short term effect. Snag longevity monitoring of similar stand replacement fires for ponderosa pine (blackbark) stands indicate a significant pulse of log biomass from burned snags starts to occur after approximately 8-15 years. Standing snags of all sizes present a much reduced fire hazard than down logs until they begin to fall. Then, this effect becomes a long term issue for those areas that had no biomass removed. Regardless of the size of the snags, brush and small material has accumulated to a point where the potential for a high rate of spread is present. With an additional elevated amount of down logs, the resistance to control (placement of firelines) and potential for intensity (effects on the tree crowns) and severity (effects on soils) is much higher.

Included in the purpose and need of the 18 Fire Recovery Project is the recovery of a ponderosa pine stand. There are primarily two courses of action that can be followed post-fire to regenerate conifers. Both are a function of time. By letting nature take its course and allowing natural regeneration, the lack of seed source and browsing by a large deer herd (deer winter range) would delay successful regeneration of ponderosa pine by decades, if ever. This is also due to global climate changes and cycles of wet periods that created favorable conditions during the establishment of the pre-fire forest. According to Beschta, “...human disturbances, unlike Mount St. Helens or El Nino, tend to be incessant, and thereby may produce conditions outside the evolutionary experience of native species.” There are no guarantees landscapes would not continue to be influenced by some human disturbances. Therefore, by choosing immediate intervention and

planting of ponderosa pine some desired attributes of forested landscapes can be jump started.

**Existing condition should not be used as “baseline” or “desired” conditions upon which to base management objectives.**

As previously stated, this ecosystem is significantly altered and natural disturbance processes may be no longer operating within historical ranges of variability. It would not be logical to use the existing pre-fire condition as a basis for management objectives. Desired conditions and management objectives are set forth in the Deschutes Forest Plan as amended by the Eastside Screens.

**“Fire suppression throughout forest ecosystems should not automatically be a management goal of the highest priority.”**

General fire suppression goals, and standards and guidelines are described in the Deschutes Forest Plan and Fire Management Plan. Fire management goals and forest wide standards and guidelines are described in the Forest Plan pages 4-73 through 4-74. Fire suppression as a management goal is beyond the scope of this salvage proposal and analysis. However, management of fuel loadings to facilitate the eventual reintroduction of prescribed fire to mimic its historic role is a desired condition within the project area.

**“From a watershed perspective, the region suffers an ecosystem health problem, but the primary cure rests in curtailing human activities known to be damaging and counterproductive, and repairing or restoring roads that act as permanent sources of adverse impact.”**

The analysis conducted for the 18 Fire Recovery Project is landscape-based. Currently, there is a temporary public closure in the fire area. This action was intended to protect human safety and to curtail human activities such as inappropriate access off of the road system.

The Bend Fort Rock (BFR) Ranger District conducted an analysis post fire to determine the best use of the current transportation system within the fire area. An access management plan for the area has been developed which proposes to obliterate 7 miles of access and close 5.6 miles. These recommendations are common to all action alternatives in the document.

Because of the high level of existing roads, a relatively small number of miles of temporary roads would be needed to access the interior of proposed units (Alternative 2 – 3.5 miles). Established for a specific short-term purpose and to prevent low-level casual use, such roads are decommissioned at the completion of their intended use.

**“We recommend that management of post-fire landscapes should be consistent with the following principles.”**

- a. **“Allow natural recovery and recognize the temporal scales involved with ecosystem evolution.”**      **“Human intervention on the post-fire landscape may substantially or completely delay recovery... or accentuate the damage.”**
- b. **“There is little reason to believe that post-fire salvage logging has any positive ecological benefits, particularly for aquatic ecosystems.”**
- c. **“There is considerable evidence that persistent, significant environmental impacts are likely to result from salvage projects... These impacts include soil compaction and erosion, loss of habitat for cavity nesting species, loss of structurally and functionally important large woody debris.”**

The 18 Fire Recovery Project analyzed both passive and active management scenarios (Chapter 3, DEIS). According to Everett (1995), the protection of short and long-term recovery elements may be in conflict, but protecting the resource with the longest recovery period should be given added emphasis. By emphasizing the restoration of a dry, ponderosa pine forest the active management approach may have a better chance at maintaining long-term biodiversity following the fire than a custodial approach.

