CHAPTER 3

Chapter 3 Changes Between Draft EIS and Final EIS

A portion of the soil section has been updated to add more research information on soil biota populations and a listing of previous vegetation management activities (Table 3-3A).

In the Wildlife section population trend information was updated in Table 3-6 for MIS and Species of Concern. Wildlife and Botany effects have been amended to reflect the revised Regional Forester's Sensitive Species List. The effects summary in the Wildlife Biological Evaluation was moved from Appendix D to Chapter 3.

In the Air Quality section the potential effects of landing pile burning on the Three Sisters Wilderness Area Class I Airshed was further clarified.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Introduction

This chapter of the FEIS 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 nonsystem (~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 Management Requirements. 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 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 repellant) 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 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 6th field subwatersheds. Both 6th field watersheds are in the 5th 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 water bodies or essential fish habitat (Walker, 2003).

The project area contains 10 land type 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 land type 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 Bessie 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 land types 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 land types 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 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 land types 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 land types with localized areas of sensitive soils (Table 3-1). It should be emphasized that only portions of these total land type 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: Land type Acres Containing Localized Areas of Sensitive Soils within the 18 Fire

SRI Map Unit Symbol	Geomorphology (Representative landforms)	Type of Concern**	Land type 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 land types, 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-forths 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)	
	1st Year	2nd Year
Low	20 – 30	31 – 45
Moderate	31 – 45	46 – 60
High	46 – 60	61 – 75
Severe	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 land types 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.

Table 3-3A. Past Activities within Salvage Unit 1

Project Name	Year	Activity	Acres
East Lava River	1978	Precommercial Thinning	26
Bessie	1980	Precommercial Thinning	65
Beetle Juice	1989	Precommercial Thinning	84
ET	1992	Commercial Thinning	3

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:

Unit 1: 9.2 miles (13.4 acres) **Unit 2**: 0.6 miles (0.9 acres)
Unit 3: 0.3 miles (0.5 acres) **Unit 4**: 0.8 miles (1.2 acres)
Unit 5: 0.3 miles (0.4 acres) **Unit 6**: 0.3 miles (0.4 acres)

Unit 7: 0.1 miles (0.1 acres) **Unit 8**: 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 it does not go through any proposed 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 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.

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 occurring 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	Percent within Unit
01 / 1,620	18.0	13.4	1.0	2 %
02 / 27	0.0	0.9	0.0	3 %
03 / 23	0.0	0.5	0.0	2 %
04 / 149	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 / 114	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 Sl-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 (FEIS 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 spacing 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.

FEIS Unit Number	*Unit* **Acres**	*Existing Detrimental* **Soil Conditions**		*Estimated Detrimental* **Soil Conditions After Salvage Harvest**		*Estimated Detrimental* **Soil Conditions After Restoration**	
		Acres	**Percent of Uni**	**Acres**	**Percent of Uni**	**Subsoil Acres**	**Percent of Uni**
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 (FEIS, 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 (Craigg, 2000). Subsoiling treatments have been implemented with good success due to the absence of rock fragments on the surface and within soil profiles. Although rock fragments can limit subsoiling opportunities on some landtypes, hydraulic tripping mechanisms on this specialized equipment help reduce the amount of subsurface rock that could potentially be brought to the surface by other tillage implements. Most of the surface organic matter remains in place because the equipment is designed to allow adequate clearance between the tool bar and the 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. 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.

Although the biological significance of subsoiling is less certain, these restoration treatments likely improve subsurface habitat by restoring the soils ability to supply nutrients, moisture, and air that support soil microorganisms. Research studies on the Deschutes National Forest have shown that the composition of soil biota populations and distributions rebound back toward pre-impact conditions following subsoiling treatments on compacted skid trails and log landings (Moldenke et al., 2000).

Table 3-5. Potential Sources and Extent of Soil Restoration Opportunities within Proposed Activity Areas of the Eighteen 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	Total Percent within Unit
01 / 1,620	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 / 149	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 / 114	2.3	0.4	0.0	2 %

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 at the earliest. 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. Alternative 1 would defer fuel reduction opportunities at this time. If a large amount of fuel is present during a future wildfire, soil temperatures can remain high for 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. 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 (FEIS, 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 affect 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.

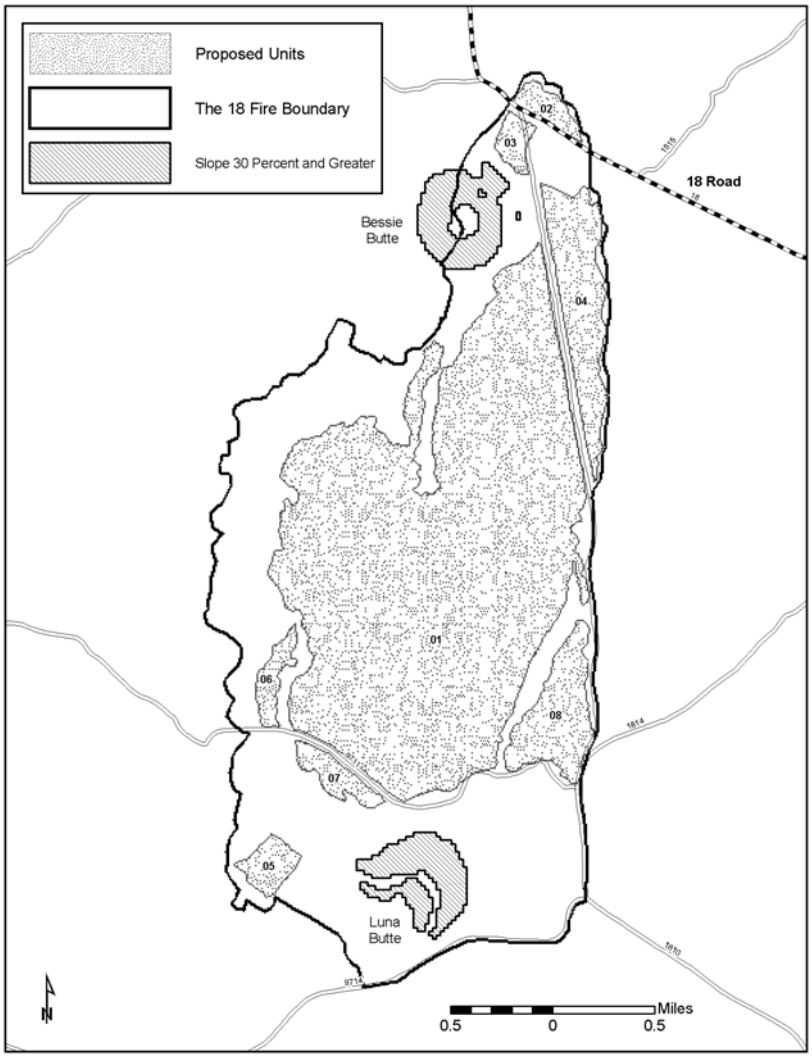
Based on these disturbed area estimates, the percentages of detrimental soil conditions would increase above existing conditions by approximately 8 to 11 percent in each of the proposed activity areas. None of these activity areas would exceed the LRMP standard of 20 percent following implementation 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 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 surface 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 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 (FEIS, 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. 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 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 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 BMP 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 BMP 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 productiviy 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 and 2004). 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 of landing piles 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 IDT 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 BMPs listed for the soil resource (FEIS, 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 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 BMPs determine the overall magnitude of soil disturbance within the individual activity areas proposed for these restoration treatments. All reasonable 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 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 BMPs (FEIS, 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 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 IDT 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 FEIS. 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.

Background: The following meets the direction provided by FSM 2600, the Deschutes National Forest (DNF) Land and Resource Management Plan as amended (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.

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 3-6 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	Occur-rence*	Management Indicator Species	FWS Species of Concern	ODFW Sensitive Species	Ecological Indictor Species**
Northern goshawk (NTMB, MBTA)	S/G5	X	X	X	X (1)
Sharp-shinned hawk (NTMB, MBTA)	S/G5	X			(4)
Red-tailed hawk (NTMB, MBTA)	C/G5	X			(7-generalist)
Cooper's hawk (NTMB, MBTA)	S/G5	X			
Golden eagle	U/G5	X	BCC (BCR 9)		(6)
Flammulated owl (NTMB, MBTA)	U/G4		BCC (BCR 9)	X	X (1, 2a, 4, 5-interspersed grassy openings and thickets)
Northern pygmy- owl (MBTA)	U/G5			X	(2a, 7-open forests, edges)
Lewis' woodpecker (NTMB, MBTA)	U/G4	X	BCC (BCR 9)		X (2a-large snags, 7-burns)
White-headed woodpecker (MBTA)	U/G4 (declining, local extirp-ation, BBS)	X	BCC (BCR 9)	X	X (1-PP, 2a, 2b, 7-sugar pine foraging, large LOS patches)
Hairy woodpecker (MBTA)	C/G5				X (2a, 2b, 7-burns)
Black-backed woodpecker (MBTA)	R/G5	X		X	X (1-LPP, 2a, 2b, 7-burns)
Williamson's sapsucker (NTMB, MBTA)	R/G5 (declining, BBS)	X	BCC (BCR 9)	X	X (2a-large snags, 2b, 7-higher elevations)
Pygmy nuthatch (migratory, MBTA)	U/G5			X	X (1-PP, 2a, 2b, 7-large trees)
White-breasted nuthatch (migratory, MBTA)	U-C/G5				X (1-PP, 2a, 2b)
Mountain chickadee (migratory, MBTA)	C/G5				(1, 2a, 2b, 5)
Green-tailed towhee (NTMB, MBTA)	U/G5				X (3)
Olive-sided flycatcher (NTMB, MBTA)	U-C/G4 (declining, BBS)		BCC (BCR 5)	X	X (1, 2a, 7-burns, clearings, edges w/ conifers)
Dusky flycatcher (MBTA)	U/G5				X (3, 7- clear-cuts)
Chipping sparrow (NTMB, MBTA)	U/? (declining, BBS)				X (7- open understory w/regenerating pines)

Table 3-6 continued

Species	Occur-rence*	Management Indicator Species	FWS Species of Concern	ODFW Sensitive Species	Ecological Indictor Species**
Mountain bluebird (NTMB, MBTA)	U-C/G5				X (2a, 7- burns, openings)
Rock wren (MBTA)	U/G5				X (7-talus, rock, clear-cuts)
Mule deer	C	X			(7-shrubs winter range)
American marten	R	X		X	X (1-MC, LPP, 7-CWM concentrations)
Yellow-pine chipmunk	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,
Western fence lizard	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/Global Conservation Status: G4 Apparently Secure, G5 Secure (source Nature Serve). ** Special habitat requirements codes: 1 = late and old successional forest (LOS), 2a = snags, 2b = logs, 3 = mature shrubs, 4 = dense conifers for nesting/foraging, 5 = meadows or grassy openings for foraging, 6 = special/unique habitats (rock, cliffs, caves, etc.), 7 = other, noted. Abbreviations: LPP = lodgepole pine, PP = ponderosa pine, 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, 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 with at least 95 percent tree mortality. 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 stand replacement regimes.

Big Game

As previously noted, approximately 96 percent of the project salvage area is classified as winter range (Management Area 7, Deer Habitat). 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 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 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 on Indicator Species for more detailed information on species dependent upon shrub habitats.

Roads and Trails
The area has a road density of 3.6 miles per square mile (Figure 3-30). 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 LRMP (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 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 ICEMP 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://wwwnotes.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

Unit	Diameter Mid-Point	Ht.	No. Per Acre	Notes
Salvage Units	6”	35’	14.6	50.3 tons of dead material per acre.
1 to 8	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	6	35’	17.2	21.8 tons of dead material per acre
area	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' 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 snags).
***Lewis' woodpecker**	Territory 15 ac.	Open forests. Patches of burned forest. Target >50% of burns un-salvaged. Retain all snags >21" dbh and 50% of snags 12-21" in fire salvages. Overall, retain 25 snags per acre 9"+ dbh in burns. Usually secondary nester but may excavate (12"+ snags, with 26" mean).
Williamson's sapsucker	Territory 10-20 ac.	Prefer open ponderosa pine for nesting. Excavate soft, decayed wood (12" dbh minimum, with 21"+ preferred). 1.5 snags/ac.
Hairy woodpecker	Territory 25 ac.	Open forests along edges and in burned areas. Primary excavator (10" minimum, with 17"+ preferred). 1.3-1.9 snags/ac. (burns 41.8/ac.) Light to moderate decay usually.
***White-headed woodpecker**	Home range 250-500 ac.; territory 20 ac.	Open old-growth ponderosa pine with large trees for foraging and snags for nesting. Pine seeds (ponderosa and sugar) are important forage in the winter. Will use short snags and tall stumps in open areas (averages 12% canopy cover). Target 10 trees per acre >21" dbh with >2 trees per acre >31" dbh; 10-40% canopy closure; 1.4 snags per acre >8" dbh with >50% >25" dbh, mean 18". Burns 51.4 snags/ac.
***Pygmy nuthatch**	Territory 2-4 ac.	Prefer older, mature ponderosa stands but will forage in young stands. Target 10+ trees per acre of 21" dbh+, including 2 trees per acre >31" dbh. Secondary nester or primary excavator in snags or dead portions of live trees (8" dbh 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.
***Chipping sparrow**	Territory 3-7 ac.	Open forest with patches of regenerating trees or shrubs. Openings with forbs and grasses are important for foraging. Edges and clearcuts are utilized. Target 10-30% canopy cover, 20-60% shrub cover with >20% sapling cover, especially pines.
Mountain bluebird	Territory 5-15 ac.	Open forests, clear-cuts, edges of meadows, and burned areas. Secondary cavity nester (minimum 9" dbh). Burns 29.7 snags/ac.
Yellow-pine chipmunk	Home range <2.5-25 ac.	Open forests with shrub understories. Coarse woody debris is important, including stumps and logs, for nests (rocky areas also used). Seeds from trees and other plants are required. An important agent in the 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 describes the principal habitat elements that the selected Indicator Species will require. Specific Desired Future Conditions (DFC) 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

Table 3-9 was developed from DecAID Advisor and shows future desired conditions for both large (150 years+) and small-medium ponderosa pine (40 to150 years) structural stages. The former is provided for comparative information, and the latter will be the basis for specific DFC 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 DFC that has 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)/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
Lewis' woodpecker (15 ac.)	1 (?/?/24.8 burns)	1 (12"/26")	1 (individual and small clumps)	2
Williamson's sapsucker (15 ac.)	1 (1.5/?/?)	1 (12"/21")	2 (mix)	2
Hairy woodpecker (25 ac.)	1 (1.6/?/41.8 burns	1 (10"/17")	2 (mix, edges)	2
White-headed woodpecker (20 ac.)	1 (1.4/6.4/51.4 burns)	1 (8"/26")	2 (individual)	2
Pygmy nuthatch (3 ac.)	1 (1.4/?/?)	1 (8"/18")	2 (mix)	2
Mountain bluebird (5-15 ac.)	1 (?/?/29.7 burns	1 (9")	1 (individual)	NA
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, well distributed across each harvest unit, and located, where feasible around lava outcrops. Patches can range in size from ½ to15 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 then 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	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 (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/ 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/?
Lewis' woodpecker	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
White-headed woodpecker	3	1	1 (nests, forage green)	1	3	2 (nests)	3/?
Pygmy nuthatch	1	1	1 (nests, forage)	2	2	NA	2/?

Table 3-12 continued

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**
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
Chipping sparrow	3	2	NA	1	3	1 (grass preferred)	1 (grass edges)/?
Mountain bluebird	2 (juniper)	3	1 (second-ary)	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 exclosure 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 exclosure, 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).

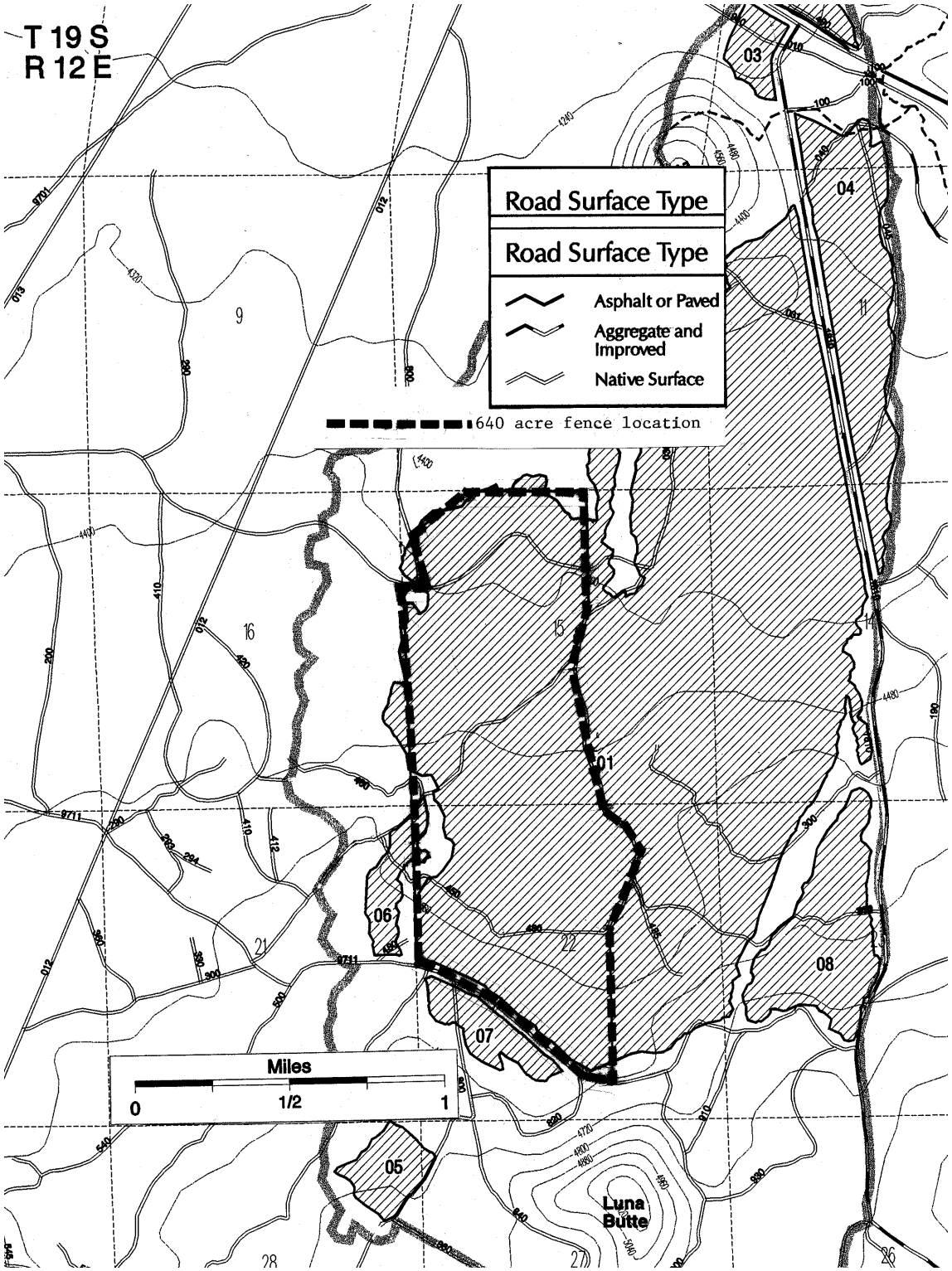
Alternative 1
Overall a negative effect on deer because the area would reforest very slowly, which would be an undesirable rate of recovery of important hiding and thermal cover on winter range. The summer range portion of the project is small (68 acres) and the recovery of hiding cover less critical. 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 1.9 miles per square mile from 3.6.

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.

(Space left intentionally blank for map on following page).

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.
Table 3-13 displays the number of snags per acre and future CWD (minimum of 5 inches in diameter and 40 feet long) percent ground cover and is applicable to many of the MIS that follow the table.

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 (2,009 acres)*	6”	14.6	0	Total CWD 3.2 percent
	9	19.1	1.4	
	12	10.5	1.1	
	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	Total CWD 8.1 percent
	9	19.1	1.4	
	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	Total CWD 4.1 percent
	9	20.8	1.5	
	12	10.8	1.1	
	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 (Tables 3-8, 3-10), 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 units, outside the snag patches, (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 2
Reforestation would establish suitable habitat sooner provided it incorporated an open canopied forest structure with openings.

Alternative 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:
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 TES and Habitats Evaluated and Biological Evaluation (BE)/Assessment for details.

Northern spotted owl (MIS): Refer to TES and Habitats Evaluated and BE/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 is 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. Alternative 2 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 Alternative 2.

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 TES and Habitats Evaluated and BE/Assessment for details.

Wolverine (MIS): Refer to TES and Habitats Evaluated and BE/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). Alternative 2 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 Alternative 2. 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
This 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 Alternative 2 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. Alternative 2 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). Alternative 2 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. Alternative 2 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 GTRs.

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 Alternative 2 have been modeled through time (source P. Powers, project silviculurist). 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.

TES 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
Haliaeetus leucocephalus	**Northern bald eagle**	**T, OR/T**
Strix occidentalis caurina	Northern spotted owl	T
Felis lynx canadensist	Canada lynx	T
Rana pretiosa	Spotted frog	C, OR/S
Histrionicus histrionicus	Harlequin duck	S, SOC
Podiceps auritus	Horned grebe	S
Podiceps grisegena	Red-necked grebe	S, OR/S
Bucephala albeola	Bufflehead	S
Cotumicops noveboracensis	Yellow rail	S
Agelaius tricolor	Tricolored blackbird	S
Centrocercus urophasianus	**Greater or Western sage-grouse**	**S, SOC, OR/S****
Buteo regalis	**American peregrine falcon**	**SOC*, S, OR/E**
Accipter gentiles	**Northern goshawk**	**SOC*, OR/S**
Buteo regalis	Ferruginous hawk	SOC, OR/S,
Corynorhinus towsendii townsendii	**Pacific western big-eared bat**	**SOC, OR/S**
Gulo gulo luteus	California wolverine	S, SOC, OR/T
Martes pennanti pacifica	Pacific fisher	S, SOC, OR/S
Sorex preblei	Preble's shrew	SOC
Sylvilagus idahoensis	**Pygmy rabbit**	**S, SOC, OR/S**

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 previously in this section 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.

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, its 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 large 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.

Alternatives 2 and 3 would mitigate the loss of coniferous habitat in the area by reforestation. However, the benefits would at best be in the mid-term (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 could reduce the probability of future large 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 Alternative 2 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 percent 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 on approximately 50 percent of the project area (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.

Alternative 3 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 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. Negative effects from the Fuzzy Project were mitigated via the environmental assessment.
- The adjacent Kelsey Project will be affecting habitats. 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 18 Fire Roadside Salvage Project removed snags from a narrow strip along the major roads within the 18 Fire Recovery Project area. It is not expected to contribute to cumulative effects on snag dependent species due to the limited area impacted (73 acres) and the retention of green trees and snags within this area.
- Existing roads, motorized trails, gas line corridors, gravel pits, and powerlines are found throughout the surrounding area. Alternative 2 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. The 18 Fire Project action alternatives will restore the habitat. 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, N**o Impact; **Pygmy rabbit,** No Impact; and **Greater sage-grouse,** No Impact;

For species with federal status: **Northern bald eagle,** No Effect.

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 and matting to control vegetation; 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.

Air Quality

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.

Smoke Management would be regulated by the Department of Ecology and The Oregon Department of Forestry according to the Oregon Smoke Management Plan Oregon Revised Statutes 477.013. The policy of the plan is to improve the management of prescribed burning as a forest management and protection practice; and to minimize emissions from prescribed burning consistent with the air quality objective of the Interim Air Quality Policy on Wildland and Prescribed Fires, Federal Clean Air Act, and the State of Oregon Clean Air Act Implementation Plan developed by the Department of Environmental Quality under ORS 468A.035 [1989 c.920 s.2].

The State Forester will:

1. Coordinate the administration and operation of the plan
2. Issue additional restrictions on prescribed burning in situations where the air quality of the entire state or any part thereof is, or would likely become, adversely affected by smoke.
3. Issues daily burning instructions when needed.
4. Annually evaluates state-wide burning operations under the plan and provides copies of the summary to interested parties.

The Department of Environmental Quality will:

1. Maintain real time air quality monitoring network that is used by ODF;
2. Provide information on field burning activities;
3. Establishes criteria for air pollution emergencies and notifies ODF of episode stages such as alerts, warnings, and emergencies;
4. Regulates the emissions of air pollutants to ensure compliance with adopted standards, limits, and control strategy plans. The ODF smoke Management Plan is jointly developed plan that governs prescribed burning;

5. Notifies the Department of Forestry when the air in the entire State or portions thereof is or would likely become adversely affected by smoke.

Federal Land Management agencies (U.S.D.A., Forest Service (USFS)) are required by law to follow the directions of the State Forester for the protection of air quality in conducting prescribed burning operations. They will follow the smoke management weather forecasts and smoke management instructions, as provided by the Oregon Smoke Management Plan and the Operational Guidance for the Oregon Smoke Management Program, (Directive 1-4-1-601). Agency officers in restricted area will make daily reports relating to burning operations.

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. 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 Emissions 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
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. 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 because pile burning would be conducted under favorable weather conditions, avoiding impacts to Three Sisters Wilderness and urban areas. Burning would be conducted when the prevailing wind patterns reflect a west or northwest flow which would result in minimal potential for impacts. Because of measures designed to disperse smoke during favorable conditions, implementation of action alternative are expected to protect air quality related values and have no visible impacts to the Three Sisters Wilderness area. Other monitoring techniques will include posting personnel as lookouts on burn days.

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).

Botanical Resources

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 31 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.

In the summer of 2004, three mosses, two lichens, and one fungus were added to the TES plant species list. There is no habitat present for these species within the project area; they are associated either with flowing streams in moist, high-elevation forests, and/or moist, high-elevation forests in the Cascades.

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 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 Environmental Assessment 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.

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 lack of traditional cultural plants within the project area no effects are anticipated.

Noxious Weeds

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 (*Centaurea maculosa*) population exists in the seedbank along the 18 Road and dalmation toadflax (*Linaria dalmatica*) 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 (*Centaurea maculosa*) 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/Exotic 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.

Russian thistle (*Salsola kali*) is an exotic (not noxious) weed that is located in a small portion of Unit 1 (less than 90 acres). As as annual plant, hand pulling is an effective treatment.

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 (late 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 targeting the individual weed plants. The area actually treated within the fire area is well less than one acre.

