Lost Lulay Thinning

Environmental Assessment and
Finding of No Significant Impact

Environmental Assessment Number OR080-08-06

March 2010

Salem District
Linn County, Oregon

T.10 S., R. 1 W. section 25; T.10 S., R. 1 E. section 23, 25, 29;
T.10 S., R. 2 E. section 19; T.11 S., R. 1 E. section 5, W.M.

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BLM
Salem District

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BLM/OR/WA/AE-10/045+1792

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FINDING OF NO SIGNIFICANT IMPACT[1]

The Bureau of Land Management (BLM) has conducted an environmental analysis (Environmental Assessment Number OR080-08-06) for a proposal to thin approximately 544 acres located on BLM lands within the Cascades Resource Area. The *Lost Lulay Thinning Environmental Assessment* documents the environmental analysis of the proposed commercial thinning activity. The EA is attached to and incorporated by reference in this Finding of No Significant Impact determination. The analysis in this EA is site-specific and supplements analyses found in the *Salem District Proposed Resource Management Plan/Final Environmental Impact Statement,* September 1994 (RMP/FEIS). The proposed thinning activities have been designed to conform to the *Salem District Record of Decision and Resource Management Plan*, May 1995 (RMP) and related documents which direct and provide the legal framework for management of BLM lands within the Salem District (*EA Section 1.3*).

The project is located in T.10 S., R. 1 W. section 25; W.M., T.10 S., R. 1 E. section 23, 25, and 29; W.M., T.10 S., R. 2 E. section 19; W.M., and T.11 S., R. 1 E. section 5; W.M. in Linn County, Oregon. The proposed action is to thin approximately 544 acres of 30 to 70 year-old timber stands. Approximately 455 of these acres are in the Matrix land use allocation (LUA), and 89 acres in the Riparian Reserve LUA.

The EA and FONSI will be made available for public review from March 31, 2010 to April 30, 2010. The notice for public comment will be published in a legal notice in the *Stayton Mail* newspaper. Written comments should be addressed to Cindy Enstrom, Field Manager, Cascades Resource Area, USDI Bureau of Land Management, 1717 Fabry Road. S., Salem, Oregon 97306. Emailed comments may be sent to OR_Salem_Mail@blm.gov. Attention: Cindy Enstrom.

Based upon review of the *Lost Lulay Thinning EA* and supporting documents, I have determined that the proposed action is not a major federal action and would not significantly affect the quality of the human environment, individually or cumulatively with other actions in the general area. No environmental effects meet the definition of significance in context or intensity as defined in 40 CFR 1508.27. Therefore, supplemental or additional information to the analysis in the RMP/FEIS in the form of a new environmental impact statement is not needed. This finding is based on the following discussion:

Context: Potential effects resulting from the implementation of the proposed action have been analyzed within the context of the project area boundaries, and the Crabtree and Thomas Creek 5th field watersheds. This project area would affect approximately .2% of the 100,022 acres in the Crabtree 5th field watershed and .5% of the 75,066 acres in the Thomas Creek 6th field watershed. (*EA section 1.1.1*) [40 CFR 1508.27(a)]:

Intensity:

1. The resources potentially affected by the proposed thinning activities are: vegetation and forest stand characteristics, hydrology, fisheries and aquatic habitat, soils, wildlife, air quality and fire hazard/risk, recreation, visual resources and rural interface areas, cultural resources, and carbon storage, carbon emissions and climate change.

[1] This section of the Lost Lulay Thinning EA is the Draft Finding of No Significant Impact (FONSI). The Cascades Field Manager will finalize the FONSI in the Decision Rationale document after the public comment period.

The effects of commercial thinning are unlikely to have significant adverse impacts on these resources [40 CFR 1508.27(b) (1)] for the following reasons:

- *Project design features* described in (EA section 2.3.4) would reduce the risk of effects to affected resources to be within RMP standards and guidelines and to be within the effects described in the RMP/EIS.
- *Vegetation and Forest Stand Characteristics* (EA section 3.3.1): 1/ No special status vascular plant species or bryophytes would be affected. 2/ Noxious Weeds – Increases in the number of invasive/non-native plants are expected to be short lived because all areas with ground disturbing activities be re-vegetated with native species (EA section 2.3.4); and native species would naturally re-vegetate after thinning activities (EA section 3.3.1.1). The proposed action would not result in adverse effects to BLM Special Status Species or Bureau Assessment Species because no suitable habitat for any species known or likely to be present would be lost or altered to a degree that may impact existing populations. Therefore, the project would not contribute to the need to list any BLM Special Status Species (EA sections 3.3.1; 3.3.3; 3.3.5).
- *Hydrology; Beneficial Uses, Fisheries and Aquatic Habitat; and Soils (EA sections 3.3.2-3.3.4)*: Road construction would occur on gentle slopes with stable, vegetated surfaces. Gentle to moderate slope gradients in this project area provide little opportunity for surface water to flow. Stream protection zones (60 feet on perennial streams, 30 feet on intermittent streams) would maintain current stream temperatures by retaining the current vegetation in the primary shade zone and most of the current levels of shading in the secondary shade zone. Stream protection zones are also expected to prevent sediment as a result of overland flow or surface erosion in logging units from reaching streams during storms of less than a 10 year return interval (*EA section 3.3.2*). The proposed action will abide by and meet State of Oregon water quality standards.
- *Soils*: Soil Compaction is limited to no more than ten percent of each unit's acreage with less than two percent potential loss of productivity.
- *Wildlife* (EA section 3.3.5): 1/ Stands proposed for thinning are not presently functioning as late-successional old growth habitat. 2/ Existing snags and coarse woody debris (CWD) would be retained. The few large (≥ 15 inches diameter and ≥ 15 feet tall) snags that would be felled for safety or knocked over by falling and yarding operations would be retained as CWD. 3/ No suitable habitat for BLM Special Status species known or likely to be present would be lost. Therefore, the project would not contribute to the need to list any BLM Special Status species. 4/ Thinning would not significantly change species richness (a combination of species diversity and abundance) of the Migratory and Resident Bird community. No species would be extirpated in stands as a result of thinning. 5/ See # 2, for effects to northern spotted owl.
- *Air Quality and Fire Hazard/Risk* (EA section 3.3.6): After 3 to 5 years the fine fuels generated by thinning would be decayed in the units and the risk of surface fire would decrease to near current levels. The thinning itself would decrease the risk of a canopy fire. The proposed action would comply with State of Oregon Air Quality Standards by strict adherence to smoke management regulations. For example, slash burning would take place when wind and air movement patterns would dissipate smoke within 12 hours, reducing the effect on air quality.

- *Carbon Storage, Carbon Emissions and Climate Change* (EA section 3.3.7):
  - *Carbon Storage and Carbon Emissions:* Table 14 of the EA shows that during the 30 year analysis period the effects of the proposed thinning would result in a net decrease in carbon storage of 14,500 tonnes of carbon (C) compared to the No Action alternative. Carbon calculations show that 30 years after treatment, the live tree carbon in the thinned stands (40,900 tonnes C) would be 8,100 tonnes less than the live tree carbon storage before thinning (49,000 tonnes C). See cumulative effects, # 3 of the FONSI.
  - *Climate Change:* The U.S. Geological Survey, in a May 14, 2008 memorandum to the U.S. Fish and Wildlife Service, summarized the latest science on greenhouse gases and concluded that it is currently beyond the scope of existing science to identify a specific source of greenhouse gas emissions or sequestration and designate it as the cause of specific climate impacts at a specific location.

- *Visual Resources, Recreation, and Rural Interface (EA section 3.3.8*): Changes to the landscape character would be low and would comply with Visual Resource Management guidelines because the project would maintain a forested setting. Some disturbance to vegetation would be observable after thinning activities and would be expected to develop an undisturbed appearance within five years. .

2. The proposed thinning activities:

- Would not affect:
  - public health or safety [40 CFR 1508.27(b)(2)]
  - unique characteristics of the geographic area [40 CFR 1508.27(b)(3)] - There are no parklands, prime farmlands, wild and scenic rivers, wilderness, or ecologically critical areas located within the project area (*EA Section 3.3.10, Table 16);*
  - districts, sites, highways, structures, or other objects listed in or eligible for listing in the National Register of Historic Places, nor would the proposed action cause loss or destruction of significant scientific, cultural, or historical resources [40 CFR 1508.27(b)(8)] (*EA Section 3.3.10, Table 16).*

- Are not unique or unusual. The BLM has experience implementing similar actions in similar areas without highly controversial [40 CFR 1508.27(b) (4)], highly uncertain, or unique or unknown risks [40 CFR 1508.27(b) (5)].
- Do not set a precedent. The proposed action does not set a precedent for future actions that may have significant effects, nor does it represent a decision in principle about a future consideration [40 CFR 1508.27(b) (6)].
- Are not expected to adversely affect: *Endangered or Threatened Species* listed under the Endangered Species Act (ESA) of 1973 [40 CFR 1508.27(b) (9)].
  - *ESA Wildlife - Northern spotted owl (EA Section 3.3.5):* Effects to the species are not significant because: The project maintains dispersal habitat, and does not affect suitable owl habitat within and between known owl sites; habitat conditions are expected to improve as thinned stands mature (>20 years); residual trees would increase in size and be available for recruitment or creation of snags, culls and CWD for prey species and nesting opportunities, particularly in Riparian Reserves. ESA Consultation is described in *EA section 5.1.1.1.*

- *ESA Fish* – Upper Willamette River (UWR) *steelhead trout* and Upper Willamette River *Chinook salmon (EA Section 3.3.3):* Effects to ESA fish are not significant because thinning is not expected to affect these species for the reasons stated in the Hydrology section, above. The increased turbidity from log fill removals and culvert replacement is unlikely to be visible or measurable beyond 0.5mile downstream of project sites. The closest ESA listed fish are >1.5 miles downstream (*Table 7*) thus they would not be affected by turbidity produced from project actions. New road construction would be located in stable locations and would not contribute to degradation of aquatic habitat. ESA Consultation is described in *EA section 5.1*.

- Do not violate any known Federal, State, or local law or requirement imposed for the protection of the environment [40 CFR 1508.27(b) (10)] (*EA Sections 1.3; 3.3.10*).

3. The Interdisciplinary Team (IDT) evaluated the project area in context of past, present and reasonably foreseeable actions [40 CFR 1508.27(b) (7)] and determined that there is a potential for cumulative effects on water quality and fisheries, and on carbon storage. These effects are not expected to be significant for the following reasons:

   - Water Quality/Fisheries: The proposed action would be expected to temporarily increase stream sediment and turbidity as a result of culvert replacement, road renovation, road maintenance, road use and log fill removal. There is a theoretical potential for increases in stream sediment and turbidity as a result of thinning and logging operations (*EA Sections 3.3.2; 3.3.3; 3.3.4*). These effects are not expected to be significant for the following reasons:
     - Any sediment increase resulting from thinning would be too small to be discernable relative to background sediment yields, would not be expected to violate ODEQ water quality standards and would decrease quickly over time, returning to current levels within three to five years as vegetation increases (Dissmeyer, 2000).
     - The limited magnitude (less than 0.03 percent of the total sixth field watershed sediment supply (Hydrology Report, p. 25)) and duration (primarily major storm events during the first year following disturbance) of this effect would likely be insignificant for water quality on the watershed scale. Cumulatively, the proposed action and connected actions would be unlikely to result in any detectable change for water quality on a sixth or seventh field watershed scale and would be unlikely to have any effect on any designated beneficial uses, including fisheries.

   - Carbon storage and carbon emissions:
     - The proposed thinning would contribute to cumulative effects to carbon storage and carbon emissions. Table 14 shows that carbon emissions resulting from the proposed thinning over the next 10 years would total 2,833 tonnes of carbon or 10,400 tonnes of carbon dioxide (tonnes C*3.67) (0.00001 Gt). Current annual global emissions of carbon dioxide total 25 billion tonnes (25 Gt) of carbon dioxide, (IPCC 2007, p. 513), and current annual U.S. emissions of carbon dioxide total 6 billion tonnes (6 Gt) (EPA 2007, p 2-3). Global emissions over 10 years total 250 billion tonnes of carbon dioxide and U.S. emissions of carbon dioxide total 60 billion tonnes. Therefore, the short-term emissions from the proposed thinning would constitute 0.00004 percent of current global emissions and 0.0002 percent of current U.S. emissions, for the 10 year period. This emission would be so small that its incremental contribution to global and national emissions would be not be measurable at the level of precision of the global and national emissions.

- In addition, the net carbon emissions would be of short duration. Within 10 years, the remaining trees in the harvest units would sequester 2,167 tonnes of carbon, restoring 76 percent of the carbon loss from fuel burning, harvested wood, and harvest operations emissions (*Table 14, EA section 3.3.7*). The proposed thinning would result in a net decrease of 8,100 tonnes of carbon stored in live trees over the thirty years following the proposed thinning. This decrease would reduce the 50.7 million tonnes (1.69 million tonnes/year) accumulation of carbon on BLM-managed lands in western Oregon during that 30 year time period by 0.016 percent. (2008 FEIS, p. 4-537).

Approved by: Cindy Enstrom 3/31/2010

Cindy Enstrom, Cascades Resource Area Field Manager Date

LOST LULAY THINNING ENVIRONMENTAL ASSESSMENT

1.0 INTRODUCTION

This EA analyzes the impacts of proposed commercial thinning operations and connected actions on the natural and human environment within the boundaries of Crabtree and Thomas Creek fifth field watersheds. The EA will provide the decision-maker, the Cascades Resource Area Field Manager, with current information to aid in the decision-making process. It will also determine if there are significant impacts not already analyzed in the Environmental Impact Statement for the Salem District's Resource Management Plan and whether a supplement to that Environmental Impact Statement is needed or if a Finding of No Significant Impact is appropriate.

Section 1 of this EA for the proposed Lost Lulay Thinning project provides a context for what will be analyzed in the EA, describes the kinds of action we will be considering, defines the project area, describes what the proposed action needs to accomplish, and identifies the criteria that we will use for choosing the alternative that will best meet the purpose and need for this proposal.

1.1 Proposed Action

The Cascades Resource Area, Salem District Bureau of Land Management (BLM), proposes to implement forest management activities within the Crabtree and Thomas Creek fifth field watersheds. Proposed forest management activities are commercial thinning to maintain the health and growth of existing dense forest stands. Connected actions include such restoration activities as: fuels management; removal of failing log-fill culverts; mulching, seeding, and fertilizing for roadway stability; improving roads and blocking access after completion of operations (*EA Sections 2.0 and 3.0*).

1.1.1 Project Area[2] Location and Vicinity

The Lost Lulay Thinning Project area is within the Crabtree and Thomas Creek fifth field watersheds, in Linn County, Oregon. The Crabtree watershed contains 100,022 acres; the BLM administers 18,008 of those acres. The Thomas Creek watershed contains 75,066 acres; the BLM administers 12,684 of those acres. This project would thin approximately 544 acres. BLM-administered land is intermixed with privately-owned land, creating an assortment of ownership patterns.

The project is located within Township 10 South, Range 1 West section 25, Township 10 South, Range 1 East, Sections 23, 25 and 29; Township 10 South, Range 2 East, Section 19; and Township 11 South, Range 1 East, Section 5. The nearest town to the project area is Scio, Oregon. See EA Section 7.2, Vicinity Map.

[2] Project Area is defined as that area that is directly affected by project operations (e.g. thinning units, area cleared for landings, roads and rights-of-way). The area around the Project Area, especially BLM managed lands in the same contiguous block of ownership, is referred to as the "project area vicinity" or similar term.

1.2 Purpose of and Need for Action

1.2.1 Need for the Action

Data analysis and field examinations by BLM staff have identified specific stands in which growth rates will soon decline or have already started to decline, and/or in which structural diversity is limited due to overstocking (the stands contain more trees than the sites have water, nutrients, and growing space to sustain). These overstocked stands in the project area need immediate forest management activities to reduce the number of trees per site to allow remaining trees to have sufficient water, nutrients and space for additional growth to meet RMP objectives.

On Matrix lands designated for the sustained production of timber, overstocked stands with their declining growth rates, have resulted in reduced volume yield and value over the planned timber rotation. The proposed forest management activities are needed in the project area stands to reverse these trends so the stands will persist and contribute to future forest production and other goals of the NWFP.

On Riparian Reserve lands designated for restoring and maintaining the ecological health of watersheds and aquatic ecosystems (RMP p. 5), and for providing habitat for terrestrial species (RMP p. 9), overstocked conifer stands have resulted in simple stand structure and declining growth rates that result in delayed development of large diameter snags and other habitat characteristics associated with late-successional forests.

1.2.2 Purpose (Objectives) of the Project

This project has been designed under the *Salem District Record of Decision and Resource Management Plan*, May 1995 (RMP) and related documents which direct and provide the legal framework for management of BLM lands within the Salem District (*EA Section 1.3*). The Lost Lulay Thinning project area is within the Matrix (General Forest Management Area (GFMA) and Connectivity/Diversity Block (Connectivity)) and Riparian Reserve land use allocations (RMP p. 5; NWFP p. A-4, A-5; *EA section 1.3*). The following RMP and Northwest Forest Plan (NWFP) objectives would be applied to achieve the purpose of this project.

Within the Matrix Land Use Allocation:

1. Manage developing stands on available lands to promote tree survival and growth and to achieve a balance between wood volume production, quality of wood, and timber value at harvest; (RMP p. 46) and increase the proportion of merchantable volume in the stand, to produce larger, more valuable logs, to anticipate mortality of small trees as the stand develops, to maintain good crown ratios and stable, wind-firm trees (RMP p. D-2) by applying commercial thinning treatments.
2. Supply a sustainable source of forest commodities from the Matrix land use allocation to provide jobs and contribute to community stability (RMP pp. 1, 20, 46-48); and select logging systems based on the suitability and economic efficiency of each system for the successful implementation of the silvicultural prescription, for protection of soil and water quality, and for meeting other land use objectives (RMP P. 47) by developing timber sales that can be successfully offered to the market place.

Within the Riparian Reserve Land Use Allocation:

3. Maintain water quality standards (RMP p.2) and improve stream conditions by:
    - Removing decaying log fill stream crossings that restrict stream flows, accumulate sediment and pose a threat of future failure.
    - Maintaining effective shade for streams pursuant to BLM's TMDL agreement with the State of Oregon.
    - Develop large conifers to provide future recruitment opportunities for large coarse woody debris, large snag habitat and in-stream large wood.
4. Develop long-term structural and spatial diversity, and other elements of late-successional forest habitat, and control stocking (stand density) to acquire desired vegetation characteristics and improve diversity of species composition within the Riparian Reserve LUA.

These objectives would be accomplished by applying commercial thinning treatments within the Riparian Reserve LUA concurrent with treatments in the adjacent Matrix LUA, removing merchantable material only when it is consistent with the purposes for which the Riparian Reserves were established (RMP pp. 9-15, D-6, NWFP p. B-31).

Within Both Land Use Allocations

5. Protect, manage, and conserve federal listed and proposed species and their habitats to achieve their recovery in compliance with the Endangered Species Act and Bureau special status species policies (RMP p. 28).
6. Maintain and develop a safe, efficient and environmentally sound road system (RMP p. 62) and reduce environmental effects associated with identified existing roads within the project area (RMP p. 11) by:
    - Providing appropriate access for timber harvest, silvicultural practices, and fire protection vehicles needed to meet the objectives above;
    - Perform proper road maintenance to prevent road deterioration or failure and to prevent road generated sedimentation that exceeds ODEQ turbidity standards.
7. Increase protection for the public, facilities and high-value resources from large, intense wildfires in the rural/urban interface (RMP, pp. 39, 43) in accordance with the National Fire Plan's Healthy Forest Initiative and Restoration Act by:
    - Reducing natural and activity-based fuel hazards on BLM-administered lands in rural interface areas,
    - Protecting resources on BLM-administered land from potential wildfires originating on adjacent private land by reducing fuel hazards,
    - Controlling access to limit potential human sources of wildfire ignition.

1.2.3 Decision Factors

In choosing the alternative that best meets the purpose and need, the Cascades Resource Area Field Manager will consider the extent to which each alternative would:

1. Provide timber resources and revenue to the government from the sale of those resources (objectives 1 and 2);

2. Reduce the costs both short-term and long-term of managing the lands in the project area (objectives 1 and 2);

3. Provide safe, cost-effective access for logging operations, fuels management and fire suppression (objectives 2, 6, and 7) ;
4. Reduce competition-related mortality and wildfire risk, and increase tree vigor and growth (objective 1 and 7);
5. Reduce erosion and subsequent sedimentation from roads (objectives 3 and 6);
6. Provide for the establishment and growth of conifer species while retaining structural and habitat components, such as large trees, snags, and coarse woody debris (objectives 4 and 5);
7. Promote the development of healthy late-successional characteristics in the Riparian Reserve land use allocation (objective 4);
8. Establish a defensible area for use during extended fire suppression activities and possibly reduce the overall size of a wildfire (objective 7); and
9. Reduce potential human sources of wildfire ignition by controlling access (objective 7).

1.3 Conformance with Land Use Plan, Statutes, Regulations, and other Plans

This project is in conformance with the management direction and objectives of the 1995 Salem District Resource Management Plan (1995 RMP), as amended. The proposed commercial thinning activities in the project area have been designed to conform to the following documents, which direct and provide the legal framework for management of BLM lands within the Salem District:

1. *Salem District Record of Decision and Resource Management Plan, May 1995 (RMP):* The RMP has been reviewed and it has been determined that the proposed thinning activities conform to the land use plan terms and conditions (e.g. complies with management goals, objectives, direction, standards and guidelines) as required by 43 CFR 1610.5 (BLM Handbook H1790-1). Implementing the RMP is the reason for doing these activities (RMP p.1-3);
2. *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl, April 1994 (the Northwest Forest Plan, or NWFP);*

   Land Use Allocations: The area proposed for treatment falls within the following Land Use Allocations (LUA) as defined in the Northwest Forest Plan (NWFP) and the Salem District RMP:

   - Matrix (Matrix LUA) - including General Forest Management Area (GFMA) and Connectivity/Diversity Block (CONN). The management objectives for this land use allocation include: to produce a sustainable supply of timber, provide connectivity between Late Successional Reserves, provide habitat associated with all age classes, and provide structural components such as down logs, snags and large trees (RMP p. 20). See EA section 1.2.2.
   - Riparian Reserve (Riparian Reserve LUA). The primary management focus for the Riparian Reserve LUA is to meet the Aquatic Conservation Strategy Objectives described in the RMP (pp. 5-6) "to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands."