The Forest intends to implement the proposed activities in a manner in which the needs of soil, wildlife, and other ecosystem resources are provided for within the context of the treatment proposal. The DEIS lists the design elements and mitigation measures that have been developed.

As noted before there are no aquatic or aquatic-influenced (riparian) areas within or adjacent to the Eighteen Fire Recovery Project Area., a majority of the recovery taking place would allow recovery processes to occur with limited intervention.

Areas proposed for treatment within the 18 Fire generally do not exceed 15 percent and there are no identified areas of erosion concern identified with salvage operations. Slopes within the project area exceeding 30% are confined to Bessie and Luna Buttes. Neither of the buttes is included in any salvage or mechanical treatment areas. Ground-based harvest systems would be implemented using designed layouts intended to limit the extent of multiple machine trips and associated detrimental compaction. Since detrimental soil disturbance would not exceed 20 percent, significant environmental impacts to the soil resource would not occur.

Harvest prescriptions (using ) have been designed to provide snags and coarse woody debris to address the needs of all cavity nesting, foraging and associated dependent species. Bitterbrush would be planted on identified road obliterations and other reclaimed transportation and logging facility developments such as landings and temporary roads. There are also a minimum of 1801 acres within the fire perimeter that are not proposed for salvage that would be left to recover naturally.

Human intervention following wildfires does not always cause adverse impacts to

resources. Although little can be done to control organic matter loss during wildfires, every opportunity must be taken to revegetate the site so that organic litter can be restored as quickly as possible (DeBano, 1991). Coarse woody debris and surface litter are currently deficient in some burned portions of the project area. Decaying wood and organic litter are critical for maintaining the soils ability to retain moisture and provide both short and long-term nutrient supplies for the growth of vegetation. Mycorrhizal fungi and soil organisms also depend upon the continuing input of woody debris and fine organic matter.

Human intervention is needed to expedite the establishment and restoration of ponderosa pine stands, reduce excessive fuel loadings and the potential for high-severity reburns, and improve the hydrologic function and productivity on compacted soils dedicated to specific roads and logging facilities that would no longer be needed for future management.

Under Alternative 2, salvage harvest operations would be expected to accelerate the accumulation of woody debris where these materials are currently lacking within portions of some activity areas. Enough fallen trees and other organic materials would likely be generated after salvage activities to meet recommended guidelines for maintaining soil productivity during the fire recovery period.

The proposed activity areas avoid areas with sensitive soils. There are no sensitive soils with high erosion hazards within the project area. Sensitive soils with steep slopes (greater than 30 percent) were excluded from management consideration. Salvage harvest and fuel reduction treatments would occur on gently sloping lava plains (0 to 15 percent slopes) that contain well-drained soils with low hazards for surface erosion. The removal of fire-killed trees would have no affect on evapotranspiration rates and potential increases in overland flows of water. Logging slash and fallen dead trees would provide additional ground cover that would slow the velocity of any runoff water and improve the soils ability to resist erosion from precipitation events or snowmelt that occurs during the fire recovery period.

Over the next 20 years, it is expected that the majority of fire-killed trees will become heavy fuel loadings that increase the risk for future wildfires to an unacceptable level. Post-fire sampling estimates indicate that potential biomass from down woody debris could range from 40 to 60 tons per acre within areas affected by stand-replacement fire (Plot Sampling, 2003). High-to-extreme fire hazard and potential for excessive soil heating exists when downed woody debris exceeds 30 to 40 tons per acre (Brown et al., 2003). If a large amount of fuel is present during a future wildfire, soil temperatures can remain high for long duration and excessive soil heating would be expected to produce large changes in soil chemical, physical, and biological properties (DeBano, 1991).