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.

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 9.9 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 (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. Past treatment of noxious weeds has reduced the density of weeds on many sites, including the 18 Road. Treatments 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 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. Region 6 of the Forest Service is in the process of preparing an Invasive Species EIS that will analyze the effects of this chemical on the environment.

*Diacamba 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.

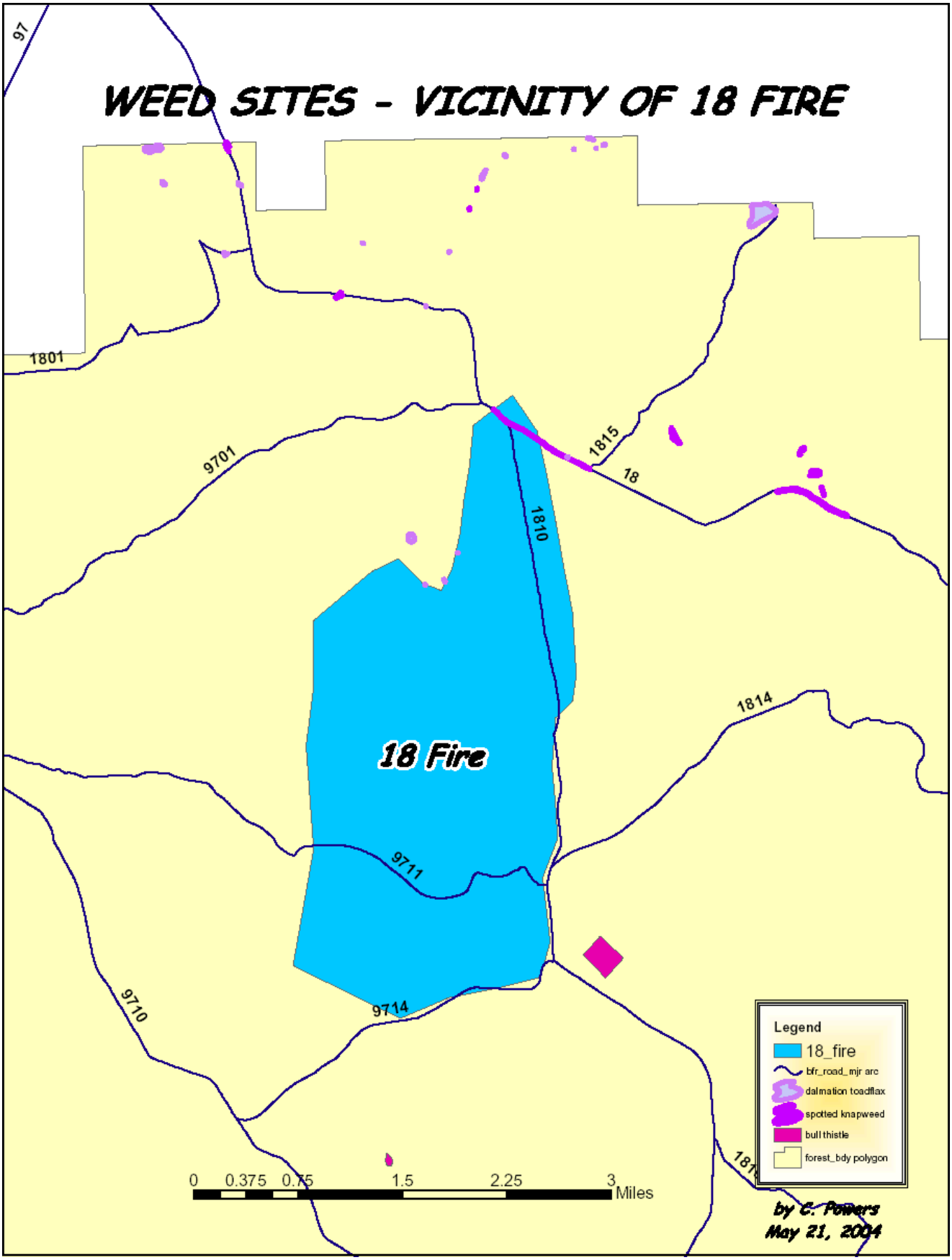
The discussion for chemical treatment remains the same for these alternatives as for the No Action alternative.

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, of approximately 11,080 acres of vegetation management 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.



Cultural Resources

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 19th 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, but was excluded from ground disturbing activities.

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
Central and South Central Oregon	167,623	224,735	57,112	34.1
Jefferson County	13,676	19,009	5,333	38.9
Klamath County	57,702	63,755	6,053	10.5
Deschutes County	74,958	115,367	40,409	53.9
Crook County	14,111	19,182	5,071	35.9
Lake Co.	7,176	7,422	245	3.4

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 medium ages than Oregon, in fact Prineville's, Madras's, and Redmond's medium age has actually decreased since 1990. Whereas more rural counties like northern Klamath County and unincorporated areas such as La Pine, are much older than the National or Oregon average 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 (1250), and lumber and wood products (1,150). In Lake County the three largest sectors were government (940), trade (500), and lumber and wood products (290). In Klamath County the three largest sectors were finance, insurance, real estate government (5,580), trade (5,510), and government (5,400).

Unemployment rates in the 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 low economic diversity, dominated by either one manufacturing sector industry (lumber and wood products) or limited trade sectors (Les Schwab in

Crook County), have had their economies lag behind Oregon's as a whole. 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 in-migration. 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:

Diameter Class (dbh)	Total estimated Dead and Green Trees Remaining
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 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).
- FEIS 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 FEIS.

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	FEIS
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 sections of this FEIS. 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 FEIS. 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

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 are 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.

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 over time. 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 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 (Figure 3-2) 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 (see Air Quality).

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 deer 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 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 Alternative 2 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 Vegetation Management 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 reduce the fire risk to 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? Based on scientific literature effects of fire salvage on future reburn potential, resistance to control, rate of spread, and fire intensity is unknown.

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 of Fire Area
MA 7 Deer Habitat	2,887	76 %
MA 8 General Forest	901	24%
MA 9 Scenic Views	22	Less than 1%

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. 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 vegetative competition and browse. 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 removed the overstory following stand establishment in the late 1970s.

Fire Effects

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 volatize the aerial retardant applications on other than the flanks of the fire. Evening humidity, temperatures and a drop in the wind allowed 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 was completed on 73 acres adjacent to the 18, 1810, and 9711 roads under the 18 Fire Roadside Salvage CE, 2003.

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, 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 occurs from the seed bank (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 the scarified seed, 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 and 2002). Through evaluation of tree rings on trees, the 18 Fire area has not had a fire 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).

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 intensity 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. Perennial forbs and grasses 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, 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 in the middle of the fire, since the intensity of the fire killed the majority of trees 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 immediately, 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 or seed 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 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 under a fire regime, which replicates natural development, then fire should be reintroduced within 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.

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 remaining live trees.

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. 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 due to importance of the remaining trees on Luna and Bessie Buttes for wildlife and scenic views.

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 Forest Vegetation Simulator (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/fmsc/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 and 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 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 Recovery Project covered many of the units proposed. 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 number of trees, which were desired for snag retention (18 Fire Wildlife Report, Lowrie). This does not include the 5 percent of units (1, 4, and 8), 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 not due to 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.

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 of 16 inches dbh occurred at approximately 70 years 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 percent 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 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 (1995 and 2004) 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 FEIS 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 microsites 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 (General Forest, Management Area 8) 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 volatized. 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 seed 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 l and ll" (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 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 phenmenon 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 within 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

Structural Stage	Description
	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 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 major 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 Vegetation Management EA project area and documentation of methodology can be found in the silviculturist report for that project. 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

	Salvage Area			Non Salvage Area		
Down Fuels Tons / Acre	0-6"	6-12"	>12"	0-6"	6-12"	>12"
Average Fuels tons/acre estimated @2045	3	6	3.5	3	10.5	7

Future Percent Crown Cover @ 2045	Crown Cover %
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.

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).

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 and dry climate. 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 live trees per acre, trees available for snag recruitment will be limited. 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 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 treatment of stands with thinning, fuels treatments and timber sales will continue and 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 Vegetation Management EA's. Past fires have impacted 14,000 acres 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. Young stand conditions and open grass and brush can be expected to dominate and increase in the 18 Fire surrounding 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.

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, crown cover over 32 percent of the stand replacement fire area is expected. 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. Based on the estimated

survival rate it is expected that the stands will 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 develop a healthy stand, which will provide for future forest needs including large diameter trees for wildlife habitat and large snag recruitment. 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 by reforesting at variable levels with ponderosa pine seedlings on over 80 percent of the high mortality 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 on 50 percent of the total fire area where salvage reduces the snags and subsequent fuels and 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 salvage does not occur. 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 and will mimic historical conditions where pockets of mortality and fuels occurred and were subsequently reduced through frequent fire return (Agee 1993). Species which require high levels of snags in proximity to green tree stands will be provided for under this alternative (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 to 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. 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. Areas which have received no salvage treatment will be mostly brush and grass fields. Future areas within the fire, which are thinned and receive prescribed fire treatments would 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 l and ll" (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 slightly more than 50 percent of the fire. 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. The moderate and high fire intensity area 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 more successful than waiting a few years after the fire. Once brush and grasses are established it will be very difficult to establish trees.

In the future, 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 salvage guidelines for 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.

In a two year study, Sexton (1998) in his thesis found a growth loss in the salvage area when compared to an unsalvaged area. The salvage areas had reductions in overstory shade (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, snags, 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.

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 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. 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.

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 a high level of standing snags and a lot of 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 form 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 because there would be no way to protect the stands from wildfire when it returns. Reintroduction of prescribed fire and natural processes within the area with the high fuels levels for the next eight decades is not expected.

Alternative 3 will not generate an economic return to assist offsetting the costs of reforestation and restoration of 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 Vegetation Management EA's. 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

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 GTR's 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 and western pine beetles 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

Significant Insects related to the 18Fire		
Species	**Habitat**	**Behavior**
Western pine beetle, *Dendroctonus brevicomis*	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.
Mountain pine beetle, *Dendroctonus ponderosae*	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.
Pine engraver, *Ips pini*	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
Red turpentine beetle, *Dendroctonus valens*	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.
Coleoptera:	Recently dead wood	Wood borers*; feed on the cambial tissue between the

Significant Insects related to the 18Fire		
Species	**Habitat**	**Behavior**
Cerambycidae **(longhorned beetle)** ***Coleoptera: Buprestidae*** **(flat-headed beetle)** ***Hymenoptera: Siricidae (woodwasps, horntails)***	of varying species.	bark and the wood before entering the sapwood. The majority of wood borers usually infest trees within the first year after tree death. Roles as primary decomposers: strong association with fungi which produce stains and considerably faster rates of decay.
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.		

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. 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 FEIS 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 beetles 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 one 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

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 proposed by the project will have little effect on recreation uses. 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 such as recreation, hunting, wood cutting, and sight-seeing. 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 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.

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.

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.

Access to the top of the Bessie Butte trail was totally burned over in 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 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.

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 form 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
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 Bessie Butte trail is outside of proposed harvest activity areas. The difference as perceived by the public would be proportionate to the acres treated.

Alternative 2 could potentially have the shortest turnaround time 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 will be added pressure and recreation use in adjacent open areas as the use will continue and grow.

Roads and Transportation

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 IDT 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.
- Highway Safety Act road meets the safety requirements for mixed traffic, including passenger vehicles.

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 with 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 (20 yards) 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 IDT, 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 Decision Memo that implements the recommendations of the Kelsey Road Analysis 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 (see alternative maps).

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. 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 7.0 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

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 burned 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, see Figure 1-3), 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.

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 3,810 acres (100 percent) of the existing vegetation community within the 18 Fire Recovery Project 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, which may lead to even more severe large-scale wildfires 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 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 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 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 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. The current vegetation condition after the 18 Fire 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 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 increased emphasis on road closure and reforestation under this alternative is expected to help enhance both short and long-term scenery.

Range Allotment

Introduction
The following addresses the 18 Fire Recovery Projects affects on overlapping grazing allotments. Refer to Chapter 1 of this FEIS 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 ¾ 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. The same scenario did not occur along main roads within the 18 Fire Recovery Project area.

Sheep and goats could use the West and East pastures of the Bessie Allotment on a periodic basis beginning in the fall of 2005 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 could be allowed beginning in late summer of 2006, provided all improvements specified in the Cinder Hill Environmental Assessment had been constructed and the ¾ 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.

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 ¾ 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 meet 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 could 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 could continue outside the burn area for sheep and goats beginning in 2005. Cattle grazing could be allowed in the East Pasture, which was unaffected by the 18 Fire. Cattle grazing in the West Pasture could 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 waterset 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 to 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 ¾ 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".

Cumulative Effects

Foreseeable management activities are assumed to occur as planned in the schedule of projects for the Deschutes National Forest. Cinder Hill EA 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 fall of 2005 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 Cinder Hill EA and would need to be completed prior to any cattle use in the Bessie Allotment.

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.

Other Disclosures

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 either in a previous resource section or below.

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.

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 pernnial streams, rivers, riparian areas, wetlands, lakes, or resevoirs 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 percent 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 project 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 were 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 (Reforestation)

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.

Alternative 2 (Proposed Action)

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 aromic hydrocarbines (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:

Acrolene – 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 difficultly 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.

Preparers and Contributors

Preparers

Steve Bigby, USDA Forest Service Deschutes National Forest, Bend/Fort Rock Ranger District, Transportation Planner/Road Manager

Contribution: Transportation planning; completion of Roads Analysis
Education: Oregon Institute of Technology
Experience: Forest Service – 15 years

Rob Evans USDA Forest Service Deschutes National Forest, Bend/Fort Rock Ranger District, Silviculture Operations Team Leader

Contribution: Records Keeper
Education: B.A. Political Science, University of Iowa, M.S. Forest Management, Utah State University;
Experience: Forest Service – 24 years including 7 years as Forest Planning Analyst

Maurice Evans USDA Forest Service Deschutes National Forest, Central Oregon Fire Management, Fuels Planner

Contribution: Fire/Fuels Specialist
Education: B.S. Forest Resources and Conservation; BS Agricultural Business; BS Agricultural Science; University of Florida
Experience: Forest Service – 12 years

Lucy Hamilton, USDA Forest Service, Deschutes National Forest, Bend/Fort Rock Ranger District, Archaeologist

Contribution: Heritage Program input
Education: BS, Anthropology, Northern Arizona University
Experience: Forest Service – 16 years

Rod Jorgenson, USDA Forest Service Deschutes National Forest, Bend/Fort Rock Ranger District, Soil Scientist

Contribution: Soils Report
Education: B.S. Soils, California State Polytechnic University, Pomona, California.
Experience: Forest Service – 26 years

Marv Lang, USDA Forest Service, USDA Forest Service Deschutes National Forest, Bend/Fort Rock Ranger District , Recreation Forester

Contribution: Recreation input
Education: B.S. Forest Management, University of Washington
Experience: Forest Service – 28 years

Dennis Lipscomb, USDA Forest Service, USDA Forest Service Deschutes National Forest, Bend/Fort Rock Ranger District , District Check Cruiser

Contribution: Inventory plots and statistics
Education: B.S. Natural Resources, University of Nevada, Reno
Experience: Forest Service – 31 years

Jim Lowrie, USDA Forest Service, Deschutes National Forest, Bend/Fort Rock Ranger District, Wildlife Biologist

Contribution: District Wildlife Biologist input
Education: BS Wildlife Science, Oregon State University
Experience: 27 years with the Forest Service, 29 years total with the federal government

Mark Macfarlane, USDA Forest Service Deschutes National Forest, Bend/Fort Rock Ranger District, Environmental Coordinator

Contribution: Writer/Editor
Education University of Oregon
Experience: Forest Service – 29 years.

Charmane Powers, USDA Forest Service, Deschutes National Forest, Bend/Fort Rock Ranger District, Ecologist/Botanist

Contribution: Botany, Noxious Weeds
Education: B.S., Natural Resources, Evergreen University
Experience: Forest Service – 15 years

Pete Powers, USDA Forest Service, Bend/Fort Rock Ranger Station, Forester

Contribution: Silviculture
Education: B.S., Forestry, Washington State University
Experience: F orest Service – 14 years, Peace Corps, Community Forester – 2 years

Don Sargent, USDA Forest Service Deschutes National Forest, Bend/Fort Rock Ranger District, Range Technician

Contribution: Range
Education: B.S. Forest Resource Management, Humboldt State University
Experience: Forest Service – 26 years; Certified Professional in Rangeland Management

Jim Schlaich, USDA Forest Service, Deschutes National Forest, Bend/Fort Rock Ranger District, Forester

Contribution: District Interdiscplinary Team Leader
Education: BS Forest Management, Utah State University
Experience: Forest Service – 27 years

Walt Schloer, USDA Forest Service, Deschutes National Forest, Bend/Fort Rock Ranger District, District Ranger

Contribution: Line Officer providing management guidance and oversight
Education: B.S. Forest Management, University of Minnesota
Experience: Forest Service - 42 years

Gini Stoddard, USDA Forest Service, USDA Forest Service Deschutes National Forest, Bend/Fort Rock Ranger District, GIS Analysis

Contribution: GIS Maps and Analysis
Education: B.S. Natural Science, Western Oregon State University
Experience: Forest Service – 20 years

Tom Walker, USDA Forest Service, Deschutes National Forest, Bend/Fort Rock Ranger District, Fisheries Hydrologist

Contribution: Water Quality
Education: B.S. Fisheries Science, Oregon State University

Experience: **Forest Service – 15 years**

Ronnie Yimsut, Bend/Fort Rock Ranger District, Deschutes National Forest, Landscape Architect

Contribution: **Social Ecology, Scenic Resources input**
Education: **B.S. Landscape Architecture, University of Oregon, 1987**
Experience: **Forest Service – 16 years; Two years university instructor, trainer, and public facilitator on civil rights issues.**

To Whom the Draft EIS, Summary, or Web Availability Notification Was Sent

Elected Officials
Senator Ron Wyden
Senator Gordon Smith
Representative Greg Walden

City of Bend
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
- Deschutes National Forest, Supervisor's Office
- Deschutes National Forest, Bend-Ft. Rock Ranger District

U.S. Dept. of Interior

Office of Environmental Policy and Compliance
Bureau of Land Management, Division of Natural Resources
U.S. Fish and Wildlife Service
U.S. Department of Energy
Office of Environmental Compliance
U.S. Department of Commerce
National Marine Fisheries Service, Habitat Conservationists Division
U.S. Department of Defense
U.S. Army Engineers Division, North Pacific
U.S. Dept. of Housing and Urban Development, HUD CPD
Regional Administrator, Federal Aviation Administration Northwest Mountain Region

American Indian Tribes

The Klamath Tribes
The Burns Paiute Tribe
The Confederated Tribes of the Warm Springs Reservation

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	7th 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	

Individuals

Mike Hotchkiss	
William Burton	Allan Holmes
Pam Wise	Bob Wilkens
Kevin Murray	Brandon Bugge
Tom Turner	Cindi O'Neil
James D. Noteboom	Dale Luhman
Pat Harris	Dave & Janette Roth
Dennis Krakow	David H. Tjomsland
Bob Mullong	Daylin Melhorn
Keith & Janet Nash	Dick Nelson
Gina Steward	Gary & Avery Fraizer
Gordon K. Baker	Harriet Heisey
Jim & Judith Knapp	Irwin Holzman
Charla Q. Ranch	James B. & Marsha Stone
Cort Vaughan	Jeremy Boyer
Lawerence Brumwell	John Dotson
Chuck Downen	Jon Cain
Richard Cahl	Kathryn J. Nachand
Sam Sobotta	Keenan Howard
Stephen Roth	Kenneth Burbank
Stan Edwards	Kenneth Doggett
John & Susan Moseley	Kim D. Ward
John & Leslie Hofferd	Lloyd Althison
Kate Kimball	Paul Dewey
Dave McClain	Peggy Speiger
Brian Svedin	Richard Tetz
Maria Boroja	Robert P. Davison
Robert Speik	Roger White
Martin & Marie Hansen	Russell Thomas
The Seidenverg Family	Sam Dinsdale
Tom Sedgwick	Scott Silver
Richard & Ann Ross	Susan & John Pindar
Joani Dufourd	Terry Eccles
James Boydston	Windy Potok

Literature Cited

Range

Amsberry, K. and R. J. Meinke. 2002. Responses of Botrychium pumicola to habitat manipulation in forested sites in south-central Oregon (Draft Internal Report).

Belsky, J. A., A. Matzke, and S. Uselman. 1997. Survey of livestock influences on stream and riparian ecosystems in the western United States. Oregon Natural Desert Association, Portland, Oregon.

Belsky, J. A., and D. M. Blumenthal. 1997. Effects of livestock grazing on stand dynamics and soils in upland forests of the interior west. Conservation Biology, Volume 11: 315 – 327.

Belsky, J. A. and J. L. Gelbard. 2000. Livestock grazing and weed invasions in the arid West. Scientific report published by the Oregon Natural Desert Association, 31 pages.

Bishop, C., E. O. Garton, and J. W. Unsworth. 2001. Bitterbrush and cheatgrass quality on 3 southwest Idaho winter ranges. Journal of Range Management, Volume 54: 595 – 602.

Bradford, D., F. Reed, R. B. LeValley, C. Campbell, and S. Kossler. 2002. Livestock grazing on the National Forests – why continue to do it? Rangelands, Volume 24: 4 – 11.

Clements, C. D. and J. A. Young. 2001. Antelope bitterbrush seed production and stand age. Journal of Range Management. Volume 54: No. 3, 269 – 273.

Council for Agricultural Science and Technology (CAST). 2002. Task force Members: Wouldiam C. Krueger (Cochair), Department of Rangeland Resources, Oregon State University, Corvallis; Matt A. Sanderson (Cochair), U.S. Department of Agriculture, Agricultural Research Service, University Park, Pennsylvania; James B. Cropper, U.S. Department of Agriculture, Natural Resources Conservation Service, University Park, Pennsylvania; Mary Miller-Goodman, Department of Agronomy and Soils, Auburn University, Alabama; Claudia E. Kelley, Department of Rangeland Resources, Oregon State University, Corvallis; Rex D. Pieper, Department of Animal and Range Sciences, New Mexico State University, Las Cruces; Pat L. Shaver, U.S. Department of Agriculture, Natural Resources Conservation Service, Corvallis, Oregon; M. J. Trlica, Department of Rangeland Ecosystem Science, Colorado State University, Fort Collins. Reviewers: Vivien G. Allen, Department of Plant and Soil Science, Texas Tech University, Lubbock; Dwight Fisher, U.S. Department of Agriculture, Agricultural Research Service, Watkinsville, Georgia; Kris M. Havstad, U.S. Department of Agriculture, Agricultural Research Service, Las Cruces, New Mexico; Phillip L. Sims, U.S. Department of Agriculture, Agricultural Research Service, Woodward, Oklahoma. Environmental impacts of livestock on U. S. grazing lands. Task force report, No. 22:1-16.

Drut, M. S. 1994. Status of sage grouse with emphasis on populations in Oregon and Washington. Audubon Society of Portland, 43 pages.

Gedney, D. R., D. L. Azuma, C. L. Bolsinger, and N. McKay. 1999. Western juniper in eastern Oregon. General Technical Report PNW-GTR-464. November 1999.

Gentner, B. and J. A. Tanaka. 2002. Classifying federal public land grazing permittees. Journal of Range Management, Volume 55: 2 – 11.

Hanf, J. M., P. A. Schmidt, and E. B. Groshens. 1994. Sage grouse in the high desert of central Oregon: results of a study, 1998-1993. U. S. Department of the Interior, Bureau of Land Management Series P-SG-01, Prineville, OR. 56p.

Holechek, J. L. 2001. Western ranching at the crossroads. Rangelands, Vol. 23:17 – 21.

Maestas, J. D., R. L. Knight, and W. C. Gilgert. 2002. Cows, condos, or neither; What's best for rangeland ecosystems? Rangelands, Volume 24(6):36 – 42.

Management Guidelines for Greater Sage-grouse and Sagebrush-steppe Ecosystems. 2000. Guidelines produced by an interagency, interdisciplinary sage-grouse planning team, 43 pages.

Miller R. F. and L. L. Eddleman. 2001. Spatial and temporal changes of sage grouse habitat in the sagebrush biome. Technical Bulletin 151:1-35.

Moore, Tam. 2002. Western game officials seek grouse plans. Capital Press, Agricultural Weekly. March 15, 2002.

Moore, Tam. 2001. Agencies aren't waiting for sage grouse listing. Capital Press, Agricultural Weekly. November 30, 2001.

Rey, M. 2002. Federally owned rangelands: Are there new grounds for common ground? (Speech) by Under Secretary of Agriculture Mark Rey , 67th North American Wildlife and Natural Resources Conference Dallas, Texas; April 4, 2002.

Rosenstock, S. S. and C. V. Riper III. 2001. Breeding bird responses to juniper woodland expansion. Journal of Rangeland Management. Volume 54, No. 3, 226 – 232.

Savory, A. 2002. With Careful Management, Grazing can help restore the Western Range. Headwaters News, March 13, 2002.

Schroeder, A. W. 1999. Historical Perspective of Livestock Grazing Upon the Public Land Within the Western United States (Amicus Brief). The Grazer. No. 32: 2 – 7.

Severson, K. E. and P. J. Urness. 1994. Livestock Grazing: A Tool to Improve Wildlife Habitat. Ecological Implications of Livestock Herbivory in the West. Pages 232 – 249.

Soils

Beschta, R. L. et al, 1995. *Wildfire and Salvage Logging, Recommendations for Ecologically Sound Post-Fire Salvage Logging and Other Post-Fire Treatments on Federal Lands in the West*.

Brown, James K., E.D. Reinhardt, K.A. Kramer; 2003. *Coarse Woody Debris: Managing Benefits in the Recovering Forest*. USDA Forest Service General Technical Report RMRS-GTR-105.

Cafferata, Peter H. 1983. *The Effects of Compaction on the Hydrologic Properties of Forest Soils in the Sierra Nevada*. USDA Forest Service, Pacific Southwest Region Watershed Management Staff; Earth Resources Monograph 7.

Clayton, J.L., 1990. *Soil Disturbance Resulting from Skidding Logs on Granitic Soils in Central Idaho*, USDA Research Paper INT-436, Ogden, Utah. 9 pages.

Craigg, T.L., 2000. *Subsoiling to restore compacted soils. In: "Proceedings, Twenty-first Annual Forest Vegetation Management Conference*", January 2000; Redding, CA. Forest Vegetation Management Conference, Redding, CA.