This includes terrestrial habitat, water quality and quantity, and aquatic habitat. See EA section 1.2.2. For the Lost Lulay Thinning Project, the Riparian Reserve LUA includes the stream and the area extending from the edges of the stream channel (each side) to a distance equal to the height of:

- For fish-bearing streams – a slope distance equal to the height of two site potential trees. For this project this is 440 feet each side of the stream channel.
- For non-fish-bearing streams - a slope distance equal to the height of one site potential tree. For this project this is 220 feet each side of the stream channel.

In addition, the NWFP/ROD (p.B-31) also states that "Active silvicultural programs will be necessary to restore large conifers in Riparian Reserves ". The NWFP/ROD (p.C-32) and the RMP (p. 11) direct the BLM to apply silvicultural practices for Riparian Reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives. The RMP (p. D-6) states that merchantable logs may be removed "where such action would not be detrimental to the purposes for which the Riparian Reserves were established". EA section 3.4 describes the project's compliance with the Aquatic Conservation Strategy, including the nine ACS objectives.

3. *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines, January 2001.*

The analysis in the Lost Lulay Thinning EA is site-specific, and it supplements and tiers to analyses found in the *Salem District Proposed Resource Management Plan/Final Environmental Impact Statement*, September 1994 (RMP/FEIS). The RMP/FEIS includes the analysis from the *Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl*, February 1994 (NWFP/FSEIS). The RMP/FEIS is amended by the *Final Supplemental Environmental Impact Statement for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines*, November 2000.

Information from the *Crabtree Watershed Analysis* (July 2001) and *Thomas Creek Watershed Analysis* (December 1996) has been incorporated into the development of the proposed thinning activities, and into the description of the Lost Lulay EA's affected environment and the environmental effects and is incorporated by reference. The *Crabtree Watershed Analysis* (July 2001) and *Thomas Creek Watershed Analysis* (December 1996) covers the project area. Chapter 7 contains management findings and recommendations for both watershed analyses. "This section describes the types of actions or activities that the BLM could implement in both the Crabtree and Thomas Creek Watershed to improve conditions and positively influence trends (CCWA p. 7-4 and TCWA p. 7-99)." EA sections 3.1 - 3.4 show how the Lost Lulay thinning project meets the Aquatic Conservation Strategy in the context of the PCFFA cases.

The above documents are available for review in the Salem District Office. Additional information about the proposed activities is available in the *Lost Lulay Thinning EA* Analysis File (LLYAF), also available at the Salem District Office.

1.3.1 Survey and Manage Species Review

The Lost Lulay thinning project is consistent with court orders relating to the Survey and Manage mitigation measure of the Northwest Forest Plan, as incorporated into the Salem District Resource Management Plan.

On December 17, 2009, the U.S. District Court for the Western District of Washington issued an order in Conservation Northwest, et al. v. Rey, et al., No. 08-1067 (W.D. Wash.) (Coughenour, J.), granting Plaintiffs' motion for partial summary judgment and finding a variety of NEPA violations in the BLM and USFS 2007 Record of Decision eliminating the Survey and Manage mitigation measure. Previously, in 2006, the District Court (Judge Pechman) had invalidated the agencies' 2004 RODs eliminating Survey and Manage due to NEPA violations. Following the District Court's 2006 ruling, parties to the litigation had entered into a stipulation exempting certain categories of activities from the Survey and Manage standard (hereinafter "Pechman exemptions").

Judge Pechman's Order from October 11, 2006 directs: "Defendants shall not authorize, allow, or permit to continue any logging or other ground-disturbing activities on projects to which the 2004 ROD applied unless such activities are in compliance with the 2001 ROD (as the 2001 ROD was amended or modified as of March 21, 2004), except that this order will not apply to:

A. Thinning projects in stands younger than 80 years old (emphasis added):
B. Replacing culverts on roads that are in use and part of the road system, and removing culverts if the road is temporary or to be decommissioned;
C. Riparian and stream improvement projects where the riparian work is riparian planting, obtaining material for placing in-stream, and road or trail decommissioning; and where the stream improvement work is the placement large wood, channel and floodplain reconstruction, or removal of channel diversions; and
D. The portions of project involving hazardous fuel treatments where prescribed fire is applied. Any portion of a hazardous fuel treatment project involving commercial logging will remain subject to the survey and management requirements except for thinning of stands younger than 80 years old under subparagraph a. of this paragraph."

Following the Court's December 17, 2009 ruling, the Pechman exemptions are still in place.

Judge Coughenour deferred issuing a remedy in his December 17, 2009 order until further proceedings, and did not enjoin the BLM from proceeding with projects. Nevertheless, I have reviewed the Lost Lulay thinning project in consideration of both the December 17, 2009 and October 11, 2006 order. Because the Lost Lulay thinning project entails no regeneration harvest and entails thinning in stands less than 80 years old, I have made the determination that this project meets Exemption A of the Pechman Exemptions (October 11, 2006 Order), and therefore may still proceed to be offered for sale even if the District Court sets aside or otherwise enjoins use of the 2007 Survey and Manage Record of Decision since the Pechman exemptions would remain valid in such case.

1.3.2 Relevant Statutes/Authorities

This section is a summary of the relevant statutes/authorities that apply to this project.

Oregon and California Act (O&C) 1937 – Requires the BLM to manage O&C lands for permanent forest production, in accord with sustained-yield principles. Management of O&C lands must also protect watersheds, regulate stream flow, provide for recreational facilities, and contribute to the economic stability of local communities and industries.

Federal Land Policy and Management Act (FLPMA) 1976 – Defines BLM's organization and provides the basic policy guidance for BLM's management of public lands.

National Environmental Policy Act (NEPA) 1969 – Requires the preparation of environmental impact statements for Federal projects which may have a significant effect on the environment.

Endangered Species Act (ESA) 1973 – Directs Federal agencies to ensure their actions do not jeopardize threatened and endangered species.

Clean Air Act (CAA) 1990 – Provides the principal framework for national, state, and local efforts to protect air quality.

Archaeological Resources Protection Act (ARPA) 1979 – Protects archeological resources and sites on federally-administered lands. Imposes criminal and civil penalties for removing archaeological items from federal lands without a permit.

Clean Water Act (CWA) 1987 – Establishes objectives to restore and maintain the chemical, physical, and biological integrity of the nation's water.

Healthy Forests Initiative (HFI) 2002 - Focuses on reducing the risk of catastrophic fire by thinning dense undergrowth and brush in priority locations that are identified on a collaborative basis with selected Federal, state, tribal, and local officials and communities. The initiative also provides for more timely responses to disease and insect infestations.

1.4 Scoping and Identification of Relevant Issues

1.4.1 Scoping

External scoping (seeking input from people outside of the BLM) for the Lost Lulay Thinning project was conducted by means of a letter mailed to 73 individuals, businesses, organizations, and government agencies on February 20-21, 2008. The letter requested comments concerning issues to be addressed within the project area. A total of five (5) comment letters were received from adjacent land owners, Oregon Wild and one (1) phone conversation comment. These letters and phone conversation record are available for review at the Salem District BLM Office, 1717 Fabry Rd SE, Salem, Oregon.

Internal scoping (gathering information from people within the BLM) was conducted by the Interdisciplinary Team (IDT) through record searches, field reviews and the project planning process.

1.4.2 Relevant Issues

Based on input from the public and the Interdisciplinary Team plus information contained in the ROD/RMP, the following issues were identified. These issues provide a basis for comparing the environmental effects of the alternatives and aid in the decision-making process.

The major issues brought forward were used to formulate alternatives, identify appropriate design features, or analyze environmental effects. The following major issues were identified:

1.4.2.1 Issue 1: Riparian management and Aquatic Conservation Strategy

Commenters expressed concerns about buffer widths, Riparian Reserve widths, thinning prescriptions within Riparian Reserves, water quality and general management considerations. This issue is addressed in the following sections of this EA: 1.2 – Purpose and Need; 2.3.1 – Proposed Action; 2.3.3 – Connected Actions; 2.3.4 – Project Design Features; 3.3.1 – Vegetation; 3.3.2 – Hydrology; 3.3.3 – Fisheries; 3.3.5 – Wildlife; 3.3.10 – Authorities; 3.4 – ACS; and 5.1 - Consultation.

1.4.2.2 Issue 2: Potential impacts to Special Status Species (includes ESA threatened/ endangered species)

Commenters expressed concern about northern spotted owls and their habitat and other special status species. This issue is addressed in the following sections of this EA: 1.2 – Purpose and Need; 2.3.1 – Proposed Action; 2.3.4 – Project Design Features; 3.3.1 – Vegetation; 3.3.3 – Fisheries; 3.3.5 – Wildlife; 3.3.10 – Authorities; 3.4 – ACS; 5.1 – Consultation; and 7.1 – Other Tables.

1.4.2.3 Issue 3: Economic viability of timber sale

Commenters expressed concern that harvest prescriptions and logging plans be designed for an economically viable timber sale that would be feasible for a range of potential purchasers and operators. This issue is addressed in the following sections of this EA: 1.2 – Purpose and Need; 2.3.1 – Proposed Action; 2.3.2 – Logging Systems; 2.3.3 – Connected Actions; and 2.3.4 – Project Design Features.

1.4.2.4 Issue 4: Invasive Non-Native Plants

Commenters expressed concern about spread of invasive non-native plants due to proposed forest management operations. This issue is addressed in the following sections of this EA: 2.3.4 – Project Design Features; 3.3.1 – Vegetation; and 3.3.10 – Authorities.

1.4.2.5 Issue 5: Transportation system

Commenters expressed concerns about road use, construction and stabilization.

This issue is addressed in the following sections of this EA: 1.2 – Purpose and Need; 2.3.1 – Proposed Action; 2.3.3 – Connected Actions; 2.3.4 – Project Design Features;, 3.3.2 – Hydrology; 3.3.3 – Fisheries; 3.3.4 - Soils, 3.3.6 – Fire/Fuels; 3.3.8 – Recreation and Rural Interface; 3.3.10 – Authorities; 3.4 – ACS; and 7.2 – Maps.

1.4.2.6 Issue 6: Stand Management

Commenters expressed concerns about forest management practices and their effects on future timber harvest, windthrow and big game habitat. This issue is addressed in the following sections of this EA: 1.2 – Purpose and Need; 2.3.1 – Proposed Action; 2.3.4 – Project Design Features; 2.5 – Alternatives Considered, 3.3.1 – Vegetation; 3.3.5 – Wildlife; 3.3.6 – Fire/Fuels; 3.3.7 – Carbon/Climate, 3.3.8 - Recreation and Rural Interface; 3.3.10 – Authorities; 3.4 – ACS; and 7.1 – Other Tables.

1.4.2.7 Issue 7: Carbon Sequestration (Storage) and Climate Change

The BLM identified concerns about the effect of thinning on carbon sequestration and climate change based on comments received for other projects. This issue is addressed in the following sections of this EA: 2.5 – Alternatives Considered, and 3.3.7 – Carbon/Climate.

1.4.3 Issues Considered But Eliminated From Further Analysis

The following issues were received during the scoping period and reviewed by the Interdisciplinary Team.

- Land Tenure: Commenters asked about potential sale of scattered BLM parcels to private individuals. Land tenure is outside of the scope of this EA.
- Land Use Allocation: Commenters on other projects have suggested that BLM lands be managed for carbon sequestration and storage. This use is not a management objective in any land use allocation in the RMP. Land use allocation changes are outside of the scope of this EA.

1.5 Decisions to be Made

This analysis will provide information for the decisionmaker to make the following decisions:

- To determine if a Supplemental Environmental Impact Statement (SEIS) should be prepared based on whether the proposed action would result in significant impacts to the human environment not already analyzed in the EIS prepared for the Salem District RMP and its amendments.
- If there are any such additional impacts that are significant, we will determine whether the project proposals could be modified to mitigate the impacts so an SEIS would not be necessary. If we determine there is no need to prepare SEIS, we will document this determination in a Finding of No Significant Impact (FONSI).
- To determine at what level, where, and how to harvest trees on BLM-administered lands allocated to the programmed timber harvest base within the project area.
- To implement or not implement proposed restoration projects (fuels management, replacing culverts for unimpaired fish passage, and decommissioning roads) on BLM-administered lands within the project area and, if so, which projects, at what level, and where.

2.0 ALTERNATIVES

2.1 Alternative Development

Pursuant to Section 102 (2) (E) of the National Environmental Policy Act (NEPA) of 1969, as amended, Federal agencies shall "…study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources."

There were no unresolved conflicts concerning alternative uses of available resource. Therefore, this EA will analyze the effects of the current "Proposed Action" and "No Action alternative" (which provides the baseline to evaluate effects).

2.2 Planning and Implementation Process

The BLM would require the timber sale operator to accomplish the following actions as required in the timber sale contract written by the BLM. The BLM would develop the timber sale contract to implement the actions described below and the project design features (PDF) that follow (*EA Section 2.3*). These actions and the PDF, taken together, form the best management practices (BMP) that the IDT developed based on the principles of the BMP described in Appendix G of the RMP/FEIS and Appendix C of the RMP which the IDT adapted to the site specific conditions of the proposed Lost Lulay Thinning project.

2.3 Proposed Action

The Proposed action is to thin approximately 544 acres of 30 to 70 year-old timber stands (*Table 1, EA Section 7.2.2 - Maps*):

Table 1: Summary of the Proposed Action Thinning

Unit	Unit Acres	Land Use Allocations		
		Matrix		Riparian Reserve
		General Forest Management Area (GFMA)	Connectivity (CONN)	
25A-10S1W	51	45	0	6
25B-10S1W	34	20	0	14
21A-10S1E	50	44	0	6
23A-10S1E	13	13	0	0
23B-10S1E	67	64	0	3
25-10S1E	147	0	112	35
29A-10S1E	32	20	0	12
29B-10S1E	33	33	0	0
19A-10S2E	25	0	25	0
5A-11S1E	65	55	0	10
5B-11S1E	27	24	0	3
TOTAL	**544**	**318**	**137**	**89**

Key to Abbreviations: 29A-10S1E (etc.) = Section 29, analysis area (unit) A, Township 10 South, Range 1 East; All units would use a ground based yarding system.

2.3.1 Proposed Treatments

In the Matrix LUA:

The BLM proposes to commercially thin[3] 455 acres of overstocked 30-70 year old forest stands within the Matrix Land Use Allocation (LUA). Of this, 318 acres are in General Forest Management Area (GFMA) and 137 acres are in Connectivity. The objectives of this treatment are to: promote timber volume growth and quality; develop a healthy forest that can resist windthrow, disease and wildfire; and provide habitat for a variety of wildlife species. An additional goal in Connectivity is to recover old growth conditions in approximately 100-120 years, but at this stage of stand development management for GFMA and Connectivity objectives is congruent.

The commercial thinning would implement a "thin from below" prescription that generally designates trees to be retained based on a combination of tree size, crown position[4], spacing, species mix, vigor and potential future log quality (Silvicultural Prescription for Lost Lulay, 2008). Specifically, the prescription proposes to:

- Retain trees that are larger than the average diameter for the stand, emphasizing the largest, healthiest and best formed dominant and co-dominant trees;
- Cut and remove suppressed and intermediate trees, and co-dominant trees directly competing with the trees selected for retention to make light, water and nutrients available for healthy growth of those trees to be retained;
- Maintain spacing to provide adequate growing room for retained trees based on target stocking (number of trees per acre to be retained in each stand *(Table 18)*;
- Maintain an average canopy closure of retained dominant and co-dominant trees ranging from 55 to 70 percent following thinning; and
- Maintain a mix of the species present in the stand.

In the Riparian Reserve LUA

The BLM proposes to commercially thin 89 acres of overstocked 30-70 year old forest within the Riparian Reserve LUA. This prescription would contribute to Aquatic Conservation Strategy (ACS) objectives by applying silvicultural treatments designed to maintain or restore healthy forest stands that can resist windthrow, disease and wildfire in order to protect watershed and aquatic resources; and provide habitat for a variety of wildlife species. Specifically the prescription proposes to apply the following treatments:

- Implement active restoration by commercially thinning, in conjunction with operations in the adjacent Matrix stands, portions of the Riparian Reserve to accelerate development of late successional forest characteristics by reducing stocking that will allow light to reach the forest floor so that understory vegetation will grow.
- The thinning prescription and marking guides would be essentially the same as for the adjacent Matrix thinning at this stage of stand development.

[3] In commercial thinning material from cut trees is used for wood products.

[4] Crown position indicates the relative position of the live crown (branches) of a tree relative to the crowns of other trees in the forest canopy. Dominant and co-dominant trees are generally the tallest trees, most exposed to sunlight – also called "overstory trees" or "the overstory". Intermediate tree crowns reach into the canopy enough to get some light from above but not from the sides and are generally small and crowded. Suppressed trees are shaded by all of the other crowns and have low growth rates and low vigor as a result of competition with overtopping trees.

- Maintain aquatic features by retaining stream protection zones (SPZ) - minimum width of 60 feet slope distance on each side of perennial streams[5] and 30 feet slope distance on each side of intermittent streams[6]. These SPZ are also designed to prevent sediment generated by logging operations from reaching the streams and prevent loss of shading on those streams to avoid increasing water temperature;
- Protect potentially unstable slopes by including them in SPZ;
- Practice passive restoration by not treating:

o Areas where hardwood trees and brush species already provide elements of structural complexity; and

o Areas where logging is not feasible in conjunction with operations in the adjacent Matrix thinning.

2.3.2 Logging Systems

The entire project area would be designed for harvest using conventional ground-based logging equipment.

In ground based logging, the BLM requires the logging operators to propose a plan that best uses their particular combination of equipment and operating techniques to accomplish the project within the requirements of the contract, including stipulations to implement the proposed action and project design features described in this EA (*EA section 2.3.4*). Authorized BLM personnel review the written plan and examine skid trail and landing locations prior to approving the plan. The plan then becomes an enforceable part of the contract which is administered by trained and authorized BLM personnel.

Additional areas associated with some proposed harvest units were dropped from the proposal during planning because the IDT determined that the benefits of treating these small areas were relatively small compared to the costs of roads, landings, set-up and operation of a skyline yarding system to thin scattered one to five acre areas with a skyline system.

2.3.3 Connected Actions

1. Road Work (*EA Section 2.4; EA Section 7.2 - Maps***):**

- *New Road Construction:* The BLM would design and construct approximately ½ mile of new road to provide access to the proposed thinning project area for logging and hauling.
  "New Construction" is building a road where none existed before. In this project, for analysis purposes, "new construction" also includes reconstruction of deteriorated roads with large (dominant and co-dominant) trees growing in the road prism.
  The BLM may elect to rock some or all of the new roads on Matrix, or use them natural surface, depending on conditions and needs during operations. New roads in the Riparian Reserve LUA would not be rocked and the BLM would only allow them to be used in the dry season (typically July through October) and with dry conditions.
- *Road Improvement:* The BLM would improve approximately 1/4 mile of unmaintained, existing roads so timber yarding and hauling can take place.

[5] Streams that flow all year.
[6] Streams that dry up at least part of the year.

"Road Improvement" upgrades an existing road to a higher design standard than the original design. Upgrades may include widening the subgrade, changing the alignment so it can be used by modern trucks, upgrading from natural surface to rock surface, and removing substantial vegetation and some trees from the road prism.

- *Road Renovation:* The BLM would renovate approximately 12 miles of unmaintained, existing roads so timber yarding and hauling can take place.
  "Road Renovation" restores an existing, unmaintained or decommissioned road to its original design standards. Actions include removing vegetation from the roadbed and subgrade; blading and shaping the roadbed and ditches; repairing small slides and slumps; cutting brush adjacent to the road; maintaining, repairing, adding and replacing culverts; and adding rock to replace depleted rock surfaces. Approximately 3 miles of private road that would be used as the haul route for this project would be maintained by the road owners.
- *Culvert Installation*:
  - Replace four undersized or damaged culverts at stream crossings (two in Section 25, 10S1W, two in Section 19, 10S2E). One of these streams (section 19) is intermittent; the remaining three streams are perennial. One of the culverts to be replaced in Section 25 is designed to provide a pump chance (small water impoundment for firefighting), which would be cleaned and repaired in conjunction with culvert replacement.
  - Cross drain culverts: Replace six and install two cross drain culverts to provide drainage to road side ditches. These culverts are not in streams.
- *Log Fill Culverts:* The BLM would use two stream crossings that currently have log fills in 10S1E section 25.
  - Road 10-1E-25.06: Replace the log fill culvert with a standard culvert before log haul and then block and winterize the road after logging operations.
  - Road 10-1E-24: Use the log fill culvert for logging operations with the possibility of replacing the log fill with a stand culvert depending on stability of log fill. If the log culvert can be used, additional fill would be placed on the sunken grade and shaped to allow log haul. The culvert for this stream crossing would be removed after logging operations and the stream channel would be restored to its natural grade, woody debris placed in channel and on banks, and soil stabilized and vegetated.

2. **Landings:** The BLM would require the timber sale operator to construct landings according to the approved logging plan (*EA section 2.3.2*).

3. **Fuels Treatments** The BLM would require the operator to reduce forest fuel accumulations after thinning operations have been completed on approximately 285 acres (includes areas outside of proposed harvest unit boundaries) in order to reduce the potential for human caused ignition, and to reduce the rate of spread and intensity and facilitate wildfire control if a fire does start. The BLM would assess each area designated for fuels treatment (*EA section 7.2 - maps*) during logging operations and after they are completed to determine the most appropriate method or combination of methods of fuels treatment to implement. The BLM fuels management specialist has prepared the following preliminary fuels treatment recommendations, which is shown on Table 2.

Table 2: Fuels Treatment Recommendations

Section	Machine Pile and Burn, or Other Treatment[7]	Treatment Acres
25 - 10S1W	Unit A- 20 acres along the north and west property lines for 300 ft. Unit B- 13 acres along the road with another 4 acres in the riparian area treated with hand lop and scatter.	37
21 - 10S1E	In the northeast portion of the unit and along the road.	22
29 - 10S1E	Along the western boundary.	13
5 - 10S1E	Unit A- the entire parcel 80 acres.- treatment would include some clean-up in the eastern portion of the section. Unit B- 26 acres.	106
23 - 10S1E	Unit A	12
25 - 10S1E	In the east half of the unit and 400 ft. to the west along the road.	95
Total Acres of Fuels Treatment to be Accomplished with the Proposed Timber Sale		285

If a market for the slash material develops to the point where it would be economical and energy efficient to remove and transport the slash to a cogeneration (cogen) power facility or utilize this biomass (wood pellets, chips, etc), removing slash from the site could replace active fuels treatments in some or all of the above locations. The final selection of fuel treatment method would be made after logging, based on the BLM Fuel Specialist's evaluation of the amount and characteristics of the fuels and the availability and effectiveness of equipment that is available at the time. If 60 to 80% of the slash material were removed from the site following logging and a fire occurred, the level of stand mortality expected would be very low due to the substantial decrease in expected fire behavior, duration and the intensity of heat produced.