Under Alternative 2, fuel reductions would be accomplished by whole-tree yarding salvaged trees and the logging slash would be machine piled and burned on log landings. Over time, the residual trees that remain after harvest will gradually fall to the ground, and it is estimated that future fuel loadings would be reduced to an acceptable



average range of 15 to 20 tons per acre. Although this method removes potential sources of woody debris off-site, it would not cause additional soil impacts because burning would occur on disturbed soils that already have detrimental conditions. Soil restoration treatments would be implemented to reduce the amount of detrimentally disturbed soil on log landings following these post-harvest activities.

Under the action alternatives, soil restoration treatments would be applied with a winged subsoiler to reclaim and stabilize detrimentally compacted soil on certain management facilities. Under Alternative 2, subsoiling treatments would be implemented on all temporary roads, all log landings, and approximately 500 feet of all main skid trails that lead into log landings following post-harvest activities. Under Alternatives 2 and 3, road decommissioning (obliteration) treatments would alleviate compacted road surfaces on about seven miles of local system road which are no longer needed for long-term access. Restoration treatments, such as subsoiling, are designed to loosen compacted soil and improve the hydrologic function and productivity on disturbed sites. Subsoiled areas are expected to reach full recovery through natural recovery processes within the short-term.

**“No management activity should be undertaken which does not protect soil integrity.”**

- a. **“Soil loss and compaction are associated with both substantial loss of site productivity and with off-site degradation (water quality).”**
- b. **“Reduction of soil loss is associated with maintaining the litter layer.”**
- c. **“Although post-burn soil conditions may vary dependent upon fire severity, steepness of slope, inherent erodibility, etc., soils are particularly vulnerable in burned landscapes.”**
- d. **“Post-burn activities that accelerate erosion or create soil compaction must be prohibited.”**

The interdisciplinary team acknowledged the potential for adverse impacts to the soil resource and established design criteria to address this issue. The proposed management activities would occur on gently sloping lava plains that contain well-drained soils with high infiltration rates and low hazards for surface erosion. Due to the minor amount of severely burned soil and adequate amounts of existing soil cover, the effects of ground-disturbing management activities would likely be similar to those observed in unburned stands of live trees. The development and use of temporary roads, log landings, and skid trail systems are the primary sources of physical disturbance that would result in adverse changes to soil productivity. The majority of soil impacts would be confined to known locations in heavy-use areas that can be reclaimed when these facilities are no longer needed for future management.

The combined effects of current soil disturbances and those predicted from implementation of the proposed actions were addressed in the Environmental Effects section. The environmental effects of each of the alternatives are described and tracked by three issue indicators. One of these indicators addresses the probable success in

project design and implementation of management requirements and mitigation measures that would be applied to minimize adverse impacts to soil productivity.

In order to protect or maintain soil conditions at acceptable levels, plans for projects must include provisions for mitigation of ground disturbances where activities are expected to cause resource damage. Mitigation measures are specific actions that could be taken to minimize, avoid or eliminate potentially significant impacts on the resources that would be affected by the alternatives, or rectifying the impact by restoring the affected environment (40 CFR 1508.02). Various research references and both Regional policy (FSM 2520, R-6 Supplement No. 2500-98-1) and LRMP direction were used as guidance in determining design elements and mitigation needs for this project proposal.

Under Alternative 2, the management requirements, mitigation measures and Best Management Practices (BMPs) listed for the soil resource (DEIS, Chapter 2) are incorporated into the project design to avoid or minimize potentially adverse impacts from ground-disturbing management activities. Operational guidelines are included in design elements that provide options for limiting the amount of surface area covered by logging facilities and controlling equipment operations to minimize the potential for detrimental soil disturbances in random locations of activity areas. The steep slopes on Bessie and Luna buttes were excluded from the proposed activity areas in order to avoid soil displacement and potential erosion damage on sensitive soils. Other examples of project design criteria include limiting the amount of traffic off designated areas or operating equipment over frozen ground or a sufficient amount of compacted snow. Although logging over snow or frozen ground is not a requirement it can be used in lieu of other methods such as designated skid trails. Soil restoration treatments, including road decommissioning, would be applied to rectify impacts by reducing the amount of detrimentally compacted soil committed to specific roads and logging facilities.