DeBano, Leonard F. 1991. *The Effects of Fire on Soil Properties*. USDA Forest Service General Technical Report INT-280. Pages 151-156.

Froehlich, H.A., D.E. Aulerich, R. Curtis, 1981. *Designing Skid Trail Systems to Reduce Soil Impacts from Tractive Logging Machines*, Research Paper 44, Forest Research Laboratory, Corvailis, Oregon. 13 pages.

Garland, John J. 1983. *Designated Skidtrails to Minimize Soil Compactio*n.

Geist, Michael J., J.W. Hazard, and K.W. Seidel; 1989. *Assessing Physical Conditions of Some Pacific Northwest Volcanic Ash Soils After Forest Harvest*. 5 pages.

Graham, Russel T., Alan E. Harvey, Martin F. Jurgensen, Theresa B. Jain, Jonalea R. Tonn, Deborah S. Page-Dumroese. 1994. *Managing Coarse Woody Debris in Forests of the Rocky Mountains*. USDA Forest Service Research Paper INT-RP-477. Pages 1-13.

McNabb, D.H., Froehlich, H.A., 1983. *Conceptual Model for Predicting Forest Productivity Losses from Soil Compaction.*

National Council for Air and Stream Improvement. 1999. *Silviculture and Water Quality: A Quarter Century of Clean Water Act Progress*. Special Report No. 99-06.

Page-Dumroese, D.S. 1993. *Susceptibility of Volcanic Ash-Influenced Soil in Northern Idaho to Mechanical Compaction*. USDA Forest Service Research Note INT-409, Ogden, Utah. 5 pages.

Powers, R.F., T.M Alves, T.H. Spear. 1999. *Soil Compaction: Can it be Mitigated? Reporting a Work in Progress*. Proceedings, Twentieth Annual Forest Vegetation Management Conference, Redding, CA.

Sussmann P. 2003. *18 Fire Burned Area Emergency Response (BAER)*, Soil Specialist Report.

USDA Forest Service. 1998. *FSM 2520, Forest Service Soil Quality Standards*, Region 6,
R-6 Supplement No. 2500-98-1.

USDA Forest Service. 1996. *Final Interpretation of Forest Plan Standards and Guidelines* SL-3 and SL-4, Document 96-01, Soil Productivity.

USDA Forest Service. 1995, 1996, 1997 and 1999. *Soil Monitoring Reports*. Deschutes National Forest, Pacific Northwest Region.

USDA Forest Service. 1990, 1992 and 2003. *Summarized Plot Sampling Data for Awbrey-Hall Fire* (1990), *Horse Butte Fire* (1992) *and Eighteeen Fire* (2003) *on the Deschutes National Forest*.

USDA Forest Service. 1990. *Land and Resource Management Plan*, Deschutes National Forest, Pacific Northwest Region.

USDA Forest Sevice. 1988. FSH 2509.22, Forest Service Soil and Water Conservation Practices Handbook.

USDA Forest Service. 1988. *General Water Quality Best Management Practices*, Pacific Northwest Region.

USDA Forest Service. 1976. *Soil Resource Inventory*, Deschutes National Forest, Pacific Northwest Region.

Walker, T. 2003. Letter to the Files regarding results of Field Reconnaissance of the 18 Fire Recovery Project Area.

Fire

Agee, J.K. 1993. *Fire Ecology of Pacific Northwest Forest*. Island Press, Covelo, CA.

Brown, J. K. 2003. *Coarse Woody Debris: Managing Benefits and Fire Hazard in the Recovering Forest*

USDA Forest Service General Technical Report, RMRS-GTR-105.
Rocky Mountain Research Station.

Clean Air Committee of Bend, 1997. *Air Quality in Central Oregon*

Hardy, C.C. 1991. *Emission Factors* version 11/15/91.

Plot Sampling Data, 2003

Forest Vegetation and Timber Management

Agee, J.K. *Fire as a Coarse Filter for Snags and Logs*. PSW GTR 181. 2002

Agee, J.K. *Fire Ecology of Pacific Northwest Forests*. Island Press, Washington DC1993

Agee, J.K. *The Influence of Forest Structure on Fire Behavior*. Presented at 17th Annual Forest Vegetation Management Conference in Redding California1996

Arno, S. *Age-Class Structure of Old Growth Ponderosa Pine/ Douglas-fir Stands and its Relationship to Fire History.* INT-RP-481. 1995

Beschta, R. and others. *Wildfire and Salvage Logging: Recommendations for Ecologically Sound Post-Fire Salvage Management and Other Post-Fire Treatments on Federal Lands in the West*. 1995

Brown, & Smith eds. *Wildland fire in Ecosystems: Effects on Flora*. Rocky Mountain Research Station . GTR RMRS-GTR-42 vol2. 2000

Brown J. Coarse *Woody Debris: Managing Benefits and Fire Hazard in the Recovering Forest*. Rocky Mountain Research Station RMRS-GTR-105. 2003

Cleary & others. *Regenerating Oregon's Forests*. Extension Manual 7. Oregon State University Extension Service. 1978

Cochran, P. and others. *Suggested Stocking Levels for Forest Stands in Northeastern Oregon and Southeastern Washington*. Pacific Northwest Research Station PNW-RN-513. 1994

Everett, R. and others. *Snags Dynamics in Chronosequence of 26 Wildfires on the Eastslope of the Cascade Range in Washington State*. International Journal of Wildland Fire. 1999

Franklin & Dyrness. *Natural Vegetation of Oregon and Washington*. 1973

Franklin, J. *Comments on Draft Environmental Impact Statement for Biscuit recovery Project*. 2004

Flanagan, P. *Survival of Fire-Injured Conifers in Eastern Washington*. FMN 56(2):13-16.2001

Graham, R. and others. *The Effects of Thinning and Similar Stand Treatments on Fire Behavior in Western Forests*. PNW GTR-463. 1999

Goodman L.USDA *Forest Service Reforestation Requirements following Salvage Sales: letter to Forest Supervisors*. File Code 2470/2430. 2002

Hartman, D. and others. *Conversion Factors for the Pacific Northwest Forest Industry*. Institute of Forest Products.

Kolb S. Robberecht R. *High Temperature and Drought Stress Effects on Survival of Pinus ponderosa Seedlings*; Tree Physiology 16, 665-672 Heron Publishing. 1996

Lowell E. Willits S. Kramer. *Deterioration of Fire-Killed and Fire-Damaged timber in the Western United States*. Pacific Northwest Research StationPNW-GTR-292. 1992

Lynch, *Effects of a Wildfire on Mortality and Growth of Young Ponderosa Pine Trees*. IFRES 1959

Maffei H. Eglitis A. Andrade Ts. USDA Forest Service, White Paper: *Definition and Procedures for Classifying Stands as Imminently susceptible to Insect Attack and Wildfire*. USDA Deschutes National Forest. 1996

Malaby S. *Summary of the 1999 Results from the Lone Pine Fire Study Area Winema National Forest* (unpublished) 2002

Mellen K. & Ager A. *A Coarse Wood Dynamics Model for the Western Cascades*. PSW-GTR-181. 2002

Mitchel & Martin. *Fire & Insects in Pine Culture of the Pacific Northwest.* In proceedings Sixth Conference on Fire and Forest Meteorology Society of American Foresters 1980

Omni & Martinson. *Effects of Fuels Treatment on Wildfire Severity.* Western Forest Fire Research Center Colorado St. Univ. 2002

Oregon State Forest Practices Rules:629-610-0000. 2003

Paulson S. *Reforestation of Salvaged Areas; Letter to Forest Supervisors*.. File No. 2470. 1992

Rheinberger, S. USDA Forest Service Region 6 Office Portland personal communication.

Saab and others. *Selection of Fire-Created Snags at two spatial Scales by Cavity-Nesting Birds.* 2002

Schopmeyer. *Seeds of Woody Plants in the United States*. Misc. Pub. NO. 654. 1948

Sessions, J. and others. *The Biscuit Fire: Management Options for Forest Regeneration, Fire and Insect Risk Reduction and Timber Salvage.* Oregon State University. 2003

Sexton, T. *Ecological Effects of Post-Wildfire Management Activities on Vegetation Composition, Diversity, Biomass and Growth and Survival of Pinus ponderosa and Purshia tridentate:* A Thesis. 1998

Toupin, Rick USDA Forest Service Region 6 Office. Portland personal communication.

USDA Forest Service. Interim *Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales*: Regional Forester's Forest Plan Amendment # 2. 1995

USDA Forest Service, Record of Decision: Land and Resource Management Plan: Deschutes National Forest (Deschutes Forest Plan). 1990

USDA Forest Service, Record of Decision: for Amendments to Forest Service and Bureau of Land Management Planning documents Within the Range of the Northern Spotted Owl (Northwest Forest Plan). 1994

USDA Forest Service, Deschutes National Forest: A Late Successional Reserve Overview. 1995

USDA Forest Service. Deschutes National Forest Draft Minimum Stocking Guidelines. 1994 draft.

USDA Forest Service Deschutes National Forest. Davis Late-Successional Reserve Assessment. 1995

USDA Forest Service Deschutes National Forest. Odell Watershed Analysis. 1999

USDA Forest Service Deschutes National Forest. Davis Fire Rapid Assessment. 2003

USDA Forest Service. Forest Vegetation Simulator (FVS) available at www.fs.fed.us/fmsc/fvs. Region 6 SORNEC variant accessed November 19,2003

Volland. *Plant Associations of the Central Oregon Pumice Zone*. R6-ECOL-104. 1985

Wagner, W. *Guidelines for Estimating the Survival of Fire-Damaged Trees in California*. PSWFRES paper 60. 1961

Weatherby & others. *Evaluation of Tree Survival on the Payette National Forest 1995-1999*. FHP Rpt. R4-01-01. 2001

Wildlife

Altman B. and A. Holmes. 2000. *Conservation strategy for landbirds of the east-slope of the Cascade Mountains in Oregon and Washington.* Version 1. OR-WA Partners in Flight. 97 pp., appendices.

Ambrose C. et al. 2003. *Restoration or exploration? Post-fire salvage logging in America's national forests.* American Lands Alliance. 24 pp.

Bate, J. 1995. *Monitoring woodpecker abundance and habitat in the central Oregon Cascades.* MS Thesis, University of Idaho, Mosco, Idaho. 116 pp.

Beschta, R. et al. 1995. *Wildfire and salvage logging: recommendations for ecologically sound post-fire salvage management and other post-fire treatments on federal lands in the west.* Oregon State University, Corvallis, OR. 16 pp.

Brown, H. et al. 1995. *Reptiles of Oregon*. Seattle Audubon Society, Seattle, WA. 176 pp.

Csuti, B. et al. 1997. *Atlas of Oregon wildlife*. OSU Press, Corvallis, OR. 525 pp.

Guenther K. and T. Kucera. 1978. *Wildlife of the Pacific Northwest: occurrence and distribution by habitat, BLM district, and national forest.* USDA Forest Service, Pacific Northwest Region. 128 pp.

Haggard, M. and G. William. 2001. *Effects of stand-replacement fire and salvage logging on a cavity nesting bird community in eastern Cascades, Washington.* Northwest Science, Vol. 75, No. 4., 387-396.

Harrod, R., W. Gaines, W. Hartl, and A. Camp. 1998. *Estimating historical snag density in dry forests east of the Cascade Range.* USDA Forest Service, Pacific Northwest Research Station. General Technical Report, PNW-GTR-428. 17 pp.

Johnson, D. and T. O'Neil, managing directors. 2001. *Wildlife-habitat relationships in Oregon and Washington.* OSU Press, Corvallis, OR. 736 pp.

Marcot, B. et al. 2002. *The DecAID repository: background information for DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon.* USDA Forest Service, Pacific Northwest Research Station and Pacific Northwest Region, Portland, OR. Available on-line at: http://wwwnotes.fs.fed.us:81/pnw/DecAID/DecAID.nsf.

Marshall, D. B. ed., et. al. 2003. *Birds of Oregon*. OSU Press, Corvallis, OR. 752 pp.

McIver, J. and L. Starr, tech eds. 2000. *Environmental effects of postfire logging: literature review and annotated bibliography*. USDA Forest Service, Pacific Northwest Research Station, Portland, OR. General Technical Report PNW-GTR-486. 72 pp.

NatureServe. 2004. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.0. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: September 16, 2004). 31 p. summary.

Oregon Department of Fish and Wildlife. 1997. *Sensitive species.* Portland, OR. 13 pp.

Paige, C. and S. A. Ritter. 1999. *Birds in a sagebrush sea—managing sagebrush habitats for bird communities.* Partners in Flight Western Working Group. Boise, ID.

Ruggiero, L. ed., et al. 1994. *American marten, fisher, lynx and wolverine in the western United States. USDA Forest Service.* General Technical Report. RM- 254. 184 pp.

Silbey, D. 2000. *The Silbey guide to birds.* National Audubon Society, Alfred Knoph, New York. 545 pp.

The White House. 2001. *Responsibilities of federal agencies to protect migratory birds.* Executive Order #13186, Washington D.C. 5 pp.

Thomas, J. W. et al. 1979. *Wildlife habitats in managed forests, the Blue Mountains of Oregon and Washington*. USDA Forest Service. Agricultural Handbook No. 553. 512 pp.

USDA Forest Service. 1990. *Land and Resource Management Plan. Deschutes National Forest*, Pacific Northwest Region. Bend, OR.

USDA Forest Service. 1994. *Wildlife tree and log implementation strategy. Deschutes National Forest*, Pacific Northwest Region. Bend, OR. 53 pp.

USDA, Forest Service. 1995. *Revised environmental assessment for the continuation of interim management direction establishing riparian, ecosystem, and wildlife standards for timber sales with revised appendix B and decision notice.* Pacific Northwest Region, Portland, OR. 25 pp, appendices.

USDA, Forest Service. 2000. *Regional forester's sensitive animal list.* Pacific Northwest Region, Portland, OR. 9 pp.

USDA, Forest Service and USDI Fish and Wildlife Service. 2001. *Memorandum of understanding between: executive order on responsibilities of federal agencies to protect migratory birds.* 01-MU-11130117-028. Washington D.C., 7 pp.

USDI, Fish and Wildlife Service. 2000. *Federally listed threatened, endangered, proposed, candidate species and species of concern which may occur in Oregon*. Portland, OR. 8 pp.

USDI, Fish and Wildlife Service. 2000. *Federally listed threatened, endangered, proposed, candidate species and species of concern which may occur in Deschutes County, Oregon.* Portland, OR. 2 pp.

USDI, Fish and Wildlife Service. 2001. *Birds protected by the migratory bird treaty act.* List of migratory birds. 15 pp.

USDI, Fish and Wildlife Service. 2002. *Birds of conservation concern.* Arlington, VA. 99 pp.

Vander Wall, S. 1994. *Seed fate pathways of antelope bitterbrush: disposal by seed-caching yellow pine chipmunks*. Ecology 75(7). Ecological Society of America. 16 pp.

Volland, L. 1985. *Plant associations of the central Oregon pumice zone*. USDA Forest Service, Pacific Northwest Region. R6-ECOL-104-1985. 138 pp.

APPENDIX C: GLOSSARY OF ABBREVIATIONS AND TERMS

Abbreviations

ATV	All Terrain Vehicle
BE	Biological Evaluation
BAER	Burned Area Emergency Rehabilitation
BMP	Best Management Practice
CCF	100 Cubic Feet
CE	Categorical Exclusion
CFR	Code of Federal Regulations
CWD	Coarse Woody Debris
DBH	Diameter Breast Height
DEIS	Draft Environmental Impact Statement
DFC	Desired Future Condition
DNF	Deschutes National Forest
EA	Environmental Assessmemt
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FFE	Fire and Fuels Extension
FEIS	Final Environmental Impact Statement
FSH	Forest Service Handbook
FSM	Forest Service Manual
FVS	Forest Vegetation Simulator
GIS	Geographic Information System
GRT	Green Replacement Trees
HRV	Historic Range of Variability
ICBEMP	Interior Columbia Basin Final Environmental Impact Statement
IDT	Interdisciplinary Team
KV	Knutson-Vandenberg Act
LOS	Late Old Structure
LRMP	Land Resource Management Plan
MA	Management Area
MMBF	Million Board Feet
MIS	Management Indicator Species
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NF	National Forest
NFMA	National Forest Management Act
ODFW	Oregon Department of Fish and Wildlife
OHV	Off Highway Vehicle
PAG	Plant Association Group
TPA	Trees Per Acre

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.

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 habitants.

Diversity - The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

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 FEIS 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 Variablity (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

IDT - 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 (IDT) - 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.

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
FINAL: Version 2.1
September 21, 2004

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 (referenced as the "Eastside Screens"; USDA, 1995). Projects proposed in occupied or potential habitat of any 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. Projects 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. PDCs for proposed species may be included in the BA but are optional for the management agencies.

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. The Proposed Action Alternative would salvage 1936 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 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, quaking aspen, or extensive areas of forested lavas.

Approximately 96 percent 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, 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. 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 (i.e. tree crown mortality), as well as steep slopes have been excluded from the project area (1801 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 remainder of the fire (i.e. 1801 acres of non-salvage) has 11 percent in moderate/high intensity and 89 percent in low intensity. In total 2420 acres (64%) of the gross area of the fire (3810 acres) were in moderate/high intensity (i.e. stand replacement) regimes.

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
Haliaeetus leucocephalus	**Northern bald eagle**	**T, OR/T, MIS**
Strix occidentalis caurina	Northern spotted owl	T, MIS
Felis lynx canadensist	Canada lynx	T
Rana pretiosa	Spotted frog	C, OR/S
Pristiloma arcticum var. *crateris*	Crater Lake tightcoil	S
Histrionicus histrionicus	Harlequin duck	S, SOC
Podiceps auritus	Horned grebe	S
Podiceps grisegena	Red-necked grebe	S, OR/S
Bucephala albeola	Bufflehead	S
Cotumicops noveboracensis	Yellow rail	S
Agelaius tricolor	Tricolored blackbird	S
Centrocercus urophasianus	**Greater or Western sage-grouse**	**S, SOC, OR/S****
Buteo regalis	**American peregrine falcon**	**SOC*, S, OR/E, MIS**
Accipter gentiles	**Northern goshawk**	**SOC*, OR/S**
Buteo regalis	Ferruginous hawk	SOC, OR/S,
Corynorhinus towsendii townsendii	**Pacific western big-eared bat**	**SOC, OR/S, MIS**
Gulo gulo luteus	California wolverine	S, SOC, OR/T
Martes pennanti pacifica	Pacific fisher	S, SOC, OR/S
Sorex preblei	Preble's shrew	SOC
Sylvilagus idahoensis	**Pygmy rabbit**	**S, SOC, OR/S**

Note: *E=Endangered, T=Threatened, C=Candidate for Federal listing, P=Proposed for Federal listing, SOC=USFWS Species of Concern, MIS=LRMP Management Indicator Species. * = 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, lynx** 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 (e.g. migration, accidental) of being in the projects area.

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 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'Neil, 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 project 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 (indirect, direct and cumulative)

Alternative Descriptions— Refer to the project environmental impact statement for a complete description of the alternatives and the environmental consequences. Also, reference the attached Summary of Outputs by Alternative table. 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 1936 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.

Indirect and Direct 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, its 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 (e.g. 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 high severity wildfires, 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 high severity 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 snag levels post-salvage that are below suggested levels within the salvage area (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 (i.e. 47% of the fire area) should 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 duration of this risk is 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.
- Past prescribed burns and timber harvest areas (10-20 years old) where bitterbrush and deer cover have not fully recovered.
- The Fuzzy Project (implementation) 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. 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 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 current 18 Fire Road Salvage Project is removing 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. Further, a minimum of 3 snags per acre together with green-tree-retention will mitigate the salvage effects on indicator species.
- Existing roads, motorized trails, gas line corridor, gravel pits, etc. 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.

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. 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.

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

References

Ambrose C. et al. 2003. *Restoration or exploration? Post-fire salvage logging in America's national forests*. American Lands Alliance. 24 p.

Beschta, R. et al. 1995. *Wildfire and salvage logging: recommendations for ecologically sound post-fire salvage management and other post-fire treatments on federal lands in the west*. Oregon State University, Corvallis, OR. 16 p.

Becker, L. 2002. *Fuzzy project biological evaluation*. USDA Forest Service, Deschutes National Forest. 24 p.

Connelly, J. et al. 2000. *Guidelines to manage sage grouse populations and their habitat*. Wildlife Society Bulletin 2000, 28(4):967-985.

Cutsi, B. et al. 2001. *Atlas of Oregon wildlife.* Oregon State University Press, Corvallis, OR. 525 p.

Galbler, et al. 2000. *Predicting the suitability of habitat in southwest Idaho for pygmy rabbits.* Journal of Wildlife Management 64(3):759-764.

Johnsgard, P. 1990. *Hawks, eagles, & falcons of North America*. Smithsonian Institution Press. 403 p.

Johnson, D. and T. O'Neil, Managing Directors. 2001. *Wildlife-habitat relationships in Oregon and Washington.* Oregon State University Press, Corvallis, OR. 736 p.

Keown, K. and B. Webb. 2004. *Kelsey project biological evaluation (draft).* USDA Forest Service, Deschutes National Forest.

Marcot, B. et al. 2002. *The DecAID repository: background information for DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon.* USDA Forest Service, Pacific Northwest Research Station and Pacific Northwest Region, Portland, OR.

Marshall, D. et al. editors. 2003. *Birds of Oregon*. Oregon State University Press, Corvallis, OR. 247 p.

McIver, J. and L. Starr, tech eds. 2000. Environmental effects of postfire logging: literature review and annotated bibliography. USDA Forest Service, Pacific Northwest Research Station, Portland, OR. General Technical Report PNW-GTR-486. 72 p.

USDA Forest Service, et al. 2003. *Joint aquatic and terrestrial programmatic biological assessment for federal lands within the Deschutes basin administered by Bureau of Land Management Prineville office and all lands within the Deschutes and Ochoco National Forests*. June 2003-June 2006. 107 p., plus Appendix.

USDA Forest Service, Region 6 1995. Revised environmental assessment for the continuation of interim management direction establishing riparian, ecosystem and wildlife standards for timber sales with revised appendix b and decision notice (Eastside Screens).

USDI Bureau of Land Management, et al. 2000. Management guidelines for sage grouse and sagebrush-steppe ecosystems. 42 p. w/Appendix.

USDI Bureau of Land Management. 1995. Sage grouse in the high desert of central Oregon: results of a study, 1988-1993.

USDI Fish and Wildlife Service. 2002. Birds of conservation concern. Arlington, VA. 99 p.

USDI Fish and Wildlife Service. 2003. Endangered and threatened wildlife and plants; 90-day finding on a petition to list the western sage grouse. Federal Register/Vol. 68, No. 26. 6500-6504.

Utah Division of Wildlife Resources. 2003. Web information: pygmy rabbit briefing meeting and summary of pygmy rabbit petition. 2 p. and 11 p. respectively.

18 Fire Salvage Project
Wildlife Report

By: Jim Lowrie, District Wildlife Biologist
Bend-Ft. Rock Ranger District
Deschutes National Forest
FINAL: ***Version 2.3, 9/21/04***

Table of Contents

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; 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 Salvage 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.

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 1936 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 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% of the salvage area (1868 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 1: Selected Wildlife Species Summary

Species	Occur-rence*	Management Indicator Species	FWS Species of Concern	ODFW Sensitive Species	Ecological Indictor Species**
Northern goshawk (NTMB, MBTA)	S/G5	X	X	X	X (1)
Sharp-shinned hawk (NTMB, MBTA)	S/G5	X			(4)
Red-tailed hawk (NTMB, MBTA)	C/G5	X			(7-generalist)
Cooper's hawk (NTMB, MBTA)	S/G5	X			
Golden eagle	U/G5	X	BCC (BCR 9)		(6)
Flammulated owl (NTMB, MBTA)	U/G4		BCC (BCR 9)	X	X (1, 2a, 4, 5-interspersed grassy openings and thickets)
Northern pygmy- owl (MBTA)	U/G5			X	(2a, 7-open forests, edges)
Lewis' woodpecker (NTMB, MBTA)	U/G4	X	BCC (BCR 9)		X (2a-large snags, 7-burns)
White-headed woodpecker (MBTA)	U/G4 (declining, local extirp-ation, BBS)	X	BCC (BCR 9)	X	X (1-PP, 2a, 2b, 7-sugar pine foraging, large LOS patches)
Hairy woodpecker (MBTA)	C/G5				X (2a, 2b, 7-burns)
Black-backed woodpecker (MBTA)	R/G5	X		X	X (1-LPP, 2a, 2b, 7-burns)
Williamson's sapsucker (NTMB, MBTA)	R/G5 (declining, BBS)	X	BCC (BCR 9)	X	X (2a-large snags, 2b, 7-higher elevations)
Pygmy nuthatch (migratory, MBTA)	U/G5			X	X (1-PP, 2a, 2b, 7-large trees)
White-breasted nuthatch (migratory, MBTA)	U-C/G5				X (1-PP, 2a, 2b)
Mountain chickadee (migratory, MBTA)	C/G5				(1, 2a, 2b, 5)
Green-tailed towhee (NTMB, MBTA)	U/G5				X (3)
Olive-sided flycatcher (NTMB, MBTA)	U-C/G4 (declining, BBS)		BCC (BCR 5)	X	X (1, 2a, 7-burns, clearings, edges w/ conifers)
Dusky flycatcher (MBTA)	U/G5				X (3, 7- clear-cuts)
Chipping sparrow (NTMB, MBTA)	U/? (declining, BBS)				X (7- open understory w/regenerating pines)
Mountain bluebird (NTMB, MBTA)	U-C/G5				X (2a, 7- burns, openings)

Table 1 continued

Species	Occur-rence*	Management Indicator Species	FWS Species of Concern	ODFW Sensitive Species	Ecological Indictor Species**
Rock wren (MBTA)	U/G5				X (7-talus, rock, clear-cuts)
Mule deer	C	X			(7-shrubs winter range)
American marten	R	X		X	X (1-MC, LPP, 7-CWM concentrations)
Yellow-pine chipmunk	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,
Western fence lizard	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/Global Conservation Status: G4 Apparently Secure, G5 Secure (source Nature Serve). ** Special habitat requirements codes: 1 = late and old successional forest (LOS), 2a = snags, 2b = logs, 3 = mature shrubs, 4 = dense conifers for nesting/foraging, 5 = meadows or grassy openings for foraging, 6 = special/unique habitats (rock, cliffs, caves, etc.), 7 = other, noted. Abbreviations: LPP = lodgepole pine, PP = ponderosa pine, 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, 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, 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. 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 (i.e. tree crown mortality), as well as steep slopes, have been excluded from the project area (1801 acres). Within the salvage area 100% of it is in the moderate/high category of burn intensity. At least 90% of moderate burn intensity trees and at least 95% of the high intensity trees are dead. The 1801 acres of non-salvage has 11% in moderate/high intensity and 89% in low intensity. In total 2420 acres (64%) of the gross area of the fire (3810 acres) were in moderate/high intensity (i.e. stand replacement) regimes.