It is expected that at least 10-20% of the total fuel loading would have to remain scattered on site in the form of larger size logs and pieces in order to meet the down coarse wood requirements.

4. Preventing Unauthorized Off-Highway Motor Vehicle (OHV) Use (RMP p. 41)

- Existing gates that currently limit OHV use to low intensity would be maintained and kept closed according to requirements of the road owners during operations and when the project operations are completed. The operator would take appropriate measures to prevent public access (including OHV) when logging and hauling operations are active.
- Where existing physical barriers currently block OHV access, the logging operator would prevent unauthorized access during operations as part of their normal security measures. The BLM would require that physical barriers be replaced at the end of operations, as well as other measures described under Design Features (*EA section 2.3.4).*

[7]"Machine pile and burn" is the fuel treatment alternative with the greatest potential impact, so it was selected as the treatment to analyze. Alternative treatments may include: lop and scatter, crushing, hand pile and burn, mastication, or fuel removal (for biomass utilization).

- The BLM authorized contract administrator would ensure that operators make skid trails impassible for OHV as required by the timber sale contract and as described under Design Features (*EA section 2.3.4*). The BLM would require that the operator block and otherwise close roads according to design criteria developed by BLM staff that would effectively eliminate OHV use while making it feasible for fire suppression personnel to open those roads with bulldozers commonly used for wildland fire initial attack response.
- Road and skid trail closure methods would be designed to prevent erosion and avoid damaging retained trees. See Design Features (*EA section 2.3.4*).

5. Special Forest Products (SFP) (RMP p. 49)

The BLM would sell permits for collecting Special Forest Products from the harvest units if there is a demand for the products, and collection would not interfere with proposed project operations. Special Forest products are commercial products other than timber (capable of being measured in board feet) that can be found in the forest and can include: edible mushrooms, firewood, posts and poles, and transplants of native plants.

2.3.4 Project Design Features

This section summarizes the project design features (PDF) that would further reduce the project's effects on the affected resources described in EA section 3.1-3.4. PDF described in this section would be implemented in the proposed action unless otherwise specified. These design features are based on the management guidance, design features and best management practices (BMP)described in the RMP/FEIS (pp. 2-35 – 2-37, 4-11 – 4-14, G-1 – G-2, S-1 – S2) and RMP (pp. 23-24, C-1 – C-2). Based on its combined experience, professional judgment, familiarity with published research, and field analysis of this project area, the BLM Interdisciplinary Team of Resource Specialists (IDT) then refined them into the proposed action and project design features (PDF) described in this EA.

The BLM would incorporate these design features into the project layout, contract requirements, and contract administration to ensure that the project is implemented as analyzed in this EA and that the risk of effects to the resources are no greater than those described in EA Section 3.0-3.4.

The BLM would require the operator to implement each of the following project design features, unless otherwise stated. Performance would be monitored by authorized BLM personnel. The Contracting Officer enforces compliance with the contract and would suspend operations if the operator fails to perform the required preventive and restorative practices analyzed in this EA. The BLM timber sale contract requires bonding in an amount sufficient for the BLM to complete restoration work if the operator fails to perform the preventive and restorative requirements of the contract.

1. Soil Productivity:

In All Timber Harvest Operations:

The BLM would require the operator to design and implement a plan for logging operations in accordance with the timber sale contract to:

- Limit the area compacted by those logging operations to less than ten (10) percent of the harvest area, calculated for each timber sale contract unit ("unit") (RMP, C-2). The logging operations plan would include: length, width and location of skid trails; size and locations of landings; and other equipment and operating techniques to be used.
- Locate skid trails to avoid concentrating runoff water flows that could cause rill or gully erosion with potential to displace soil more than a few feet.
- Lift the leading end of all logs off of the ground during skidding (one-end suspension) to prevent the blunt ends of logs from displacing soil and creating a channel for erosion.
- Limit landing size to the minimum area needed for safe and efficient operations. Compaction caused by landing construction and operations which is outside of road rights-of-way would be included in the 10 percent maximum allowable compacted area.
- Retain some logging slash and debris on the forest floor to return nutrients and organic matter to the soil. The amount of slash retained is site specific and considers the amount of pre-existing organic material on the ground.
- Implement erosion control measures to prevent rill or gully erosion that would displace soil more than a few feet. Typical measures include: shaping to modify drainage (water bars, sloping, etc.); tilling; placing logging slash and debris on bare, compacted or disturbed soil such as skid trails; and seeding with native species.
- Block roads, skid trails and any other access points and obstruct them with logging slash and debris to prevent use by Off Highway Vehicles (OHV)
- Seed and mulch disturbed soil associated with roads and landings, using native species and sterile mulch as described in PDF for vegetation in EA section 2.3.4.

In Ground-based Skidding and Other Ground Based Logging Operations:

- The BLM would allow skidding (dragging logs behind a skidder) operations only during dry soil conditions, when soils have the most resistance to compaction.
- Authorized BLM personnel would examine the operator's proposed skid trail locations and approve them for use only when they comply with the approved logging operations plan and meet the following conditions:
    - Use existing skid trails whenever they are feasible for use in logging (lead toward an approved landing, on stable ground, located where they are needed), are properly spaced to stay within the 10 percent compacted area, do not cross wet or fragile areas, and are aligned on the slope to avoid channeling water and causing erosion.
    - Locate new skid trails only on slopes not greater than 35 percent to avoid gouging, soil displacement, and erosion with effects exceeding those analyzed in the FEIS (pp. 4-11 through 4-13).
    - Generally limit uphill skidding to slopes of 20 percent or less to avoid soil displacement from skidders breaking traction.[8]

[8] Traction is a highly variable combination of the power required to skid logs, equipment characteristics and soil strength, and the potential to break traction increases as slope steepness increases. BLM field experience confirms that 20 percent slope consistently provides for adequate traction while steeper slopes require additional site-specific evaluation.

- The BLM would only approve operation of mechanized falling/processing, log handling machinery and fuels treatment machinery on slopes not greater than 45 percent. The BLM would require these machines to operate only on approved skid trails or on top of a slash and brush mat that is sufficiently thick (as determined onsite by the BLM) to avoid displacing soil and to dissipate ground pressure and avoid deep compaction.
- In unit 29A 10S1E, create a temporary crossing of an ephemeral (little or no flow at any time) channel using woody debris to provide a stable base for equipment to cross without damaging soils or banks. Equipment crossings would be limited to equipment types and operations that would not damage soils or banks. The bulk of this material (that can be removed without disturbing soil or channel banks) would be removed after operations to prevent unauthorized use of the crossing location.

In Other Operations:

- Pile logging slash and debris to be burned on the compacted area of the landings to affect the minimum area necessary for safe operations. The BLM would require that the piles be tightly constructed with and designed to create a small "footprint" of soil where heat could reduce soil productivity.
- Cover the piles with plastic sheeting during the dry season and conduct burning operations after a consistent pattern of fall rains begin and the soil is wet to the touch at least six inches deep into the surrounding soil profile in order to reduce the amount of heat potentially imparted to the soil. The BLM expects the combination of wet soils that can resist heat and covered piles that are still dry enough to burn to occur in November in the Lost Lulay area.

2. **Water Quality and Aquatic Habitat/Fisheries:** The objectives are to: protect water quality (RMP 5-6, 22-23, C-1, C-11) and aquatic habitat/fisheries (RMP 5-6, 27-28). The standard for water quality is the Water Quality Standards set by the Oregon Department of Environmental Quality (Oregon DEQ). Also see ***Hydrology/Channels/Water Quality: Specialist Report for the Lost Lulay Project*** (the *Hydrology Report*)(2008), pp. 19-29

   In All Logging and Road Operations:

   The logging system PDF that prevent or reduce potential erosion also contribute to achieving the objectives to protect water quality and aquatic habitat/fisheries by preventing sediment transport to streams, wetlands[9] and riparian zones[10]. The BLM would also implement the following requirements and practices to protect water quality and aquatic habitat/fisheries:

   - New roads would be constructed to not increase the size of the stream network (Wemple et al. 1996). New, improved and renovated road surfaces would be designed to drain surface water to adjacent slopes where it would infiltrate into the soil and groundwater.

[9] Wetlands are areas with enough surface or ground water to support vegetation adapted to saturated soil conditions. Generally includes swamps, marshes, bogs and similar areas. See FEIS 6-17 for a more detailed definition. Also see RMP 10.

[10] Riparian zones are biologically associated with streams, ponds and wetlands and are not equivalent to Riparian Reserves, which are a Land Use Allocation. See FEIS 6-12 for definitions. Also see RMP 10 and 24-25.

- Prevent sediment runoff from entering streams in amounts that would cause a visible increase in turbidity in those streams by using one or more of the following methods: maintain vegetation in the ditch; create small settling basins; or install straw bales, wattles or other artificial filters.
- Shape road surfaces and/or add rock to the road surface as directed by the BLM to prevent sediment runoff from entering streams and increasing turbidity in those streams.
- Haul logs only during times and road conditions that would not generate sediment that would enter streams and cause a visible increase in stream turbidity.
    - On natural surface roads – The BLM would allow the operator to haul and conduct other operations on these roads only during the dry season (typically June through October) and dry conditions when there is no surface mud and the surface supports traffic without creating ruts that damage the subgrade.
    - On rock surface roads, not otherwise restricted – The BLM would allow the operator to haul and conduct other operations on these roads only when traffic and other activities would not "pump" fines (sand, silt and clay size particles) to the surface where they could be washed into streams by runoff.
- Stabilize all new roads and some existing roads after use to prevent erosion and reduce changes to natural drainage patterns. The BLM would require the operator to use one or more of the following methods: water bars or other surface shaping to drain runoff water to vegetated slopes; surface tilling; seeding with native species; sediment traps, and/or other techniques to promote infiltration and prevent erosion and sediment transport to streams that would cause a visible increase in turbidity, and increases in peak flows. Culverts and the subgrade would be left intact so that the road can be renovated for future use or fire control with minimal disturbance and expense.
- To ensure ongoing compliance with Oregon Department of Environmental Quality (ODEQ) water quality standards, the BLM timber sale administrator and the BLM harvest inspectors would visually monitor turbidity (a visible reduction in water clarity (Hydrology Report p. 21) [11] during normal timber sale contract administration and do additional checks during wet weather patterns. The ODEQ standard is less than ten percent increase in turbidity.
- If turbidity is visible in the stream where haul roads cross streams, the BLM would check for turbidity beyond the mixing zone downstream (about 100 meters). If water clarity is visibly altered beyond the mixing zone, the BLM would suspend hauling and other operations that are contributing to the turbidity immediately and require the operator to immediately reduce fine sediment runoff into the stream by one or more of the techniques described in the following paragraphs. The BLM would allow operations to resume when weather and road conditions combined with measures taken to reduce sediment are deemed sufficient to comply with State of Oregon turbidity standards.

[11] Turbidity is a measurement of water clarity and is not convertible into a volume measurement of sediment yield unless correlated to suspended sediment data. For a description of sediment supply and transport processes in forested watersheds and the effects of forest management on these processes the reader is referred to Suspended Sediment Dynamics in Small Forest Streams of the Pacific Northwest (Takashi et al, 2005). Unless otherwise stated, "sediment" or "sediment runoff" means sediment that enters streams in amounts that cause a visible increase in turbidity beyond the mixing zone of 100 meters below the point where it enters the stream.

- When natural surface roads would be kept intact over winter for use on this project the next year, the BLM would require the operator to use one or more of the following methods to prevent erosion and sediment transport to streams that would cause a visible increase in turbidity: matting, mulching, constructing water bars or other surface shaping to drain runoff water to vegetated slopes, seeding, sediment traps and blocking the entrance.
- The BLM would restrict road construction, stabilizing operations to the dry season (typically June through October) and dry conditions when no surface mud or sediment laden runoff would be generated.
- To ensure compliance with Oregon Department of Environmental Quality (ODEQ) water quality standards the BLM would require culvert replacements at stream crossings to be done during the "in-water work period", the driest part of the year – July 15 – August 31 - and use work methods such as dewatering and sediment traps as directed by the BLM to reduce potential sediment generation that could increase turbidity.
- To ensure compliance with Oregon Department of Environmental Quality (ODEQ) water quality standards, for the log fill stream crossings in Section 25, 10S2E the BLM would require the operator to:
    - Modify existing log fill stream crossings (shaping and repairing road surface or replacing the fill with a temporary culvert), use and remove the temporary crossing (log fill or temporary culvert) during the same "in-water work period", the driest part of the year – July 15 – August 31 - and use work methods such as dewatering and sediment traps as directed by the BLM to reduce potential sediment generation that could increase turbidity.
    - Remove the culvert and/or fill, and restore the channel width, bank angle, cross sectional area and grade of the stream to match channel dimensions upstream and to provide for passage of water and sediment without causing the channel to either aggrade (fill in) or degrade (incise).
    - Place the removed logs in and adjacent to the stream channel as directed by the BLM hydrologist and/or fisheries biologist to provide continued presence of the large woody debris (LWD) element of stream structure.
    - Seed and mulch all disturbed soil at stream crossings with native species seed approved by the BLM and sterile mulch (free of non-native seed).

Other Components of Hydrologic Functions, Aquatic Habitat and Fisheries (Channel, Bank, Temperature, Etc.):

- Directionally fall trees[12] in the harvest units so that they do not enter the SPZ, to avoid impacts to the SPZ.
- If any trees or snags in the SPZ must be felled for safe logging operations, the BLM would require the operator to leave them on site as CWD habitat.

[12] Directional felling means to cut trees so that they fall in a specific, desired direction to achieve objectives. In this case the objective is to avoid impacts to the SPZ.

- BLM engineers would locate and design roads to be constructed in upland areas on stable ground with side slopes generally less than 30 percent that do not require extensive cut-and-fill construction methods, in order to avoid increasing mass failure (landslide) potential and to avoid intercepting groundwater.

3. Stand Structure, Wildlife Habitat and Other Vegetation:

To protect remnant old growth, wildlife habitat, and other retained trees, the BLM would require the operator's approved logging plan to include operational methods to:

- Maintain intact and standing snags larger than 15 inches diameter and taller than 15 feet (IDT BMP based on Wildlife Report) during logging activities, with rare exceptions for safe operations as required by Oregon Occupational Safety and Health Division (OR-OSHA, Oregon Occupational Safety And Health Standards, OAR Chapter 437, Division 7, Forest Activities). The BLM marking guidelines would direct the markers to make a conscious effort to protect large standing snags (at least 15 inches diameter, Wildlife Report, pp. 7-8) by marking some of the prescribed number of leave trees per acre as close to these snags as possible. Consider snags when planning road and landing locations to avoid impacts to snags larger than 15 inches diameter and taller than 15 feet whenever the BLM determines it is safe and feasible to do so.
- Retain Coarse Woody Debris (CWD) meeting RMP standards of at least 20 inches diameter and 20 feet long wherever feasible (RMP p. 21) and protect them from logging damage. Leave existing CWD in place whenever feasible.
- The required logging operations plan would include a design for skid trail location and operating techniques that require minimal movement of CWD to protect its physical integrity. (RMP p. 21).
- Retain some (number varies according to local abundance) trees that have desirable characteristics for wildlife habitat, such as multiple tops, broken tops, large limbs, disease, dead areas being used by cavity excavators, deep crevices and cavities.

To reduce the spread of invasive/non-native plant species:

- Seed and mulch exposed soil using native plant species seed and sterile mulch, in order to stabilize the soil and prevent establishing invasive/non-native plant species on disturbed soil in the project area.
- Clean all ground-disturbing logging and road construction equipment to be free of off-site soil, plant parts and seed prior to entering the project area to prevent introducing invasive and non-native plants into the project area. The BLM would require the operator to make that equipment available for BLM inspection before moving it onto the project area.
  If the BLM determines that there are high priority (species that are not yet widespread in this region and which have the potential to spread to new areas) weed species in the project area that could be transported to new sites outside of this area, clean all ground-disturbing logging and road construction equipment to be free of soil, plant parts and seed at a BLM approved site prior to leaving the project area, or at an approved industrial wash facility immediately after leaving the project area.

4. **Threatened, Endangered or Other Special Status Plant and Animal Species:**

- The BLM would require the operator to operate under the following seasonal restrictions to minimize disturbance to the northern spotted owl (NSO) as follows:
  - As required by the Letter of Concurrence (LOC), Definitions and General Standards (pp.11-12), no operations within disruption distance (0.25 mile for most activities) of known spotted owl sites during the NSO critical nesting season, March 1 – July 15.
  - No blasting operations within disruption distance (1 mile) of known spotted owl sites during the NSO nesting season, March 1 – September 30.
- The BLM would restrict or suspend operations at any time if plant or animal populations that need protection are found during ongoing surveys or are found incidental to operations or other activity in the area. The BLM would modify project boundaries at any time to buffer plant or animal species/populations that require protection (protocol specific to each species) that are found during ongoing surveys or are found incidental to operations or other activity in the area.

5. **Fire and Air Quality:**

To reduce the risk of fire and risks to air quality:

- The BLM would conduct all burning operations in compliance with the Oregon Smoke Management Plan to maintain air quality and visibility in a manner consistent with the Clean Air Act.
- The BLM would require the operator to construct slash and debris piles for burning according to the following requirements to achieve clean burning, to protect retained trees and to prevent burning anything outside of the piles:
  - construct piles with compact fuel arrangement to promote efficient burning;
  - place landing piles on soil already compacted by landing operations;
  - place piles to avoid heat damage to crowns and boles of retained trees; and
  - cover piles with plastic sheeting to keep fuels dry so they would burn efficiently during the wet season.
- The BLM would prepare a Burn Plan that would define specific parameters for burning operations. These parameters include acceptable ranges for weather conditions (temperature, relative humidity, wind direction and wind speed ranges), forecasted weather conditions, fuel moisture in the pile, and fuel moisture in adjacent fuels.

  The Burn Plan would also specify personnel needs, equipment needs, and escape fire prevention plans in order to conduct safe, efficient and effective burning operations.
- The BLM would require the operator to meet or exceed ODF fire prevention and fire suppression equipment standards.

6. **Public Safety, Rural Interface and Recreation:** Oregon Occupational Safety and Health Administration (OR OSHA) and the BLM would require the operator to place signs, temporarily block roads with vehicles or moveable barricades, and/or use flaggers to ensure public safety while logging, hauling and fuel treatment operations are active.

7. **Cultural Resources:** The BLM would restrict or suspend ground disturbing activities immediately if prehistoric cultural resources are encountered during project implementation. The BLM would conduct a professional evaluation of the resource site and develop appropriate management practices to protect it.

8. **Seasonal Restrictions and Operational Periods:** The Seasonal Restrictions and Operating Periods are summarized in *Table 3*.

Table 3: Summary of Seasonal Restrictions and Operational Periods

Seasonal Restriction	Reason
Most logging and road work	Northern spotted owl nesting season
Falling and yarding	Bark slippage
Hauling	Water quality and sedimentation
Skidding operations	Soil compaction
Road Construction / Decommissioning	Soil damage/erosion control
In-water work, roads*	Protect fish and aquatic habitat
Logging operations	Fire season, ODF regulated use

Key	Operations allowed.	Operations restricted, modified or allowed depending on conditions.	Operations restricted

* Includes log fill removal and temporary culvert installation/removal.

2.4 No Action Alternative

The No Action alternative describes the baseline against which the effects of the proposed action can be compared, i.e. the existing conditions in the project area and the continuing trends in those conditions if the BLM does not implement any of the proposed activities. Consideration of this alternative also answers the question: "What would it mean for the objectives to not be achieved?" The "No Action alternative" means that no timber management actions or connected actions would occur.

If this alternative were to be selected, the following activities would take place in the project area at this time: silviculture treatments for either Riparian Reserve habitat enhancement or Matrix timber management; timber harvest; road construction, renovation, improvement or closure; stream crossing restoration projects such as culvert upgrades or removal of failing culverts; and fuel reduction projects. Only normal administrative activities and other uses (e.g. road use, programmed road maintenance, harvest of special forest products on public land) would continue on BLM managed lands within the project area.

On private lands adjacent to the project area, forest management and related activities would continue to occur. Selection of the No Action alternative would not constitute a decision to change the land use allocations of these lands nor set a precedent for consideration of future action proposals.

2.5 Alternatives Considered But Not Analyzed In Detail

- Prescription to treat disease pockets: Unit A in 10S-1W-25 has evidence of laminated root disease *Phellinus weirii* and was considered for a heavier thinning (than described in the proposed action) with an underplanting of disease resistant species. This alternative was dropped from further consideration because of its potential to complicate fisheries consultation as the project area streams drain (more than 1 mile) to listed fish habitat in Crabtree Creek.
- Skyline logging: Additional acres for some thinning units were considered, requiring skyline logging. The portions of the proposed thinning units that would require skyline logging due to slope steepness were small, scattered, and would require additional road construction. Each of these factors increases cost. The IDT determined that thinning treatments in these areas would be beneficial, but are not required for long term stand viability. The IDT decided to drop these areas from further consideration to increase the economic viability of the planned timber sale and reduce the amount of road construction required to accomplish the project. (*EA section 2.3.2*.)
- Reserve the Stands in the Project Area for Carbon Storage: This alternative was not analyzed in detail for the following reasons.
    - It does not respond to the purpose for the project (*EA section 1.2*);
    - It is not in conformance with the RMP which sets the basic policy objectives for the management of the project area, in which Matrix lands are managed primarily for timber production, and Riparian Reserves are managed to help develop late successional habitat conditions in line with the Aquatic Conservation Strategy. The RMP does not include a Land Use Allocation that reserves lands or stands for carbon storage; and this alternative
    - It is substantially similar in design to the "No Action alternative" which is analyzed in the EA, in that this alternative would leave the stands unaltered and unmanaged just as under the "No Action alternative".

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

3.1 Analysis Assumptions and Methodology of the Analysis

Sources Incorporated by Reference: *Crabtree and Thomas Creek Watershed Analyses*

3.1.1 Analysis Assumptions

General

Timber management activities will occur on BLM-administered lands allocated to planned, sustainable harvest.

The type, quantity, and impacts of allocating these lands for the type and quantity of these timber management activities were analyzed in the Salem RMP/FEIS for both the short-term (10 years) and long-term (decades). Under the RMP, this applies to Matrix/GFMA lands in the proposed project area.