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

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

**“Preserve species’ capability to naturally regenerate.”**

**“If warranted, artificial regeneration should use only species and seed sources native to the site, and should be done in such a way that recovery of native plants or animals is unhampered.”**

No emergency seeding of grasses or forbs was recommended by the Burn Area Emergency Rehabilitation team. The elevated risk of erosion due to the loss of surface cover was not deemed to be enough to justify additional emergency measures due to the gentle slopes, well-drained soils, and low severity burn characteristics.

Planting of native ponderosa pine seedlings is proposed, ranging from 0 acres in Alternative 1 (note 73 acres of roadside planting was included in a previous decision) to 1936 acres (2009 acres when combined with the 73 acres) in Alternatives 1 and 2.

Natural regeneration of conifers throughout the fire is unlikely to occur at significant rates since last year's seed sources were burned before full maturation. The return of native annuals and shrubs has occurred to significant cover levels within other fire salvage areas on the Forest and has already become well established during the first growing season following the 18 Fire.

**“Do not impede the natural recovery of disturbed systems.”**

Much of the fire area would have limited intervention on the post fire landscape. What Beschta considers “natural recovery” would range from 98% in Alternative 1 to 47% in Alternatives 2 and 3. Exotic noxious weed populations are being monitored and would be combated (if found) to limit their influence on delaying the recovery of native species. Treatment of known sites under the 1998 Deschutes National Forest Noxious Weed EA and monitoring of noxious weeds began immediately post-fire and would continue.

The Eighteen Fire burned in a classic mosaic pattern of moderate and lightly burned areas. Based on field reconnaissance, approximately 61 percent was classified as low burn severity and 39 percent was determined to be moderate burn severity (BAER Soil Specialist Report, 2003). Although the fire caused high mortality of overstory trees, ground-level heating was typically not elevated to temperatures capable of altering soil properties that affect site productivity. The minor extent of severely burned soil was generally confined to isolated spots beneath downed logs or around root crowns of individual trees. These sites were minor inclusions in areas mapped as moderate burn severity and likely comprise less than one percent of the burned acreage.

All burned areas are susceptible to short-term increases in surface runoff and erosion until vegetative recovery takes place. The sandy textures of the dominant, ash-influenced soils have high infiltration rates that account for low amounts of overland flow and natural erosion. There are no sensitive soils with high erosion hazards in the project area. Monitoring results of previous fires on the district indicate that overland flow of water and evidence of surface erosion is typically nonexistent in burned areas with gentle slopes. Steep slopes with sparse vegetation generally have greater amounts of surface runoff which increases the erosion potential. Therefore, sensitive soils with steep slopes

(greater than 30 percent) on Bessie and Luna buttes were excluded from management consideration. Livestock grazing is currently postponed to allow the recovery of herbaceous vegetation.

All soils are susceptible to soil movement whenever rainfall intensities or snowmelt are great enough to cause overland flow. Measurements of post-fire infiltration rates of surface soils did not indicate elevated levels of hydrophobic (water repellent) soil conditions that would lead to increased runoff and accelerated erosion. At the present time, adequate soil cover currently exists within the proposed activity areas to control erosion rates within tolerable limits. Under Alternative 2, the proposed salvage harvest and fuel reduction treatments are not expected to cause accelerated erosion rates that would have any long-term adverse effects to soil productivity. The absence of stream channels within or adjacent to the project area assures that there is no potential for overland flow of sediments that could affect listed 303(d) waterbodies or essential fish habitat outside of the project area.

Decommissioning and closure of roads as noted would aid in natural recovery processes, returning areas capable of supporting vegetation to a less disturbed condition. There would be no new construction of roads that would be retained as part of the transportation system. Approximately 3.5 miles (total) of temporary road would be constructed to allow access to some activity areas, but these roads would be obliterated upon completion of salvage activities. Currently, there is a temporary public closure in the fire area to prevent inappropriate access off of the classified road system. All reasonable Best Management Practices (BMPs) for timber management and road systems would be applied to protect the soil resource and control erosion on roads and logging facilities that may be used during project implementation.