Big Game— As previously noted, approximately 96% of the project salvage 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 high severity 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 (e.g. yellow-pine chipmunk and golden-mantle ground squirrel), and neotropical migrant birds, such as green-tailed towhee (Paige and Ritter, 1999). Many of these species, particularly the seed-caching rodents, such as the yellow-pine chipmunk, serve an important ecological role in the regeneration of shrub species (Vander Wall, 1994). 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 (i.e. width, level of use) of road, its location, and the season of use.

Late and Old Structure Habitat (LOS)/Old Growth Management Areas (OGMA)— There was no classified LOS present in the project area or designated OGMAs (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 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 diameter-at-breast-height (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 dead and green trees. Vacated cavities are subsequently used by many other birds and small mammals (i.e. secondary cavity users). Selected wildlife species known or suspected to occur in the 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 (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 (EIS) for ICBEMP were also reviewed. Neither document was ever finalized or required direction, however 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 CWM guidelines were focused on maintaining snags and CWM >21 inches dbh and did not adequately 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 ICEMP 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://wwwnotes.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 (refer to the map in the Appendix for unit locations).

Table 2: Existing Post-Fire Snag Levels

Unit	Diameter Mid-Point	Ht.	No. Per Acre	Notes
1	6”	35’	15.8	Total of 49.7 tons of material per acre.
(1539 ac)	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.
(27 ac./23 ac.)	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.
(142 ac.)	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.
(34 ac.)	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.
(29 ac./34 ac.)	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.
(108 ac.)	9		30.0	
	12		30.7	
	15		14.7	
	18		4.0	
	24		1.3	
Out-side*	10.6-13.5		10.8 dead/15.2 live	* Two outside areas: s. of road #9711/southern portion of fire (i.e. non-salvage areas)
	13.6-16.5		6.4/12.8	
	16.6-19.5		1/5	Note: total of 19.2 snags/ac. >10.6" dbh outside
	19.6+		1/3.2	Note: total of 36.2 live/ac. >10.6" dbh outside

***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. Live trees had to have a minimum of 20% green crown.*

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 capability of the project habitats. 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 snags).
Lewis'	Territory 15 ac.	Open forests. Patches of burned forest. Target >50% of burns

woodpecker		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 usually.
****White-headed woodpecker***	Home range 250-500 ac.; territory 20 ac.	Open old-growth ponderosa pine with large trees for foraging and snags for nesting. Pine seeds (ponderosa and sugar) are important forage in the winter. Will use short snags and tall stumps in open areas (averages 12% canopy cover). Target 10 trees per acre >21" dbh with >2 trees per acre >31" dbh; 10-40% canopy closure; 1.4 snags per acre >8" dbh with >50% >25" dbh, mean 18". Burns 51.4 snags/ac.
****Pygmy nuthatch***	Territory 2-4 ac.	Prefer older, mature ponderosa stands but will forage in young stands. Target 10+ trees per acre of 21" dbh+, including 2 trees per acre >31" dbh. Secondary nester or primary excavator in snags or dead portions of live trees (8" dbh 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.
****Chipping sparrow***	Territory 3-7 ac.	Open forest with patches of regenerating trees or shrubs. Openings with forbs and grasses are important for foraging. Edges and clearcuts are utilized. Target 10-30% canopy cover, 20-60% shrub cover with >20% sapling cover, especially pines.
Mountain bluebird	Territory 5-15 ac.	Open forests, clear-cuts, edges of meadows, and burned areas. Secondary cavity nester (minimum 9" dbh). Burns 29.7 snags/ac.
Yellow-pine chipmunk	Home range <2.5-25 ac.	Open forests with shrub understories. Coarse woody debris is important, including stumps and logs, for nests (rocky areas also used). Seeds from trees and other plants are required. An important agent in the 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 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 pine (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 reviewed for importance to individual indicator species. The summary after the table will provide specific Desired Conditions that have unique numbers, e..g. DC#1.

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
Lewis' woodpecker (15 ac.)	1 (?/?/24.8 burns)	1 (12"/26")	1 (individual and small clumps)	2
Williamson's sapsucker (15 ac.)	1 (1.5/?/?)	1 (12"/21")	2 (mix)	2
Hairy woodpecker (25 ac.)	1 (1.6/?/41.8 burns	1 (10"/17")	2 (mix, edges)	2
White-headed woodpecker (20 ac.)	1 (1.4/6.4/51.4 burns)	1 (8"/26")	2 (individual)	2
Pygmy nuthatch (3 ac.)	1 (1.4/?/?)	1 (8"/18")	2 (mix)	2
Mountain bluebird (5-15 ac.)	1 (?/?/29.7 burns	1 (9")	1 (individual)	NA
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/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 each salvage unit. In addition, retain 34 snags (10" dbh) and/or recent blowdown per acre to meet the log cover element of 1.4% per acre. Do not include un-salvaged areas outside of the units in computing the averages.

DC#2—At least 50% of the snags should be 10"-20" dbh and the balance of 50% 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 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. Areas of rocky lava outcrops may be selected for snags retention. Patches can range in size from ½-15 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 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. The larger patches exceeding 5 acres should be strategically located.

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 then 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. The effects analysis will also note the un-salvaged areas within the burn (i.e. 47% of the area) 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. 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 (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 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 5000 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 Desired Condition is designed to address meeting the long-term objectives for the GTR habitat component (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 (average 35) 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 (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.

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 400 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 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.

DC#6—Develop thermal cover (40% canopy and 30 feet tall; minimum 30% canopy and 15' tall) 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 400 feet in width. Tree densities

should be adjusted to account for mortality, costs, etc. Thermal cover patches should be adjacent to forage areas and at least 400' from open, system roads.
DC#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'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 (e.g. fencing). 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/?
Lewis' woodpecker	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
White-headed woodpecker	3	1	1 (nests, forage green)	1	3	2 (nests)	3/?
Pygmy nuthatch	1	1	1 (nests, forage)	2	2	NA	2/?
Green-tailed towhee	NA	2	NA	1	NA	1	1/?
Olive-sided flycatcher	2 (edge)	1 (edge, gaps)	1 (dead tops)	1	NA	2 (migration)	1/1
Chipping sparrow	3	2	NA	1	3	1 (grass preferred)	1 (grass edges)/?
Mountain bluebird	2 (juniper)	3	1 (second-ary)	1	NA	1	1/1
Yellow-pine chipmunk	3	2	2 (logs)	2	3	1	1/?

Western fence lizard	3	3	2 (logs)	2	NA	2	1/?

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

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 (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.
DC#11—Provide corridors via reforestation to reconnect LOS stands and OGMAs around the project. Note: There is one OGMA about one mile west of the project area.

Environmental Consequences (indirect, direct and cumulative)

Alternative Descriptions— Refer to the project environmental impact statement for a complete description of the alternatives and the environmental consequences. A Summary of Outputs by Alternative is in the Appendix of this report. 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 1936 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 (refer to the Appendix map). 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. 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 (refer to Outputs table in Appendix).

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 exclosure within Unit 1; 2) reforestation will provide winter range objectives of 40:60 cover to forage ratio on the larger salvage units (i.e. 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 exclosure, 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.

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 and obliteration 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 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 (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 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.

Alt. 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% of the area from foraging and somewhat restrict movement of animals through the area. The 200 trees per acre density will provide hiding cover and the 300 trees per acre density both hiding and thermal cover in the long-term (source P. Powers, project silviculturist, FVS data runs). The projected amounts of hiding cover in the mid- (hiding) to long-terms (thermal) are 34% for each in the project area (LRMP objectives of 10% hiding and 30% thermal cover). 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. Road density would be reduced to 1.9 miles per square mile from 3.6.

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, Focal Species):

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 be negative.

Alt. 2—Salvage harvest would reduce the number of snags below the level recommended by DecAID (i.e. Table 3), which is to retain >50% of burns un-salvaged. The adjacent un-salvaged burnt forest is 1801 acres or 47% of the fire area, which is very close to the DecAID recommendation. The within unit snag retention levels (i.e. 17 snags/logs >10" dbh per acre; source J. Schlaich, Project Team Leader) are less than the average recommended by DecAID (i.e. 25 snags per acre). 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.

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 of 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 (i.e. 17 snags/logs >10" dbh per acre) than that recommended by DecAID (i.e. 41.8 snags per acre; Tables 3 and 5). The adjacent un-salvaged burnt forest (1801 acres; 47% of the fire area) together with the unit retention levels would, however, exceed the DecAID recommendation when combined. 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, Focal Species):

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 (i.e. 17 snags/logs >10" dbh per acre) that is less than that recommended by DecAID (i.e. 51.4 snags per acre; Tables 3 and 5). The adjacent un-salvaged burnt forest (1801 acres; 47% 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.

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 (Focal Species):

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 (Focal Species):

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 (i.e. 17 snags/logs >10" dbh per acre) that is less than that recommended by DecAID (i.e. 29.7 snags per acre; Tables 3 and 5). The adjacent un-salvaged burnt forest (1801 acres; 47% 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.

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. An average of 14 logs 10"+ diameter per acre would be left within the salvage units.

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. An average of 14 logs 10"+ diameter per acre would be left within the salavage units. 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): 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 (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. 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 action alternatives 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. However, 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' 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):

Alt. 1—Effects similar to mule deer, except that dominance by grass species would be more beneficial.

Alt. 2—Effects similar to mule deer. Elk generally require larger cover patches and will benefit from the fenced reforested area after they regain access. However, the area is much more important to deer, as elk use is incidental.

Alt. 3—Effects 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 (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. 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 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 moderate to large volumes of dead (e.g. white-headed woodpecker, Lewis' woodpecker) would have less benefit due to the salvage removals. Non-salvaged areas outside of the project area (47% of the fire area with an average of 19.2 snags/ac.) and inclusions within it (i.e. 5% of larger units plus scattered individual snags) would mitigate the reduction in snags. Within the moderate/high intensity burn areas (i.e. stand replacement), 411 acres (17% of the gross 2420 acres) would not be salvaged. Finally, 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 (i.e. 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 (i.e. 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 (i.e. ~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.

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. 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— 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. 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 (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 high intensity wildfires, 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). In general, 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% 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 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 (i.e. 47%) 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 (e.g. 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).

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 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.
- Past prescribed burns, wildfires, and timber harvest areas (10-20 years old) where bitterbrush and deer cover have not fully recovered.
- The Fuzzy Project (implementation) 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. 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 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 (i.e. hiding and thermal cover) of past (Fuzzy) and future (Opine, Kelsey, 18 Salvage, and Aspen) projects on Deer Habitat Management Area (MA 7) overlapping the North Paulina Deer Herd area are as follows: Kelsey hiding @ 23%, thermal @ 24%; Fuzzy hiding @ 11%, thermal @ ~4%; Opine @ 9.6% hiding, 2.5% thermal; and 18 Salvage @ 0% hiding, 0% thermal. Collectively the projects will result in 11% hiding cover (LRMP objective of 10%) and ~8% thermal cover (LRMP objective of 30%) across MA 7 for the North Paulina deer herd.
- The current 18 Fire Road Salvage Project is removing 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. Further, a minimum of 3 snags per acre together with green-tree-retention will mitigate the salvage effects on indicator species.
- Existing roads, motorized trails, gas line corridor, gravel pits, etc. 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.

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.

Summary of Applicable Project Design Criteria (PDC) and Mitigation Measures (MM)

The following items are noted in order to meet existing direction and/or to meet the previously described Desired Conditions. Reference the environmental impact statement for the final determinations on the incorporation of the PDCs and MMs into the project.

PDCs— Project Design Criteria are generally required LRMP Standards and Guidelines (S&Gs) and Eastside Screens standards. Desired Conditions (DCs) that would be met by the PDCs will be referenced in brackets.

Management Area 7 (Deer Habitat):

***PDC 1*:** Restrictions on motorized and OHV recreation could be implemented on a seasonal basis between December 1 and March 31 and during hunting seasons (M7-1).

PDC 2: 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 3: 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 4: 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 5: 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 6: 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 7: 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 8: 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 9: 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 10: 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 11: Deer summer range—Target open road densities are 2.5 miles per square mile… (WL-53). [DC #9]

PDC 12: 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 13: Deer summer range—Travel corridors will be provided…. (WL-56). [DC #7]

PDC 14: Deer summer range—If possible, a narrow strip of trees should be left along roads to reduce view distances (WL-58). [DC #5]

PDC 15: 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 1.4% of CWD coverage per acre. [DC #1, #2, #3]

PDC 16: 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 17: Provide connectivity between LOS stands and designated Old Growth Management Areas (Eastside Screens standard). Reference the preceding Desired Conditions for deer cover and the Implementation Guidelines in the Appendix in order to plan the cover patches in conjunction with the long-term corridor objectives. [DC #11]

PDC 18: Maintain open, park like 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 19: 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. If winter time activities are necessary in order to mitigate the impacts on other resources (e.g. logging on snow/frozen ground to reduce soil compaction) then the contract should be as short as possible. Avoid logging when the area is being heavily used or crossed by migrating deer. Generally, early logging in the winter is preferable to later periods. However, heavy snowfalls may move wintering deer out of the area due to a lack of coniferous canopy.

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. Refer to the Implementation Guidelines in the Appendix for details. Vexar tubes, vegetation matting or fertilization 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 an average of 35 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 to achieve these objectives should be determined by considering site factors of productivity, vegetation competition, and other site characteristics. The use of vexar tubes to reduce animal damage is acceptable. Vegetation control matting or fertilization may also be used on 50% of these trees to promote growth rates. The other trees above the minimum objectives should not have vegetation control or fertilization, in order to produce a stand with variable canopy heights. Refer to the Implementation Guidelines in the Appendix for additional details.

MM5: Animal damage control, including gopher baiting/trapping, will only be done 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. Also, reference the PDC in the BE/BA relating to using poison for pocket gopher control.

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 not exceed the maximum allowable amounts of fuels in order to provide some hiding cover for deer and reduce potential illegal off-road access.

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. Migrants include species that use ground cover (i.e. unburnt shrub islands), residual green trees, and snags. A waiver could be granted provided that a nesting survey of the area was conducted which confirmed that there would be no significant adverse impacts on migratory birds.

MM11: Avoid impacting existing un-burnt "islands" of shrubs with salvage activities.

MM12: Post the area as closed to any type of firewood cutting.

Project Analysis Conclusions

The 18 Fire Salvage 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 (i.e. within 40 years and 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). Modeling (source P. Powers, project silviculturist) suggests that only 1.2 to 1.7 snags (>12" dbh) per acre 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 silviculurist). It is estimated that tree plantings of 200 trees per acre will provide about 16% crown cover in 40 years and 34% in 100 years. Plantings of 300 trees per acre would provide about 21% crown cover in 40 years and 36% in 100 years. Of the 1868 acres of

winter range within the salvaged portion of the fire, 530 acres (i.e. Unit 1, 5 and 7) would be planted at 200 trees per acre and 179 acres (i.e. 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 (i.e. summer range). Thus, the modeling would suggest that thermal cover would be developed on approximately 641 acres (i.e. 30%+ canopy cover) of winter range or 34% of the area after about 100 years. Also, assuming that both tree planting densities would provide hiding cover would give the same percentage on winter range, and 100% 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 1227 acres (Units 1, 2, 3, 4, 6, and 8; 66% of the winter range) would be at 50 trees per acre, which would not provide any hiding or thermal cover but should provide high quality forage areas. The above acreages are gross and include the 5% of Units 1, 4 and 8 (gross acreage 1789 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% hiding cover and 30% 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 with other protection 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% of the fire area, should adequately provide for most 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:

- 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; Dudley and Saab, 2003).
- Monitor the success of road/area motorized vehicle closures, including the effectiveness of enforcement actions. Adjust tactics in a timely fashion to address problems.
- Document the effectiveness of the plantation fence in restricting big game access.
- Install strategically located photo points to document the recovery of the area.

For the No Action alternative:

- Monitor the use of the area by mule deer.
- Determine the snag use by wildlife post-salvage for at least 2 years (Bate, 1995).
- Install strategically located photo points to document the recovery of the area.

Knutsen-Vandenberg Projects

The following K-V projects are planned for the project area:

- Reforestation including fencing to exclude big game species.
- 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 provided that the applicable PDCs and MMs are met.

Appendix

Table A: No Action Effects (Worksheet)

Indicator Species	Effects on Habitat Elements*							
	Snags/ Logs	Soli-tude	LOS	Large Trees	Open Canopy	Closed Canopy	Openings /Edges	Notes
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*							
	Snags/ Logs	Soli-tude	LOS	Large Trees	Open Canopy	Closed Canopy	Openings /Edges	Notes
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***							
	Snags/ Logs	**Soli-tude**	**LOS**	**Large Trees**	**Open Canopy**	**Closed Canopy**	**Openings /Edges**	**Notes**
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

* *

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 ≥ 10 inches dbh would be retained on the 2,420 acres of stand replacement wildfire and 17 dead trees per acre ≥ 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 3.6 miles per square mile to 1.9 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

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 – 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 3.6 miles per square mile to 1.9 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.

Species	Probability
Castilleja chlorotica (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

Thirty-one plants are currently on the Regional Forester's Sensitive Species List (FSM 2670.44, 7/04) 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
Agoseris elata	Tall agoseris	ONHP List 2	S	S	D
Arabis suffrutescens var. *horizontalis*	Crater Lake rockcress	Sp. Of Concern ONHP List 1	---	S	---
Arnica viscosa	Shasta arnica	ONHP List 2	D	S	S
Artemisia ludoviciana ssp. *estesii*	Estes' artemisia	Sp. Of Concern ONHP List 1	D	S	---
Aster gormanii	Gorman's aster	Sp. Of Concern ONHP List 1	S	S	S
Astragalus peckii	Peck's milk-vetch	Sp. Of Concern ONHP List 1	D	D	S
Botrychium pumicola	Pumice grape-fern	Sp. Of Concern ONHP List 1	D	D	---
Calamagrostis breweri	Brewer's reedgrass	ONHP List 2	S	S	S
Calochortus longebarbatus var. *longebarbatus*	Long-bearded mariposa lily	Sp. Of Concern ONHP List 1	S	S	S
Carex hystricina	Porcupine sedge	ONHP List 2	S	S	S
Carex livida	Pale sedge	ONHP List 2	S	S	S
Castelleja chlorotica	Green-tinged paintbrush	Sp. Of Concern ONHP List 1	D	S	S
Cicuta bulbifera	Bulb-bearing water-hemlock	ONHP List 2ex	S	S	S
Collomia mazama	Mt. Mazama collomia	Sp. Of Concern ONHP List 1	S	S	S
Dermatocarpon luridum (LICHEN)			S?	S?	S?
Gentiana newberryi var. *newberryi*	Newberry's gentian	ONHP List 2	D	S	D
Leptogium cyanescens (LICHEN)			S?	S?	S?
Lobelia dortmanna	Water lobelia	ONHP List 2	S	S	D
Lycopodiella inundata	Bog club-moss	ONHP List 2	S	D	S
Lycopodium complanatum	Ground cedar	ONHP List 2	S	S	S
Ophioglossum pusillum	Adder's-tongue	ONHP List 2	S	S	S
Penstemon peckii	Peck's penstemon	Sp. Of Concern ONHP List 1	S	S	D
Pilularia americana	American pillwort	ONHP List 2	S	S	---
Ramaria amyloidea (FUNGUS)			D?	D?	D?
Rorippa columbiae	Columbia cress	Sp. Of Concern ONHP List 1	S	S	S
Rhizomnium nudum (MOSS)			D	D?	D?
Scheuchzeria palustris var. *americana*	Scheuchzeria	ONHP List 2	D	S	S
Schistostega pennata (MOSS)			S	D	S
Scirpus subterminalis	Water clubrush	ONHP List 3	S	D	S
Scouleria marginata (MOSS)			S?	S?	S?
Thelypodium howellii ssp. *howellii*	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.

APPENDIX G: RESPONDING TO GENERAL PRINCIPLES AND RECOMMENDATIONS OF BESCHTA ET AL. (1995, 2004)

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 and "Postfire Management on Forested Public Lands of the Western United States", 2004.

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 the18 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 FEIS address the issues raised by Beschta et al (1995). All bold text is from the Beschta document. This is followed by pertinent text from "Postfire Management on Forested Public Lands of the Western United States", 2004. The IDT also reviewed and considered the Declaration of Jonathan J. Rhodes in the United States District Court for the Western District of Washington at Seattle, June, 2004 in the FEIS. Mr. Rhodes along with Dr. Beschta is one of the coauthors of the 2004 "Postfire Management on Forested Public Lands of the Western United States"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 and the Environmental Consequences Chapter of the FEIS. 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 FEIS.

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 BMP's would be employed. In a letter dated 11/25/2003, the District Fisheries 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 (FEIS, pg. 49). 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 FEIS 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 G-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 and addressed by using whole tree yarding and limited salvage (30 trees/per/acre). 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 to15 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. To protect deer habitat and curtail human activities a permanent winter seasonal closure will be implemented.

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, FEIS). 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 FEIS, Chapter 2 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 18 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 slope and there are no identified areas of erosion concern identified with salvage operations. Slopes within the project area exceeding 30 percent 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 1,801 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 (FEIS, Chapter 3). 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 IDT 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 BMPs listed for the soil resource (FEIS, 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 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 including 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 years' 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 percent in Alternative 1 to 47 percent in Alternatives 2 and 3. Exotic noxious weed populations are being monitored and treated 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 18 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 has not occurred since 1990 and 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 repellant) 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 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 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 18 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 CWD within the 3,810 acre fire.

Table G-2 shows the percentage of trees that would remain in each diameter class by alternative within the 3,810 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 G-3 shows the percentage of CWD 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 36%	1,390 4.1%	1,390 4.1%	1,390 4.1%
Lethal (Stand Replacement)	2420 64%	73 3.2% 3,737 8.1%	411 8.1% 2,009 3.2%	73 3.2% 3,737 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 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 BMPs (FEIS, 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 FEIS 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 3, 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 2.9 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 applicable 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.[1] 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 2,420 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 BAER team did not recommend any post-fire structural restoration projects.

[1] November 19th, 2002 letter from the Regional Forester to Forest Supervisors

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.

The recommendations for road obliteration (decommissioning) and road closures (inactivation) are being carried forward from the Kelsey Roads Analysis and incorporated into the design of the action alternatives.

Immediately following the 18 Fire, resource conditions were assessed as part of the 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 IDT 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 FEIS. 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 IDT 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 FEIS 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 FEIS 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 British Thermal Units 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 FEIS. 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 FEIS. All lands within and adjacent to the 18 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.

"Postfire Management on Forested Public Lands of the Western United States", (*Conservation Biology*, Volume 18 Issue 4, August 2004)

The general themes that emerge throughout this paper: (1) native species are adapted to natural patterns and processes of disturbance that produce and maintain diverse ecosystems, and (2) reducing the negative effects of past management practices and avoiding additional impacts of future practices will promote regional recovery of biodiversity.

The authors note that: "While "active restoration" may be required in some postfire situations (Kauffman et al. 1997), such activities should be carefully considered and aimed at complementing natural recovery processes. Benefical active restoration activities might include reducing sediment production from firelines and roads, replacing faulty drainage structures, and planting native species depleted by fire or previous management activities." The following text in bold is broad headings contained in this document followed by how it was addressed.

Promoting Natural Recovery Processes

The authors mention under this heading that rehabilitation of firelines, roads and planting of conifers may be needed where seed sources of native species have been lost by fire. As noted in the FEIS, ponderosa pine would be replanted where the seed source has been lost and bitterbrush would be planted on road closures. Soil disturbances from fire suppression activities were stabilized to prescribed rehabilitation requirements immediately following control of the fire. None of these soil disturbances caused cumulative increases in detrimental soil conditions for any of the activity areas proposed for salvage logging (FEIS, Chapter 3). Based on the disturbed area estimates for Alternative 2, the percentages of detrimental soil conditions would increase above existing conditions by approximately 12 to 14 percent in each of the proposed activity areas (FEIS, Table 3-4). This would leave at least 84 percent of the unit areas in an undisturbed condition. Soil restoration treatments (subsoiling) would be applied to reduce the cumulative amount of detrimentally compacted soil within all eight of the proposed activity areas (FEIS, Chapter 2). Subsoiled areas would have favorable soil physical conditions that improve the soils ability to supply nutrients, moisture, and air that support vegetative growth and biotic habitat (FEIS, Chapter 3).

Fireline rehabilitation has already been accomplished. No fire lines were constructed in any riparian areas because none exist within or adjacent to the fire area.

Alternative 2 takes the approach that the uncertainties in post-fire recovery management, do not support choosing either a passive or active management philosophy but strives to blend them with a limited removal of fire-killed trees, reforestation and road closures and obliterations to provide for both high quality wildlife habitat and commodity production.

See discussion in Appendix G above.

Protecting Soils

Although the 18 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 and the hydrologic function of soils (FEIS, Chapter 3). 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). Although the fire killed vegetation and reduced evapotranspiration rates within affected areas, most of the water yielded from this landscape is still expected to be delivered to streams as subsurface flows that emerge at lower elevations outside the project area. 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 non-existent in burned areas with gentle slopes (FEIS, Chapter 3). 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 (FEIS, Chapter 3).

As disclosed in the FEIS, management direction is incorporated into soil restoration objectives that would be applied to reduce cumulative levels of detrimental soil conditions anticipated from this project. There are no violations of Regional policy (FSM 2520, R-6 Supplement No. 2500-98-1) or LRMP management direction for maintaining and/or enhancing soil conditions in any of the activity areas. None of the activity areas would exceed the Regional and LRMP standard of 20 percent detrimental soil conditions following salvage harvest activities (FEIS, Table 3-4).

The environmental consequences are discussed at length in the FEIS, Soils section in Chapter 3. Also see responses to DEIS Comment Letters 7-11, 7-58, 7-69, 7-71, 8-10, 8-11, 8-23 and 8-61 in Appendix H.