- Future timber management activities on those BLM-administered lands will re-use the transportation system of skid trails, landings and truck roads proposed for this project.
- The Riparian Reserve LUA on BLM-administered lands will be managed for protection of watershed values such as drinking water, water quality and aquatic habitat and for terrestrial wildlife habitat on both a local and landscape level.
- If the proposed action is implemented, no further silvicultural treatments would be anticipated for approximately the next 20 years in these stands, both Matrix and Riparian Reserve.
- Potential warming and drying trends predicted by some global climate change models within the next 20 years would not change these management recommendations because BLM's experience with similar projects has demonstrated that the same principles and effects apply to similar forest stands in warmer and drier areas further south and at lower elevations within the *Tsuga heterophylla* (western hemlock) forest zone classification. Warming and drying could theoretically increase stresses in overcrowded stands, but the BLM cannot reliably quantify this effect with current modeling tools and believes that the range of forest conditions and effects would continue to be within the ranges analyzed.
- Most private forest lands in the Crabtree and Thomas Creek watersheds will be intensively managed with regeneration harvests scheduled on commercial economic rotations occurring at 50-60 year intervals (PRMP/FEIS 1994, p. 4-3). BLM observations of recent trends in industrial forest management indicate that this interval may be reduced to 30-40 years for some landowners.

Vegetation/Silviculture

- As relative density[13] (RD) increases above 50 percent competition for light, nutrients and water begins to reduce growth rates and increase stresses on individual trees and on the stand as a whole. Forest stands with relative densities above 65 percent have lower tree vigor, higher mortality of suppressed trees, and higher susceptibility to insects, disease, and more severe fire behavior than stands with lower densities (Perry, 1994; Hann and Wang 1990; Curtis 1982). These conditions reduce stand resiliency and resistance to environmental stresses.

Soils

- All lands on BLM are classified as either, *Suitable* for timber production, *Suitable but fragile* for a variety of reasons (e.g., nutrient status, compacted surfaces, slope gradient, etc.) or *Non-suitable*. BLM practice is to locate proposed timber harvest unit boundaries to avoid areas that are *Non-suitable*.
- If less than ten percent of the ground surface is compacted (≥10 percent increase in density) by logging operations (e.g. ground based equipment and landings), then impacts and potential reductions in growth and yield are within the standards analyzed in the FEIS/RMP.

[13] Relative density (RD, using Curtis' system) is a measure of crowding in a stand of trees, expressed as a percentage of density (based on number and size of trees) relative to a theoretical maximum density.

- See the Hydrology section of this EA for discussion of assumption for WEPP modeling of soil erosion.

Air Quality/and Fire Hazard /Risk

- Climate change may change the duration and severity of wildfire season to an unknown extent during the project period (three years of operations plus up to three years for fine fuels to deteriorate), but that any such overall increase would not be expected to exceed the conditions used to model fire potential for this time period because the models were developed using a wide range of conditions that include potential variation in the range of conditions at this site.

Recreation/Visuals/Rural Interface

- Access to the project area will continue to be controlled by gates and road owner policy as it now is.

3.1.2 Methodology

General

The forest condition information was compiled from a variety of sources:

- The RMP/FEIS provided general vegetation information for the Salem District planning area as of September 1994.
- A wide range of published research provided ongoing baseline information specific to forest vegetation and the impacts of managing or not managing forest stands (*EA section 9.0*).
- GIS data, aerial photographs and satellite imagery, FOI records, resource specific field surveys (see the following EA sections for specific surveys conducted) and field reconnaissance by BLM resource specialists were used to describe vegetation, habitat and plant and animal species present on BLM lands.
- Aerial photographs from the last 50 years, satellite imagery, GIS data and field reconnaissance by BLM personnel at various times from 2005-2008 were used to assess changes and to determine present forest conditions (species, structure, canopy cover, size classes) on all land ownerships within the Lost Lulay 6th field watersheds.

Vegetation

- For stand structure information, Stand Exams were conducted under BLM administered contracts in 2002 and 2006 and additional stand information was gathered by BLM personnel.
- The BLM analyzed the data using BLM's EcoSurvey Program and used it as the basis for the description of existing vegetation and forest stand characteristics and for developing the prescriptions that would be implemented under the Proposed Action.
- For Threatened/Endangered/Special Status/Special Attention botanical species and Survey & Manage Botanical Species, The BLM botanist for Cascades Resource Area conducted two types of surveys within the project area and vicinities; Known Site Surveys (Data Search) and Field Surveys (Botanical Inventory).
    - *Known Site Survey*: Prior to field surveys, the botanist reviewed data bases for the presence of known Threatened or Endangered (T/E), Special Status Species (SSS), Survey and Manage (S&M) and Invasive/Non-native plant species in or near the

project area; evaluated habitat requirements for T/E, SSS and S&M species; and evaluated the known habitat in the proposed harvest area(s) for habitat suitability for T/E, SSS and S&M species.

- *Field Surveys:* The botanist conducted botanical inventories of the proposed harvest areas for T/E, SSS and S&M species on 04/21/08, 05/20/08 and 08/07/08.

Hydrology

- The Water Erosion Prediction Project (WEPP) soil erosion model was used to predict potential changes in erosion and sediment yield from actions proposed in this EA. Documentation of the WEPP model is available at the following web site: http://fsweb.moscow.rmrs.fs.fed.us/fswepp. The WEPP model is a physically-based soil erosion model developed by an interagency group of scientists from the U.S.D.A. Agricultural Research Service, Forest Service, and Natural Resources Conservation Service and the U.S.D.I. Bureau of Land Management, and Geological Survey.

Fisheries and Aquatic Habitat

- Resident fish distribution was determined from electro-fishing surveys of project area streams during March-April 2009 conducted by BLM Fisheries Biologists.
- Locations and conditions of existing culverts, proposed stream crossings, and log hauling roads were examined during March-April 2009.

Soils

- Soil maps and descriptions of project soil characteristics from the Natural Resource Conservation Service web site: http://www.or.nrcs.usda.gov/pnw_soil/or_data.html were used to develop large scale (project-wide) soil descriptions.
- Site specific conditions on BLM lands in the project area were mapped and field-verified in the Timber Production Capability Classification (TPCC) database (Power and Tausch. 1987). From the TPCC preface: "The purpose of the TPCC is to interpret soil and land characteristics to assist in timber management planning and in the application of practices which will maintain or enhance production over a long period of time".
- The WEPP (Water Erosion Prediction Project) soil erosion model was used to predict potential changes in erosion and sediment yield.
- BLM Resource Specialists for soil and hydrology visited the project area multiple times, performing both formal surveys and informal reconnaissance, including digging small pits, to evaluate site specific conditions.

Wildlife

Cascades Resource Area Wildlife Biologists assessed potential effects to terrestrial species by using the following methodologies:

- For Special Status/species of concern: They compiled a list of species in the Cascades Resource Area using BLM wildlife databases, BLM Special Status Species lists (BLM IM OR-2008-038), Oregon Natural Heritage Information Center lists (ONHIC 2007), various wildlife field guides, literature, and texts.
- The biologists visited the project area during the 2002, 2003, and 2008 field seasons and examined habitats in and adjacent to proposed Lost Lulay units.

- From the Cascades Resource Area list, the wildlife biologists compiled a list of Special Status/species of concern documented or suspected to occur in the Lost Lulay Project Area based the proposal's geographic location, elevation, and knowledge of habitats present gained through air photo interpretation, stand exam data, GIS information, and field reconnaissance. For each of those species they determined habitat associations and the presence or absence of suitable habitat. The resulting list of special status species which are known or suspected to occur in the Lost Lulay Project Area and their habitat preferences is included in EA section 7.1, Table 19.
- For Bureau Strategic species (a new category identified in Instruction Memorandum BLM IM OR-2007-072, July 25, 2007): Biologists looked for the species incidental to other surveys. No additional surveys are required.
- For migratory and resident birds: The biologists developed a list of migratory and resident birds and addressed them according to new interim guidance in Instruction Memorandum BLM-IM-WO-2008-50. To develop this list they identified bird species which are documented or suspected to nest on BLM lands in the Cascades Resource area, then identified which of those species have at least a low probability of nesting in the Lost Lulay Project Area. They consulted a variety of sources and criteria to identify a list of priority species, sources and species priority determination are listed in Appendices A and B of the Wildlife Report.
- For northern spotted owl (NSO): . There are two historic known spotted owl sites in the vicinity of the proposed units. The North Fork Neal Creek known spotted owl site was last occupied by a nesting pair in 1994. The last pair response was in 2005, and the last single response was in 2007. There were no responses in 2006, 2008, or 2009. The Lulay known spotted owl site was last occupied by a nesting pair in 1993. The last response from a pair was in 1999, and the last response from a single bird was in 2002. The Lulay known spotted owl site has been consistently surveyed since then and there have been no spotted owl responses. Additional surveys for northern spotted owls may be conducted.
- Additional surveys: The BLM conducted surveys for red tree voles in 10S-1E-29 and 11S-1E-5 in the spring of 2003. Red tree voles were confirmed to be present in 10S-1E-29 units A and B; and 11S-1E-05 unit A.

3.2 General Setting/Affected Environment

Sources Incorporated by Reference: Crabtree and Thomas Creek Watershed Analyses

Existing Watershed Condition

The Lost Lulay project area is located within the Crabtree and Thomas Creek watersheds.

Crabtree Creek

Crabtree Watershed Analysis (July 2001) covers 100,022 acres of Linn County. The watershed area stretches from its confluence with the South Santiam River in T.10S., R.2W., to Crabtree Mountain in T.11S., R.3E., and Green Peter in T.12S., R.2E. Eighteen percent of the land is in Federal (BLM) ownership, two percent is owned by State, thirty-eight percent is owned by Private Industries, and forty-two percent is owned by Private Non-Industrial. Under the current Resource Management Plan, there are four land use allocations (LUA) represented in the Crabtree Watershed.

Those land use allocations are General Forest Management Areas (GFMA), Connectivity/Diversity Blocks (CONN), Late Successional Reserves (LSR), and Riparian Reserves (RR). Within the Federal ownership, forty percent is in GFMA, twenty-three percent is in CONN and thirty-seven percent is in LSR. The total percentage of RR inside these LUA is forty-four percent and fifty-six percent outside RR.

Historical Human Use in the Watershed:

Native Americans maintained permanent villages in the Willamette Valley and lower reaches of Willamette tributaries. Their subsistence activities were closely tied to various plants available in the Willamette Valley, particularly camas and tarweed, and family groups moved to temporary camps from March to November to harvest various plant resources. During their seasonal round however, from late summer into early fall, some small groups embarked on hunting, fishing and berry picking expeditions into the Cascades and Coast Ranges while others remained near plant resources in the valley.

Fire was set to the dry prairie of the Willamette Valley for a number of resource management purposes, including manipulating habitat for hunting, promoting favored plant species, and preparing tarweed for harvest.

Homesteading and Settlers raised sheep and milk cows and grazed their livestock along the creek and meadows. Homesteading activities include construction of cabins, clearing of small number of acres for cultivation, and planting of fruit trees (CWA pp. 14-1).

Existing Condition

There is approximately 603 miles of mapped road in the Crabtree Watershed. 130 miles of these roads are on federal (BLM and USFS) lands. Average total road density across all ownerships is estimated at 3.86 miles per square mile (miles/mile^2), 4.68 miles/mile^2 on federal lands (CWA pp. 5-12, 5-13). Approximately 92 percent of the roads are within 100 feet of a stream (CWA pp. 5-33).

Approximately eighty (80) percent of the Crabtree Watershed as a whole is dominated by closed-canopy conifer forests; 10 percent of the watershed area is covered by mixed conifer-broadleaf forests (CWA pp.5-2), based on Interagency Vegetation Mapping Program satellite imagery and mapping). These stands are predominantly open sapling/brush seral stands 10- to 40-years of age, which lack structure and characteristics of late-successional stands (CWA pp. 5-36).

On BLM land within the Crabtree watershed approximately 17 percent of the forest stands are in this mid-seral stage, 44 percent are in early-seral stage, and 35 percent are in mature and older forest seral stages. On BLM land, there is approximately 21 percent of old growth more than 200 years of age (CWA pp. 5-4). None of which are proposed for harvest in the Lost Lulay thinning project. BLM land is within the General Forest Management Area (GFMA) portion of the Matrix land use allocation (LUA) and the Riparian Reserve LUA described in the Salem District Resource Management Plan (RMP p.5), (NWFP p. A-5; CWA pp. 1). For additional description of stands and vegetation, see EA Section 3.3.1, Vegetation and Forest Stand Characteristics. Average slope gradients in the watershed are less than 20 percent (CWA pp. 5-45).

The following acreage summaries provide additional context for the project:

- There are approximately 18,008 acres of BLM managed land in the Crabtree watershed (GIS data base). These acres include:
    - 7,209 acres within the Matrix (General Forest Management Area (GFMA)) land use allocation (LUA)
        - 144 acres of thinning is proposed within the Matrix (GFMA) LUA for the Lost Lulay project.
    - 3,053 acres within the Riparian Reserve LUA
        - 33 acres of thinning is proposed within the Riparian Reserve LUA for the Lost Lulay project.
- 177 total acres of the Crabtree watershed are proposed for thinning in the Lost Lulay thinning project.

Thomas Creek:

Thomas Creek Watershed Analysis (December 1996) covers 75,066 acres of Linn County. The watershed stretches from Rogers Mountain in T.10S., R.2W., to McCully's Mountain in T.10S., E.2E. and Snow Peak in T.11S., R.2E., to Monument Peak in T.10S. R.4E.

Seventeen percent of the land is in Federal (BLM) ownership, less than half of a percent is owned by USFS, about two and a half percent is owned by State, fifty percent is owned by Private Industries, and thirty percent is owned by Private Non-forest. Under the current Resource Management Plan, there are four land use allocations (LUA) represented in the Thomas Creek Watershed. Those land use allocations are General Forest Management Areas (GFMA), Connectivity/Diversity Blocks (CONN), Late Successional Reserves (LSR), and Riparian Reserves (RR). Within the Federal ownership, forty-four percent is in GFMA, thirty-nine percent is in CONN and seventeen percent is in LSR. The total percentage of RR inside these LUA is forty-two percent and fifty-eight percent outside RR.

Historical human use in the watershed:

Native Americans burned the prairie/forests to provide safety from other tribes, maintain game forage for hunting purposes and to ease travel. Early settlers harvested and converted much of the oak savannah and open mixed conifer hardwood stands to dense conifer stands to agricultural/farm lands (TCWA pp. 4-22, 4-23).

Existing Condition

There is approximately 586 miles of mapped road in the Thomas Creek Watershed. 102 miles of these roads are on federal (BLM and USFS) lands. Average total road density on federal lands estimated at 5 miles/mile^2 (TCWA pp. 5-38).

Approximately eighty (76) percent of the Crabtree Watershed as a whole is dominated by closed-canopy conifer forests; 5 percent of the watershed area is covered by mixed conifer-broadleaf forests (TCWA p.5-31), based on Interagency Vegetation Mapping Program satellite imagery and mapping). These stands are predominantly open sapling/brush seral stands 10- to 40-years of age.

On BLM land within the Thomas Creek watershed approximately 27 percent of the forest stands are in this mid-seral stage, 46 percent are in early-seral stage, and 5 percent are in mature and older forest seral stages.

On BLM land, there is approximately 14 percent of old growth more than 200 years of age (TCWA p. 5-30, 5-32). None of which are proposed for harvest in the Lost Lulay thinning project. BLM land is within the GFMA and CONN portions of the Matrix LUA and the Riparian Reserve LUA described in the Salem District Resource Management Plan (RMP p.5), (NWFP p. A-5; TCWA p. 1-6). For additional description of stands and vegetation, see EA Section 3.3.1, Vegetation and Forest Stand Characteristics.

The following acreage summaries provide additional context for the project:

- There are approximately 12,986 acres of BLM managed land in the Thomas Creek watershed (GIS data base). These acres include:
  - 5,717 acres within the Matrix (General Forest Management Area (GFMA) and Connectivity (CONN)) land use allocation (LUA).
    - 174 acres of thinning is proposed within the GFMA LUA for the Lost Lulay project.
    - 137 acres of thinning is proposed within the Conn LUA for the Lost Lulay project.
  - 4,436 acres within the Riparian Reserve LUA.
    - 56 acres of thinning is proposed within the Riparian Reserve LUA for the Lost Lulay project.
- 367 total acres of the Thomas Creek watershed are proposed for thinning in the Lost Lulay thinning.

Cumulative Actions

Past Actions - BLM timber sales: Lulay Camp, 2003, 289 acres of thinning

Private Actions - Industrial clearcuts adjacent to units

Future - BLM timber sales: None currently proposed in long range planning.

3.3 Resource Specific Affected Environment and Environmental Effects

This section of the EA describes the current condition and trend of the affected resources and the environmental effects of the alternatives on those resources. The interdisciplinary team of resource specialists (IDT) reviewed the elements of the human environment, required by law, regulation, Executive Order and policy, to determine if they would be affected by the proposed action (BLM Handbook H-1790-1: p. 137), [40 CFR 1508.27(b)(3)], [40 CFR 1508.27(b)(8)] (*EA section 3.3.10*), and issues raised in scoping (*EA section 1.4*).

The resources potentially affected by the proposed thinning activities are described in the following sections: Vegetation and Forest Stand Characteristics; Hydrology; Fisheries and Aquatic Habitat; Soils; Wildlife; Air Quality and Fire Hazard/Risk; Carbon Storage, Carbon Emissions and Climate Change; and Recreation, Visual Resources and Rural Interface.

3.3.1 Vegetation and Forest Stand Characteristics

Sources Incorporated by Reference: *Lost Lulay Silvicultural Prescriptions Commercial Thinning, Soo 2008 (Silviculture Report); Cascades Resource Area Botanical Report Proposed Lost Lulay Timber Sale, Fennell 2008 (Botany Report); Cascades Resource Area Wildlife Report Lost Lulay Project, England and Murphy 2008 (Wildlife Report); Lost Lulay Thinning Project Air Quality and Fire Hazard/Risk Specialist Report, Raible 2008 (Fuels Report). Additional sources: Stand Exam data and analysis, botanical surveys, field reconnaissance by BLM personnel, Crabtree and Thomas Creek Watershed Analysis, Salem District Forest Operations Inventory (FOI) data, Salem District Timber Production Capability Class (TPCC), Salem District Geographic Information System (GIS) data, Salem District archival records.*

Affected Environment

Stand Structure and Development

In general, the majority of the stands proposed for thinning in the project area were logged and re-planted in the 1960's to late 1970's, with the exception of the 50 to 70 year old stands, which were logged then regenerated naturally. The species removed from these stands include Douglas-fir, western hemlock, western redcedar and grand fir. Stand age ranges from 20 to 73 years, primarily in early to mid seral stage. The proposed project area stands are even-aged and mostly in the General Forest Management Area and some in the Connectivity/Diversity Blocks and Riparian Reserve (*Table 1*).

Matrix LUA (GFMA and CONN)

The uplands in the proposed project area are approximately 455 acres and are dominated by Douglas-fir. The stands are well stocked from 70 to 100 percent and have slopes ranging from 5 to 75 percent. The average Curtis relative density is 62 and there is an average of 227 trees per acre. Stand ages vary from 30 to 70 years, and the mean breast height diameter ranges from about 12 to 20 inches. In the understory, vegetation species consists of swordfern, vine maple, ocean spray, salal, and dwarf Oregon grape.

Riparian Reserve LUA

The Riparian Reserve stands proposed for thinning are similar to and contiguous with the Matrix stands proposed for thinning. When BLM lands in the Lost Lulay Thinning project area were originally logged and reforested, there was no distinction made between forest stands in what is now classified as Riparian Reserve and those in Matrix.

Stands in the Riparian Reserve that are naturally developing structural complexity are not proposed for treatment; therefore they are not "in the project area". Forest stands that are associated with ecological riparian zones where the water table largely defines site conditions typically developed more species and structural diversity with hardwood trees, brush species and western redcedar providing greater variety than is found in the adjacent uniform conifer stands.

The Riparian Reserves in the proposed project area are approximately 89 acres and are dominated by Douglas-fir with scattered western hemlock, grand fir, bigleaf maple and red alder. Canopy cover ranges from 72 to 88 percent and Curtis Relative Density ranges from 56 to 72. The trees per acre ranges from 138 to 343 with mean breast height diameter ranging from about 12 to 20 inches. In the understory, vegetation species consists of swordfern, salal, vine maple, beaked hazelnut, and dwarf Oregon grape.

Table 4: Stand Characteristics

Section and Unit	Township Range	Acres	Seral Stage	CWD (Linear feet/acre) **	Snags/100 ac >15"Diameter & >15'High **	Stand Age*	Trees per Acre	Average Diameter	Curtis RD
				Hard/Soft	Hard/Soft				
25A	10S 1W	51	Early Mid	0+/160	0+/20	35	222	13.5	60
25B	10S 1W	34	Early Mid	0+/<60	0+/20	32	237	12.8	59
21A	10S 1E	50	Late Mid	120/240	0+/0+	69	121	19.7	58
23A	10S 1E	13	Mid	0+/>60	0+/240	39	184	14.9	58
23B	10S 1E	67	Mid	0+/>60	0+/240	40	308	12.2	72
25	10S 1E	147	Mid	>60/240	0+/80	51	222	14.6	68
29A	10S 1E	32	Early Mid	0/<60	0/0	30	253	11.8	56
29B	10S 1E	33	Early Mid	0/<60	0/0	30	257	12.3	61
19A	10S 2E	25	Mid	<60/240	0/150	47	176	16.8	66
5A	11S 1E	65	Mid	<60/<60	50/0+	38	227	13.2	59
5B	11S 1E	27	Mid	<60/<60	50/0+	40	208	13.4	58

*As of Stand Exams in 2008. Correlation between stand exam units (FOI types) and proposed thinning units is not exact. Ages, T/A, Diameter and RD separated by a comma (##, ##) denote two FOI types within the treatment unit.

** 0 = None found or observed 0+ = None found on sample plots but some observed.

Characteristics of the Proposed Thinning Units (*Tables 4 and 18*):

T.10S, R.1W, Sec. 25

Unit A: This 51 acre stand is located in GFMA and is even-aged. The stand is well-stocked with 222 trees per acre with a basal area of 220 square feet. Douglas-fir is the dominant species in the stand with grand fir as the minor species and bigleaf maple as the hardwood species estimated to be about 19 trees per acre. The average age is 35 years and the average diameter is 13.5 inches. The stand Curtis Relative Density is 60, total canopy cover is 83 percent and crown ratios range from 25-50 percent. The understory consists of swordfern, vine maple, beaked hazelnut and oceanspray. There is a significant amount of laminated root rot throughout this proposed unit. There are about 3 live trees per acre with laminated root rot with 50 damaged trees per acre related to the disease.