Project design and the level of success in implementing the management requirements, mitigation measures and Best Management Practices (BMPs) determine the overall magnitude of soil disturbance within the individual activity areas proposed for these restoration treatments.

## Recommendations on Post-fire Practices \_\_\_\_\_

**“Salvage logging should be prohibited in sensitive areas.”**

- a. **“Logging on sensitive areas is often associated with accelerated erosion and soil compaction.”**
- b. **“Salvage logging by any method must be prohibited on sensitive sites, including: severely burned areas (no duff layer), on erosive soils, on fragile soils, in roadless areas, in riparian areas, on steep slopes, or any site where accelerated erosion is possible.”**

Sensitive soils were considered to be those identified in the Deschutes LRMP. Sensitive soils within the project area include: 1) soils on slopes greater than 30 percent, 2) soils

associated with frost pockets in cold air drainages, and 3) soils that occur in localized areas of rocky lava flows. There are no potentially wet soils with high water tables or sensitive soils with high erosion hazard ratings that would require special mitigation.

As described in the previous responses (above), sensitive soils that could be adversely impacted by ground-disturbing management activities were excluded from management consideration or, in the case of roadless areas or riparian areas, simply do not exist within or adjacent to the Eighteen Fire Recovery Project Area.

**“On portions of the post-fire landscape determined to be suitable for salvage logging, limitations aimed at maintaining species and natural recovery processes should apply.”**

- a. **“Dead trees (particularly large dead trees) have multiple ecological roles in the recovering landscape including providing habitat for a variety of species, and functioning as an important element in biological and physical processes. In view of these roles, salvage logging must leave at least 50% of the standing dead trees in each diameter class; leave all trees greater than 20 inches dbh or older than 150 years; generally, leave all live trees.”**
- b. **“Because of soil compaction and erosion concerns, conventional types of ground-based yarding systems should be generally prohibited.”**
- c. **“Helicopter and cable systems using existing roads and landings may be appropriate, however, even these... methods could locally increase runoff and sediment.”**

The value of dead trees in biological and physical processes is recognized by the team and addressed in the snag and downed wood habitat and soils sections of Chapter 3. The 18 Fire Recovery Project Area has missed several fire return intervals and the current level of snags is far greater than would exist under a normal fire regime. Prescriptions for salvage, under Alternative 2, would remove only a portion of the dead trees. As stated before, all live trees would be retained under all alternatives, regardless of fire damage. Many of these severely damaged green trees can be expected to die during the coming years and provide replacement snags in addition to the dead trees already being retained for wildlife habitat and coarse woody material (CWM) within the 3810 acre fire.

Table C-2 shows the percentage of trees that would remain in each diameter class by alternative within the 3810 acre fire:

**Table G-2:**

**18 Fire Trees Retained by Diameter Class**

	Alternative 1		Alternative 2		Alternative 3	
Diameter Class by (dbh)	Percent Dead Trees Retained	Percent Dead & Green Trees Retained	Percent Dead Trees Retained	Percent Dead & Green Trees Retained	Percent Dead Trees Retained	Percent Dead & Green Trees Retained

4-7.5"	100%	100%	100%	100%	100%	100%
7.50-10.5"	99.7%	99.8%	99.7%	99.8%	99.7%	99.8%
10.51-13.5"	97.7%	98.3%	66.8%	75.2%	97.7%	98.3%
13.51-16.5"	97.7%	98.4%	38.1%	57.5%	97.7%	98.4%
16.51"-19.5"	97.7%	98.5%	35.3%	58.3%	97.7%	98.5%
19.51"+	97.9%	98.5%	55.7%	68.8%	97.9%	98.5%

These levels are a result of Deschutes LRMP direction for retention, recruitment and cycling of snags and coarse woody material at levels that maintain ecological processes across the landscape (based on Decaid).