There is no potential for overland flow of sediments to reach stream channels outside of the project area (FEIS, Chapter 3) combined with the absence of any riparian areas obviates any concern over effects to aquatic systems. The sandy textures of the soils derived from Mazama ash have high infiltration and percolation rates and hydrophobic conditions are not a concern.

Detrimental soil conditions (Table 3-4) would remain considerably below Regional standards after completion of salvage harvest.

Banning Introduction of Exotic Species

Grass seeding and introduction of exotic species would not occur.

Curtailing Livestock Grazing

As noted in the FEIS under the Range Allotments section, the area has been inactive since 1990 and grazing would not occur until vegetation recovery has occurred.

Restricting Postfire Logging

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 (FEIS, Chapter 3). The activity areas proposed for ground-based salvage logging do not occur on landtypes that contain sensitive soils (FEIS, Chapter 3). None of the proposed activity areas overlap landtypes with steep slopes greater than 30 percent (FEIS, Figure 3-1), potentially wet soils with seasonally high water tables, or sensitive soils with high erosion-hazard ratings that would require special mitigation. On gentle to moderately sloping terrain, the maneuvering of equipment generally does not displace soil surface layers that would qualify as a detrimental soil condition (FEIS, Chapter 3, FSM 2520 definitions). Accelerated surface erosion is not a major concern because adequate soil cover currently exists to control erosion on the dominant soils and landforms that were affected by the 18 Fire (FEIS, Chapter 3). All applicable BMPs would be applied to control surface erosion on and adjacent to roads and logging facilities that would be used during project implementation (FEIS, Chapter 3).

The management requirements, mitigation measures, and BMPs listed for the soil resource (FEIS, Chapter 2) are all designed to minimize, avoid, or reduce potentially adverse impacts from the ground-disturbing activities proposed with this project. Although equipment traffic can decrease soil porosity on volcanic ash-influenced soils, compacted sites can be mitigated by tillage with a winged subsoiler (Powers, 1999). Adequate amounts of snags and coarse woody debris would be retained following project activities to maintain soil biological integrity and provide habitat for dependent wildlife species.

Alternative 2, as noted above, includes many of the recommendations provided by Beschta et al in their paper “Wildfire and Salvage Logging”, 1995. As noted by the authors in their 2004 paper “Logging may be suitable where accelerated soil erosion and increased soil compaction are unlikely to occur and where there will be no impairment of hydrologic and soil biological integrity.”

Although some additional compaction can be expected (Table 3-4) only areas which meet these criteria were included in the salvage proposal. Salvage logging is prohibited on sensitive sites, riparian areas, fragile soils, severely burned soils, roadless areas, watersheds where sedimentation is already a problem, and where significant impacts to early successional vegetation, surface erosion or mass soil erosion are likely to occur.

Prohibiting New Road Construction

Accelerated short- and long-term sediment production from roads is not a concern and although an estimated 3.5 miles of temporary road would be established there would be no effects on aquatic systems or accelerated erosion. All temporary roads would be obliterated by tilling (subsoiling). No permanent roads would be constructed or reconstructed. The flat terrain does not necessitate landing construction.

The following (**in bold**) from The Declaration of Jonathan J. Rhodes in the United States District Court for the Western District of Washington at Seattle, June, 2004 was also considered pertinent to this appendix:

B. Logging and fuel treatments are unlikely to reduce the adverse effects of fire on watersheds and aquatic resources.

C. Logging and fuel treatments are unlikely to reduce fire impacts due to their transient effects and a low probability of high severity fire.

The FEIS recognizes that there is no universally accepted view on reburn potential and intensity (FEIS, Chapter 3, Fire and Fuels section). Although snag removal is often done to reduce likelihood and intensity of re-burns, no studies have documented the effect of this practice in actual fires (McIver and Starr, 2000). Only a few studies have examined how fuel treatments affect fire behavior, but those that have do indicate that fuel treatments can reduce fire impacts (Martinson and Omi, 2003). The contribution of large woody fuel to surface fire intensity is likely underestimated in fire behavior models (Brown et al. 2003). The removal of larger snags probably reduces fire severity and spread potential, but the magnitude of the effect is not known. The FEIS is not concerned with the transient effects of fuels reduction but instead focuses on the size and amount of CWD needed for wildlife habitat and the potential for soil damage at the log/soil interface due to sustained, elevated temperatures from the consumption of CWD in a dry, ponderosa pine plant association type where complete combustion of CWD, regardless of diameter, is the norm.

APPENDIX H
Response to Comments and Agency Letters

Introduction

A 45-day comment period for the 18 Fire Recovery Project Draft Environmental Impact Statement (DEIS) was provided for interested and affected publics, including appropriate local, state, and federal government agencies and Tribes. This period lasted from July 2, 2004 through August 16, 2004. During this period, the Forest Service received comments from different sectors of the public, with a range of concerns and questions. Some comments resulted in a clarification of discussions within the DEIS. The responsible official is considering the comments in the decision-making process.

> ***Substantive Comments:*** Comments that are within the scope of the proposed action, have a direct relationship to the proposed action, and include supporting reasons for the Responsible Official to consider"

The Forest Service received 10 different responses during the comment period, from 11 sources. The completed comment record and coded substantive comments are kept within the 18 Fire Recovery Project public record and are available for review at the Bend-Ft.Rock Ranger District, Bend, Oregon. The following table lists the comment letters received.

Comments Received During the DEIS 45-Day Comment Period[2].

Letter	Author	Organization
1	Troy Reinhart	
2	Gordon Baker	
3	John Morgan	Ochoco Lumber Company
4	Glen Ardt	Oregon Department of Fish and Wildlife
5	Judith Leckrone Lee	U.S. Environmental Protection Agency
6	Charles H. Burley	American Forest Resource Council
7	Doug Heiken/James Johnson	Oregon Natural Resources Council/Cascadia Wildlands Project
8	Asante Riverwind	Blue Mountains Biodiversity Project
9	Dean Richardson	
10	Barbara Schroeder	

Comment Analysis Process

Public responses submitted regarding the 18 Fire Recovery Project Draft EIS were documented and analyzed using a process called content analysis. This is a systematic method of compiling, categorizing, and capturing all public viewpoints and concerns submitted during the official comment period in response to the Draft EIS. Information from public field reviews, office visits, letters, phone calls, emails, and other sources are all included in this analysis. Content analysis helps the USDA Forest Service clarify, adjust, or incorporate additional technical information in preparation of the FEIS.

Interdisciplinary team specialists read all public responses and identified separate substantive comments within them that relate to a particular concern, resource consideration, or requested management action. Each comment was categorized by resource, utilizing a code for each public response that has been specifically tailored to record letter number and comment number. Each

relevant comment is coded and verified for accuracy and consistency. The IDT members provided responses to comments where appropriate.

Finally, it is important to recognize that the consideration of public comment is not a vote-counting process in which the outcome is determined by the majority opinion. Relative depth of feeling and interest among the public can serve to provide a general context for decision-making. However, it is the appropriateness, specificity, and factual accuracy of comment content that serves to provide the basis for modifications to planning documents and decisions. Further, because respondents are self-selected, they do not constitute a random or representative public sample. NEPA encourages all interested parties to submit comment as often as they wish regardless of age, citizenship, or eligibility to vote. Respondents may therefore include businesses, people from other countries, children, and people who submit multiple responses.

Every substantive comment and suggestion has value, whether expressed by one respondent or many. All input is read and evaluated and the IDT attempts to capture all relevant public concerns in the analysis process.

There are two main principles crucial to capturing the full range of public concerns - context and the need to capture respondents' sentiments and reasoning. They underscore the complexity of the coding process. A single comment referring to two or more resource areas could be legitimately coded to any of several categories. Innumerable permutations among multiple resources, perspectives, and emphases add to the complexity. The specialists have made every attempt to classify comments in a way that fairly represents respondents' concerns, and that facilitates the planning team's efforts to respond to those concerns.

Comment Response

Each similar comment was combined using a title or theme to help the reader easily find responses to similar comments.

The IDT reviewed the comments and responses from each resource and considered the substance of the concerns across all applicable natural resource elements, evaluated whether they triggered a change in the environmental analysis, and drafted responses. For some concerns, they reviewed the original letters or other input to ascertain the full contexts for the concern statement.

Responses are written to address these public concerns. In general, the agency responded in the following five basic ways to the substantive public comments as prescribed in 40 CFR 1503.4: 1) Modifying alternatives; 2) Developing and analyzing alternatives not given serious consideration in the DEIS; 3) Supplementing, improving, or modifying the analysis that the DEIS documented: 4) Making factual corrections; and 5) Explaining why the comments do not need further Forest Service response.

This response document follows the organization of the public concern summary as prepared by the IDT.

Comments in Support of Alternative 2

"I support the most aggressive and economically profitable salvage of timber from the 18 Fire. It is essential for the reforestation of the area, good forest ecology and for the economy that the maximum amount of timber is salvaged." (1-1)
"I approve of and support the Forest Service selection of Alternative 2, which proposes a balanced effort of salvage and ecological restoration of the fire-damaged area. It is apparent that all of the critical elements associated with fire restoration were considered in

the study that led to your recommendation. Alternative 2 reflects good stewardship of our national forests by the Forest Service." (2-1)
"We support the purpose and need for action to commercially harvest the burned trees to recover their economic value and to expedite restoration activities following the recent catastrophic wildfires. In addition, we support activities that will reduce high fuel loads." (3-1)
"ODFW supports the removal of dead trees in Alternative 2 given the Forest's intention to retain adequate trees for snags and down logs." (4-1)
"I am in favor of this project, both salvage and reforestation." (9-1)
"'We encourage you to move forward as quickly as possible with this proposed project." (3-7)

No response necessary.

AIR QUALITY
"We recommend including an analysis of any potential impacts of prescribed fire on visibility conditions in the Three Sisters Wilderness Class I airshed in the final EIS." (5-2)

Response # 1: Additional analysis of any potential impacts of pile burning on visibility conditions in the Three Sisters Wilderness was included in the FEIS. The Oregon Smoke Management plan (Oregon Revised Statutes 477.013) administered by the Oregon Department of Forestry and Department of Environmental Quality takes into account all Designated Areas and Class 1 Federal areas. A mitigation measure (FEIS page 29) is included to address this concern. On burn day, persons responsible for burning operations modify their firing and mop-up procedure to consider effects to Class 1 airsheds and sensitive areas. Monitoring is done by the State Forester to insure compliance with the smoke management program and to determine the effectiveness of smoke management procedures. Real time air quality monitoring data is available to the State Forester through a computer link with the Department of Environmental Quality and is used by Forest Service personnel to schedule prescribed fire operations.

Given the level of uncertainty associated with prescribed fire weather forecasts, if a certain threshold is reached where particulate release is undesired, such as impacting a sensitive area, firing operations are ceased and immediate mop-up procedures are initiated.

BEST AVAILABLE SCIENCE
"The agency has an obligation to respond in the final NEPA document to responsible opposing viewpoints concerning the consequences of the proposed action." (7-79)
"The Forest Service is applying outdated analysis and management prescriptions and rejects without adequate explanation the best available science with respect to post-fire management that is contained in the "Beschta report." (7-1)
"The EIS should respond to the new peer-reviewed Beschta report in the latest issue of the journal Conservation Biology. The DEIS only talks about the old Beschta report and dismisses it based on faulty data and analysis. (7-12)

Response # 2: The IDT reviewed the most current science available during preparation of the FEIS, including the new peer review Beschta report, 2004. The literature is cited throughout the document and listed in the Literature Cited section including opposing viewpoints. Alternatives 2 and 3 were designed to incorporate many scientific viewpoints including Beschta (see Beschta discussion in the Range of Alternatives, comment section). Also, a point by point response to the Beschta report is located in the FEIS, Appendix G.

"The authors (Franklin) do not recommend leaving 3 snags/acre over 13.5" dbh. They recommend removing post-fire fuels to the extent they are uncharacteristic. The 18 fire was not uncharacteristic. Large fires stand replacing fires in ponderosa pine forests may be rare but not unheard of." (7-6)

Response # 3: As noted in the comment "Large fires stand replacing fires in ponderosa pine forests may be rare but not unheard of" acknowledges that the 18 Fire was uncharacteristic. Alternative 2 removes some of the uncharacteristic post-fire fuels loads, while leaving a minimum of 3 snags/acre over 13.5" dbh within the fire salvage areas, juxtaposed with non-salvage areas that range from ½ acre to 15 acres (FEIS, Chapter 2, Alternative 2). The total percent of the 18 fire that has salvage proposed is @50 percent (Table 2-1) under Alternative 2. Franklin, Sexton, Brown, etc were used to determine characteristic levels of fuel loading, and the appropriate level of fire salvage for the dry, ponderosa pine plant association (Chapter 3, Forest Vegetation and Timber Management; Fire and Fuels).

"The DEIS (p 79) says that DecAID is the most current scientific information which seems to ignore the fact that"

> ***"DecAID is NOT: … a snag and down wood decay simulator or recruitment model [or] a wildlife population simulator or analysis of wildlife population viability. … Because DecAID is not a time-dynamic simulator … it does not account for potential temporal changes in vegetation and other environmental conditions, … DecAID could be consulted to review potential conditions at specific time intervals and for a specific set of conditions, but dynamic changes in forest and landscape conditions would have to be modeled or evaluated outside the confines of the DecAID Advisor." (7-7)***

"The bottom line is that current management at both the plan and project level does not reflect all this new information about the value of abundant snags and down wood." (7-27)
"The Forest Service relies on outdated science (and Standards & Guidelines based on that same bad science) to determine snags to be retained." (7-35)

Response # 4: Desired conditions of snag and CWD habitat are based in part on management recommendations and guidelines provided by the Deschutes National Forest Land and Resource Management Plan, Deschutes National Forest Wildlife Tree and Log Implementation Strategy and Eastside Screens as modified by the best available science contained in the Interior Columbia Basin Final Environmental Impact Statement (ICBEMP), ICBEMP DEIS, DecAID, Beschta and other literature (Chapter 3, Wildlife). An extensive time-dynamic simulator analysis of fuels, snags, green trees and snag recruitment is located under the Forest Vegetation and Timber Management section of Chapter 3.

BIG GAME
"The agency must address the adverse effects of salvage logging on big game habitat, especially in areas allocated for big game management in the applicable resource management plan." (7-50)
"The 18 Fire burned a significant portion of designated Deer Winter Range. The DEIS proposes to log this designated area, however the agency fails to address the need to designate new additional DWR to provide for the needs of these species." (8-57)

Response # 5 The effects of salvage logging on big game habitat is addressed extensively under the Wildlife section of Chapter 3. None of the alternatives identified the need to designate new additional DWR to provide for the needs of big game.

"***There is also no doubt that big game use dead and down trees for cover. The removal of large number of dead trees and hazard trees through salvage logging, will make a bad situation worse for big game and exacerbate LRMP violations. The DEIS does not look at both ends of the temporal cover gap. The DEIS over-emphasizes the "development" of big game cover in the future, but fails to recognize the value of retaining that cover which currently exists." (7-9)***
"Although fire may have reduced big game habitat, salvage logging will make a bad situation worse by reducing cover and delaying recovery of vegetation species that are favorable for foraging and hiding cover. Even dead trees can provide hiding or thermal cover for a period of time. The NEPA analysis must assess the lost cover associated with salvage logging of dead trees, either those killed by the fire or that will die in the near term from fire-related damage." (7-49)

Response # 6: The retention of 60 percent of the dead snags greater than 4" dbh on the salvage areas (Table 3-13) juxtaposed with non-salvage areas that range from ½ acre to 15 acres (FEIS, Chapter 2, Alternative 2) and retention of all dead snags on @ 50 percent of the fire area (Table 2-1) combined with identified road closures (Chapter 3, Roads and Transportation), topographic cover, reforestation and a road closure order were designed to address short-term big game cover needs. Over the long-term a seasonal road closure in deer winter range would address cover needs (FEIS, page 5).

"***The DEIS also builds roads in violation of big game road density standards, and makes an unsupported claim that salvage logging will facilitate big game movement." (7-10)***

Response # 7: Target open road densities in the LRMP are used as a threshold for further evaluation rather than an absolute standard (LRMP, pg. 4-115). None of the action alternatives build or reconstruct any permanent roads (FEIS, Figure 3-30). Alternative 2 establishes 3.5 miles of temporary road to facilitate salvage. "Following timber harvest operations, the temporary access routes would be obliterated and reconditioned to a natural state" (FEIS, pg.165).

BIRDS
"The NEPA analysis failed to consider significant new information on pileated woodpeckers including:

a. Pileated woodpeckers need more and larger roosting trees than nesting trees. They may use only one nesting tree in a year, they may use 7 ore more roosting trees.
b. West of the Cascades, pileated woodpeckers tend to prefer nesting in decadent trees rather than snags.
c. West of the Cascades, standing snags are important foraging sites because down wood may be too wet to harbor carpenter ants (the favored foods of the pileated woodpecker).
d. West of the Cascades, Pacific silver fir is often used for nesting (but not roosting).
e. West of the Cascades, western redcedar is often used for roosting (but not nesting)." (7-36)

Response # 8: The 18 Fire area is located "east" of the Cascades (Figure 1-1). The action alternatives would have no effect because it is normally absent from the area. It rarely uses pure ponderosa pine habitat. Any future occupancy would likely be incidental and short-term in the pursuit of insects attracted to the area (FEIS, pg.94).

"Be sure to protect the following bird species of conservation concern to the U.S. Fish & Wildlife Service . . ." (7-74)
Response # 9: All MIS, species of concern, and focal birds species were considered in the Wildlife section of Chapter 3 (FEIS). There would be no or only minor short-term negative effects on any of these species.

"***Goshawks also have an extensive foraging territory. It is likely that nesting pairs may utilize both or either underburned portions of the area as well as adjacent older green forest areas. It is also likely that burned, open-forest edge areas within the proposed logging units may be utilized as additional occasional foraging territory by this species. The DEIS fails to address impacts to this species such as how logging removal of remaining canopy cover, and further fragmentation of the area's forests, will affect adult and juvenile Goshawks, or other direct, indirect, or cumulative effects to the species. The DEIS fails to disclose if there are any Goshawk historic—or seasonally rotated-- nesting areas within or adjacent to the proposed logging "units." (8-49)***

"***We are concerned about the affect of the planned transformation of the commercial logging units from burned snag forests, to open near barren terrain where insufficient remaining snags are incapable of providing for the forest-cover which is necessary for continued goshawk use of this area."(8-50)***
"***The proposed tree re-planting may also harm current and historic mixed conifer habitat needed by this species (Goshawk), if the replanting shifts these forest stands to false, agency formula-concocted, open single-storied forest or single species "forests" in areas which were historically more diverse in species composition or age groupings." (8-51)***

Response # 10: Effects to the goshawk including nesting and foraging habitat is discussed on page 93, FEIS in the Wildlife section. The 18 Fire is identified as a Plant Association Group ponderosa pine dry (FEIS, pg.139). There is no mixed conifer habitat within or adjacent to the 18 Fire.

The proposed project area contains goshawk nesting and foraging habitat within unburned, lightly burned, and areas of mixed intensities. There is no proposal to alter these habitats.

"Compliance with both the NFMA and the MBTA requires that all alternatives presented within the DEIS must be capable of protecting forest habitat for these many native forest species, and of reversing any current downward population trends. Such a course of proactive protective action is also required by the ESA and the NEPA, Presidential and USFS directives, and the Migratory Bird Treaty Act, as well as credible conservation science and ethical integrity. However, in violation of these legal and ethical requirements, the DEIS presents action alternatives which would severely imperil neotropical and native avian species populations, resulting in both individual mortality to these species as well as irreparable harm to already seriously impaired habitat." (8-52)
"Further, the DEIS did not deal with the direct, indirect and cumulative impacts that the project would have on migratory birds. The USFS has on record a study by Brian Sharp ("Avian Population Trends in the Pacific Northwest" as cited above), which concludes that commercial logging in public forest lands in Oregon plays a significant role in the continuing population declines of several neotropical migrant bird species. The failure to disclose the full conclusions and implications of this study in the DEIS is particularly egregious in that the study was done for Region 6 of the Forest Service specifically on Central and Eastern Oregon forests. The lack of adequate scientific assessment of this study fails to meet NEPA's requirement for high quality scientific analysis that would

satisfy the "hard look" standard. Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 353 (1989); Blue Mountains Biodiversity Project v. Blackwood, 161 F.3d 1208 (9th Cir. 1998) cert. denied, Ochoco Lumber Co. v. Blue Mountains Biodiversity Project, 119 S.Ct. 2337 (1999)." (8-55)

"***The past and continuing logging-oriented management of the forests of Oregon and Washington, which provide nesting and fledgling habitat for numerous migratory birds, has resulted in severe ongoing population declines in forest canopy-dependent migratory and native birds. (reference: "Avian Population Trends in the Pacific Northwest" by Brian Sharp). Among the many avian species experiencing population declines due to Forest Service logging projects are: band-tailed pigeon, rufous hummingbird, olive-sided flycatcher, winter wren, song sparrow, golden-crowned kinglet, pine siskin, solitary vireo, willow flycatcher, tree swallow, red-eyed vireo, yellow warbler, yellow-breasted chat, and others as well. This information was not adequately addressed in the DEIS despite the obvious direct adverse impacts to many migratory and native bird species from the removal of forest canopy cover and forest structural continuity which would occur with the implementation of this project." (8-54)***

"***The proposed logging would further seriously reduce existing forest-dependent migratory bird habitat, which has already been significantly diminished due to the cumulative impacts of past management and the resultant severity of the fire. The proposed logging "units" would also irreparably fragment migratory bird habitat. Areas that were not logged would also be negatively impacted by generalist bird species favored by the environmental conditions created in highly fragmented logged-over forests." (8-53)***

Response # 11: Discussions on all possible species that could utilize the 18 Fire area were not included within the analysis. Species chosen for analysis were those listed as Threatened or Endangered by USFWS, Regional Forester's Sensitive Species, Management Indicator Species, Deschutes National Forest LMRP, Migratory Focal Species from Altman 2000, and Birds of Conservation Concern from USFWS. These representative species cover the range of habitats within 18 project area. Many species do not have habitat within the project area; others do not have habitat within the proposed units due to the lack of vegetation. The direct, indirect, and cumulative effects are displayed for each of these chosen for analysis.

Current population trends were disclosed for some species not for others. NatureServe. 2003. Nature Serve Explorer: An online encyclopedia of life [web application]. Version 1.8. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: September, 2004) was used as a source. Trend data for all avian species has been added to the FEIS, Chapter 3, in the Wildlife section.

The Brian Sharp paper was not used to determine current population trends. Sharp looked at Breeding Bird Survey (BBS) data from 1968 through 1994. The author ties population trends to habitat availability. The author states, "The period that BBS data are available coincides with the period of most intensive timber harvest from national forests in the Pacific Northwest." Habitat loss was greatest during that time. The author also noted "Declines of neotropical migrants and residents were less pronounced in the period 1980 to 1994 than 1968-1994. Average harvest levels were substantially reduced in the 1990's." The author shows that more species are increasing on National Forests during 1980 to 1994, than declining. Harvest levels as well as logging practices have changed dramatically since 1994.

Trend data from 1968 to 1994 for snag habitats and birds may not be an accurate description of current trends because of the reduction in harvest and current logging practices that utilizes less regeneration harvest and leaves more snags and down wood. Ohmann, in a 1994 paper,

recognized the change in logging practices. "Furthermore, snag densities in older stands on previously harvested sites reflect logging practices quite different from those used today."

The 18 Fire reduced fragmentation by turning approximately 2,420 acres into an early seral stage. Reducing snag densities on 1,936 acres of this habitat does not create fragmentation. Snag strategies are in place to provide various densities across the landscape. There is no proposal to salvage any green trees. The proposal would provide varying habitat across the project area.

Reference: Sharp, Brian E. 1996. Avian Population Trends in the Pacific Northwest. The Institute for Bird Populations. Bird Populations #: 26-45; Ohmann, McComb, & Zumrawi; Snag Abundance For Primary Cavity-Nesting Birds On Nonfederal Forest Lands In Oregon And Washington; Wildlife Society Bulletin 22:607-620, 1994 http://www.fs.fed.us/pnw/pubs/journals/ohmann-snagabundance.pdf Altman, Bob. 2000 Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington, Version 1.0, Prepared for the Oregon-Washington Chapters of Partners in Flights; Helen M. Kim, Chopping Down the Birds: Logging and the Migratory Bird Treaty Act, 31 Envtl. L. 125 (2001). Also refer to: Chapter 3 Wildlife, Wildlife (Snags and Down wood); Chapter 3 Wildlife, Threatened and Endangered Species; Chapter 3 Wildlife, Regional Forester's Sensitive Species; Chapter 3 Wildlife, Management Indicator Species; Chapter 3 Wildlife, Survey and Manage Species; Chapter 3 Wildlife, Species of Conservation Concern.

"As has been the case in many national forest areas this past century, when burned areas are commercially logged, among the many harmful impacts is the loss of viable habitat for black-backed woodpeckers and other post-fire associated species. Among the significant irreparable harms caused by such logging, are: 1) the loss of species in the area which predate upon bark beetles and other insect; 2) serious continuing population declines of black-backed woodpeckers (Oregon State listed as Sensitive) and forest dependent neo-tropical migrant birds; 3) significant increases in the adverse impacts of unchecked bark beetle populations." (8-65)

Response # 12: Effects on black-backed woodpeckers and other fire opportunists is discussed at length in the FEIS (Wildlife, Chapter 3). Alternative 2 (proposed action) would have insignificant effects on the population viability of this species (black-back woodpecker) because large numbers of snags would be retained, including substantial patches and the scale of the project is small in relation to the species range (FEIS, pg.94).

BOTANY
"Both pre-fire, and post-fire, botanical surveys must be disclosed for the project area. Within a severe burn area such as this, all listed, and proposed listed, plant species and their habitat—including especially soils and soil moisture retention capacity--must be protected." (8-35)

Response # 13: There are no listed threatened or endangered plant species that are known to exist within or adjacent to the project area. Botanical resources including surveys are discussed at length in the FEIS (pgs. 108 to 117).

CONSISTENCY WITH THE DESCHUTES NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN

"In this case the DEIS fails to disclose how the project will comply with the Deschutes LRMP Standards & Guidelines for soils, big game habitat, and snag habitat." (7-78)

Response # 14: The project is consistent with the LRMP for soils, big game habitat, and snag habitat (see FEIS, Soils, pg.68 to 69, Wildlife, big game and snag habitat, pgs.75 to 104).