Unit B: The 34 acre stand is located in GFMA and is even-aged. The stand is well-stocked with 237 trees per acre with a basal area of 211 square feet. Douglas-fir is the dominant species in the stand with grand fir as the minor species and bigleaf maple as the hardwood species estimated to be about 19 trees per acre. The average age is 32 years and the average diameter is 12.8 inches. The stand Curtis Relative Density is 59, total canopy cover is 93 percent and crown ratios range from 25-60 percent. The understory consists of swordfern, dwarf Oregon grape, vine maple and oceanspray.

T.10S, R.1E, Sec. 21

Unit A: The 50 acre stand is located in GFMA and is even-aged. The stand is well-stocked with 121 trees per acre and a basal area of 256 square feet. Douglas-fir is the dominant species in the stand with western hemlock as the minor species and bigleaf maple as the hardwood species estimated to be about 29 trees per acre. The average age is 69 years and the average diameter is 19.7 inches.

The stand Curtis Relative Density is 58, total canopy cover is 88 percent and crown ratios range from 20-40 percent. The understory consists of swordfern, vine maple, Oregon oxalis and dwarf Oregon grape.

T.10S, R.1E, Sec. 23&25

All units combined are about 227 acres. Section 23 is located in GFMA and section 25 is in CONN. These stands are even-aged, well-stocked with a range of 184-315 trees per acre and basal area range of 222-265 square feet. Douglas-fir is the dominant species with western hemlock, western redcedar and grand fir as minor species, and bigleaf maple as the hardwood species estimated to be about 18.4 trees per acre. The average age range is 39-51 years and the average diameter range is 12.2-14.9 inches. The stand Curtis Relative Density range is 58-72, total canopy cover is 82-87 percent and crown ratios range from 20-80 percent. The understory consists of swordfern, vine maple, salal, oceanspray, Oregon oxalis and dwarf Oregon grape. There is a small amount of laminated root rot in T.10S, R.1E, Section 23 Unit A.

T.10S, R.1E, Sec. 29 and T.11S, R.1E, Sec. 5

All units combined are about 154 acres. These stands are located in GFMA and are even-aged. These stands are located in GFMA, are even-aged, well-stocked with a range of 208-257 trees per **acre** and a basal area range of 192-213 square feet. Douglas-fir is the dominant species with western hemlock and grand fir as the minor species and bigleaf maple as the hardwood species estimated to be about 99 trees per acre. The average age range is 30-40 years and average diameter range is 11.8-13.4 inches. The stand Curtis Relative Density range is 56-61, total canopy cover is 77-88 percent and crown ratios range from 20-60 percent. The understory consists of swordfern, vine maple, California blackberry, oceanspray, Oregon oxalis and dwarf Oregon grape.

T.10S, R.2E, Sec. 19

This 25 acre stand is located in CONN and is even-aged. The stand is well-stocked with 212 trees per acre and basal area of 313 square feet. Douglas-fir is the dominate species with western hemlock as the minor species and red alder as the hardwood species estimated to be about 57 trees per acre.

The average age is 47 years and the average diameter is 16.8 inches. The stand Curtis Relative Density is 66, total canopy cover is 85 percent and crown ratios range from 25-75 percent. The understory consists of swordfern, vine maple, beaked hazelnut and salal. There is a lot of coarse woody debris 25"+ in this stand when compared to all other units proposed in the project area.

Analysis in Support of the Thinning Prescription

Matrix (GFMA) LUA:

The stands in the project area are even-aged stands of mixed conifers and are dominated by Douglas-fir. The stands are well stocked and dense. None of the stands in the Lost Lulay project area have reached CMAI. The vegetation ages in these stands are primarily in early to mid seral stage (30 to 70 years of age). Some portions of these stands were commercially thinned about 30 years ago, to maximize volume production from these lands.

Additional reasons for commercial thinning include:

- immediate return of volume,
- development of larger residual trees,
- fire hazard reduction,
- increasing growth and diversity of understory vegetation,
- accelerating the development of future spotted owl habitat (see *EA section 3.3.5,* Wildlife),
- maintaining the health and vigor of the stand, and
- providing options for future management

The proposed thinning treatment is designed to meet all of these objectives.

Riparian Reserve LUA:

The Riparian Reserves are even-aged and are similar to the upland vegetation. These areas are well stocked and dense with mixed conifers. Vertical canopy structure is lacking in terms of understory trees and/or shrubs and vegetation. Habitat and vertical development could be facilitated through thinning in these areas. In about 20 years the stands would need to be evaluated for further silvicultural treatment such as creating clumps and gaps to meet management objectives.

Survey Results for Threatened or Endangered /Special Status/ Survey and Manage Plant Species

- Comprehensive botanical inventories were conducted by field surveys of the proposed harvest areas on April 21st, May 20th and July 7th, 2008 (Botany Report, pp. 1-3).
- One Bureau Sensitive Special Status vascular plant (*Cimicifuga elata)* is known from three sites adjacent to or in the vicinity of the proposed harvest units in Sec. 23, T.10S., R.1E., WM.
- Special survey emphasis was given to particular Sensitive Species based on habitat requirement of those species and the known habitat in the proposed harvest areas.
- No Threatened & Endangered or Special Status lichen, bryophytes or fungi species were found during site surveys and there are no known sites within the proposed harvest areas or close proximity as determined by a search of known site data.

Survey Results for Invasive / Non-native Plant Species

Based on observations of the location and abundance of invasive species made during field surveys, invasive species are present along open roads in and adjacent to the proposed Lost Lulay Thinning area, but they are not strong competitors with native species. Areas of past ground disturbance (e.g. old roads) within and adjacent to the proposed project areas were absent of invasive species (Botany Report pp. 8-9) likely due to their inability to compete with native vegetation and the lack of available sunlight.

BLM field surveys found the following BLM Manual 9015 Class C and/or Oregon Department of Agriculture (ODA) List B invasive/non-native species were found to occur adjacent to the proposed harvest area(s) within road corridors; meadow knapweed (Centaurea pratensis), himalayan blackberry (*Rubus discolor*), tansy ragwort (*Senecio jacobaea*), bull thistle (*Cirsium vulgare*), Canadian thistle (*Cirsium arvense*), St. John's wort (*Hypericum perforatum*), and scotch broom (*Cytisus scoparius*) (Botany Report pp. 3-4).

Survey results show that all of the invasive/non-native species identified were found to inhabit road corridors (areas of high light and soil disturbance) in both Matrix and Riparian Reserves and none were found within the proposed harvest areas outside of road corridors. These invasive/non-native species are regionally abundant and well distributed throughout northwest Oregon and eradication is not practical due to the widespread ubiquitous nature of their infestations (Oregon State Department of Agriculture Weed Mapper). The BLM botanist conducted a Noxious Weed Risk Assessment of the project area and determined that the area has a risk rating of "moderate" (Botany Report, p. 9). A moderate rating indicates the proposed project could proceed as planned with measures in place to control and/or prevent the establishment of invasive/non-native plant species in areas of ground disturbance.

Environmental Effects

3.3.1.1 Proposed Action

Within the Matrix LUA

Stand Structure and Development

Observed Characteristics and Direct Effects Immediately after Thinning:

Immediately following a thinning the stands should appear healthy with minimal logging damage[14] to the residual trees. Some soil disturbance from yarding maybe evident. Most of the stand should appear more uniform in spacing and tree size. There will be an increase of radiant sunlight through the stands to the understory due to the reduction of dense canopy cover. Crowns of retained trees would receive sunlight from the sides as well as above, and lower limbs would be less shaded.

Fewer trees and lower relative density would result in less competition for site resources (light, nutrients and water). Enough light would reach the forest floor to allow establishment of native ground cover species, and brush understory with some conifer regeneration.

The canopy would be more open than it is currently so that the crowns of retained trees would receive sunlight from the sides as well as above, and lower limbs would be less shaded. Species mix should be about the same as before the commercial thin harvest treatment. Average stand diameter would be increased, since the bulk of the harvested trees would be in the smaller diameter classes.

In 25A-10S1W, laminated root rot (*Phellinus weirii*) has spread throughout the stand. The root rot pockets will continue to spread, creating canopy gaps over the next decades. The removal of infected trees and potentially infected trees may help slow down and reduce further root-to-root spread throughout the stand.

Observed Characteristics and Trends in the Long Term:

In the next 20 years, growth on the residual trees should continue at a steady rate, which would be greater than the growth rate if the area remained unthinned.

[14] The BLM considers a logging-damaged tree as one that has had its cambium removed from more than 50% of the circumference of its bole, and a minimal amount of damage would typically be not more than two trees per acre (2 TPA) having that amount of damage.

The crowns should expand and fill the opened spaces created by the thinning and the site should be fully occupied so that growth is slowing down by the end of the second decade after thinning. The understory vegetation and species diversity should have increased and then become less vigorous as canopy closes. The effect of the thinning on total net yield in the GFMA should be positive since available site resources would be redistributed and utilized by fewer stems. For subsequent rotations the productivity of this site should be maintained. It should produce a sustainable supply of timber and still meet all of the other resource objectives outlined in the ROD and RMP.

Indirect Effects:

As site resources (light, nutrients, water) are concentrated on fewer trees, the growth rates of the retained trees increases and the trees are more vigorous and healthy compared to what they would be in a crowded stand[15]. With faster growth rates, it is reasonable to assume that more trees would get larger faster, with proportionate increases in average log volume and timber value for the remainder of the rotation (the planned cycle of a forest stand from establishment to regeneration harvest). The faster growth rates after thinning would also provide trees of suitable size for snags (15+ inches diameter) and CWD (20+ inches diameter) as needed for management plans sooner than would be available without thinning.

In the Pacific Northwest, many studies have been done which document the differential growth rates and structural development of thinned versus unthinned forests. Two of the most recent studies are: Emmingham *et al*, 2007; and Davis *et al*, 2007. All such studies include an unthinned "control" treatment for comparison purposes. In a research context, the controls test the scientific "null hypothesis," that is, whether or not the treated stands would have shown the same growth and development with no treatment whatsoever.

Roberts, et al (2007) looked at wind damage following the implementation of variable-density thinning prescriptions. They found no significant difference in wind damage following thinning, between thinned and unthinned areas. Further, internal edges created by gaps, skid trails, and unthinned patches did not inherently increase wind damage risk.

The paper also recommends that care be taken to locate gaps and skid trails away from topographically vulnerable positions.

BLM experience with similar thinning projects has shown that thinning as prescribed in the proposed action retains sufficient strength in the stand to resist windthrow of more than scattered individual trees. As trees in the stand become more vigorous, increased root mass) as the roots spread into areas previously occupied by competing trees) and limb-to-limb contact that further dampens swaying, wind-firmness will continue to increase.

There is a theoretical, unquantifiable risk that an unusually intense windstorm in the first year to three years would result in more extensive windthrow than would occur in the untreated stands. Observations of stands within the general project area that were thinned approximately 20 years ago support the BLM's conclusion that we would not expect increased windthrow.

[15] This is the same concept as thinning carrots in a vegetable garden. So many seeds typically sprout that the crowded carrots would be small and unhealthy if not thinned. The first thinning is usually done when the carrots are too small to be eaten (precommercial thinning). When some of the carrots are harvested during the growing season they may be large enough to eat (commercial thinning) and the ones left in the ground will grow larger until harvested in the fall (regeneration harvest).

Trees damaged by logging would either survive to be logged in future timber harvest, develop decay pockets that could be used by cavity excavating/nesting wildlife species, or die and become snags or woody debris.

Threatened, Endangered and Special Status Plant Species

No Suitable habitat to support any T/E species was identified within or adjacent to the proposed project area. Although suitable habitat to support some Special Status Species (SSS) was identified within the proposed project area, no SSS were found. Suitable habitat will remain in both the thinned area and reserves, and no adverse impact to suitable habitat, or any undiscovered SSS is anticipated. The proposed project would not contribute to the need to list any SSS.

Invasive/Non-native Plant Species

It is unlikely that this project would result in the spread of any of the invasive species populations present within and adjacent to the proposed thinning units, along roads accessing these units or along roads where log haul would take place for the following reasons.

A slight increase in the number of individual invasive/non-native plants is likely to occur as a result of project activities. In the professional opinion of the BLM botanist, the increase in the number of plants would be so small as to be difficult to quantify because of the widespread and ubiquitous nature of the invasive species populations identified in the proposed project area (see affected environment). For example, if 10 new scotch broom were to start growing as a result of the proposed action, the increase would be undetectable compared to the current regional scotch broom population of many millions of plants.

In the short term (1-5 years) some areas of soil disturbed by logging and road construction/ stabilization operations may become infested with species already present in the area. The BLM anticipates that the infestations would be short lived due to competition by native species. This conclusion is based on the BLM's general observations throughout the Cascades Resource Area and specific observations of forest stands within and adjacent to the Lost Lulay Thinning project that have been commercially thinned in previous years and show little or no difference in their invasive/non-native species population composition compared to untreated stands.

In addition, BLM's experience shows that the seeding it would conduct on disturbed soil in exposed areas (non-forested areas such as roads) with native grass species would prevent establishment of invasive/non-native species populations in these areas.

Based on more than a decade of BLM experience with washing equipment, visual inspection of that equipment by BLM personnel, and monitoring invasive species after logging, washing of earth moving and logging equipment before entering BLM land has proven to be an effective method to reduce the risk of spreading invasive species. In addition, if known invasive species are identified in or adjacent to the proposed harvest area, washing of earth moving and logging equipment before they leave BLM land would reduce the risk of spreading these invasive species to other areas.

Within the Riparian Reserve LUA:

Stand Structure and Development

The thinning prescription and logging methods are essentially the same in the Riparian Reserves as they are in the adjacent Matrix portions of the treatment area. Therefore, the environmental effects are essentially the same as described above for thinning on Matrix.

The focus of the description of environmental effects to vegetation and stand structure on Matrix ground emphasized the effects important to timber production. The following description of environmental effects to vegetation and stand structure in the Riparian Reserve emphasizes the effects important to ACS objectives.

Observed Characteristics and Direct Effects Immediately after Thinning:

Immediately following the commercial thin, the riparian reserves should appear healthy with minimal damage to the residual trees. Some soil disturbance from yarding may be evident. Most of the riparian reserves should appear more uniform in spacing and tree size with the exception of some gaps from non-uniform natural spacing of trees. There will be an increase of radiant sunlight in the riparian reserves due to the reduction of canopy cover. Species mix should be about the same for the overstory as before the commercial thin harvest treatment.

Fewer trees and lower relative density would result in less competition for site resources (light, nutrients and water). The canopy would be more open than it is currently so that the crowns of retained trees would receive sunlight from the sides as well as above, and lower limbs would be less shaded. Enough light would reach the forest floor to allow establishment of native ground cover species, and brush understory with some conifer tree regeneration within three to five years. Small clumps and gaps created by spacing would also introduce variation in the density, distribution and species mix of ground cover plants and brush and conifer understory.

Hardwood trees and conifer species having low local abundance to be retained in the stand would have less competition for site resources and should have higher survival and growth rates than would be expected if the stands were not thinned.

Skid trails should not create linear canopy gaps since the 12 ft. width is less than the average leave tree spacing and there is no direct impact to the canopy, but the compacted trail would be visible on the ground and take one to two decades longer to grow ground cover and understory than the 90 percent of the ground based yarding area in the Riparian Reserve that is not compacted by skid trails.

Observed Characteristics and Trends in the Long Term:

In the next 20 years, growth on the retained trees should continue at a steady rate, which would be greater than the growth rate if the area remained unthinned. The crowns would expand and fill the spaces created by the thinning and the site should be fully occupied so that growth is slowing down by the end of the second decade after thinning. The understory vegetation in the thinned area should be well established and vigorous by year five, but start to become less vigorous after about 15 years as the site resources become concentrated in the trees and less light reaches the forest floor.

Indirect Effects:

As site resources are concentrated on fewer trees, the growth rates of the retained trees increases and the trees are more vigorous and healthy compared to what they would be in a crowded stand. With faster growth rates, it is reasonable to assume that more trees would get larger faster.

The faster growth rates after thinning would provide trees of suitable size for snags (15+ inches diameter) and CWD (20+ inches diameter) sooner than would be available without thinning. Thus, accelerated growth would help meet Terrestrial Recommendation 1 of the CCWA (p. 8) and TCWA (p. 99) to "… develop and maintain later seral forest stand characteristics. Desirable stand characteristics include larger trees for a large green tree component and recruitment of large standing dead and down coarse woody debris in future stands…"

Retaining minor conifer species and hardwoods and the development of understory vegetation would also help meet Terrestrial Recommendation 1, which continues: "…multi-layered stands with well developed understories, and multiple species that include hardwoods and other minor species."

Since Riparian Reserve stands tend to be more on stream canyon slopes rather than on exposed upland ridges, they tend to be more sheltered from high winds than Matrix stands on exposed ridges. The BLM expects, based on experience with similar projects, even less windthrow in Riparian Reserves than in Matrix stands. Individual windthrown trees and small windthrown patches of trees contribute to structural complexity as natural openings with "debris pile" habitat that develops into a brush patch and eventually, again, conifers.

Trees damaged by logging would either survive and perhaps develop decay pockets that could be used by cavity excavating/nesting wildlife species, or die and become snags or woody debris.

Long Term Management Objectives:

To continue accelerated development of late seral characteristics beyond two to three decades after thinning, a second treatment would be needed approximately 20 years after this proposed thinning. At that time, the expected abundance of trees larger than 20 inches diameter with healthy crowns and understory of ground cover species, brush and conifer seedlings/saplings would provide opportunities to enhance and accelerate the late seral characteristics that would be developing.

The following photos indicate the visual differences in stand characteristics that typically result from thinning prescriptions. Photos by K. Walton, 2009

Photo 1: Dense stand proposed for thinning in NW¼ Section 25, T. 10 S., R. 1 E. Photo taken from natural surface spur road proposed for renovation, planned for use in ground based logging.

Photo 2: Example of treatment of similar stand, Lulay Camp Timber Sale 5 years after commercial thinning. Note unthinned reserve island to right of photo center (white tag, orange paint) for comparison. NW¼ Section 19, T. 10 S., R. 1 E. Photo taken from natural surface spur road used for ground based logging.

Photo 3: Example of a nearby stand, approximately 20 years older than the stand in photo 2, 5 years after second entry thinning in the Lulay Camp timber sale. NW ¼ Section 29, T. 10 S., R. 1 E. Photo taken from landing used for ground based logging.

Photo 4: Stand proposed for treatment in NE ¼ Section 29, T. 10 S., R. 1 E.

Photo 5: Riparian Reserve thinning 5 years after treatment, ground based logging. SW ¼ Section 19, T. 10 S., R. 1 E.

3.3.1.2 Cumulative Effects

The cumulative effects to the vegetation from 544 acres of commercial harvest treatment in the short term will be the partial removal of vegetation in the proposed project area units. The long term effects of thinning produces no changes to the landscape mosaic. In a broader perspective, the sixth field watershed that surrounds the immediate adjacent lands and the proposed project area in the north and to northeast are primarily owned by private and assumed mostly agriculture use.

In the south and southeast the land owners are mostly private industries and assumed lands to be in early seral stage. Industrial land immediate adjacent lands to the proposed project area are owned primarily by private industries. Seral stages on these lands are assumed to be in early stages (0-5+ years of age) to some early mid seral stages (30-40 years of age) as a result of intense 40 year harvest cycles. Small portions of land adjacent to the proposed project area are privately owned and are assumed to be in mid (40 to 60 years of age) to mature (120-199 years of age) seral stages. These lands are not intensively managed for commercial timber production.

3.3.1.3 No Action Alternative

Stand Structure and Development (all land use allocations)

The stands would continue to grow but at a reduced rate. Crowns would remain closed and there would be more suppression mortality resulting in more snags and down wood, especially in the smaller (less than 15" DBH) size classes. Understory vegetation would further be reduced in quantity and diversity because of the ever-reduced light reaching the forest floor. In the Matrix LUA, at rotation age there would be smaller trees of lower quality to harvest and total net yield would be reduced below the potential for the site.

Within the Riparian Reserve LUA especially, there would be slower development of the 20+ " DBH trees desirable for future snag and coarse woody debris recruitment and fewer of them would reach this size within the next 20 years. The dense stands would not increase in vigor and may decline in vigor, making them more susceptible to disease, insects, windthrow and fire. This condition would not meet O&C Act, or RMP objectives and would not fulfill the Purpose and Need for this project.

Laminated root rot *(Phellinus weirii)* would continue to spread throughout the stand by root-to-root contact infecting uninfected trees. The resulting canopy gaps would continue to enlarge and infected trees would continue to decline in growth, stability, and vitality.

Threatened/Endangered/Special Status/Special Attention/ Survey & Manage Plant Species

With no human caused changes and excluding natural disturbances to the habitat that currently exists at the proposed project sites, no impact to any known or undiscovered Threatened, Endangered, Special Status, Special Attention, and Survey and Manage botanical species would be expected to occur. However, as the habitat in the proposed project area naturally changes over time, species composition for the different botanical groups would change, increasing and decreasing during different stages of succession as suitable environmental conditions and substrates become available.

Invasive / Non-native Plant Species (including Noxious Weeds)

Over time existing populations of invasive/non-native species would decline in number of plants and vigor as native vegetation (including trees) displaces the non-natives species. These species would likely maintain a small population along roads and in natural openings and population size may increase in areas where natural disturbances occur. Management activities on land not managed by the BLM and public access into the area (as described in section 3.3.8 of this EA) may result in introducing additional species, or increasing populations of species that are currently in the area.

3.3.2 Hydrology

Sources Incorporated by Reference: *2008 Hydrology/Channels/Water Quality: Specialist Report for the Lost Lulay Project (Hydro Report); WEPP (Water Erosion Prediction Project) Report for Lost Lulay*

Affected Environment

Project Area Setting

The project area is located in the Oregon Western Cascades range at elevations between 700-1,600 feet[16]. Portions of the project are in the transient snow zone (TSZ), an elevation zone subject to rain-on-snow events (ROS) that have the potential to increase peak flows during winter or spring storms. This zone varies with temperature during winter storms but is assumed to lie between 1,500 - 3,000 feet in elevation.

The project area receives approximately 58-68 inches of rain annually and has a mean 2-year precipitation event of 3.0 inches in a 24-hour period (estimated at: http://www.nws.noaa.gov/ohd/hdsc/noaaatlas2.htm).