Table C-3 shows the percentage of CWM estimated to occur within 15 years based on the cover or “footprint” provided by down logs/acre at least 10 inches in diameter on the large end, 5 inches on the small end and at least 40 feet long:

**Table G-3:  
18 Fire CWM/Acre “Footprint”**

Burn Intensity	Acres and Percent Within 18 Fire Perimeter	Acres and “Footprint of CWM Retained by Alternative		
		Alt. 1	Alt. 2	Alt. 3
Non-Lethal	1390	1,390	1,390	1,390
	36%	4.1%	4.1%	4.1%
Lethal (Stand Replacement)	2420	73	411	73
	64%	3.2%	8.1%	3.2%
		3,737	2,009	3,737
		8.1%	3.2%	8.1%

The desired footprint based on Decaid for the plant association groups within the 18 Fire Recovery Project Area is 1.4 percent. All alternatives would exceed this level.

The effects analysis for the soil resource addresses this issue by comparing post-fire existing conditions to the anticipated conditions which would likely result from implementing the action alternatives. As described in previous responses, soils in the proposed activity areas were not severely burned, and salvage logging would occur on gently sloping lava plains (0 to 15 percent slopes) that contain well-drained soils with low hazards for surface erosion. Sensitive soils that could be adversely affected by ground-based logging activities were excluded from all proposed activity areas. Adequate soil cover currently exists to slow the velocity of any runoff water and control erosion rates within tolerable limits. Monitoring of previous fires on similar soils and landforms has shown that overland flow of water and evidence of surface erosion is typically nonexistent within both logged and unlogged portions of burned areas. It is expected that the use of modern, ground-based equipment and designated skid trail systems would result in similar effects to those observed in unburned areas.

Under Alternative 2, the development and use of temporary roads, log landings, and skid trail systems are the primary sources of physical disturbance that would result in adverse changes to soil productivity. The majority of soil impacts would be confined to known

locations in heavy-use areas that can be reclaimed when these facilities are no longer needed for future management. Best Management Practices (BMPs) would be applied to control erosion on and adjacent to roads and logging facilities that would be used during project implementation. The management requirements, mitigation measures and Best Management Practices (DEIS, Chapter 2) are incorporated into the project design to avoid or minimize potentially adverse impacts to the soil resource.

Salvage harvest operations would be expected to accelerate the accumulation of woody debris where these materials are currently lacking within portions of some activity areas. Enough fallen trees and other organic materials would likely be generated after salvage activities to meet recommended guidelines for maintaining soil productivity. This would expedite decomposition processes and input of organic materials into the soil surface.

**“Building new roads in the burned landscape should be prohibited.”**

The action alternatives of the 18 Fire Recovery Project EIS do not include any permanent road construction although they do propose to establish or reopen temporary roads. In order to prevent low-level casual use, such roads and landings are decommissioned at the completion of their intended use. Because of the high level of existing roads, a relatively small number of miles of temporary roads would be needed to access the interior of proposed units (Alternative 1 – 0 miles, Alternative 2 – 3.5 miles, Alternative D – 0 miles). At the completion of the sale, all temporary roads would be decommissioned and revegetated with ponderosa pine and native species such as bitterbrush.

Alternatives 2 and 3 propose to reduce the number of open roads by closing 5.6 miles and obliteration of 7.0 miles to improve habitat effectiveness for big game. There is no potential for run-off and sediment delivery problems. All reasonable Best Management Practices (BMPs) for road systems would be applied to protect the soil resource and control erosion on roads that may be used as haul routes for this project.

**“Active reseeding and replanting should be conducted only under limited conditions.”**

- a. **“Active planting and seeding has not been shown to advance regeneration and most often creates exotic flora. Therefore, such practices should be employed only where there are several years of evidence that natural regeneration is not occurring.”**
- b. **“Native species from regional stocks that may enhance fire resistance of site may be planted if the effect is to not homogenize the landscape.”**
- c. **“Seeding grasses into burned forests has been shown to disrupt recovery of native plants and is likely to create more problems than it solves.”**
- d. **“The use of pesticides, herbicides, and fertilizers should generally be prohibited.”**

No seeding of native forbs and grasses was recommended by the BAER process and none has occurred within the fire perimeter. ). The return of native annuals and shrubs has

occurred within other fire salvage areas on the Forest and has already become well established post-fire.