CUMULATIVE EFFECTS

"Recognize the effects of compound disturbances such as fire and fire suppression followed by logging and treatment of activity fuels." (7-42)

"In addition to the impacts from the 18 Fire, the area suffers from the adverse cumulative impacts of decades of prior logging. Past logging throughout this area has contributed to the greater area's fragmentation and loss of both LOS and green forest habitat. Portions of the area also experienced severe burns in 1996, and much of these areas were still in long-term recovery from this earlier fire, in addition to the past logging. However, the DEIS for this project fails to adequately disclose and address these extensive cumulative impacts and fragmentation to the area's forests and wildlife, including its soil resiliency and water retention and water table levels. While the 18 fire area may not have any fish bearing streams or even any ephemeral water-courses, its soils play a role in the water retention and water tables levels upon which the area's aquatic systems ultimately depend. However the DEIS fails to address this issue or to analyze the potential impacts of this proposed logging to these systems." (8-7)

"Currently there are three other timber sales, adjacent to the 18 Fire and/or located across the Bend/Fort Rock Ranger District which cumulatively affect available habitat for wildlife species and would further fragment the area's forest. Together these four sales are occurring at approximately the same time period, and in the same geographic area. These sales are: the Kelsey Sale—which is interspersed with the 18 Fire sale, the Lava Cast Sale, and the Lodgepole Mistletoe Reduction Sale. NEPA, as well as ample judicial case law (BMBP vs. Blackwood, Hash Rock, Mule, etc.) very clearly requires that the FS must conduct one EIS process for adjacent and interspersed sales. Synergistically these sales will significantly compound the already extensive adverse impacts across the ranger district to wildlife habitat, forest connectivity, impaired soil conditions, hydrological functioning, and the district's aquatic systems and fish species." (8-8)

"It is clear from our surveys of the project and surrounding area, that the greater area has been significantly harmed by decades of over-logging and excessive road building, significantly fragmenting area forests, harming area soil quality, and the districts watershed resiliency and soil water retention. While the DEIS does peripherally address some of these impacts, it fails to fully disclose the extent and seriousness of these impacts, or the serious declines of forest-dependent wildlife, botanical, and aquatic species populations due to the extensive adverse impacts to their habitat from past and ongoing management actions. The DEIS fails NEPA's legal requirements entirely by failing to conduct one EIS process disclosing and analyzing the impacts of all the past and concurrent sales together." (8-9)

"The 18 Fire area, and much of the surrounding adjacent forests have been extensively logged in the past. The forests throughout are severely fragmented, and it is likely that numerous wildlife species endemic populations suffer from imperiled viability due to the significant adverse cumulative impacts from this prior logging. (8-14)"

"***Third, the DEIS fails to conduct an adequate cumulative impacts analysis for wildlife species and their habitat." (8-38)***

Response # 15: The effects of all past, present, and foreseeable future management activities was included in the FEIS. See FEIS, **Soils**, pages 36 to 74; **Wildlife**, pages 75 to 104; **Fuels**, pages 132 to 137; and **Forest Vegetation and Timber Management**, pages 138 to 155.

ECONOMICS
"With necessary fuel treatment costs factored in, the economic analysis will result in a negative NPV." "The Forest Service economic analysis fails to account for the log-term costs of weed infestations, soil degradation, habitat degradation, fire hazards, etc." (7-15)
"It would be better to admit that fuel reduction and restoration, if done right, will not pay for itself and must be supported by appropriated dollars." (7-82)
"Evidence suggests that the proposed project will not result in positive income." (8-69)

Response # 16: The Economic and Social Analysis (FEIS, pg 121 to 131) clearly shows that timber salvage (Alternative 2-Table 3-18) with fuels treatments costs (Table 3-17) factored in will have a positive PNV.
The PNV would be negative (FEIS, pgs.121 to 131) for all alternatives when including all non-salvage related projects and costs (Table 3-19).
The Forest Service is not mandated by law to show a profit from land management activities.

"The DEIS is incomplete because it fails to provide an adequate economic analysis of the proposed project." (8-67)
"The DEIS fails to contain an adequate economic analysis of the project as a whole and does not include all costs incurred by the proposed project. The DEIS does not analyze or disclose expenditures such as the cost to prepare the project (including administrative overhead, publication costs, survey costs, tree marking costs, etc.), nor does it include expenditures such as reforestation, aquatic, and terrestrial mitigation measures. The DEIS also fails to disclose the added costs incurred by the agency from failing to comply with NEPA, and conducting six nearly identical post-fire EIS projects for both the Deschutes and the Malheur's fires. Included in this assessment should be the costs which will be likely incurred by appeals on each of these six fire projects and six likely lawsuits as well." (8-68)
"In proposing the 18 Fire DEIS timber sale, the Forest Service failed to meet NEPA's requirements to fully disclose the direct, indirect, and cumulative economic impacts of the timber sale program and to give appropriate consideration to environmental amenities in the NEPA process by failing to incorporate important natural resource benefits and externalized costs into the DEIS." (8-70)
Third, the Forest Service violated the Multiple Use, Sustained Yield Act (MUSYA) by failing to incorporate important natural resource benefits and externalized costs into the DEIS and its
timber sales." (8-71)

Response # 15: The FEIS (page 127) does analyze and disclose expenditures such as the cost to prepare the project (including administrative overhead, publication costs, survey costs, tree marking costs, etc.). Direct, indirect, and cumulative economic effects were included in the analysis (pages 131 to 131). Net public benefits are measured by both qualitative and quantitative criteria rather than a single measure or index such as PNV or benefit cost ratio (FEIS, Chapter 3).

EMERGENCY SITUATIONS
"AFRC encourages the Deschutes National Forest to request the Regional Forester issue the Emergency Situation declaration for the 18 Fire Recovery Project." (6-2)

"Please begin work right away!" (9-2)

Response #16: An emergency situation determination is currently under consideration.

FENCING AND CONSTRUCTION
"The Forest proposes to construct a deer proof fence around a 640 acres parcel, which we oppose." (4-2)

Response # 17: The Bend-Ft. Rock Ranger District has removed 3 big game fences (Wampus, Ryan, and Finley) enclosing a total of 1,832 acres during 2004. During the previous 7 years the District has not built any other big game fences and has removed an additional 436 acres of fence. Another 297 acres of big game fencing is planned for removal in 2005. No other big game fences are planned at this time. This 640 acre fence would be removed when the young trees are above browse height.

FUEL LOADING
"This project has no real activity fuel treatment so it will greatly increase fire hazard. Whole tree yarding will not do the job. The branches and tops of dead trees will be far more brittle and tend to shatter upon felling and moving to the landing. The EIS does not disclose this." (7-1)
"The new DEIS must also adequately address current agency plans to scatter smaller diameter limbs and logging slash across the forest floor, thereby increasing the potential for a reburn in the area." (8-64)

Response # 18: Modern mechanized feller buncher systems (FEIS, pg.8) do not fell trees. They are accumulated and placed in bundles for skidding to a landing. District experience with fire salvage of other black-bark ponderosa pine sales has shown negligible breakage. Smaller diameter limbs and logging slash will not be scattered.

"The fuels analysis (pp 127-128) just talks about tons of fuels/acre and does not account for the different degrees of fire hazard presented by different fuel sizes." (7-16)
"The DEIS does not disclose the increased fire hazard caused by leaving 34 small snags/acre with all their fine canopy fuels, while moving a significant portion of the canopies of the large trees from the canopy to the surface fuel profile, and eliminating the offsetting effect of large water-filled snags that will be removed through salvage logging." (7-20)
"The agency's fire/fuel analysis must address these issues and recognize the fact that the fine fuel associated with snags (i.e. the branches) fall to the ground over time and decompose over time." (7-51)
"If fuels must be removed, the agency should remove the smaller fuels that are most hazardous and leave the largest logs that are least flammable and most valuable for habitat and other ecological services." (7-62)

Response # 19: One goal of this project it to manage future fuel loads and fuel arrangement to be within a manageable range for both fire control and ecosystem processes (FEIS, pg.132). Currently, the fire hazard is low, however within 15 to 20 years as the snags fall and

accumulate over the burned area, shrubs and grasses will be the dominate fuel type with a higher risk of high severity ground fire. During the next 40 years modeling shows that the small diameter snags (less than 12 inch dbh) and limbs will exhibit considerable decay (FEIS pgs.138 to 155) and as a result enhance soil productivity (FEIS pgs. 36 to 74). In other words, any increased fire hazard caused by leaving small snags within the salvaged area will largely be negated by decay and the extended time period during which they fall.

"The NEPA analysis asserts that leaving large numbers of snags is unsafe and the NEPA document describes an undesirable scenario with respect to the no action and restoration alternatives, but the NEPA document fails to acknowledge the fire risks associated with salvage logging including: (a) salvage logging will remove most of the largest logs that least prone to burn (because large logs hold the most water the longest and they have relatively high ratios of volume to surface area), (b) salvage logging leave behind almost all of the smallest material which is most prone to drying and burning (e.g., relatively low ratio of volume to surface area), (c) the proposed action may lop and scatter the tops of large trees that are too big for the ground-based harvest machinery, (d) salvage logging equipment and workers could start fires, (e) increased human access increases the risk of human caused ignition, (f) the replanting will create a fuel load that is dense, uniform, extensive, volatile, and close to the ground (During an extreme weather conditions this is one of the most extreme fire hazards in the forest)." (7-60)

"The NEPA document also fails to disclose that NOT salvage logging (e.g., natural recovery) may have some countervailing benefits in terms of fire risk and reburn potential, including: (a) large logs store water, (b) standing snags provide some shade, (c) regrowth tends to be more patchy and less dense and continuous, (d) fuels in the form of branches and dead trees fall to the ground slowly over time and have a chance to decay as they added, (e) falling snags over time ten to break up the continuity of fuels in the form of brush and reprod." (7-61)

"The agency is not permitted to saddle the no action alternative with a worst case scenario in terms of future fire. The NEPA document describes the no-action alternative in terms of its inherent high risk of intense future fire, but the NEPA document lacks any recognition that during favorable conditions of weather and fuel moisture a low-severity or mixed-severity fire could occur in the project area and such as fire would likely accomplish much of what this project is attempting to accomplish without all the adverse consequences from ground disturbance. This shows a strong bias against the no-action alternative." (7-64)

"The agency's bias is further evidenced by the fact that the NEPA analysis fails to disclose that during extreme weather conditions (hot, dry, and windy) a canopy fire could easily kill the forests areas whether they are treated or not." (7-65)

"***The agency's use of inaccurate "tons per acre" fuel load formulas also violates the NEPA and contradicts the reality of credible science such as this report. This flawed formula fails to account that large diameter logs and snags are not fuel loads—and should not be counted as part of the fuel load tonnage per acre." (8-21)***

"***Selection of the logging alternative would only set the stage for even more severe fires in this area in the future. Added to this would be the increased risk of fire due to extensive small diameter seedlings and trees (as these seedlings mature) mixed in with the dried out, solar exposed woody debris left by the logging operations, and the abundance of small diameter snags—and future downed small diameter logs-which too would be left." (8-22)***

"***Extensive intense fires such as the 18 Fire generally leave largely medium to large diameter limbs, trees, snags, and logs. These have been clearly shown in scientific research to not only not be a fuel loading problem, contrary to the DEIS's false assertions and formulas, but instead medium and large diameter logs and snags act as moisture reservoirs for many years after drought and wildfire. This has been well proven in a study by MP***

Amaranthus, DS Parrish, and DA Perry entitled "Decaying Logs as Moisture Reservoirs After Drought and Wildfire" which was published by the USFS in "Proceedings of a Watershed '89" on pages 191-194." (8-63)
"Decaying Logs as Moisture Reservoirs After Drought and Wildfire" (Amaranthus, Parrish, and Perry), clearly shows that medium to large diameter snags and downed trees are not only not fuel loads but that these act as water reservoirs, which, even after months of drought and post fire conditions, contain water. These size logs and snags serve important roles in the forest ecosystem, providing additional essential sources of moisture retention as well as both habitat and nutrients as they break down and decay—replenishing the forest soils. There is no credible ecological need to remove most of these size logs and snags—especially any snags above 12" to 16" dbh or more." (8-20)

Response # 20: Regardless of burn intensity almost all existing down logs were consumed by the 18 Fire (FEIS pg 38 to 40). Complete consumption of down logs under wildfire conditions, regardless of size, is characteristic of the ponderosa pine dry plant associations on the Bend-Ft.Rock Ranger District. One of the objectives of this project is to reduce the likelihood of stand replacement fire in regenerated stands, particularly during the early stages of stand development to promote long-term survival and growth of young conifers (FEIS pg.133). It is also understood that the fuels treatment prescribed for the 18 Fire will not eliminate wildfire, but will significantly reduce the resistance to control of any fire that may develop within the project area.

The Forest Service has reviewed Amaranthus et al, 1989. The literature cited references to the Douglas-fir forests of the Siskiyou National Forest. The Siskiyou is typically influenced by coastal weather patterns at 44 air miles (study plot) and 40 inches of rainfall as compared to an interior east Cascade weather pattern and 12 inches of precipitation for the 18 Fire. The 18 Fire is a much drier site, where large logs can dry out much more quickly. Amaranthus, 1987, discusses the moisture holding ability of logs in advance stages of decay (Class II and III). All down logs and snags that existed pre-fire and remain, would be retained. All trees that were killed by the fire would not be in the advanced stages of decay as discussed by Amaranthus et al. Amaranthus, et al acknowledges the following: "*A balance between fuel management guidelines and protection of the wood component of forest soils is critical. Large accumulations of woody residue can create a potential for wildfires of increased intensity, which would result in a lack of organic material and thus limit subsequent growth."* Although the report has merit, the applicable science is limited in this eastside forest type, where the west side weather and harvest techniques differ from the site-specific conditions associated with the 18 Fire area. On the Bend-Ft. Rock Ranger District, fuel moisture samples have been taken monthly from April to November from 1996 to present. The Lava Butte site where measurements are taken is within a 4¼ mile of the fire perimeter. Trends show that the large wood moisture drops below 18 percent every year between May and October. Eighteen percent (18 percent) is a threshold where total large wood and duff consumption is likely.

The falling of snags does not change the continuity of fuel loadings in the form of brush and tree reproduction, but it does change the arrangement of fuel depth. The FEIS does evaluate the fuels conditions with treatment and without treatment and the addition of fuels accumulation from growing vegetation

"Prevention of reburn must not be used as a justification for post-fire logging, without carefully documenting the rationale and providing references to published scientific studies (not just hypotheses and speculation and anecdotes)." (7-39)

Response # 21: The 18 Fire Recovery Project FEIS discloses the potential effects of future fire behavior (FEIS, starting on page 132 to 137). Factors such as resistance to control and fireline intensity were based upon predicted levels of fuels displayed by alternative. Proposed activities are designed to reduce surface fuels to increase the efficiency and potential success of future suppression actions, reduce the severity on soils and vegetation, plus facilitate re-introduction of prescribed fire. The 18 Fire is represented by a fire regime I in the ponderosa pine plant association groups, with frequent, low intensity fires (FEIS, pg.133, Table 3-21).

A discussion on the uncertainty of reburn potential, with scientific literature references, to occur within the 18 Fire area is discussed in the FEIS on page 137. Prevention of reburn is not used as a justification for post-fire logging.

Recent monitoring has shown a correlation between reburn and an increase in detrimental effects to soil and vegetation in portions of the 2003 Booth and Bear Fire (Sisters Ranger District), where they reburned through the 1987 Cabot Lake and Brush Creek fires. Although there were parts of the Cabot Lake and 1996 Jefferson Fire that did not reburn because of lack of ground fuels sufficient to carry the fire, Shank noted an increase in the amount of detrimentally burned soils as a result of subsequent fires in areas that had previously burned.

GRAZING
"The Forest Service should close the grazing allotment and not let the permittee re-occupy the fire area to take advantage of new growth of forage." (7-18)
The fire area must be rested from grazing. 'The NEPA analysis fails to disclose the significant adverse effects of livestock grazing in a post-fire landscape in terms of degrading water quality, spreading invasive weeds, retarding vegetative recovery, soil compaction, etc." (7-52)
"In the short-term, grazing must be eliminated to allow recovery of plants, soil, and to protect water quality." (7-53)
"In the short-term, grazing must be eliminated to allow recovery of plants, soil, and to protect water quality." (7-53) "In the long-term, grazing must be eliminated of the agency is sincere about re-establishing natural fire regimes which depend on natural fuel profiles, which are seriously adversely affected by livestock grazing." (7-54)
"The NEPA analysis must address the cumulative effects of logging and grazing on water quality and discuss the fact that further grazing will retard the attainment of riparian and aquatic management objectives in violation of the applicable land management plan as amended." (7-68)

Response # 23: The 18 fire has one (1) range allotment (Bessie). The last year it was grazed was in 1990. The fire area would be rested from grazing until fall 2005 at the earliest. The Bessie allotment is not currently active and there is no foreseeable use predicted to occur in 2005. The effects of grazing on a post fire landscape are disclosed in the FEIS (pgs. 169 to 173).

There will be no effect on water quality because there are no ephemeral, intermittent or perennial streams within or adjacent to the project area (FEIS, pg. 17). There are no areas of sensitive soils with high water tables or high erosion hazard ratings within the project area (FEIS, pg. 43 to 45). There is no potential for overland flow of sediments to reach stream channels outside the project area (FEIS, pg. 17, 41, and 100).

HAZARD TREE
"The NEPA analysis must at least disclose how many large snags will be protected vs. felled for safety under the preferred alternative." (7-37)
"The NEPA analysis also fails to acknowledge that the public assumes certain risk when recreating on public lands, so not every hazardous tree on every dead end spur road needs to be felled and removed." (7-38)

Response # 24: Alternative 2 was designed for worker safety as well as for snag retention by using clumping (or buffers) where possible (FEIS, Chapter 2, pg.21 and 22). Mechanized harvesting machines do not require felling of snags for worker safety because the machine operators are protected in the cab (personal communication Bend-Ft. Rock Ranger District, FSR, Loren Sessa). Any felling of snags would occur only around landings and would be negligible. Substitute snags are designated for retention to replace any snags needing to be felled for safety (FEIS, pg. 21).

HISTORIC RANGE OF VARIABILITY
"The NEPA document repeatedly invokes the concept of "historic range of variability" (HRV) to justify industrial intervention such as logging and roading. However, the HRV concept is meaningless unless a scale is specified (preferably both a temporal and spatial scale)." (7-63)

Response # 25: The eastside screens, which identified the use and comparison to HRV, indicate that using a regional level is not necessary in an area where disturbance regimes, forest types, and environmental settings are relatively uniform (Page 4 Interim Ecosystem Standard, Eastside Screens). The spatial scale for the fire area is compared to the District Area. The temporal scale used was the condition found prior to European Settlement (FEIS pgs.138 to 155).

INSECTS
"Additionally, as the Forest Service concluded in its study (Crater Lake) on decades of attempting to utilize commercial "salvage" logging to control –or minimize—the spread and adverse impacts of bark beetles, such a method is doomed to failure, as it would require the logging destruction of the very forests they were attempting to "save." (8-66)

Response # 26: The effects of insects and decay is discussed in the FEIS on pages 156 to 159. The FEIS makes no claim that an insect outbreak will be averted by the proposed action (FEIS, pg.158).

LIVE TREES
"Also, we strongly disagree with the decision not to include live trees in the proposed commercial harvest." (3-3)
"Salvage: Protect all live trees (for soil recovery processes and for snag and down wood recruitment.)" (7-45)

Response # 27: The FEIS did not identify a need to harvest dying trees (Purpose and Need, Chapter 1, pg. 5 to 17). The FEIS recognizes that many of the damaged trees will die over the next 10 to 20 years. These "time release" snags will provide needed habitat and help shorten the "snag gap" between when current existing snags fall down and new snags are created by the regenerated forest (FEIS, pgs.75 to 104, and 138 to 155).

MITIGATION

"Each proposed mitigation measure, including all BMPs, must be evaluated at the site-specific level for "effectiveness" and "ability to implement." This analysis must reflect: availability of funding and personnel, institutional constraints, water quality objectives, soils, topography, geology, land-form, channel morphology, vegetation, OHV use, and climate." (7-66)

"Until the agency is able to substantiate its proposed mitigation measures - i.e., that they are appropriate, will be implemented, and will be effective - the agency must withdraw the proposed project." (7-67)

"The agency should disclose and describe the full environmental impacts of the proposed action without compensatory mitigation, then describe proposed mitigation and how it would compensate for the predicted impacts." (7-77)

Response # 28: Mitigation measures and management requirements have all been evaluated for effectiveness and ability to be implemented (FEIS, pgs. 23 to 29). No compensatory or required mitigation was identified in the FEIS.

… "***Some timber sales do not collect enough KV to implement non-required KV." (pp 13-14). The Forest Service has a NEPA obligation to disclose the risk of running out of K-V funds before they are done with the mitigation projects identified in the alternatives." (7-81)***

Response # 29: A K-V funding priority list has been added to Chapter 2 of the FEIS, page 34. No compensatory mitigation was identified in the FEIS. It is anticipated that priorities 1 through 5 would be 100 percent financed with partial funding of reforestation. All the K-V projects are enhancement opportunities and not required mitigation (see response to #25).

MONITORING

"It will be interesting to compare the forest recovery in the salvage area to the recovery in the non-salvage area in the coming years." (2-2)

Response # 30: The USDA Forest Service Central Oregon Interagency Ecology Program has established monitoring plots in the 18 Fire to compare forest recovery in the salvage and non-salvage areas (FEIS, pg.30).

NOXIOUS WEEDS

"This project will seriously spread noxious weeds. The DEIS does not explain how non-noxious but nonetheless invasive weeds will also be spread, and the EIS does not disclose that weed vectors are directly proportional to the magnitude of ground disturbance so the logging alternative will be far worse than the no-logging alternatives." (7-19)

"The invasive weed sites in the analysis area and along all log and gravel haul routes should be fully inventoried and documented as part of the NEPA process for this project." (7-75)

Response # 31: A noxious weed risk assessment, which includes consideration of exotic plants that do not have "noxious" status, was prepared for this project along with weed control measures that will be undertaken during project implementation (FEIS, pgs. 111 to 117). Included is direct, indirect, and cumulative effects, and a discussion of the risks from heavy machinery associated with logging poses for weed introductions and spread. To be included, as a result of the discovery of a new Russian thistle (an exotic species; not noxious)

site in the summer of 2004, will be the requirement to minimize soil disruption at this site. Control measures for weeds were largely effective in preventing introduction or spread of noxious weeds in the 73 acre roadside salvage (District monitoring files).

District weed personnel continue to monitor and treat the 18 Fire and associated system roads.

OTHER COMMENTS RECEIVED

The Forest Service must prepare a new programmatic EIS to consider the effect of salvage logging on young complex forests and the development of complex older forest." (7-22)

"Before relying on DecAID, the agency must prepare a comprehensive NEPA analysis to consider alternative ways of ensuring viability of all species dependent upon snags and dead wood." (7-29)

"It is clear that a programmatic EIS must be conducted for the litany of post-fire sales proposed both in the Deschutes and elsewhere in Region 6 interior Columbia basin forests." (8-72)

"***The agency must prepare a programmatic EIS to comprehensively disclose and consider:***

A. the natural range of variability within interior NW forest ecosystems, and the existing rarity of complex mature and Late/Old Structure forests (LOS) (e.g., forests that are unsalvaged after disturbances). "Since the numbers of large snags are below the natural range of variability across the landscape, the agency must retain all large snags to start moving the landscape toward the natural range of variability, or the agency must carefully justify in the NEPA analysis every large snag it proposes to remove." (8-1) See Jerome J. Korol, Miles A. Hemstrom, Wendel J. Hann, and Rebecca A. Gravenmier. Snags and Down Wood in the Interior Columbia Basin Ecosystem Management Project. PNW-GTR-181. http://www.fs.fed.us/psw/publications/documents/gtr-181/049_Korol.pdf This paper estimates that even if we apply enlightened forest management on federal lands for the next 100 years, we will still reach only 75 percent of the historic large snag abundance measured across the interior Columbia Basin, and most of the increase in large snags will occur in roadless and wilderness areas.

B. the ecological values (such as wildlife habitat) associated with snags, dead wood, and complex forest ecosystems. See Rose, C.L., Marcot, B.G., Mellen, T.K., Ohmann, J.L., Waddell, K.L., Lindely, D.L., and B. Schrieber. 2001. Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management, Chapter 24 in Wildlife-Habitat Relationships in Oregon and Washington (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001) http://www.nwhi.org/nhi/whrow/chapter24cwb.pdf

C. given the regional deficit of complex forest ecosystems and the fact that many species, such as woodpeckers and secondary cavity users, appear to be adapted to exploit the structure and resources available within disturbed forests, " . . . the agencies should comprehensively consider and disclose the direct and indirect effects of salvage logging on species associated with complex interior forests." (8-2) The Forest Service has numerous Management Indicator Species whose populations have not been monitored, so the agencies lack the information necessary to ascertain that the salvage logging program will maintain species viability.

D. the effects of salvage logging on the development of complex forest habitat;

E. all the new science related to salvage logging and dead wood, including but not limited to: Beschta R.L., J.J. Rhodes, J.B. Kauffman, R.E. Gresswell, G.W. Minshall, J.R. Karr, D.A. Perry, F.R. Hauer, and C.A.Frissell, In Press. Post fire management on forested public lands of the western USA. Cons. Bio., 18:x-xx. And Rose et al.

F. the cumulative impacts, resulting from the extensive planned and proposed logging projects, to numerous forest-dependent wildlife species, including adverse impacts to

resident, rearing, and foraging habitat as well as adverse impacts to essential wildlife travel routes, including dispersal and migration corridors." (8-1)
"It is clear that a programmatic EIS must be conducted for the litany of post-fire sales proposed both in the Deschutes and elsewhere in Region 6 interior Columbia basin forests." (8-72)

Response # 32: Preparation of a programmatic EIS(s) is outside the scope of this analysis.