The project area drains to three separate 6th field sub-watersheds (Neal Creek, Lower Crabtree Creek and Roaring River) with approximately 65,500 acres (100 miles^2) in combined drainage area. The two major stream systems in the area are Crabtree Creek to the south and Thomas Creek to the north, both tributary to the South Santiam river fourth field #17090006 (U.S.D.I.,1974). The South Santiam is utilized as a drinking water source for the city of Jefferson and part of the project area lies within the municipal watershed. The project is not in a key watershed.

Channel and Wetland Morphology (ACS Objective 3)

Project Area Stream Channels

The streams in the project area reflect the geologic origin of the western slopes of Snow Peak[17]. Most of the terrain is composed of weathered rocks of basaltic-andesitic flows, flow breccia and pyroclastic deposits (extrusive volcanics) dating to the Tertiary period around 18-35 million years ago (Walker, 1991). In some areas, the Columbia River basalt group overlay the older volcanics (such as along the ridgeline in Section 25, T10S, R.1W.).

All of the channels on BLM land in the Lost Lulay project area observed in the field are classified as currently in *proper functioning condition* (PFC) because there is adequate vegetation, landform, or large woody debris present to dissipate stream energy, filter sediment, aid ground-water recharge, aid floodplain development, stabilize stream banks and maintain channel characteristics. A determination of "proper functioning condition" means that the channel elements and physical processes are in working order relative to an area's capability and potential. It does not mean that the channel is functioning at full biological potential or that nothing could be improved by human intervention (i.e., placing additional wood structure, repairing infrastructure, thinning adjacent forest, etc.).

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[16] Unless otherwise indicated, geographic information is an estimate derived from the BLM's GIS database.

[17] For a more detailed description of stream channel formation and geomorphology the reader is referred to ***Geomorphology of Steepland Headwaters: The Transition From Hillslopes to Channels*** (Benda *et al*., 2005).

Intermittent Channels

Stream channels immediately adjacent to, or in some cases within, the proposed treatment units are primarily first order headwater channels with intermittent or ephemeral flow. These small tributary channels formed in the deep soils of the benches and ridges in the project area and flow intermittently on the surface before disappearing underground, only to pop out again down-slope. It's likely that ground water and intricate patterns of subsurface flow, as opposed to surface run-off, is the primary system of water delivery to these channels. Most are lower gradient (4-10%) with small substrates reflecting the adjacent soils. Utilizing the Montgomery-Buffington typology (*Montgomery & Buffington, 1997*), these channels would be classified as colluvial: "small, headwater streams at the tips of a channel network that flow over a colluvial valley fill and exhibit weak or ephemeral fluvial transport." Most have too low of a gradient to be subject to debris torrents or landsliding.

Perennial Channels

The small headwater tributaries adjacent to the proposed treatment units eventually reach the larger, perennial streams Neal Creek, Roaring River or Crabtree Creek. None of the project area is immediately adjacent to these channels. Roaring River and Crabtree Creek flow predominately through private lands and lack of access means that there is little opportunity to view these channels in the field. Neal Creek flows through BLM land and is an extremely stable, moderately confined bedrock channel with low levels of sediment and large wood (Rosgen B1 type) (Rosgen, 1996).

These larger 3rd- 4th order streams have entrenched into the relatively resistant bedrock forming constrained valleys with moderately steep adjacent slopes (average 50-60%).

There is a low to moderate supply of gravel and cobble sized material actively transported in these Rosgen "B3" channels. Utilizing the Montgomery-Buffington typology (*Montgomery & Buffington, 1997*), these perennial streams would be classified as step-pool channels: "Step-pool morphology generally is associated with steep gradients, small width to depth ratios, and pronounced confinement by valley walls."

Roads and Stream Channels in the Project Area

There are numerous places where existing roads cross streams in and near the project area. Most of the culverts on haul routes for the project are adequate to meet 100 year flood standards. Where roads cross streams, the bed and banks of channels have been altered. Within the road prism (estimated at 30 feet maximum width) the channel surface, banks and bed have been compacted (bulk density of soils increased by as much as 30%), vegetation disturbed or removed and the bed/banks within the road prism have been obliterated.

Some stream crossings in the project area were at one time constructed from large logs placed in the stream channel and covered with dirt and rock, including two stream crossings planned for use for the project area. These date back to early-mid 20th Century logging in the area. Naturally, all of these structures have deteriorated under exposure to the elements.

The channel morphology at these locations has adjusted and as the wood structures have deteriorated through the years, streams infiltrate through the wood and gaps in the fill, additional organic material has accumulated and banks have been stabilized by vegetation. The large wood in the channel at these locations may be providing nutrients, shade and cover for some aquatic species.

Where roads cross streams, channel morphology (the shape, size and slope of a channel) is generally altered in a predictable manner and this will affect channel equilibrium (the relationship between the channels morphology and its ability to transport materials and water)[18].

Project Area Wetlands

There are no wetlands in the project area identified in: National Wetlands Inventory maps; Linn County Soil Survey; BLM GIS *Lakes* theme, for smaller wetlands, ponds and lakes; or the BLM GIS Timber Production Capability Classification (TPCC) theme, which has a category for sites with high water.

In unit 29A-10S1E there are approximately 4 small (0.1 acre) seasonal ponds where the low spots in convoluted (wrinkled) ground on a broad ridge top intercepts the seasonal water table and/or collects precipitation. They dry up completely in the summer.

Project Area Hydrology (ACS Objective 6)

Stream-flow is assumed to be typical of western Cascades streams where most runoff occurs during winter storm events[19]. There is a gaging station on a tributary of upper Crabtree Creek (Shafer Creek gage) there are no additional stream gaging stations in the Crabtree Creek watershed: the closest gaging station is downstream of Crabtree on the Santiam River near Jefferson. Two gaging stations were recently installed on Thomas Creek. None of the tributary channels in the project area have been gaged. Stream-flow is assumed to be typical of western Cascades streams where most runoff occurs during winter storm events.

Base Flow

Base-flow, or low-flow, (when mean stream discharge drops below 20% of the mean winter flow) normally begins in perennial channels sometime in July and continues from August-October. Many small headwater channels (intermittent or ephemeral) dry up completely during this period.

Peak Flow

Peak flows occur following a rapid and substantial depletion of the snow-pack during prolonged rain-on-snow periods (ROS) in the transient snow zone (TSZ) estimated to lie between 1,500 feet and 3,000 feet elevation.

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18 See: http://www.krisweb.com/hydrol/channel.htm for a discussion of factors in channel equilibrium.

[3] For a more detailed description of watershed hydrology in forested regions of the Pacific Northwest the reader is referred to ***Physical Hydrology and the Effects of Forest Harvesting in the Pacific Northwest: A Review*** (Moore *et al*., 2005).

The two largest peak flow events in the last century took place in 1964 and in February of 1996. The '64 event was estimated at or above a 100 year flood return interval while the '96 was approximately a fifty year event; both were in response to substantial snow pack melt-off. The State of Oregon has estimated peak flows for most watersheds in Western Oregon, including project area watersheds. These estimates may be viewed at the following web site http://map.wrd.state.or.us/apps/wr/wr_mapping/. Project area stream flow (including peak flow) was analyzed for the Lost Lulay project. (Hydro Report pp. 6-8)

Potential for Peak Flow Augmentation Due to Forest Harvest: Current Condition

A preliminary analysis for the risk of increases in peak flow as a result of forest harvest was conducted using the Oregon Watershed Assessment Manual watershed analysis methods for forest hydrology (OWEB, 1997 located at http://www.oweb.state.or.us/publications/wa_manual99.shtml).

Analysis indicates that the risk is low that peak-flows have been increased as a result of openings in the forest canopy in all of the project sixth field watersheds. The proportion of the sixth field watersheds in the project area within ROS varies from a high of 34% in Neal Creek to a low of 0.1% in Lower Crabtree Creek. The risk of peak flow enhancement within each 6th field varies with the proportion of this area that has been recently harvested. The proportion of ROS area with current crown closure <35% ranged from a high of 65% in Lower Crabtree Creek to a low of 10% in the Neal Creek. This analysis indicates that, in all of the project sixth field watersheds, there is currently a low risk for peak-flow enhancement due to forest openings (*Table 5*).

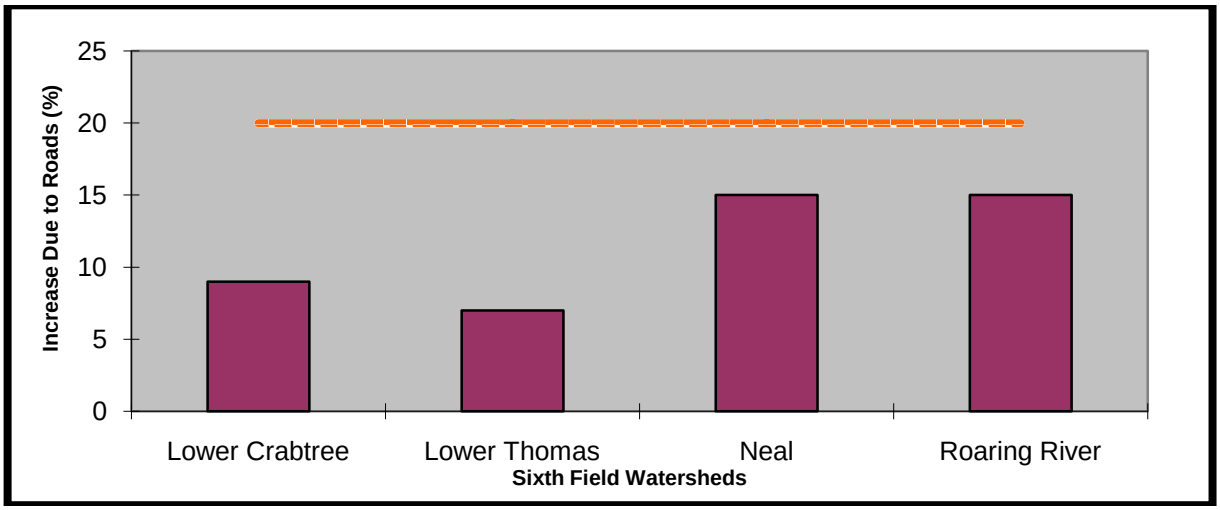
Table 5: Risk of Peak Flow Enhancement by 6th Field Watershed in Lost Lulay.

6th Field Subwatershed Name	Crown Closure in ROS Areas	Percent of Watershed in ROS Areas	Percent of ROS area with <35% Current Crown Closure	Peak-Flow Enhancement Risk
Lower Thomas Creek	50-70%	0.7% (190 acres)	36% (36/190 acres)	Low
Lower Crabtree Creek	50-70%	0.1% (26 acres)	65% (17/26acres)	Low
Neal Creek	50-70%	34% (5885 acres)	10% (575/5885 acres)	Low
Roaring River	50-70%	8% (1946 acres)	20% (374/1946 acres)	Low

Peak Flow/Water Quality Effects from Roads

Based on the analysis described in the Hydro Report (pp.7-8) the estimated values in the project watersheds range from a low of 7% in Lower Thomas Creek to as high as 15% in Neal Creek and Roaring River, so none of the sixth field watersheds in the project area are currently at risk for augmentation of peak flows due to the road network in the watershed. Figure 1 displays channel network expansion at road-stream intersections for project watersheds (estimated from Salem District ARC-GIS data).

Figure 1: Stream Channel Network Expansion by Roads in the Project Area 6th Field Watersheds.



Project Area Ground Water

There are twenty-six ground water wells for domestic water use located near the project site. The Oregon Department of Environmental Quality (DEQ) has not identified any groundwater pollution problems within project watersheds. The Water Resources Department (OWRD), together with the DEQ, is responsible for the regulation and protection of ground water quality and quantity. See http://www.deq.state.or.us/wq/groundwa/wqgw.htm.

Local conditions of groundwater relative to quantity, location, flow and quality is understood only in a general sense. Interaction between surface flow and subsurface flow is intricate and varies across the landscape in response to conditions in soils, topography and lithology. The moderately deep soils in the project area uplands are well drained and generally lack horizons which impede water infiltration. Precipitation is thus free to saturate soil surface horizons and flow deep into the subsurface, as well as down-slope, under the influence of gravity. Soils in the project area have relatively high rates of water movement as indicated by infiltration rates between 0.25 – 2 inches/hour. Thus, under natural conditions, most precipitation either drains through the soil profile or is evapotranspired.

Local lithology also dictates the quality of groundwater and, by extension, sets the base conditions for the quality of surface water. Water in Western Cascades volcanic materials is typically low in dissolved salts and nutrients with a slightly acidic pH. Temperature is a function of the soil and subsurface temperatures which vary only slightly throughout the year, hovering between 8-15 degrees Celsius ("mesic" soil temperature regime).

No detectable effects to ground water from compaction in the project area is expected because the topography, limited area of compacted soils and high variability of compaction (both in location and time) in the project area tend to nullify the potential effects of project related compaction on water movement through the soil.

Forest roads and landings in the project area that intercept water are reroute it directly to streams may have altered ground water in the project area compared to natural conditions, but we do not have the ability to calculate any potential effect. They can alter patterns of subsurface flow by intersecting ground water and rerouting it to surface streams.

This conversion of ground water to surface run-off can potentially alter the timing and size of peak flows and result in a proportionate reduction in water available for ground water storage (see the previous discussion *"Peak Flow/Water Quality Effects from Roads").*

Water Quality and Beneficial Uses (ACS Objectives 4, 5)

Oregon Department of Environmental Quality (ODEQ)

The ODEQ, under the Clean Water Act, has been delegated authority to protect the quality of all waters in the State of Oregon. Established water quality standards "not to be exceeded" for all waters of the state are published in the Oregon Administrative Rules, Chapter 340, Division 41 (Willamette Basis standards begin with 442). In addition, updated water quality standards have recently been approved by the USEPA. These standards may be reviewed at http://www.deq.state.or.us/wq/standards/Temperature/FinalRules340-041.pdf.

Designated Beneficial Uses

The State of Oregon designates the beneficial uses for which all waters of the state are utilized. Water quality standards are ultimately meant to protect these uses. Both resident and anadromous fish are downstream from several of the proposed units (*Table 6*). The City of Jefferson withdraws water from the South Santiam to treat and provide city residents with drinking water. There are no other municipal surface water withdrawal rights downstream of the project area, though there are withdrawal rights for domestic use, irrigation and livestock watering. Designated beneficial uses may be viewed on-line at: http://www.deq.state.or.us/wq/standards/GenBenUseTablesFinal/FTable340A_Willamette.pdf*)* and maps are available online at: http://map.wrd.state.or.us/apps/wr/wr_mapping/

South Santiam TMDL: Effective Shade and Stream Temperature

The proposed action is unlikely to result in a measurable change in stream temperature because field surveys, review of aerial photographs and IVMP data indicate that shading is near to full potential along most of the small streams on public lands in the project area with canopy closure exceeding 80% along most reaches. The existing riparian vegetation in the project area is adequate to maintain perennial streams in the temperature range required by the ODEQ under the Clean Water Act because the shade produced does not allow sufficient light to penetrate and increase summer stream temperatures above standards.

The Crabtree Watershed Analysis (BLM, 2001) indicated that summer stream temperatures in the Crabtree Creek main channel are above the State of Oregon's threshold of 17.8^{o} C. The Thomas Creek Watershed Analysis (U.S.D.I., 1996) did not cite any data on stream temperature for the watershed. Salem District BLM has collected summer stream temperatures at three locations in the project area watersheds: Neal Creek main-stem, South Neal Creek headwaters and on an unnamed headwater tributary to Roaring River. The Neal Creek main-stem (T10S, R.1E, section 23) data indicated that 7-day maximums remained below the state threshold throughout the summer of 2000.

Similarly, the South Fork Neal Creek (T10S, R.1E, section 27) and the Roaring River tributary (T11S, R1E, section 5) data indicated that 7-day maximums remained below the state threshold throughout the summer of 2000 (Hydro Report, pp.10-11).

Thomas Creek, Crabtree Creek, and Neal Creek are currently all listed as not meeting water quality standards for summer stream temperatures. The DEQ's 2002 303d List of Water Quality Limited Streams is a compilation of streams which do not meet the state's water quality standards (http://www.deq.state.or.us/wq/assessment/rpt0406). All the streams in the project area are subject to the conditions of the Willamette Basin TMDL completed by the DEQ in 2005 (http://www.deq.state.or.us/wq/TMDLs/docs). Essentially, the TMDL requires the recovery or maintenance of full potential shade along all perennial streams in the Willamette basin. As part of the TMDL, the BLM published the Willamette Basin Water Quality Restoration Plan which details how the BLM will implement the TMDL on federal lands. Density management projects were identified in the South Santiam portion of the plan as a priority for restoration of water quality through riparian thinning treatments and reductions in stand density.

Dissolved Oxygen, pH, and Conductivity

The Crabtree Watershed Analysis stated that "data collected by the South Santiam Watershed Council indicate dissolved oxygen and pH are probably not of concern in Crabtree Creek (Ch.5, Pg.29)." However, the Thomas Creek Watershed Analysis cited a DEQ report that identified low levels of dissolved oxygen as a non-point source pollution type in the watershed.

No data for these variables in the immediate project area was located for this assessment. Considering the low stream temperatures in the project area, together with full forest cover, it is likely that DO and pH levels are within the range of natural variation and meet state standards.

Sediment Supply, Transport and Turbidity [20]

The Thomas Creek Watershed Analysis cited a DEQ report that identified turbidity as a non-point source pollution type in the watershed. Landslides in upper Thomas Creek were identified as important source areas for fine sediments and turbidity. In the project area, due to the low to moderate slopes, landslides are uncommon.

No site specific data for stream turbidity in the project area was located for this assessment. During winter field reviews of area streams water clarity appeared high and high turbidity levels were not noted. For a description of sediment supply and transport processes in forested watersheds and the effects of forest management on these processes the reader is referred to *Suspended Sediment Dynamics in Small Forest Streams of the Pacific Northwest* (Takashi et al, 2005).

Recreation Trails and Off-Highway Vehicle (OHV) Use

A number of undesignated recreational trails on public and private lands were identified during project field work. Some of these trails are heavily compacted and eroded, primarily due to OHV traffic.

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[20] Turbidity is a measurement of water clarity and is not convertible into a volume measurement of sediment yield unless correlated to suspended sediment data. For a description of sediment supply and transport processes in forested watersheds and the effects of forest management on these processes the reader is referred to **Suspended Sediment Dynamics in Small Forest Streams of the Pacific Northwest** (Takashi *et al*, 2005).

Most of the trail networks have been developed on surfaces that were originally utilized for forestry operations, primarily old logging roads that were not intended for continual use or for recreational access. In addition, in some cases users have expanded these trails by illegal cutting and removal of trees. Although some of the trails are not properly constructed or maintained, the majority are not sources of water pollution. Nevertheless, some segments on steeper slopes have gully eroded to bedrock and are a clear source of erosion and water quality pollution.

Environmental Effects

3.3.2.1 Proposed Action

Channel and Wetland Morphology (ACS Objective 3)

Direct and Indirect Effects - Channel and Wetland Morphology

In general, there would be no direct alteration of the physical features of the project area stream channels or wetlands under this proposal. Stream banks, wetlands and channel beds are protected from direct physical alteration or disturbance by harvesting equipment. With the exception of the proposed road repairs at stream crossings, the temporary crossing of the ephemeral stream in unit 29A, and removal of the log fill stream crossings in Section 25 (replacing one with a culvert), disturbances are kept a minimum of 60 feet from all perennial stream channels and (30 feet from intermittent channels.

The proposed action is unlikely to affect stream flow in a measurable manner (see the following discussion under watershed hydrology) and therefore any indirect effects to stream channels as a result of increases in peak flows is unlikely.

Thus, the proposed action would be unlikely to result in any measurable effects, such as increases in bank erosion, channel incision, loss of floodplain connectivity or alteration of local wetland hydrology that could result from augmented peak flows or altered watershed hydrology.

No new road construction crossing perennial stream channels or wetlands is proposed. Maintenance and repair of undersized culvert stream crossings and replacement of one log fill with a culvert on an unmaintained road in section 25 is proposed. Repairs to existing roads at stream crossings, undertaken as part of normal road maintenance cycles (RMP C-2) would maintain the channel alterations currently in place. In some cases, larger culverts and more stable fills would allow for improved channel morphology over the long term by reducing sediment inputs at the crossing and by increasing the culvert's capacity to accommodate the stream during peak flows (i.e., passage of water, wood and bed-load).

In all cases of crossing repair, maintenance and/or culvert upgrades, some slight channel adjustment to grade or width may occur within the first year (varies with the timing and magnitude of storm events) following disturbance as the channel bed and banks reach equilibrium with flow and sediment transport.

Removal of the blocked and failing log fill stream crossings in section 25 (replacing one with a culvert) would provide for unrestricted stream flow and passage of sediment, organic materials and aquatic organisms while eliminating the chronic erosion and turbidity at those sites.

The BLM expects that long term effects to channel function and morphology from disturbance at stream crossings would be unlikely because previous BLM experience with these type of channel crossing (from observations and the professional judgment of the BLM field hydrologist) shows that the channels are resilient (i.e., they resist change) and would adjust to accommodate the new structures without creating bed or bank instability. Channel morphology adjustments would be unlikely to extend more than 100 feet upstream or downstream from the site of disturbance.

It is unlikely that the temporary stream crossing in Unit 29A would result in any damage to the channel or bank because BLM's past experience with these type of temporary crossings has demonstrated that the design features to be used (utilize wood and branches on site to provide a stable base for equipment to cross w/o damaging soils or banks, single round trip crossing, full suspension lifting of logs across the channel) would not damage the stable channel at this location. The crossing was field evaluated by the area forestry, hydrology and fisheries specialists to make this determination.

Effects from maintenance and repair of stream crossings would be limited to the site of disturbance (i.e., not extend more than 100 feet downstream or upstream from the disturbance) and unlikely to result in any alterations to channels or floodplains downstream or elsewhere in the watershed. Indirect effects, such as increases in bank erosion, channel incision, loss of floodplain connectivity or alteration of local wetland hydrology, to stream channel or wetland morphology or function would be unlikely because of the stability and resiliency of channels in the project area.

Project Area Hydrology (ACS Objective 6)

Direct and Indirect Effects – Watershed Hydrology

Water Yield, Base Flow, Fog-Drip, and Peak Flow

The proposal would likely result in some incremental increase in annual water yield correlated to the partial removal of the conifer over-story, however “the increase in fall and winter discharge from forest activities is likely to have little biological or physical significance” (USEPA. 1991).