The Forest Service has a policy to reforest capable lands that have been deforested as quickly as practicable.<sup>1</sup> Within areas of moderate to high mortality, natural regeneration of ponderosa pine is unlikely to occur at significant rates since last years' seed sources were burned before full maturation and the fire killed over 95 percent of the trees on 2420 acres of the fire. To wait "several years until there is evidence the natural regeneration is not occurring" would miss the window to re-establish ponderosa pine at , almost, any cost within the next 75 to 100 years. The Skeleton Fire, which was not planted and which contains similar plant association groups, has shown little or no natural regeneration during the last 8 years (personal communication with BFR Reforestation Forester, Matthew Deppmeier, 2004) due to competition for moisture with the native forbs and grasses that quickly reestablished on the fire. The strategy is not to homogenize the landscape but to move towards providing cover and thermal percentages specified for the Deer Habitat Management Area and to ensure some conifer regeneration for forest associated species.

The strategy for managing competing and unwanted vegetation associated with the 18 Fire Recovery Project activities is prevention. Design elements and site-specific recommendations for preventing introduction and spread have been incorporated into all action alternatives. These prevention strategies would alleviate most potential problems dealing with competing and unwanted vegetation. No other application of pesticides, herbicides, or fertilizers is planned within the fire perimeter.

### **“Structural post fire restoration is generally to be discouraged”**

Surface erosion by water is not a major concern on these coarse textured soils with high infiltration rates. There is no potential for overland flow of sediments to reach stream channels outside of the project area. Therefore, the Burned Area Emergency Response (BAER) team did not recommend any post-fire structural restoration projects.

Post fire restoration immediately following suppression activities included rehabilitation of dozer line which included scarification for water percolation. None of the alternatives considered in the EIS propose the installation of structures to function as sediment traps.

### **“Post-fire management will generally require reassessment of existing management.”**

- a. By increasing runoff, erosion, and sedimentation, fire may increase the risks posed by existing roads.**
- b. Therefore, post-fire analysis is recommended to determine the need for undertaking road maintenance, improvement, or obliteration.**

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<sup>1</sup> November 19<sup>th</sup>, 2002 letter from the Regional Forester to Forest Supervisors



The 18 Fire Recovery Project IDT conducted a road analysis containing recommendations for road obliteration (decommissioning) and road closures (inactivation). These recommendations are being carried forward and incorporated into the design of the action alternatives.

Immediately following the 18 Fire, resource conditions were assessed as part of the Burned Area Emergency Rehabilitation (BAER) process. An additional analysis was completed in a rapid assessment effort conducted by the district and forest specialists. These assessments considered existing management and the risks inherent in the condition of the watershed, from which numerous fire recovery and rehabilitation projects have been proposed or completed.

In order to allow for adequate recovery of herbaceous vegetation, livestock would not resume grazing in the project area until the fall of 2005, at the earliest.

**“Continued research efforts are needed to help address ecological and operational issues.”**

The interdisciplinary team acknowledges the value of continued research regarding post-fire activities. Within the Forest Service, only the research branch can conduct scientific research, therefore research projects are beyond the scope of this EIS. Local monitoring would be conducted to evaluate whether adjustments in management practices may be necessary to achieve various resource objectives. For example, although the BAER response team concluded that no emergency measures were necessary, the team compiled recommendations and funding to monitor noxious weeds. Research studies were used to develop conservative recommendations for leaving sufficient coarse woody debris following management activities (Graham et al. 1994, Brown et al. 2003).

The team recognizes that the likelihood of ignition does not change significantly as a result of salvage or increased down wood levels. What can change, however, are fire behaviors, intensities and associated effects to resources should a reburn occur. This would be one area where more research efforts could contribute to better defining the long term risks associated with limited intervention on post-fire landscapes. Ice (1996) references the reburn of the Tillamook fire in the Oregon coast range within six years following that event. Also, a previous fire on the Deschutes National Forest (Eyerly) has anecdotal references that document the reburn of thousands of snags and deadfall down wood throughout the fire area, although no evidence of the severity of this event was included.