"Salvage will retard achievement of riparian management objectives in violation of TM-1 of INFISH." (7-56)
"Salvage logging will set back vegetative recovery that has already started and thereby retard attainment of riparian and aquatic management objectives." (7-57)
"The NEPA document did not address the consequences of erosion and sedimentation within a proper framework of sediment dynamics. Aquatic habitat attributes such as spawning gravel availability or the amount of fine sediment in bed sediments are determined by hillslope sediment inputs and by the capacity of stream channels to store and transport sediment." (7-70)

Response # 33: There are no riparian areas. See response to # 23

"The agency must avoid any reduction of existing or future large snags and logs (including as part of this project) until the applicable management plans are rewritten to update the snag retention standards." (7-28)
"The applicable forest plan requires the agency to monitor the status, trend of various resources and the implementation and effectiveness of Standards & Guidelines. These monitoring requirements are directly related to special status species, water quality soil and many other forest resources that are directly affected by this project. The mandated monitoring requirements have not been met, so the agency should not implement projects affecting these resources until it fulfills its duty to monitor the resources under its care and stewardship." (7-76)
"Don't tier to the outdated forest plan. Certain areas of the forest were allocated to commodity production in the LRMP, but since the LRMP was approved the regional forester has had to adopt several regional plan amendments in order to increase protection for species associated with old forests and aquatic environments (e.g., eastside screens, PACFISH, INFISH). Other significant policy changes have been made outside of the plan amendment process, such as the Lynx Conservation Assessment and Strategy (LCAS), the National Fire Plan, the Healthy Forest Initiative, etc." (7-80)
"***Among these concerns are the agency's continuing use of the archaically outdated Forest Plan, which was adopted in 1990, and has only been peripherally amended to include the barest, inadequate pieces of numerous scientific research reports, conservation science, ecological, wildlife, watershed, and fisheries needs, goals, and objectives.***

Federal environmental policy laws and federal judicial case-law clearly require that agency Forest Plans be periodically updated, and be amended to incorporate new scientific research, ecological needs, and conservation goals." (8-16)

Response # 34: The Forest Plan has been periodically amended since its signing in 1990 to incorporate new scientific information, ecological needs, and conservation goals.

" Fourth, the 18 Fire timber sale(s) would violate the Global Climate Change Prevention Act. 7 U.S.C. § 6701 (2000). Logging national forests exacerbates adverse changes in the global climate by reducing the carbon absorption function of national forests and by releasing carbon stored by these forests into the atmosphere. The adverse ecological and economic effects of increases in atmospheric carbon caused by national forest timber sales has not been disclosed nor incorporated into the DEIS by the Forest Service when it proposed and authored the 18 Fire DEIS. This failure is a violation of the Global Climate Change Prevention Act." (8-72)

Response # 35: Plants, through photosynthesis, convert airborne carbon (CO2) into carbon or cellulous such as branches and boles. This uptake from plants and the oceans are the largest sinks of carbon. When a plant dies, carbon sequestration by that plant discontinues. Since no live trees would be harvested no net increase in atmospheric carbon would occur with this salvage timber sale. There would be a net decrease of atmospheric carbon from Alternative 2 as the dead trees are converted into wood products (carbon sink) and the newly planted trees convert airborne carbon into plant material.

"In the Draft EIS (Page 121), no cost estimate is made for the control of competing vegetation."… *"**A herbicide treatment method should be considered to control competing vegetation around trees."(10-1).***

Response # 36: The cost of matting is included in the estimate of $334,925 for planting 1936 acres. The cost is estimated to be approximately $100 to $150 per acre depending on the number of trees planted and is included in the District Files. Reforestation was considered in this analysis even though the fire and not timber salvage created the need for reforestation (FEIS, page 128). The Region 6 Office is currently looking at the active use of herbicides to reduce the cost of controlling and competing vegetation, however District experience has shown that areas such as the 18 Fire can be successfully reforested without the use of herbicides and the use of herbicides is outside the scope of this project.

PURPOSE AND NEED
" Like the Davis fire DEIS, the 18 Fire DEIS states that the 18 fire was human-caused, but does not disclose what conclusions have been reached—if any—as to whether this was an accidental fire or an intentional arson fire." (8-2)
"Our organization is extremely concerned that the current proposal to commercially log the Deer Winter Range area of the 18 Fire, much like the similar proposal to log the Davis Lake LSR, may be essentially the same as the FS previous proposal to log Warner Creek. It is clear, that unless a management policy is adopted which mandates that all fires which are potentially arson-caused (whether proven or not) can not be proposed for commercial logging sales, no LSR, old growth area, big game winter range, or other administratively withdrawn forest area will be safe from arson, as both the financial incentives and polarized-pro-logging motivations pose too great a risk." (8-3)

Response # 37: After investigation by the Central Oregon Interagency Arson Task Force, the 18 Fire was determined to be human caused fire of undetermined specific cause (FEIS, pg.4).

"We suggest rewriting the "purpose and need" as follows would be a first essential step in this direction: 1) Protect and conserve the natural resources within the fire area; 2) Utilize high quality scientific research and the site-specific needs of the area; 3) Conduct needed

restoration which both provides for the habitat needs of native post-fire forest species and the long-term reestablishment of natural forest conditions." (8-15)
"The 18 Fire DEIS's deceptively Orwellian "Purpose and Need" fails to both incorporate the abundant relevant science regarding post-fire area management, including wildlife as well as ecological needs in burned forest ecosystems, and to disclose the truth of what the agency is actually planning in the 18 post-fire area. Indeed, the purpose and need is in conflict with itself, as recovering commercial value by providing timber products is antithetical to expediting the establishment of a ponderosa pine forest ecosystem." (8-17)

Response # 38: This Purpose and Need stated in comment 8-15 has similar attributes to the 18 Fire Purpose and Need: "Expedite the establishment and restoration of a dry, ponderosa pine forest following a stand replacement fire (FEIS, pg.8)". As noted in the FEIS scientific research was used to address the site-specific needs of the area, while protecting and conserving the natural resources within the fire area. Nothing in the scientific literature suggests that timber salvage as purposed under Alternative 2, followed by planting ponderosa pine trees will not successfully establish a ponderosa pine forest (FEIS,pgs.138 to 155)

.

"Inclusion of this clause as part of the purpose and need violates both the NEPA and federal case-law, prohibiting the arbitrary and capricious predisposition of an EIS towards the selection of a logging alternative. Indeed, given this clause, the agency should not have included alternatives 1 or 3 at all, as they do not provide for the agency's interpretation of what constitutes "recovery of commercial value" —leading one to question whether the reason alternatives 1 and 3 were included at all is simply a shallow attempt by the agency to "lawsuit-proof" this DEIS from challenge with the pretense of considering all options." (8-18)

Response # 39: Inclusion of the goal "recover commercial value" does not predispose the Decision Maker from choosing either the no action alternative (Alternative 1) or a non-salvage action alternative (Alternative 3). The NEPA requires consideration of a No Action alternative. Both of these viable alternatives are important for comparative and baseline purposes with an action alternative that includes timber salvage.

RANGE OF ALTERNATIVES
"While your preferred alternative should treat more than 37 percent of the total volume within the fire area, we feel you need to be more aggressive within the scope of the proposed preferred alternative and increase the harvest volume." (3-4)
"Alternative 1 and 3 should not (have) been considered at all. A modified Alternative 2 is the best one." (3-5)

Response # 40: More salvage harvesting was not included because there was a need to provide for high quality forage habitat for woodpeckers, big game hiding cover, and soil productivity (FEIS, pgs.4 to 34)

.

"The DEIS also failed to consider another alternative (or a modified alt.3) that would leave all of the large snags and manually treat some of the small fuels <8-12 inches dbh, in order to reduce fire hazard without the loss of snag habitat or the serious adverse effects of heavy equipment and roads." (7-24)
"***The DEIS has failed to develop an alternative which would only remove snags and dead-wood fuels between 4" to 12" dbh, which is supported by conservation-science based***

recommendations that restoration actions could include the thinning and removal of small diameter fire prone fuels up to 12" dbh as needed to reasonably accomplish fuels reduction objectives (snags, downed logs, small diameter live trees wherever they are too densely placed, limbs, ladder fuels, brush, etc.)." (8-19)

Response # 41: As discussed in Response #19 small trees less than 12 inches dbh in diameter are not a current or future fuel concern due to the decay that would occur over the next 20 to 40 years.

"Please consider at least one non-commercial, restoration-only alternative that invests in restoration and recovery of the fire area by, for instance, eliminating livestock grazing, emphasizing native species recovery, not building any new roads, stabilizing soils disturbed by the fire suppression effort, decommissioning unneeded roads." (7-40)
"The NEPA analysis fails to consider a minimal restoration and natural recover alternative." (7-44)
Areas such as the 18 Fire are best left to continue to recover naturally, with the addition of such restoration efforts as are truly needed and helpful—without the additional harms of commercial logging." (8-5)

Response # 42: Alternative 3 was developed to address these concerns (FEIS, pgs. 22 to 23).

"***There must be no logging within Deer Winter Range habitat."(8-6)***

Response # 43: The goal of Deer Winter Range is 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 (LRMP, pg. 4-113).

"***The DEIS also fails to address or incorporate any of our substantive comments, raising questions as to the degree of importance the agency really attaches to citizen and ecological organization's comments during the NEPA process. Is this comment period process merely a window-dressing sham hiding and preceding the implementation of projects which have already been decided upon in advance by the agency?" (8-30)***

Response # 44: Based on scoping and a field trip with representatives of Blue Mountain Biodiversity and PROWL the following changes were made: 1) dying trees were excluded from salvage (FEIS, pg.9); 2) non-salvage clumps were added to Alternative 2 design (FEIS, pg.22); 3) the scenic views management area was excluded from salvage and reforestation (FEIS, pg.11 and 16) an additional 40 acres were excluded from salvage for monitoring the effects of salvage on vegetative recovery (FEIS, pg. 30).

"***However, the basic programmatic direction fails to evidence independent analysis or any meaningful incorporation of the Beschta post-fire management science." (8-29)***
"Also, consider an alternative modeled on the recommendations of the Beschta report" (7-41).
"The failure of the agency to incorporate Beschta Report recommendations, include those which call for leaving at least 50% of the snags of all diameter classes." (8-32)

Response # 45: The Forest Service agrees with Beschta et al. that care should be taken in designing salvage projects. The 18 FEIS contains an extensive array of guidelines and

procedures to prevent and mitigate environmental impacts during timber salvage and restoration activities (FEIS pg 23 to 29).

Appendix G of the FEIS documents how the 18 Fire Recovery Project FEIS alternatives incorporate Beschta post-fire recommendations. Alternative 2 is a timber salvage alternative that is modeled after many of the recommendations of the Beschta Report. For example under Alternative 2: no salvage logging would occur in sensitive areas, all live trees would be left, over 50 percent of all diameter classes would be retained, boom-mounted shears instead of conventional ground based equipment would be used, no new permanent roads would be built and many of the existing permanent roads would be obliterated and active reseeding or planting of grasses would not occur. No structural post fire restoration would be implemented although the lack of any surface water within or adjacent to the project area obviates this consideration.

REFORESTATION
"It is important that any replanting done by the agency reflect the historical natural diversity of species composition within this area." (8-4)

Response # 46: As discussed in the FEIS, all areas considered for reforestation (pg 138 to 155) would be planted with ponderosa pine. Except for ponderosa pine, only a few scattered juniper and lodgepole pine exist within the 18 Fire (FEIS, pg 4) and these two species can be expected to regenerate from dormant seed in the soil. Ponderosa pine seedlings will be grown from locally collected seed within the Bend/Fort Rock Ranger District and breeding zone (FEIS, pg 147).

ROAD CLOSURES
Only roads that are in poor locations should be considered for decommissioning. Keep as many roads as possible open for rehabilitation work and for future fire access, as well as for administrative and recreational uses." (3-6)
"I would like to see the roads in the area kept open after timber harvesting and I would like to see only ground based timber harvesting methods used." (1-2)

Response # 47: The Roads and Transportation section of the FEIS (pages 163 to 165) discusses the roads analysis that was done for this project. This analysis was used to identify roads needed for future administrative and recreational access, as well as roads that will not be needed. Alternative Design got timber salvage would utilize modern, ground-based, feller-buncher systems and designated skid roads to minimize soil disturbance (FEIS, pg 8).

"Consequently, EPA supports the measures included in the proposed Alternative 2 that would decommission 7.0 miles and close 2.9 miles of roads within the forest." (5-1)
ODFW supports the forest's proposal to reduce road densities by closing and rehabilitating 3.5 miles of temporary roads, decommissioning another 7.0 miles and closing an additional 2.9 miles of roads. Further, we recommend road density be reduced to 1 mile per square mile and enforced from December 1 to March 31 to protect wintering mule deer." (4-3)
"We didn't see where the forest would restrict OHV travel to designated roads and trails as purported during project planning. We recommend the Forest close the area to OHV travel except on designated roads and trails." (4-4)

Response # 48: Currently the 18 Fire project area has an area closure (FEIS, page 5). After the area closure is lifted a seasonal road closure from December 1 to March 31 to protect wintering mule deer will be implemented.

ROADS
"However, the agency has also proposed the construction of 3.5 miles of so-called "temporary roads." These new roads are slated to only be closed by the purchaser after project completion, rather than obliterated and removed completely." (8-24)
"***The DEIS fails to disclose if the tally of remaining roads—including all functional roads (and closed "temporary roads")—fails to meet Forest Plan (FP) standards, and fails to disclose how far this tally remains in violation of FP standards in general, or how the agency plans to correct this." (8-25)***
"***Action alternative 2, while pretending to reduce area road density, actually would introduce roads into presently unroaded portions of the project area--further degrading and fragmenting an already damaged ecosystem which is in violation of Forest Plan standards." (8-26)***
"***We herein emphatically state that absolutely no new roads of any kind, including so-called "temporary roads" as well as logging skid trails, skyline routes, or other management openings which further fragment the area forests (including helicopter landing decks) can be constructed within this severely fragmented forest area." (8-27)***
"***After a thorough reading of this DEIS, one is left to wonder if there are any uninventoried roadless areas or defacto roadless areas anywhere within or adjacent to the project area, and what potential impacts the proposed logging may have on contiguous forest areas." (8-28)***
*"****The DEIS fails to adequately discuss the impacts to elk and deer, and other wildlife, from the proposed logging – including proposed road construction and reconstruction –as well as the impacts from the proposed logging and the extensive fire. The DEIS fails to disclose the effectiveness – or lack thereof – of road closures in the area." (8-58)***

Response # 49: Alternative 2 establishes 3.5 miles of temporary road to facilitate salvage. "Following timber harvest operations, the temporary access routes would be obliterated and reconditioned to a natural state" (FEIS, pg.165). Target open road densities in the LRMP are used as a threshold for further evaluation rather than an absolute standard (LRMP, pg. 4-115) and the remaining 1.9 miles/square mile of open road (FEIS, Figure 3-30) would meet LRMP target open road densities.

No uninventoried roadless areas or defacto roadless areas exist withn or adjacent to the project area (FEIS pg 17).

As noted in the roads and transportation section of the FEIS (Figure 3-30) there is no road reconstruction. Effects on deer and elk are discussed on pages 75 to 104 of the FEIS. Road closure effectiveness is high (FEIS, pg 26).

SCENIC VIEWS
"The NEPA analysis must address the negative scenic impacts of salvage logging relative to natural recovery." ***(7-59)***

Response # 50: There are no proposed treatments in Scenic Views (FEIS, pg 11 and 16). The effects of the alternatives, including salvage logging, on Scenic Quality is discussed on pages 166 to 168 of the FEIS.

SNAGS/DOWN WOOD
"We do support Alternative 2, your preferred alternative, however we feel that snag levels should not exceed the Forest Plan level (3-2)

"Snag retention standards and the DEIS analysis of the value of snags and down wood are not based on high quality science." (7-5)
"The agency's reliance on DecAID in its pseudo "analysis" of potential impacts to snag dependent species fails to recognize that "DecAID is NOT: … a snag and down wood decay simulator or recruitment model [or] a wildlife population simulator or analysis of wildlife population viability. …" (8-33)
"The DEIS lacks a temporal dimension required to understand the long-term effect of salvage logging on snag habitat. Salvage logging will remove too many large snags and lead to future violations of LRMP standards for snag habitat." (7-4)
"Be sure to use the DecAID tool appropriately. The agency must address the dynamics of snag habitat over time, by accounting for snag fall rates and snag recruitment rates which are not accounted for in the DecAID advisor." (7-31)
"Blind reliance on DecAID is inappropriate. DecAID does not pick the management objective." (7-30)
"DecAID tolerance levels need careful explanation. These tolerance levels are very difficult to put in terms that are understandable by the general public, but if the Forest Service is going to use this tool they must make it understandable." (7-33)
"***The agency NEPA analysis should disclose the published literature with higher levels of snag and wood retention and discuss their potential relevance for the project." (7-32)***

Response # 51: As noted under Response #4, desired conditions of snag and CWD habitat are based in part on management recommendations and guidelines provided by the Deschutes National Forest Land and Resource Management Plan, Deschutes National Forest Wildlife Tree and Log Implementation Strategy and Eastside Screens as modified by the best available science contained in the Interior Columbia Basin Final Environmental Impact Statement (ICBEMP), ICBEMP DEIS, DecAID, Beschta and other literature (Chapter 3, Wildlife).
As noted DecAid was used appropriately as one of many guides to determine appropriate snag level retention and alternative design juxtaposed with non salvaged clumps of snags. A time-dynamic simulator analysis of fuels, snags, green trees and snag recruitment is located under the Forest Vegetation and Timber Management section of Chapter 3.
A literature review that incorporates the range of studies of snag levels and wood retention is discussed in the wildlife section of the DEIS and Appendix B.
In the past the Deschutes Wildlife Tree and Log Guide and the Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards For Timber Sales (East Side Screens), as it amends the Deschutes Forest plan, has been used for managing snags and coarse woody material. In 2002 a new tool was developed called Decayed Wood Management Advisor (DecAID) (Mellen et al., 2002) to help specialists manage snag and log levels best suited for their management area and associated wildlife species. The DecAID advisor arose from the recognition by the Pacific Northwest Region, USDA Forest Service, of the growing need to update guidelines for managing snags and down wood. Based on direction to use the best available science and guidance to manage habitat for wildlife species, DecAID is a summary, synthesis, and integration of published scientific literature, research data, wildlife databases, forest inventory databases, and expert judgment and experience. The information presented on wildlife species use of snags and down wood is based entirely on scientific research and does not rely on modeling the biological potential of wildlife populations. DecAID is an advisory tool to help managers evaluate effects, of forest conditions and existing proposed management activities on organisms that use snags and down wood. It also can help managers decide on snag and down wood sizes and levels needed to help meet wildlife management objectives. DecAID presents information on wildlife use of snag diameter, snag density, down wood diameter, and down wood percent cover, and on the range of natural (unharvested) and current (all) conditions of snag density

and down wood percent cover by diameter classes. The information is presented at three statistical tolerance levels which may be interpreted as three levels of "assurance:" low (30 percent tolerance level), moderate (50 percent tolerance level), and high (80 percent tolerance level). (Marcot et al. 2002).

The stand types associated with the project area are low elevation, ponderosa pine dry. The rational to choose a tolerance level is based on the aspect of the habitat type and the fire regime. The ponderosa pine dry PAG has a lower moisture level due to aspect and stand orientation and fires within it were probably high frequency and low intensity. Due to the frequent low intensity fires and lower vegetative production, snag and CWD levels were historically lower in these areas. Tolerance level for ponderosa pine dry would be managed at the 50 percent tolerance level. The 50 percent tolerance levels for ponderosa pine/Douglas fir (Small-Medium) Habitat Type/Structure is displayed in Table 3-9.

"Salvage: Protect all large snags." (7-46)
"At most, no trees over 12" dbh should be logged as the area has suffered far too much tree mortality and loss of habitat cover already. All medium to large snags are essential for continued habitat for woodpeckers, such as Oregon State sensitive listed Black-backed, as well as the use of the area by numerous other avian species—and the prey of these species who depend upon the many snags for habitat." (8-12)
"This project will drive the regional ecosystem further from the natural range of variability, because the entire eastside is already far below NRV for large snag habitat, and this project will remove thousands of large snags. If anything needs to be done to restore the NRV it is to remove ingrowth, that is, small material that grew up as a result of fire suppression." (7-2)
"***The NEPA analysis must account for all the values provided by snags and down wood and the effect of removing these legacy structures." (7-25)***
"***While we agree that snags and down wood must not be averaged over wide areas, we also must emphasize that snags and down wood are far below historic levels on non-federal lands, so in order to ensure viable populations of wildlife and avoid trends toward ESA listing, federal lands must be managed to compensate for the lack of down wood on non-federal lands." (7-34)***
"According to Table 3-8, Lewis' woodpeckers need 25 snags/acre, and White-headed woodpeckers need over 50 snags/acre, but the DEIS does not clearly disclose how these objectives will be met with salvage logging that removes all but 3 snags/acre. The DEIS fails to even recognize a management objective related to Black-backed woodpecker." (7-3)
"***Pages 88-94 clearly show that salvage logging will reduce snag habitat below recommended levels for many species, but the DEIS fails to disclose snag levels will only get worse for the next several decades!" (7-23)***

Response # 52: Both Alternatives 1 and 3 would retain all snags. Table G-2 page 52 shows the percent of dead and green trees retained by diameter class for all alternatives. A total of 55.7 percent of the large dead trees would be retained under Alternative 3 and 68.8 percent of the large dead and remaining large live trees

A discussion of the Historic Range of Variability is located in the Forest Vegetation and Timber Management Section of Chapter 3. The effects and values of snags and down wood and removing a portion of those is covered extensively in Chapter 3.

The wildlife section of the FEIS did not identify that any of the alternatives would lead to a trend towards ESA listing of any of the species associated with the 18 Fire project area. As

noted in the FEIS there are no private lands within or adjacent to the project area (FEIS, Chapter 1).

Species such as Lewis' and white-headed woodpeckers are provided for by leaving unsalvaged clumps within the salvage units and by leaving much of the fire unsalvaged. For example Table 3-13 shows post salvage snag and CWD levels by diameter class. Under Alternative 2, over 1,800 acres would not be salvaged and all of the snags on those acres would be available habitat for these and other associated species.

"Table 3-9 on page 81 of the EIS appears to be based on inventories that reveal "average" conditions that ignore the natural pulse of snags that would be expected after wildlife." (7-8)

Response # 53: Snag levels following the 18 Fire are at higher levels than naturally found (FEIS, page 143). As noted on page 82 of the FEIS, Table 3.9 represents general desired conditions for snags and down wood.

"The DEIS does not disclose the cumulative effects of salvage logging on habitat for wildlife associated with snags and dead wood." (7-21)
"Recognize the effects of compound disturbances such as fire and fire suppression followed by logging and treatment of activity fuels." (7-42)
"Recognize that dead and down wood are key elements of the forest ecosystem." (7-43)

Response # 54: Cumulative effects of salvage logging and other management activities within and adjacent to the project area on habitat for wildlife associated with snags and down wood and other species associated with the project areais covered extensively on pages 75 to 104 of the FEIS.

"In order for the NEPA analysis to fully address the snag habitat issue it must look carefully at the snag gap from both ends.

- ***a. The snag gap begins when too many of the current snags are gone. So the snag gap is exacerbated on the front end by salvage logging which removes too many large snags.***
- ***b. The snag gaps ends when the next stand grows to the point that it contains large trees and some of them die, so the snag gap is exacerbated on the back end if there is a significant delay in tree regeneration." (7-47)***

"Snag retention should be both clumped and well-distributed, not all clumped." (7-48)

Response # 55: The FEIS recognizes that many of the damaged trees will die over the next 10 to 20 years. These "time release" snags will provide needed habitat and help shorten the "snag gap" between when current existing snags fall down and new snags are created by the regenerated forest (FEIS, pgs. 75 to 104, and 138 to 159). In addition, green trees that survive the fire will be available to be made into snags if needed. A time dynamic simulator was included of the snag gap in the Forest Vegetation and Timber Management section of the FEIS. Planting trees would shorten this gap considerably along with the retention of all remaining live trees and complete retention of all trees within low mortality areas where additional mortality from insects can be expected both within and contiguous to the 18 Fire perimeter (FEIS 156 to 159).

As noted before snags would be both clumped and well-distributed (Response #52).

"***The proposed snag retention levels of the logging alternatives fail to address the likely increased windfall of the retained snags due to the logging-caused openings throughout the forest." (8-45)***
"***The proposed snag retention levels of the logging alternatives fail to address the likely increased windfall of the retained snags due to the logging-caused openings throughout the forest." (8-45) "The logging alternatives fail miserably to provide habitat for any avian species other than flickers (which are more tolerant of openings), hairy woodpeckers, red tail hawks (foraging habitat perhaps), and other non-forest canopy-dependent species--which are currently in abundance due to decades of over-logging having created far more open forest, clear-cut "meadows" and young sapling-congested even-aged stands." (8-46)***

Response # 56: Increased windfall of snags from logging caused openings has not been documented on the district. Snags because of the lack of green needles are very wind resistant compared to live trees. See Response # 52 for species and snag retention discussion.

SOILS
"Salvage logging and associated activities will cause cumulative impacts on soil that violate requirements to maintain 80% of soils in a non-detrimental condition." (7-11)
"The cumulative effects of standard logging practices are likely to violate soil standards." (7-71)

Response # 57: Managing soils for sustained productivity is a key issue identified on pages 14, 36 and 37 of the FEIS. There are no violations of Regional policy (FSM 2520, R-6 Supplement No. 2500-98-1) or LRMP management direction for maintaining and/or enhancing soil conditions in any of the activity areas proposed with this project. The environmental consequences are discussed at length in the FEIS on pages 36 to 74.

As disclosed in the FEIS (page 51 to 52), management direction is incorporated into soil restoration objectives that would be applied to reduce cumulative levels of detrimental soil conditions anticipated from this project. Existing detrimental soil conditions are mainly associated with existing roads and range from less than 1 percent to 3 percent of the unit areas. FSM 2520.3 specifically states: "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" (FEIS, page 52). Under Alternative 2, subsoiling treatments would be accomplished as described in a mitigation measure (FEIS, page 24 to 27), but this is not a mandatory part of the proposed actions which is required to comply with Regional and LRMP standards and guidelines for maintaining soil productivity. As disclosed in Table 3-4, none of the activity areas would exceed the Regional and LRMP standard of 20 percent detrimental soil conditions following salvage harvest activities.

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 (FEIS, page 52). One of the goals for meeting the purpose and need for this project is to expedite the establishment and restoration of a dry, ponderosa pine forest following a stand replacing fire (FEIS, page 8). Since it is unlikely that these activity areas would be re-entered for mechanical harvest within the next 40 years (FEIS, Table 3-24), some immediate soil restoration is included in the proposed actions to improve the hydrologic function and productivity on disturbed sites which also helps promote the recovery of pine trees and other native vegetation.