Outside of fog-drip zones, total removal of the forest cover usually results in an immediate increase in summer base flow, presumably due to the reduction in evapo-transpiration and interception, followed by a slow recovery to pre-treatment flows after several years (Harr et al., 1979). However, when a stand is thinned the root systems of the conifers retained quickly exploit any additional soil moisture availability and transpire it as “water use per unit of leaf area can increase dramatically” (Troendle et al., 2006). Therefore, we conclude the proposal would be unlikely to result in any measurable change to local base flow.

It is unlikely the proposed action would have a detectable effect on fog drip or a detectable effect on the base flow in project area streams because no studies have documented reductions in fog drip where close to 50 percent of the canopy is retained and less than 25 percent of the watershed is thinned and there is no data to indicate if fog-drip is an important contributor to soil moisture and watershed hydrology in the project area.

Based on the following analysis, it is unlikely that the proposed thinning would have a detectable effect on peak flows in any of the watersheds in the project area. Approximately 240 acres[21] of the project area lay in a zone subject to transient snow accumulations (TSZ) in the winter. All of these treatment areas are within the Neal Creek watershed. It can be assumed that the reduction in stand density may result in some small increase in snow accumulation and melting during ROS events.

However, it's unclear how or if variable stand retention affects peak flows because it has not been well researched (Moore et al., 2005). If all 240 acres were thinned under this proposal, it would increase openings of the TSZ in Neal Creek from 10% to 12%. In the most recent review specific to the Pacific Northwest, Grant et al. suggest that 12% of the TSZ harvested is below the level reported by any study for hydrologic change in this region (Grant et al, 2008).

This proposal would not alter existing roads in a way that would likely reduce or increase effects to peak flows attributable to the current road network and thus it would maintain the current condition and trends relative to hydrology and stream flow. Currently, the risk of hydrologic change posed by the road system is low (see discussion in Affected Environment). In addition, existing roads were inventoried by area specialists and recommendations for improvement and repair of road surfaces would be implemented under the proposed action. Some of these actions would reduce road connectivity and routing to stream channels by routing water to soil surfaces where it can re-infiltrate.

The road construction proposed for this project has a low risk of altering watershed hydrology or peak flows because proposed road locations and design would not allow intercepted water to reach stream channels any faster than precipitation which falls on the forest floor.

Compacted surfaces would be unlikely to affect infiltration because compaction would be limited to less than 10% of the project area, some of which is already compacted by previous logging operations. These compacted surfaces are located on topography with low to moderate slope so water that does not infiltrate where it falls would either be evapotranspired or infiltrate quickly into adjacent soils that are not compacted.

Ground Water

The proposed action is unlikely to affect the flow, quantity or quality of watershed groundwater because the action is unlikely to alter in a measurable manner patterns of surface flow and runoff, so there is little capacity to affect groundwater patterns which are intimately linked to the surface.

The proposed project would have no potential effect on ground water quality because no BLM action would affect nitrate, pesticide, volatile organic compounds or bacteria levels analyzed by DEQ. The proposed project would not affect ground water quantity because it would not affect the total infiltration capability of the project area, nor would it displace infiltration in any area by more than a few feet (half the width of skid trails, roads or landings).

[21] Note: This is total acreage for units 23B, 23A, 25 and 19A which are within the TSZ.

Water Quality (ACS Objectives 4 and 5)

Direct and Indirect Effects - Water Quality

Summer Stream Temperature Maximums in Perennial Streams

The Lost Lulay Thinning project would not increase summer temperature maximums in perennial streams adjacent to the proposed thinning areas because no shade producing vegetation within the primary shade zone of 60 feet from the active stream channel would be cut or removed, so shading would remain unchanged.

Also, the average canopy closure in the secondary shade zone that contributes to effective shade would be maintained above 50 percent which would not allow enough light to strike the water surface to increase the heat load. These measures are described in the Northwest Forest Plan Temperature TMDL Implementation Strategies (USFS and BLM, 2005) and by implementing them, the proposal would maintain stream temperatures in their current range and would protect beneficial uses.

The proposed action would have little potential to result in any measurable alteration of temperature regime in intermittent and ephemeral streams because almost all of the primary shade zone vegetation and at least 50 percent of the canopy in the secondary shade zone would be retained along these streams. Therefore, these channels have little potential to be heated by exposure to direct solar radiation so effects from thinning would not be detectable.

Summer Stream Temperature Maximums in Perennial Streams

Intermittent stream channels would be unlikely to have any measurable alteration of temperature regimes because they would have little potential to be heated by exposure to direct solar radiation since most primary shade zone vegetation would be retained.

Dissolved Oxygen, pH and Conductivity

It is unlikely that the proposed action would have any measurable effect on dissolved oxygen (DO) levels in project area streams because the project would not measurably change the factors that contribute to reduced DO. The proposed action would not place large amounts of fine organic material in the stream, would not alter re-aeration, and would be unlikely to result in any measurable increase in stream temperature or sedimentation.

Available data indicates that most forest management activities have little effect on pH or conductivity (USEPA, 1991).

Sediment Supply, Transport and Turbidity

The proposed action is unlikely to have a detectable effect on sediment supply, routing or turbidity as demonstrated by the following review of the processes that control both the supply and transport of sediment in forested watersheds and potential effects of management practices (Hydrology Report, pp. 18-24).

Mass Wasting

The proposed action is unlikely to affect mass wasting because very little treatment is proposed in steep headwater basins, treatment is not proposed on slopes that are steep (>60 percent, no treatments are proposed on slopes greater than 45 percent) or unstable, and continuous forest cover and its root structure is maintained.

Surface Erosion, Stream Bank And Channel Erosion

The proposed action is unlikely to increase surface erosion because water would continue to infiltrate the native soil rather than concentrating runoff that would erode soil and transport it to streams (see the discussion of Project Area Hydrology, above). The proposed action is unlikely to increase stream bank and channel erosion because it would not contribute to increasing stream flows outside of normal ranges (see the discussion of Project Area Hydrology, above). The proposed action is unlikely to increase sediment production at stream crossings to a degree that would measurably affect the sediment regime of the project area streams (see the discussion of Channel and Wetland Morphology, above).

It is unlikely that the proposed action would lead to a measurable long-term alteration in sediment delivered to streams, stream turbidity, stream substrate composition, or sediment transport regime because design features, BMPs and mitigation measures are proposed to eliminate and/or limit acceleration of sediment delivery to streams in the project area (*EA section 2.3.4*).

Road Construction, Maintenance and Log Hauling

The risk of activities in the proposed action introducing sediment that would prevent meeting ODEQ water quality standards is minimal because of the following design features and practices: New roads would not be connected to the stream system and therefore no pathway would exist for delivery of any sediment to streams generated by their construction or use. All new road construction would occur on low to moderate slopes emanating from the existing road network, on stable surfaces (i.e., surfaces that are not contributing to landsliding or mass wasting) and therefore road related landslides in these locations are also unlikely.

All road construction in the proposed action would comply with applicable water quality standards because project design features would utilize the BMPs22 required by the Federal Clean Water Act (as amended by the Water Quality Act of 1987) to reduce non-point source pollution to the maximum extent practicable.

Since road construction would occur on stable surfaces well away (generally more than 220 feet, minimum of 150 feet) from streams and incorporate design features to implement BMPs, there would be no opportunity for these roads to deliver sediment to the stream system.

Maintenance and improvements of existing roads (i.e., culvert replacement, added rock and blading of road surfaces) and construction of the temporary stream crossing would occur during the dry season. This would likely result in increased turbidity during project implementation at stream/road intersections on perennial streams. During project work, turbidity in perennial streams would be visually monitored and be maintained within limits set by the Oregon DEQ.

Turbidity at stream crossings (including the temporary crossing in Unit 29-A) may also increase slightly in the first winter following the project. This would be most evident during early winter storms where run-off on the road surface is diverted to stream channels.

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[22] http://www.epa.gov/owow/nps/forestrymgmt

Increased turbidity is unlikely to be visible or measurable beyond 800 meters below the site of the disturbance (see Foltz and Yanosek, 2005). Turbidity levels would likely decrease as disturbed road surfaces (and the channel bed) become "armored" (i.e., fines are removed). Within one or two years, the supply and transport of fines from the road surface would return to pre-project levels. Any sediment yield increase would be difficult to measure and is unlikely to contribute more than 1% to the supply or transport of sediment in these watersheds. Over the long term, road repairs should help reduce risks to water quality and watershed hydrology that these roads currently pose.

Any increases in turbidity attributable to road work and log hauling would be unlikely to exceed the State of Oregon Water quality standards (> 10 percent increase relative to background levels) and would decrease as soon as hauling and road maintenance operations are completed. Timber hauling during periods when water is flowing on roads and into ditches could potentially increase stream turbidity and suspended sediment transport with indirect detrimental effects on the streams physical and biological attributes (Cederholm et al. 1980), but since most of the harvest would be conducted with ground based equipment, hauling would be primarily in the summer. Maintenance and improvements of existing roads and log hauling may increase turbidity in project area streams relative to background or upstream water clarity during operations and during the first winter following operations.

Any overall sediment yield increase would be difficult to measure and is unlikely to contribute more than one percent to the supply or transport of sediment in the project area watersheds because project design features to implement BMP would reduce potential sediment production and transport from roads to low levels. Increased turbidity is unlikely to be visible or measurable beyond 800 meters below the site of the disturbance or stream crossing (Foltz and Yanosek, 2005).

Site Preparation

Pile burning would be unlikely to have any influence over water quality, stream channels or watershed hydrology and any effects to soils and hydrology would be short term and limited to the immediate site because the piles to be burned would be located on level ground outside of riparian areas so there is no delivery mechanism by which ash or soil from the pile locations could reach stream channels. Other fuel treatment methods (e.g. lop and scatter, mastication) do not create ash or erosion, so none could be introduced into streams.

3.3.2.2 Cumulative Effects

Channel and Wetland Morphology (ACS Objective 3)

With the exception of road maintenance sites at stream crossings and the replacement of some culverts, this proposal would be unlikely to result in any measurable direct effects to channel morphology. Since the proposal is not likely to result in effects that extend beyond the site of disturbance and these effects would be of relatively short duration (channel adjustment within one to three years) the proposal would be unlikely to contribute to any cumulative effects in these watersheds.

Watershed Hydrology (ACS Objective 6)

Since the proposal is not likely to result in measurable direct or indirect effects to peak flow the proposal would be unlikely to contribute to any potential cumulative effects to peak flows in these watersheds. Current condition of the watersheds in the project area indicates low risk for augmentation of peak flows due to forest openings.

This proposal would result in a minimal net increase in forest openings in ROS areas with crown closure <35% and would be unlikely to contribute cumulatively to the augmentation of peak flows even if they were occurring in these watersheds as a result of past forest harvest. Proposed road use and construction is unlikely to alter surface or subsurface hydrology or to contribute cumulatively to any change from current conditions in the watershed.

Since there is unlikely to be any measurable direct or indirect effect to the watershed's ground water, the proposed action carries low risk for contributing cumulatively to effects either in the uplands or in lower valley positions.

Water Quality (ACS Objectives 4 and 5)

Overall, this proposal is unlikely to have any measurable direct or indirect effect on stream temperatures, pH, or dissolved oxygen. Current conditions and trends in water quality would likely be maintained under the proposed action. Therefore, the proposal has little potential for contributing to any cumulative effects to these water quality attributes in these watersheds.

Sediment Yield Cumulative Effects

According to watershed analysis, past harvest activities and road building have likely increased sediment yields in the Thomas Creek watershed relative to an undisturbed condition. Future harvesting on private lands is likely to occur and this could also contribute to an increase in sediment yields. However, given the high variability in logging methods and their effects on different parts of the landscape, it is not feasible to predict how much additional sediment hypothetical logging on private lands would produce. Therefore, it is assumed that quantities of sediment reported in the scientific literature represent a meaningful "average" that provides a basis for comparison.

The incremental increase in sediment yield and turbidity that could be attributable to the proposed action is of such a small magnitude and duration that it is unlikely to be detectable. The estimated average increase of 0.18 tons/acre/yr directly attributable to the proposed action is an increase of 6.3 tons (35 treated acres) on a sixth field watershed basis. Accounting for the 50% estimated precision of the WEPP model, this represents between approximately 0.01-0.03% of mean annual yield in this watershed. Given the inherent variability in sediment yield measurements, on a watershed scale this is certainly not a detectable effect. The proposal would not likely increase sediment supplies to a level that would result in a direct risk to beneficial uses of the water or contribute in a detectable manner to cumulative sediment yields on the sixth field watershed scale.

In the short term, the proposed action would contribute to this increase cumulatively, but the magnitude (0.03% maximum) and duration (risk is highest in the first year following treatment) of the effect would be non-detectable relative to the overall sediment supply in these watersheds given current technology. Typically, sediment yields from forest harvest decrease over time as a negative exponential (Dissmeyer, 2000).

The quantity of surface erosion with delivery of sediment during large storm events would likely drop back to current levels (0.07 tons/acre/yr) within three to five years as the remaining forest stand fills out.

In a similar manner, the risk of short term (during the action and the first winter following) increases in stream turbidity as a result of road repair and hauling may contribute to increased turbidity levels directly below road/stream intersections. These would be maintained below the limits required by the Oregon State DEQ. Cumulatively the limited magnitude (not visible more than 800 meters downstream of the crossing) and duration (primarily in the first winter following road repairs) of this effect would be non-detectable on the scale of the seventh field watershed and would be unlikely to have any effect on any designated beneficial uses.

Over the long term, the incremental improvement of forest stand characteristics (increased species diversity and wood recruitment) in the riparian would support the cumulative improvement in these conditions that is anticipated throughout these watersheds in response to the forest plan. This would add cumulatively to the improvement in the condition of stream channels and wetlands in the watershed.

Pile burning would be unlikely to have any influence over water quality, stream channels or whatershed hydrology because any effects to soils and hydrology would be short term and limited to the immediate site.

3.3.2.3 No Action Alternative

The No Action alternative would result in the continuation of current conditions and trends at this site as described in the *Affected Environment*, above. Any existing effects in the watershed would continue to occur from the development and use of private and other agency lands (primarily agriculture, timber harvesting and road building).

3.3.3 Fisheries and Aquatic Habitat

Sources Incorporated by Reference: *Lost Lulay Fisheries Specialist Report (Fisheries Report), Hydrology Report,* ***Additional Sources Referenced:*** *Logging Systems Report*

Affected Environment

Fish Presence in Project Area

Fish presence/absence surveys were conducted for the project area and the reports are available in the Lost Lulay Thinning project files at the Salem District Office. Following are summaries of the findings of those surveys: Coastal cutthroat trout (*Oncorhynchus clarki clarki*; Behnke 1992) are relatively uncommon across the project area, as most project sites are drained by small, first and second order headwater streams, which generally do not support cutthroat trout populations due to small stream size (low flows) or steep channel gradients. Two unnamed 3rd order streams and two 2nd order streams are located on the project area, which support populations of coastal cutthroat trout. These streams are tributaries to Burmester and Neal Creeks in the Thomas Creek watershed and to Crabtree Creek in the Crabtree Creek watershed. Two other 3rd order tributary streams potentially support cutthroat trout populations adjacent to the project area.

Threatened / Endangered Species

Upper Willamette River (UWR) steelhead trout and UWR Chinook salmon are listed as 'threatened' under the Endangered Species Act of 1973 (ESA). Burmester, Crabtree, and Neal creeks and the Roaring River in the Thomas Creek and Crabtree Creek watersheds support populations of winter run steelhead trout (*O. mykiss*; Streamnet 2006, USBLM 2001, 1996). Distances from project units downstream to potential steelhead trout habitat range from 0.9 to 2.5 miles (Streamnet 2006). The upstream distribution of steelhead trout in the Roaring River ends at the weir at Roaring River State Fish Hatchery at approximately river mile 1 (USBLM 2001). Habitat for spring chinook salmon (*O. tshawytscha*) is located in Burmester, Crabtree, and Neal creeks and the Roaring River, and chinook salmon distribution is thought to end 1.5 to 4.5 miles downstream of project sites (Streamnet 2006). Table 6 shows the approximate distances from proposed project sites downstream to resident cutthroat trout habitat and potential ESA listed fish habitat[23]. Distances are in miles except where stated in feet (from the perimeter of tree harvest areas to stream banks).

Table 6: Distances to Listed Fish Habitat

Unit Number	Distance in (Miles or feet) to Fish Habitat		
	Cutthroat trout habitat	Steelhead trout habitat	Spring Chinook habitat
10S-1W-25	2.1 miles to Crabtree Creek	2.1 miles to Crabtree Creek	2.1 miles to Crabtree Creek
10S-1E-21	485 feet to Wildwood Creek; 350 feet to unnamed 2nd order tributary to Burmester Creek	1.7 miles to Burmester Creek	1.7 miles to Burmester Creek
10S-1E-23	0.2 miles to potential habitat in an unnamed 3rd order stream	0.9 miles to Neal Creek	3.6 miles to Neal Creek
10S-1E-25	1465 feet to potential habitat in an unnamed 3rd order tributary to S. Fork Neal Creek	1.8 miles to Neal Creek	4.5 miles to Neal Creek
10S-1E-29	0.8 miles to Burmester Creek	2.5 miles to Burmester Creek	2.5 miles to Burmester Creek
10S-2E-19	640 feet to an unnamed 3rd order tributary to Neal Creek	1.7 miles to Neal Creek	4.4 miles to lower Neal Creek
11S-1E-5	60 feet to an unnamed 3rd order tributary to Roaring River	1.5 miles to Crabtree Creek 1.8 miles to Roaring River	1.5 miles to Crabtree Creek 2.5 miles to Roaring River

Special Status Species Presence in the Project Area

No special status fish or aquatic species are known to inhabit project area streams.

Stream Habitat Conditions

Streams are well shaded by closed canopies provided by coniferous and deciduous trees (see Hydrology Report, p. 13). Stream channels on the project area are stable (generally cobble or gravel dominated) and well vegetated (> 90% of banks vegetated with riparian and streamside vegetation).

[23] Upstream limits of anadromous fish distribution were obtained from Streamnet (2006). Stream distances were measured using ArcGIS software.

In-stream large woody debris (LWD) numbers are low in Crabtree, Neal, and Thomas Creeks resulting in simplified aquatic habitats and less quality cover and pool habitat for fish (Hydrology Report, USBLM 2001, 1996). Only 34% of the Thomas and Neal Creek watersheds have a high potential to supply LWD to streams, because of the young age of most forest stands and the amount of non-forest land (agricultural land) adjacent to streams in these basins (USBLM 1996).

Environmental Effects

3.3.3.1 Proposed Action

Fish and Aquatic Habitat

Proposed tree thinning in riparian reserves (in units 10-1W-25, 10-1-21, 10-1-23, 10-1E-25, 10-1-29, 10-2-19, and 11-1-5) would not impact fish habitat due to minimum no-harvest buffers (60 ft perennial streams, 30 ft on intermittent streams, Lost Lulay Fisheries Report, pp. 5-8). Additionally, thinning would be conducted as to not reduce stream shade per Aquatic Conservation Strategy (ACS) Objective 8: Maintain …adequate summer and winter thermal regulation… (USBLM 1995, p. 6), and thus stream temperatures would not increase (Johnson 2004).

SPZs would intercept and infiltrate water carrying sediment from areas where trees were thinned preventing sediment delivery to streams and aquatic habitats (Olson and Rugger 2007; Rashin et al. 2006; CH2MHILL et al. 1999; and Lost Lulay Hydrology Report, pp. 19-20). Thinning in non-riparian reserve areas would also not impact fish habitat as distances of project areas to stream channels would be even greater than that from riparian reserves.

Reducing the density of trees within the RR is expected to have a long-term beneficial effect on aquatic habitat as a result of accelerating growth of the trees left in the stands. Accelerated growth of trees within the RR is expected to improve LWD recruitment potential to aquatic habitats. Aquatic habitat would improve over the long term with increased LWD recruitment because LWD stabilizes stream channels, and increases pool frequency, complexity and depth, and provides high quality cover for fish (Hicks et al. 1991).

Up to 1 mile of new road construction would have minimal negative impacts on fish and aquatic habitats (little to no increase in sediment delivery) as all new roads would be constructed on stable ground above slope breaks to riparian reserves and stream channels (Lost Lulay Fisheries Report, pp. 5-8). Additionally roads would be constructed as to not increase the size of the stream network (Wemple et al. 1996), and road surfaces would be designed to drain surface water to adjacent slopes where it would infiltrate into the soil and groundwater (Lost Lulay Hydrology Report, p. 20).

Fish habitat in Neal Creek could be impacted locally (up to 0.2 mile of habitat) and short term by the removal of log fill crossings in first order tributaries to Neal Creek in unit 10-1E-25 upon project completion (Lost Lulay Fisheries Report, p. 6). These tributaries do not support fish populations, but contribute flow to cutthroat trout habitat 0.4 to 0.5 mile downstream in Neal Creek. Cutthroat trout habitat would likely receive very small, short-term increases in turbidity during periods of higher stream flows in the first winter following removal of the log fill crossings. Turbidity increases from removal of stream crossings can occur up to 0.5 mile downstream (Lost Lulay Hydrology Report, p. 20, Foltz and Yanosek 2005). The temporary log fill crossing in unit 10-1-29 would not impact fish habitat as it is located >0.9 mile upstream of cutthroat trout habitat in Burmester Creek.

Removing the log fill for the road 10-1E-24 crossing of a 1st order stream in unit 10-1E-25 would be consistent with ACS Objective 2: maintain and restore spatial and temporal connectivity within and between watersheds (USBLM 1995, p. 6).

Special Status Species – Aquatic

The proposed action would not result in adverse effects to BLM Special Status Species or Bureau Assessment Species because no suitable habitat for any species known or likely to be present would be lost or altered to a degree that may impact existing populations. Therefore, the project would not contribute to the need to list any BLM Special Status Species.

Threatened/Endangered Species

Project design features, in particular stream protection zones (60 feet wide) and Riparian Reserve management, would prevent increases in sediment input to channels or increases in stream turbidity or temperature on all project sites, except for two temporary stream crossings in Units 10-1E-25 and one in 29A, which are located ≥2 miles upstream of steelhead trout habitat.

Any sediment impacts from these temporary crossings would be local (<0.5 mile downstream of crossings; Foltz and Yanosek 2005), and thus steelhead trout would not be affected.