The role of down and dead wood in providing for the full range of ecosystem processes and the needs of species is a difficult balance to provide for (sometimes) competing short and long-term objectives. The 18 Fire Recovery EIS provides for snag and coarse wood levels mandated by the Deschutes LRMP standards and guidelines. The introduction of the Decayed Wood Advisor (DecAID) tool developed by Marcot et al. (2002) into the wildlife analysis of this project is an ongoing endeavor used as an advisory analysis tool to help land managers evaluate effects of forest conditions and proposed management

activities on organisms that use snags, down wood, and other wood decay elements. A large number of acres within the fire perimeter would not have any wood removed as a result of proposed activities and would carry significant loads of this material into the future. Treated acres would have snags and down wood at levels that would provide for some of the needs of species associated with this component.

The environmental effects of post-fire salvage and site preparation are described within the EIS in context to existing watershed and resource conditions under a no action scenario following the fire. Effects analysis includes documentation of the results of available research to describe predicted effects from the proposed activities.

**“Additional information must be provided to the public regarding natural fires and post-burn landscapes to provide balance to a ‘Smokey Bear’ perspective of fires and forests. “**

- a. Although post-fire landscapes are often portrayed as “disasters” in human terms, from an ecological perspective, fire is part of the normal disturbance regime and renewal of natural forest ecosystems.**
- b. An increased appreciation and understanding of natural disturbance regimes in the ecology of forest ecosystems is needed by the public, and the public’s land managers.**

Although outside the scope of this analysis, changes in federal wildland fire management are evident in: The Federal Wildland Fire Management, Policy and Program Review (1995), Managing the Impact of Wildfires on Communities and the Environment – A Report to the President In Response to the Wildfires of 2000, and A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy (2001). The National Fire Plan goals are:

- Ensuring sufficient firefighting resources for the future;
- Rehabilitating and restoring fire-damaged ecosystem;
- Reducing fuels (combustible forest materials) in forests and rangelands at risk, especially near communities; and
- Working with local residents to reduce fire risk and improve fire protection.

Specific to the 18 Fire, fire regimes are addressed in both a historic and existing context as well as vegetation conditions. Though fire occurrence is natural within the dry, ponderosa pine plant association group, the fire behavior observed (rate of spread, spotting, intensity, etc.) was not. Fire behavior is largely dependent on the amount, arrangement and condition of fuels and vegetation. The conditions of fuels and vegetation for much of the 18 Fire area was outside the range of historic variability range (HRV), the fire burned at higher intensities over a larger portion of the area than would have been expected if conditions were closer to HRV.

The effects of the 18 Fire are also more severe than would be expected historically. Following fires these same sites are outside the historical range of variability in amounts of snags and logs (Everett, 1995). Unless dead material is removed and stands are subsequently managed for historical tree densities, future fuel loading will be outside the historical range of variability for dead and down, creating the potential for more intense reburn situations. The “intense reburn” assumption is based on the physics of fire behavior, the greater the amount of available fuel the greater the fireline intensity in BTU’s and the difficulty of fire suppression (Rothermel, 1983).

## **Recommendations Concerning Fire Management** \_\_\_\_\_

**“Fire suppression activities should be conducted only when absolutely necessary and with utmost care for the long-term integrity of the ecosystem and the protection of natural recovery processes.”**

This recommendation is outside the scope of the 18 Fire Recovery Project EIS. Minimum impact suppression techniques, such as using existing roads to anchor firelines were used on the 18 Fire whenever possible. Specific environmental effects of fire suppression activities on the 18 Fire are discussed under Existing Condition of the Soil Resource.

**“When land ownerships are mixed, the federal land management agencies should establish policies to prevent conflicts between re-establishment of natural disturbance regimes on federal land and the protection of private property.”**

This proposal for policy change is outside the scope of the 18 Fire Recovery Project EIS. All lands within and adjacent to the Eighteen Fire Recovery Project Area are under Federal ownership.

The National Fire Plan goals include identification of natural fire regimes, and condition class, and working collaboratively with local land owners and residents to identify fire risk and reduce fuel hazards especially near communities.