"Soil degradation occurs at thresholds that are not detected by the FS definition of "detrimental soil conditions" the NEPA analysis based on these criteria will underestimate the effects of management. NEPA requires the agency to disclose all soil impacts not just those that meet these arbitrary criteria." (7-13)
"Soil Quality Standards underestimate soil impacts. Soil degradation occurs at thresholds that are not detected by the FS definition of "detrimental soil conditions" the NEPA analysis based on these criteria will underestimate the effects of management. NEPA requires the agency to disclose all soil impacts not just those that meet these crude criteria." (7-72)

Response # 58: The Pacific Northwest Region (R-6) and all other Forest Service Regions established soil quality policy and standards that limit detrimental soil disturbances associated with management activities. Based on the best available technical data and professional judgment, standards for determining detrimental compaction, puddling, displacement, and severely burned soils were developed for monitoring observable and measurable soil characteristics that do not require expensive or time-consuming laboratory procedures. The threshold value (20 percent) is considered to be the smallest detectable change (statistically) at operational levels of monitoring. It is intended to be a warning when adjustments in management practices need to be made to prevent unacceptable loss in soil productivity. This soil quality standard and policy was incorporated at the Forest level under the Deschutes Land and Resource Management Plan (LRMP), as described on pages 51 and 52 in the FEIS. Also see response # 65.

The appropriate time to raise concerns about LRMP standards and guidelines is during the Forest Planning or Revision process. The relevancy of this threshold standard or other management direction is outside the scope of a project-level analysis.

"The DEIS (p 61) asserts that "logic and experience suggest" that logging trees over 12" dbh while leaving trees <12" dbh will result in "less intensive future wildfires." This is unsupported by the science which clearly indicates that fire hazard reduction will require removal of small material and fire hazard reduction does not require removal of large material." (7-17)

Response # 59: This comment quotes selectively and leaves out the rationale that lower fire intensity and less potential for severely burned soil would occur in areas where some of the hazardous fuels are removed through management treatments. There is no suggested correlation with the diameter size of salvaged trees. The only discussion about small-diameter trees (less than 12 inches) is the expectation that many of these dead trees will likely fall to the ground within 3 to 5 years. Experience during post-fire field assessments (BAER) indicates that severely burned soils are typically found where extreme temperatures of long duration were caused by the complete consumption of downed logs or residual stumps. On the eastside of this forest, even large-diameter logs (greater than 12 inches) are typically consumed by wild land fires during the dry summer months when fuel moistures are low. Regardless of the diameter size, heavy fuel loadings of down woody debris increase the potential for intense ground-level fires and excessive soil heating capable of altering soil properties that affect site productivity.

"Please consider all the many values of snags and down wood presented in Rose, C.L., Marcot, B.G., Mellen, T.K., Ohmann, J.L., Waddell, K.L., Lindely, D.L., and B. Schrieber. 2001." (7-26)

Response # 60: The **F**EIS acknowledged the values of snags and down wood by developing issue indicators which were used to evaluate predicted changes in the amount and composition of these important landscape components. The management requirements built into the action alternatives ensure that adequate amounts of snags and coarse woody debris would be retained following project activities to maintain soil productivity and provide habitat for dependent wildlife species. The minimum requirement of 1.4 percent (surface area) coverage of down wood for wildlife habitat would also meet the soil resource objective of 5 to 10 tons of CWD per acre to provide nutrient supplies and desirable biological benefits for maintaining soil productivity (FEIS, pg. 27).

Under natural conditions, the amount of down woody debris will gradually increase as fire-killed snags fall to the ground over time. 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). Under Alternative 2 (proposed action), the predicted fuel load would be reduced to an acceptable range of 15 to 20 tons per acre (FEIS, pg. 135).

"The NEPA analysis must consider research suggesting that the rapidity of mycorrhizae formation in young plants following disturbance may be critical. Borchers and Perry, "Effects of Prescribed Fire on Soil Organisms, Chapter 13 in Natural and Prescribed Fire in Pacific Northwest Forests, Walstad, Radosevich, and Sandberg, editors, OSU Press." (7-55)
"Respect the soil foodweb. In undisturbed ecosystems, the soil foodweb is a tightly coupled below-ground ecosystem that directly affects many above ground processes such as succession, plant establishment and growth, and erosion and water quality.
In a forest, this below-ground ecosystem is fed primarily by photosynthates exuded from the fine roots of trees. These photosynthates feed a plethora of bacteria and fungi species which feed thousands of arthropod and nematode species and so on. Each species fills a niche and represents both a sink and a source and of nutrients for other organisms.
Logging will kill trees and cut off the supply of photosythate which forms the basis of this food web, so the tightly coupled nutrient retention systems will be disrupted, allowing nutrients to "leak" from the system.
Burning slash piles also kills the below ground ecosystem and soil compaction from road building and other heavy equipment kills or destroys habitat for many soil dwelling species and shifts the below ground ecosystem from aerobic to anaerobic.
The NEPA document fails to consider these significant effects." (7-73)
"The DEIS does not sufficiently recognize the importance of mycorrhizal fungi on forest growth and productivity." (8-60)

Response # 61: The FEIS acknowledges that mycorrhizal fungi and other soil organisms depend upon the continuing input of woody debris and fine organic matter for maintaining favorable biotic habitat. A balance between management practices and ensuring adequate amounts of coarse woody debris (CWD) is an important goal for managing the soil resource (FEIS, page 46). 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). These recommendations were incorporated into a management requirement for this project (FEIS, page 27). Under Alternative 2, existing sources of woody debris and surface litter would be retained on-site and protected from disturbance to the extent possible. Enough fallen trees, broken limbs, and other logging debris would likely be available in the short-term to meet the

recommended guideline for CWD retention on these dry, ponderosa pine sites (FEIS, page 61 to 62). Also see response to comment 7-26 (above).

Losses of soil microbial and fungal populations most likely occurred where forest litter and duff layers were completely consumed in localized areas of this fire. 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). Due to the minor amount of severely burned soil, 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 (FEIS, page 38 to 40). 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). Re-growth of sprouting shrubs and herbaceous forbs and grasses are already establishing live cover in most affected areas. Microbial activity and fungal populations are expected to rebound in response to new root growth and the decomposition of woody debris and surface litter.

The effects of ground-based salvage logging would likely be similar to those observed in unburned stands of live trees. Although the recovery of biotic habitat would be delayed on compacted logging facilities, subsoiling treatments on these sites would improve subsurface conditions by restoring the soils ability to supply nutrients, moisture, and air that support soil microorganisms (FEIS, page 56 to 57). Research studies on the Deschutes National Forest have shown that the composition of soil biota populations and distributions rebound back toward pre-impact conditions following subsoiling treatments on compacted skid trails and log landings (Moldenke et al., 2000).

Under Alternative 2, much of the unusable stemwood and tops would be machine piled and burned on log landings (FEIS, page 55). This fuel reduction method would not cause additional 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 compacted soil committed to log landings following these post-harvest activities. There would be no machine piling, prescribed burning or hand treatments for reducing and/or rearranging activity-created fuels in random locations of activity areas.

"Salvage logging and associated activities such as site prep, fuel treatment, and planting kills understory vegetation which will significantly reduce site productivity." (7-58)

Response # 62: The development and use of temporary roads, log landings, and skid trail systems for ground-based logging are the primary sources of physical disturbance that would result in adverse changes to soil productivity and understory vegetation. The proposed actions do not include mechanical treatments for reducing activity-created fuels and/or preparing sites for reforestation. Scalping to prepare sites for hand planting would be used to reduce plant competition around the planted seedlings, but this activity would have a negligible effect on overall ground cover and site productivity within activity areas.

Based on the disturbed area estimates for Alternative 2, the percentages of detrimental soil conditions would increase above existing conditions by approximately 12 to 14 percent in each of the proposed activity areas (FEIS, pg. 56 to 60). This would leave at least 84 percent of the unit area in an undisturbed condition with adequate ground cover of understory vegetation and surface litter to protect the soil surface. All reasonable BMPs would be applied to control surface erosion on and adjacent to roads and logging facilities that would be used during project implementation (FEIS, page 67). Soil restoration treatments

(subsoiling) would be applied to reduce the cumulative amount of detrimentally compacted soil within all eight of the proposed activity areas (FEIS, pgs. 24 to 27). Soil restoration treatments, such as subsoiling, are designed to promote maintenance or enhancement of soil quality and the growth of vegetation. Although all pre-impact conditions are not fully restored immediately following treatment, subsoiled areas would have favorable soil physical conditions that improve the soils ability to supply nutrients, moisture, and air that support vegetative growth and biotic habitat (FEIS, pgs. 56 to 57). The recovery of herbaceous vegetation would likely occur within two to three growing seasons following treatment.

"Avoid rather than mitigate soil and water quality. Do not rely on BMPs." (7-69)

Response # 63: The use of mitigation is defined by NEPA policy included in the Council of Environmental Quality (CEQ) Manual. 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 to rectify the impact by restoring the affected environment (40 CFR 1508.02).

The management requirements, mitigation measures, and BMPs listed for the soil resource (FEIS, pages 24 to 27) are all designed to minimize, avoid, or reduce potentially adverse impacts from the ground-disturbing activities proposed with this project. Project design elements and operational guidelines for equipment use would limit the amount of surface area covered by logging facilities. All reasonable BMPs would be applied to control surface erosion on and adjacent to roads and logging facilities that would be used during project implementation (FEIS, page 66). Subsoiling treatments would be implemented within all eight of the proposed activity areas to rectify cumulative levels of detrimentally compacted soil on temporary roads and logging facilities (FEIS, page 25). If the Responsible Official selects an action alternative, these management requirements, mitigation measures, and BMPs are to be implemented during and following project activities to meet the state objectives for protecting and maintaining soil productivity (FEIS, pgs. 62 to 68).

"Post-fire soils in this area are erosive sandy soils, with many areas of sensitive soils which would be severely disrupted and displaced by the proposed logging. However, if left unlogged, area soils will be spared unneeded further degradation, and both the soil quality and recovery timeline will be improved. It is clear that if the agency is serious in its purported goal to enhance and accelerate the recovery of forest structure in this fire area, it should abandon its proposed logging plans, as such logging will only further degrade and destroy the soils upon which a healthy recovering forest depends." (8-10)
"steep slopes--units located on steep slopes need to be dropped from any proposed commercial logging." (8-11)

Response # 64: As disclosed in the FEIS (pgs. 36 to 74), 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). 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 (FEIS, page 53). The effects of ground-based salvage logging on these soil types are expected to be similar to those observed in unburned stands of live trees.

Under Alternative 2, the majority of the activity areas proposed for ground-based salvage logging do not occur on landtypes that contain sensitive soils (FEIS, pgs. 43 to 61). None of

the proposed activity areas overlap landtypes with steep slopes greater than 30 percent (FEIS, Figure 3-1), potentially wet soils with seasonally high water tables, or sensitive soils with high erosion-hazard ratings that would require special mitigation. The activity areas are located on gentle to moderately sloping terrain where the maneuvering of equipment generally does not displace soil surface layers that would qualify as a detrimental soil condition (FEIS, pg. 51, FSM 2520 definitions). Accelerated surface erosion is not a major concern because adequate soil cover currently exists to control erosion on the dominant soils and landforms that were affected by the 18 Fire (FEIS, pgs. 43 to 45).

The potential for successful regeneration is limited by properties such as soil depth, soil fertility, and temperature extremes on sites such as frost pockets, cold air drainages, and localized areas of rocky lava flows. As disclosed in the FEIS (pgs. 42 to 43), all activity areas proposed for salvage harvest and associated activities meet land suitability criteria for timber management that would allow them to be regenerated or resist irreversible resource damage. 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 (FEIS, page 60).

"Logging this area would further adversely impact soil hydrology, resulting in loss of vegetative and snag cover, loss of moisture retaining large diameter snags and logs, impaired soil resiliency and subsurface soil communities, and impaired forest stand recovery. Increased solar exposure of area soils will result in loss of water retention and increased peak flows during heavy rains and snowmelt conditions." (8-23)

"Soil hydrology and potential impacts to soils, including water retention, must be sufficiently assessed, which this EIS fails to do." (8-61)

Response # 65: Although the 18 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 and the hydrologic function of soils. Based on field reconnaissance of post-fire soil conditions, approximately 61 percent of the burned acreage classified as low burn severity and 39 percent classified as moderate burn severity (BAER Soil Specialist Report, 2003). Low severity burns generally do not remove the litter and duff layer, and most organic matter remains incorporated in the soil surface. Most areas that burned with moderate severity still have about half of the surface organic materials left in place. 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 (FEIS, pgs.38 to 39).

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. Measurements of post-fire infiltration rates of surface soils affected by moderate severity burns did not indicate elevated levels of hydrophobic (water repellant) soil conditions that would lead to increased surface runoff and extended periods of soil erosion (FEIS, pg. 39). 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). Although the fire killed vegetation and reduced evapotranspiration rates within affected areas, most of the water yielded from this landscape is still expected to be delivered to streams as subsurface flows that emerge at lower elevations outside the project area. Monitoring results of similar soils and previous fires on the district indicate that overland flow of water and evidence of surface erosion is typically non-existent in burned areas with gentle slopes (FEIS, page 48). 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 (FEIS, pg. 39).

The effects of salvage logging activities would not alter the ecological function of down woody debris within proposed activity areas because existing sources of woody debris and surface litter would be retained on-site and protected from disturbance to the extent possible. 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 Alternative 2, salvage harvest operations would be expected to accelerate the accumulation of some additional sources of woody debris where these materials are currently lacking within portions of activity areas (FEIS, page 61). The management requirements built into the action alternatives ensure that adequate amounts of snags and coarse woody debris would be retained following project activities (FEIS, pgs. 26 to 28). Existing down wood and future recruitment of fallen snags will contribute to on-site moisture retention on affected sites.

Based on post-fire field assessments (BAER) of similar fires on the eastside of this forest, even the larger-diameter logs can be completely consumed by intense ground-level fires during dry summer months when relative humidity and fuel moistures are low. Under natural conditions, the amount of down woody debris will gradually increase as fire-killed trees fall to the ground over time. Regardless of the diameter size, heavy fuel loadings of down woody materials increase the potential for intense ground-level fires and excessive soil heating capable of altering soil properties that affect site productivity.

Also see responses number 59, 60, and 61.

"The agency fails to disclose or analyze several studies regarding logging's known detrimental impacts to soils—including a study by David Perry in which he concludes that logging damage to forest soils, which have taken thousands of years to form, may take three centuries or more to fully recover. Other studies such as those by Elaine Ingham address the damage to forest soils by both logging and grass seeding, adversely impacting the ability of tree seedlings to survive. (8-31)

Response # 66: 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. The best information about the proposed actions (FEIS, pgs. 18 to 34) was used in conjunction with the location of activities to analyze the potential effects on the soil resource. Conclusions were reached through various references, local monitoring of similar activities on volcanic ash-influenced soils, LRMP direction, and nationally and regionally approved soil quality standards and guidelines. These standards and guidelines were jointly developed by soil scientists, land managers, and research scientists from FS Research Stations using the best available technical data and professional judgment. These information sources were used as guidance in determining project design elements and mitigation needs for the proposed actions (FEIS, pgs. 23 to 29).

Direct, indirect, and cumulative effects to the soil resource are addressed in the FEIS on pages 36 to 74. Most soil disturbances would be confined to known locations in heavy use areas (such as roads, log landings, and main skid trails) that can be reclaimed when they are no longer needed for future management. As disclosed in Table 3-4, none of the activity areas would exceed the Regional and LRMP standard of 20 percent detrimental soil conditions

following salvage harvest and soil restoration treatments. Also see response number 57, 58, 62, 63, and 64.

"The DEIS fails to adequately address impacts to area soils from any bulldozing which may have occurred during fire suppression activities. Both bulldozing and the proposed logging would increase the detrimental impacts to area soils and forest ecology." (8-62)

Response # 67: As disclosed in the FEIS (page 40), dozers were mainly used to clear strips of brush along the western and northern fire boundaries. Soil disturbances from fire suppression activities were stabilized to prescribed rehabilitation requirements immediately following control of the fire. None of the soil disturbances caused by bulldozers occur within any of the activity areas proposed for salvage logging. Consequently, soil disturbances from suppression activities do not increase the estimated percentages of existing and cumulative amounts of detrimental soil conditions displayed in Table 3-4. None of the activity areas would exceed the Regional and LRMP standard of 20 percent following salvage harvest and soil restoration treatments.

SOIL CUMULATIVE EFFECTS

"Recognize the effects of compound disturbances such as fire and fire suppression followed by logging and treatment of activity fuels." (7-42)

Response # 68: The effects of the wildfire and fire suppression activities to the soil resource are addressed in the FEIS on pages 38 to 40. The existing condition assessment is summarized on pages 47 to 50 of the FEIS. 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 (FEIS, page 48). Fire suppression activities did not cause cumulative increases in detrimental soil conditions within any of the proposed activity areas (FEIS, page 49). Cumulative effects to the soil resource are addressed in the FEIS (pages 64 to 68). 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 (FEIS, page 68). Also see response number 61 and 67.

"In addition to the impacts from the 18 Fire, the area suffers from the adverse cumulative impacts of decades of prior logging. Past logging throughout this area has contributed to the greater area's fragmentation and loss of both LOS and green forest habitat. Portions of the area also experienced severe burns in 1996, and much of these areas were still in long-term recovery from this earlier fire, in addition to the past logging. However, the DEIS for this project fails to adequately disclose and address these extensive cumulative impacts and fragmentation to the area's forests and wildlife, including its soil resiliency and water retention and water table levels. While the 18 fire area may not have any fish bearing streams or even any ephemeral water-courses, its soils play a role in the water retention and water tables levels upon which the area's aquatic systems ultimately depend. However the DEIS fails to address this issue or to analyze the potential impacts of this proposed logging to these systems." (8-7)

"It is clear from our surveys of the project and surrounding area, that the greater area has been significantly harmed by decades of over-logging and excessive road building, significantly fragmenting area forests, harming area soil quality, and the districts watershed resiliency and soil water retention. While the DEIS does peripherally address some of these impacts, it fails to fully disclose the extent and seriousness of these impacts,

or the serious declines of forest-dependent wildlife, botanical, and aquatic species populations due to the extensive adverse impacts to their habitat from past and ongoing management actions. The DEIS fails NEPA's legal requirements entirely by failing to conduct one EIS process disclosing and analyzing the impacts of all the past and concurrent sales together." (8-9)

Response # 69: Detrimental soil conditions from past management are mainly associated with existing roads and ground-based logging facilities which were used for timber management activities between 1979 and 1992 (FEIS, pg. 45). Although ground-based railroad logging was used to harvest ponderosa pine in portions of the project area during the 1920s and 1930s, it is expected that natural processes have restored soil quality over time. Based on more recent harvest history, it was determined that about 178 acres of previously managed areas occur within the largest of the proposed activity areas (Unit 1). Soil condition assessments were conducted within this portion of Unit 1. There was no overlap of past harvest areas with the other seven activity areas proposed for this project. Table 3-3 displays existing sources and the estimated extent of detrimental soil conditions in acres and percentages for each of the eight activity areas proposed with this project. Detrimental soil conditions are mainly associated with existing roads and range from less than 1 percent to 3 percent of the unit areas. This amount is well within the Regional and LRMP standard of 20 percent. Also see response number 57, 65, and 70.

The re-burn portions of the 1996 Bessie Butte Fire (approximately 77 acres) were low-to-moderate severity burns that consumed mainly brush patches (FEIS, pg. 48). None of the activity areas proposed for salvage logging included these previously burned acres. The Evans West and Skeleton fires of 1996 burned several miles to the east and southeast of the 18 Fire and do not overlap with the project area. Consequently, there are no cumulative effects to soil productivity from other wildfires.

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 (FEIS, page 41). The absence of stream channels within or adjacent to the project area assures that there is no potential for eroded sediments to reach any 303(d) listed water bodies or cause indirect, adverse effects to aquatic systems (FEIS, pgs. 41 and 48).

Also see response number 65 regarding soil hydrologic functions.

"Currently there are three other timber sales, adjacent to the 18 Fire and/or located across the Bend/Fort Rock Ranger District which cumulatively affect available habitat for wildlife species and would further fragment the area's forest. Together these four sales are occurring at approximately the same time period, and in the same geographic area. These sales are: the Kelsey Sale—which is interspersed with the 18 Fire sale, the Lava Cast Sale, and the Lodgepole Mistletoe Reduction Sale. NEPA, as well as ample judicial case law (BMBP vs. Blackwood, Hash Rock, Mule, etc.) very clearly requires that the FS must conduct one EIS process for adjacent and interspersed sales. Synergistically these sales will significantly compound the already extensive adverse impacts across the ranger district to wildlife habitat, forest connectivity, impaired soil conditions, hydrological functioning, and the district's aquatic systems and fish species." (8-8)

Response # 70: As disclosed in the FEIS (page 37), the soil resource may be directly, indirectly, and cumulatively affected within each of the activity areas proposed within the

project area. Burned acres that were originally included in the Kelsey Vegetation Management EA planning area were removed from this project proposal and included in the 18 Fire Recovery Project (FEIS, pg. 67). Since there is no overlap of proposed activity areas with these two project areas, 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. Likewise, there would be no cumulative soil impacts from implementation of the Lava Cast and Lodgepole Mistletoe Reduction projects because there is no overlap of activity areas within the 18 Fire Recovery project area.

Also see response numbers 65 and 69.

WILDLIFE
"Logging this area would likely result in the extirpation of many of these foraging and resident species, including the likely mortality of some individuals."(8-13)

Response # 71: No extirpations were identified (FEIS, pages 75-104).

"The EIS must disclose the habitat quality, forest stand composition(s), wildlife species utilizing the area, listed and proposed listed species known or suspected to be within the area, as well as aquatic species both within (toads, frogs, salamanders, anything??) and downstream from the area." (8-34)
"***The project's proposed logging would cause nonlisted species to trend towards listing, and listed species to trend toward jeopardy.***" ***(8-41)***
"Threatened, Endangered, and Sensitive Species. The DEIS for this project lists many wildlife species which may or may not exist within the project area. Many of these species are listed as being "suspected but not confirmed" to exist in the area. Apparently there has been little if any agency attempts to adequately survey this area for the existence of these species. As such, the agency is relying upon almost pure guesstimates regarding potential impacts to these species." (8-42)
"Second, the Endangered Species Act (ESA) requires the USFS to use the best available scientific and commercial data in assessing the impacts to species, which includes surveying for them." (8-37)
The DEIS's failure to adequately and responsibly assess the proposed project's potential adverse impacts to wolverine, including the project's likely incremental role in ongoing trends pushing this species towards uplisting under the ESA, violates NEPA and NFMA." (8-48)

Response # 72: There are no TES species within the project area. Habitat for wolverine is not found in or near the project area (FEIS, page 100, Appendix D., Biological Evaluation). There are no direct or indirect effects on any TES species (FEIS, pgs. 99 to 104, Bilological Evaluation, Appendix D).

"Among our many concerns is that of this proposed project's effect on lynx" (8-47).

Response # 73: The best available science was consulted during the assessment of lynx habitat on the Deschutes and Ochoco National Forests and the Crooked River National Grassland and this science indicated that no lynx habitat is present on the Bend-Fort Rock Ranger District or the Deschutes National Forest. Likewise, no lynx habitat has been identified and mapped in the Cascade Mountains of Oregon; therefore, no Lynx Analysis Units (LAUs) have been identified within the project area, on the Bend-Fort Rock Ranger District, or on the Deschutes National Forest. If lynx are confirmed in the project area, on the

Bend/Fort Rock Ranger District, or on the Deschutes National Forest in the future, they would receive full protection under the ESA and consultation with the US Fish and Wildlife Service would commence immediately, if necessary. There has never been a lynx confirmed in the project area. With no lynx or lynx habitat on the district an analysis of lynx prey species is unnecessary (FEIS, pg.100, Biological Evaluation, Appendix D, Canada Lynx).

"Based upon on-the-ground surveys, the habitat quality for all species is in poor condition from poor historic management activities--coupled with the impacts from the fire, which was exacerbated in intensity and extent by past illegal and harmful logging that has occurred throughout area forests under agency management." (8-39)
"***Because extensive good quality habitat will not be available for many years until much of the burned and logged areas of the planning area recover, it is unclear how wildlife species will be affected in the meantime—especially if some of the scant remaining green forest habitat available is logged across the area in other planned contiguous sales--as well as the logging of the majority of the standing large snags-- resulting in further degradation and loss of closed canopy and snag--soil holding--habitat." (8-40)***
"***The DEIS conducts a woefully inadequate review of impacts to wildlife from the proposed commercial logging." (8-36)***

Response # 74: The current wildlife habitat quality for different species is discussed at length on pages 75 to 104 and Appendix D of the FEIS. The clearcut harvesting that occurred when the area was in private ownership (FEIS, page 4) was not illegal. The majority of the large dead trees would be retained (Table G-2) and the cumulative effects of past, present and foreseeable future actions were covered throughout Chapter 3 of the FEIS.

"Management Indicator Species. Given this developing reinterpretation of the legal requirements attendant to management indicator species, it is clear that the multiple mandates in NFMA and its implementing regulations requiring population monitoring and surveying are not being even minimally met for the this proposed project." (8-43)
"Our organizations are very concerned that the planning area does not currently support viable populations of Black-backed, White-headed, and Lewis' woodpeckers, and other cavity excavators". The DEIS fails to indicate any credible surveys, or comprehensive science, which shows that the planning area is meeting the actual "tolerance levels" necessary to function as viable habitat for populations of cavity excavator species, including Black-backed, White-headed and other woodpeckers, as required by the NFMA and regional agency directives." (8-44)
"***There is not sufficient analysis in the EIS of the effects of the proposed project on American marten in the planning area." (8-56)***

Response # 75: Effects on all MIS species that utilize or could potentially the project area are included on pages 75 to 104 of the FEIS.

"***Finally, our organizations point out that the USFS continues to fail to address the cumulative impacts to deer and elk as a result of several timber projects, as well as other area fires, adjacent to the planning area (past sales—with their still overly abundant clear-cuts riddling the area--as well as current and future planned sales). The Deschutes National Forest repeatedly offers timber projects that remove deer and elk habitat, but never analyzes the cumulative habitat loss and how it will affect deer and elk." (8-59)***

Response # 76: Cumulative effects on big game are addressed on pages 96 to 99 of the FEIS.