Unit 10-1E-23 is the project unit nearest to steelhead habitat and is located 0.9 miles upstream of steelhead habitat in Neal Creek. Thinning in riparian reserves in unit 10-1E-23 would be limited to 4 acres on several 1st order tributary streams and would not impact large wood supplies in steelhead habitat in Neal Creek. No new roads or stream crossings would be built in this unit, and the existing road that would be used for log hauling is paved with no potential to deliver sediment to steelhead habitat. The other 6 project sites are located >1.5 miles upstream of steelhead habitat. All project sites are located >1.5 miles upstream of Chinook salmon habitat and Essential Fish Habitat (EFH) as designated under Magnuson-Stevens Fishery Management Act with no potential to affect these habitats. Log haul routes that cross streams with listed fish habitat are all on paved roads with no potential to deliver sediment to streams (Lost Lulay Fisheries Report, pp 1-2). Consultation with National Marine Fisheries Service on the potential effects of the project would not be required.

3.3.3.2 Cumulative Effects

The primary concern relative to the combined effects of the proposed action and other activities potentially affecting aquatic habitat and fish populations is whether these activities cumulatively increase sediment and turbidity levels, or peak flows and hence stream erosion, such that fish spawning and rearing is impacted by fine sediment filling in gravel and cobble substrates (thereby reducing rearing space, and resulting in lower egg survival, and recruitment success). A secondary concern is whether the combined effects of these activities results in cumulative impacts to instream fish habitat conditions.

The proposed action would directly impact channels at two temporary stream crossings in Unit 10-1E-25 and Unit 29A, and at a culvert replacement for road 10-1E-25.06 in Unit 25; altering channel shape and form). However, because the proposed action would not result in effects that extend beyond the stream crossings and the effects would be of relatively short duration (channel adjustment within one to three years) the proposed action would be unlikely to cumulatively impact stream channels (Lost Lulay Hydrology Report, p. 14).

With no cumulative impacts to channel morphology, there would also be no cumulative impacts to instream fish habitat (ie. pool habitat, instream cover, stream depth, etc.).

Indirect impacts of the proposed action to fish habitat and fish populations would likely be limited to short term increases in suspended sediment and turbidity in the first winter following the removal of a log fill crossing at a temporary stream crossing in Unit 10-1E-25, and the culvert replacement for road 10-1E-25.06 in Unit 25. The turbidity could possibly impact two short reaches (up to 0.1 mile each) of cutthroat trout habitat, 0.4 to 0.5 mile downstream of the stream crossings.

Cumulative effects of the proposed action and other expected timber harvest activities on adjacent State and private lands on peak flows, and sediment supply and turbidity were analyzed in the Hydrology Report (Lost Lulay Hydrology Report, pp. 15-17, 24-26). No direct or cumulative impacts to peak flows are expected (Hydrology Report, p. 16). The incremental increase in sediment yield and turbidity attributed to the proposed action (including the direct impacts discussed above) is of such small magnitude and duration that it is unlikely to be detectable at the sixth field watershed scale (Hydrology Report, p. 25). Cumulatively the limited magnitude and duration of sediment effects would be unlikely to result in a direct risk to designated beneficial uses (Hydrology Report, p. 25), including spawning and rearing success of fish populations.

3.3.3.3 No Action Alternative

Under the No Action alternative, populations of aquatic species would undergo natural increases and declines in abundance related to changes in stream temperature, sediment delivery events, and peak winter flows. Stream temperatures increase when shade from riparian canopy is lost (Johnson 2004). Substantial increases in stream temperatures can increase the metabolic costs of trout (Li et al. 2004), resulting in lower survival and recruitment, and consequently reduced population abundance (Hicks et al. 1991). During periods of accelerated sediment delivery (flooding), recruitment success would be lower because of fine sediment reducing intragravel oxygen levels resulting in higher embryo mortality, and reduced population abundance (Bjornn and Reiser 1991). High winter flows likely reduces overwinter survival of cutthroat trout in western Oregon streams (House 1995). Under the No Action alternative, canopy closure in primary and secondary shade zones along stream channels would remain similar to current levels, except for changes to tree canopy and consequently stream shade levels resulting from snow or ice break, wind storms, and wildfire. Stream temperatures would follow changes in stream shading (Johnson 2004). Dense stands of riparian trees would self-thin over time, contributing LWD to stream channels, and windthrow from storms would also contribute LWD to streams. Natural sediment inputs to streams would vary as sediment contributing events (flooding) occur within RR.

Threatened and Endangered Species

This alternative would have "no effect" on UWR steelhead trout and UWR Chinook salmon. The existing log fills on 1st order tributaries are all > 2 miles from the nearest steelhead trout and Chinook salmon habitat in Neal Creek.

3.3.4 Soils

Source Incorporated by Reference: 2008 Soils Environmental Assessment for the Proposed Lost Lulay Project (Soils Report)

Affected Environment

Typical soils in these project areas formed in colluvium (i.e., material rolling downhill) from sedimentary, tuffaceous, basalt, and andesite rock and volcanic ash. Soils in river floodplains formed in alluvium (water transported materials). Soils in the lower foothills of the project area are primarily clay to silty clay loams with high clay content in the surface horizon and low erosion hazard on slopes under 30%. Project soils are well-drained to moderately well-drained and moderately deep to very deep, with some local areas of shallow soils on ridge tops. Project soils are suited for growing Douglas-fir and western hemlock.

All of the proposed treatments are within areas classified as Suitable for timber production or Suitable but Fragile. Areas that are Suitable but Fragile would utilize design features listed in the TPCC to mitigate potential effects to soils. The only non-suitable lands in the area are wet areas and isolated areas with mass wasting potential (mapped as FWNW and FMNW, respectively). Proposed unit boundaries were developed to appropriately avoid all areas that are non-suitable. All the wet areas are adjacent to streams and wetlands, all of which are within stream protection zones (SPZ) and would not be treated. Fragile areas due to excessive slope are limited to portions of sections 23 and 25; these areas are also excluded from treatment.

Furthermore, based on field review by area specialists, soil surfaces generally appear to be in a non-compacted state and are covered with a deep layer of surface “duff” (partially decomposed organic material, mostly needles, bark and wood) that protects the mineral soil surface. Some slight compaction (increase in bulk density of less than 10% relative to un-compacted soils) may persist in the area outside of the visible skid trails and roads as a result of previous logging with heavy ground based equipment.

However, it is difficult to assess how much if any of this disturbance remains because it is obscured by tree growth and the surface duff layer. Random small pits dug by area specialists did not reveal any compacted soil surfaces beneath the duff and thus it is reasonable to conclude that compaction outside of road and skid trail surfaces, if it remains at all, is discontinuous and is not apparently impacting site productivity.

A few moderate (i.e., bulk density of the soil has been increased by over 10-20% relative to un-compacted soils) and some highly compacted soils (i.e., bulk density of the soil has been increased by 20-50%) have visibly persisted in some of the skid trails and along railroad logging routes dating back to the original logging of the sites in the 1940-50's.

Moderately compacted soils are primarily located in skid trails (where trees were dragged behind a tractor) and are generally less than 12 feet in width and discontinuous since large portions of former skid trails have been obscured by the growth of trees and development of the duff layer.

Highly compacted soils are associated with the railroad logging roads and they range from 20-30 feet in width and are generally continuous along the entire surface of the road since the top soil in these locations was scraped off and compacted during construction.

Based on the proceeding observations, a conservative estimate is that approximately 4% of the soils in the project area are slightly to moderately compacted (bulk density increase of 10-20%) and 1% highly compacted (bulk density increase of 20-50%).

Based on GIS mapping of slope classes in the project area and field reconnaissance, almost the entire proposed project is on ***low*** slope gradient (i.e., 0-30 percent). There are small areas, typically less than 100 feet wide, on ***moderate*** slopes (i.e., 30-60 percent) within the proposed project unit boundaries. Areas with continuous slopes greater than 35 percent were considered but eliminated from the proposed project area.

There are approximately 114 miles of forest roads in the Neal Creek, 95 in Lower Crabtree Creek, 174 in Roaring River and 109 in Lower Thomas Creek sixth field watersheds; occupying approximately 2.0%, 1.3%, 2.1% and 1.3% of the surface area in the respective watersheds. The average road density across all ownerships estimated at 3.7 miles per square mile (mi./mi.^{2}). Twenty-eight (28) miles of these roads are on federal lands (43 percent) with an estimated road density of 3.0 mi./mi.^{2}, which is less than the average road density in the general area.

The condition of these road surfaces varies widely from the Neal Creek Access Road which is a paved primary log haul road, to maintained rocked roads, to unmaintained natural surface roads. In the project area there are also a few remnants of old railroad grades which have not been utilized in many decades and are now either the sites for the roads described above, or have become revegetated.

The unmaintained natural surface roads exhibit a wide range of surface conditions. Some roads are open, others partially recovered with trees and vegetation encroaching on the subgrade, others have been damaged by off-highway vehicles (OHV) or used as illegal dump sites.

The expected background erosion rate (existing condition and No Action alternative) in Lost Lulay is estimated at 0.07 tons/acre/year (30 year average). Typical erosion from small, forested watersheds in the Pacific Northwest range from 0.02-19.43 with a mean of 1.75 t/ac/yr (Patric, 1984). Typical renewal rates for topsoil range from 0.12-0.8 t/ac/yr. (Pimentel, 1987). By comparison, surface erosion on croplands averages 44.5 tons/acre/year in the United States.

Photos 6-9 demonstrate the range of road conditions, roads to be renovated then closed after use. All photos are from Lost Lulay Thinning, Unit 25 10S1E. K. Walton 2009.

Environmental Effects

3.3.4.1 Proposed Action

Following completion of the proposed action, the majority of vegetation and root systems would remain, along with surface soil litter and slash from thinned trees. The expected amounts of surface soil displacement and soil compaction from commercial thinning operations would not exceed 10% of each project area, consistent with RMP standards and guidelines (p.C-1-2) because less than 10% of surface soils would be subject to operations that could result in compaction or soil displacement. The estimated rate of surface erosion, under the worst case scenario, is discussed below (see Surface Erosion Potential).

Photo 6: Currently open road

Photo 8: Road damaged by OHV use (Yellow hardhat for scale)

Photo 7:Unmaintained road, partially revegetated

Photo 9: Illegal dump on unmaintained, open road.

In addition, the proposed action would maintain sufficient mycorrhizae populations because the root systems of most trees would remain undisturbed and there is no evidence that past disturbance of the area has effected mycorrhizae populations. For the proposed action, the total area of disturbed and compacted surfaces would range from a low of 32 acres to a high of 43 acres representing 6-8% of the 544 treatment acres. Therefore, the proposed action would be expected to maintain compaction at or below the district guidelines (RMP C-2) to not compact more than 10% of ground-based logging units with skid trails and landings.

Soil Compaction and Disturbance/Displacement – Direct Effects

Skidding / Yarding

Compaction, displacement and disturbance of surface soils from ground based yarding varies with soil moisture, the quantity and type of organic material on the surface (i.e., duff and slash layer), slope gradient, the type of equipment used and the operator of the equipment.

If yarding is done using crawler tractors for all the proposed ground-based units (544 acres), the percentage of total tractor unit area impacted by surface disturbance and soil compaction as a result of skid roads would be approximately 6-8 percent (33- 44 acres). On the soils disturbed by crawler tractor skid trails, a moderate amount of top soil displacement and moderate soil compaction would be expected to occur. Other ground-based logging methods may result in less displacement and compaction.

Since most of the compaction (increase in soil density) occurs in the first pass when soils are wet and after the first three to five passes when soils are relatively dry (RMP/FEIS p. S-1) it is reasonable to assume that "shovel logging" (which uses a single pass on a slash mat) in the winter would have impacts to soil compaction and productivity that are equivalent to multi-pass skidding operations in the dry season.

Informal examination of these sites shows little evidence of compaction in limited "feel and crumble" tests and no apparent difference in tree or understory growth (personal observations). Although it was not a study point, one of the sites studied by Miller, et al (2007) (Toledo South, see p. 4) was logged in April (wet season).

No unusual compaction or rutting was described by the researchers and trees immediately adjacent to the forwarder trail showed increased growth rates over seven years compared to trees further from the trail. It is reasonable to assume, from these observations, that with careful operating techniques some ground based logging operations can be done in the wet season without damaging site productivity.

Dry season skidding or single pass "shovel logging" in the winter would be expected to result in moderate to heavy, fairly continuous compaction within the main 12 foot wide skid roads which would cover no more than 10% of the project area. Impacts would be light to moderate and less continuous on less-traveled portions of skid roads and where slash is deeper on shovel logging trails.

When using mechanized harvester systems operating on top of slash, soil impacts between skid roads are expected to result in light to moderate compaction in two discontinuous, narrow strips less than three feet in width.

Some of the potentially impacted acreage listed above for ground-based yarding systems includes existing skid roads from previous logging. Where practical, portions of these existing skid roads would be used for skid roads for this project. As a result, the amount of acreage for new or additional harvest impacts would be less than the totals listed above.

Road Construction, Maintenance and Closure

Constructing up to one mile of new roads would displace topsoil and compact subsoil on 3 acres, essentially converting it into non-forest land.

The roads to be constructed would be predominantly on moderate topography (slopes of approximately 3% to 10%), so the average total width of the clearing would be expected to be around 25 feet. This narrow clearing would have a minimal effect on overall tree spacing and stocking.

Placing slash debris over exposed natural road surfaces would decrease any potential surface erosion and runoff and provide a source of organic material to the disturbed soil. Using water bars and other shaping of the natural road surface would divert runoff onto stable, vegetated slopes and prevent the water from attaining velocities that would cause surface erosion. Blocking vehicle access would prevent creating ruts and repeated disturbance of the surface that typically contribute to erosion when vehicles continue to use a natural surface road after operations are completed. Surface rock (locations and length of road segments to be rocked would be determined during the project) would prevent soil erosion on rocked road segments.

In addition to new road constructed on previously undisturbed surfaces, approximately 12 miles of roads would be renovated under this proposal. Renovation disturbs parts of the road where vegetation has encroached into the road prism. The proportion of these existing roads where vegetated soil would be disturbed varies with the condition of the road. Overall the BLM estimates that this renovation would be the equivalent of new disturbance to a maximum average of 20% of the area of the road prism, approximately 4 acres.

Maintenance Renovation of existing, rocked roads would result in no change in the amount of current non-forest land. Some encroaching vegetation along these roads would be removed and surface rock would be added where needed. Drainage structures (e.g. culverts, catch basins, ditches, sediment traps, diversions from ditches to stable slopes) maintenance and improvements would improve drainage and road surface conditions, resulting in less road surface erosion into the surrounding area and streams. This drainage structure maintenance and improvement work would be expected to result in some minor short term roadside erosion when the established vegetation in the ditch and culvert catchment areas would be removed while cleaning or reshaping ditches and catchment basins.

Renovation of damaged road surfaces would correct drainage patterns that have resulted in soil erosion. Closure of damaged roads would stabilize the subgrades to prevent further erosion. Road closure would prevent erosion and future access for dumping. Litter-fall accumulations and the growth of vegetation generally re-establish within one-two seasons and erosion rates would be expected to return to very low levels thereafter.

Landing Construction

Log landing construction and use would compact the soil and displace top soil at the site. However, about half of the surface area used for landings would be the existing road surface (which is already compacted). The additional area adjacent to roads that would be needed for landing area is estimated to be approximately 2 percent of the total project area (11 acres). Portions of ground based landings where skidders return multiple times would be heavily compacted and would persist for several years. Soil disturbance from landings would be local to the landing area and would not affect soil resources on a watershed or landscape scale. The degree of soil disturbance and compaction in areas where logs are sorted or decked would be expected to be low (shallow and relatively quick to recover – one to three years).

Combined compaction from landings (2 percent) and skidding (6-8 percent) is less than or equal to 10 percent of the treated project area.

Surface Erosion Potential

WEPP modeling was done for 35 treated acres selected by the BLM Hydrologist as representative of treated areas in the Riparian Reserve portion of the proposed project area. The Riparian Reserve includes the portion of the treated area which has the steepest slopes and is closest to streams, and therefore has the greatest potential to erode and produce sediment. The estimated average increase in erosion/sediment production is 0.18 tons/acre/year directly attributable to the proposed action[24]. See the Hydrology section of this EA for the discussion that leads the BLM to reasonably conclude that the amount of soil eroded and deposited outside of the thinning area is too miniscule to calculate productivity loss based on soil erosion.

Site Productivity due to Soil Compaction, Disturbance/Displacement and Surface Erosion - Indirect Effects

Less than one percent reduction in site productivity would be expected from compaction and disturbance by logging operations. A recent study by the Pacific Northwest Research Station (Miller et al 2007, PNW-RP-574) found that growth of the trees immediately adjacent to skid/forwarder trails showed 3-18 percent greater growth than trees unaffected by logging trails over 7 to 11 years. It also indicated that the "rate of apparent recovery [of compacted soil in logging trails] is underestimated (Miller et al 2004)", and that the "[e]ffects of logging traffic on soil properties and tree growth are complex and depend on several factors, including…subsequent rate and effectiveness of natural remediation (freezing-thawing, wetting-drying, soil organisms, and vegetation)."

It is reasonable to assume, based on current research, that site productivity reduction would be less than the one percent analyzed in the RMP/FEIS (p. 4-12), which was based on an estimated 15-30 percent reduction in growth rates for trees adjacent to skid trails. The RMP concluded that "[t]his is considered an insignificant adverse growth impact."

The light compaction from mechanized harvester operations is not likely to measurably affect the reestablishment or growth of vegetation and is expected to have no measurable reduction in overall yield for the project area. As trees age and become established, any potential negative effect on growth from soil compaction and displacement becomes less pronounced and growth rates may approach that of trees on similar, undisturbed sites. This is especially true where the area of compaction/displacement tends to be in narrow strips, as is the case with skid trails small landings. Road surfaces and log landing areas may remain far below potential site productivity levels for many decades. It is anticipated that these roads would be used for future logging operations so that, while they may become revegetated between timber harvest entries, they would not be converted to productive forest land in the foreseeable future.

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[24] A typical sheet of printer paper is 0.004 inch thick. Calculations of soil amounts: 1 cubic yard (cy) of dry soil weighs very close to 1 ton (varies with soil type). 1 cy = 27 cubic feet (cf or ft^3) = 324 square feet (sf or ft^2) @ 1 in. deep. Predicted erosion is 0.18 tons/acre = 0.18 cy/ac. 1 Ac. = 43560 ft^2. 0.18 cy/ac. x 27 cf/cy = 4.86 cf. 2.34 cf x 12 sf @ 1" deep/cf = 58.32 sf of soil 1 inch deep. 58.32 sf ÷ 43560 sf/ac. = 0.00134 inch of soil per square foot. WEPP predicts soil loss through erosion to be approximately 1/3 of the thickness of a sheet of paper in depth.

3.3.4.2 Cumulative Effects

There are no cumulative effects to soil because the project would utilize already impacted ground (existing skid trails) whenever possible. BLM's experience with other thinning projects shows that compacted surfaces revegetate over time and in the case of many of the old skid roads in Lost Lulay have gone back to forest and the old road beds are not recognizable to the casual eye. Effects would be contained within or adjacent to the project units, and there would be no other uses affecting this resource.

3.3.4.3 No Action Alternative

Existing, maintained rocked roads would continue to be part of the transportation system and be maintained according to the Salem District transportation management plan, and would remain as non-forest land and provide access for management activities. Historic unmaintained roads and landings would be left in their current condition, which range from virtually no evidence of recovery to advanced recovery where understory vegetation is similar to adjacent areas. Vegetation and other natural processes would continue to slowly break up compaction and continue the process of recovering productive capability over time.

3.3.5 Wildlife

Sources incorporated by reference: *Cascades Resource Area EA Wildlife Report, Lost Lulay Project, 2008 (Wildlife Report); Biological Assessment of Not Likely to Adversely Affect (NLAA) Projects with the Potential to Modify the Habitat of Northern Spotted Owls Willamette Planning Province - FY 2009-2010 (BA). USDI, U.S. Fish and Wildlife Service. October 2008. Letter of Concurrence (LOC) Regarding the Effects of Habitat Modification Activities within the Willamette Province, FY2009-2010, Proposed by the Eugene District, Bureau of Land Management; Salem District, Bureau of Land Management; Mt. Hood National Forest; Willamette National Forest; Columbia River Gorge National Scenic Area on the Northern Spotted Owl and its Critical Habitat; FWS Reference #13420-2008-I-0140. USDI, Bureau of Land Management, Salem District, Cascades Resource Area. 1996. Thomas Creek Watershed Analysis (TCWA 1996). USDI, Bureau of Land Management, Salem District, Cascades Resource Area. 2001. Crabtree Creek Watershed Analysis (CCWA 2001).*

Affected Environment

Introduction

Variation in forest stand conditions within stands and at the landscape level have been identified as a key factor in providing habitat for a diversity of forest organisms (Hayes et.al. 1997; Muir et.al., 2002). Certain structural and compositional aspects that have been found to be important contributors to habitat diversity and species richness include dead wood in the form of snags and down logs, remnant live trees, and vertical and horizontal variation in tree and understory canopies. Also, hardwood trees and shrubs in particular have been found to be important contributors to forest biodiversity, providing habitat substrate, food sources, foraging substrate, and nesting opportunities. All of these features are generally lacking in the managed stands proposed for thinning. They are also features that would make the stands habitable by a broader range of forest-associated animal species.

General Stand Condition

The stands proposed for thinning in the Lost Lulay area originated between the mid-1930s to the late 1970s after the mature/old growth forest was logged. Little evidence of the previous stands are now visible, except for some scattered large CWD that represents that was left on the ground after logging.

Canopy cover is high and ranges from 77-93 percent, and understory shrub development has generally been retarded and ground cover is sparse (less than 10 percent).

Young managed stands with simple structure and limited diversity such as those proposed for thinning currently constitute a large portion of the Thomas and Crabtree Watersheds. Forest management during the period when these stands were established was designed and intended to maximize timber production. Wildlife habitat conditions were given secondary, if any, consideration during stand initiation and management. Researchers have recognized that stands initiated and managed in such a way are not "equivalent" to similar-aged unmanaged stands, and the trajectory originally intended for many of these stands "would neither contribute to nor perpetuate old-forest characteristics on these landscapes" (Hunter 1993).

Residual Old-Growth Trees, Coarse Woody Debris (CWD), and Special Habitats

Table 7 summarizes the presence of residual old growth trees, special habitats, and the amount of CWD present in the units prior to thinning. The presence of CWD, residual old growth trees and special habitats is based on stand exam data, aerial photos, and field review by specialists. CWD must be at least 20 inches in diameter at the large end, 20 feet in length, and in decay classes 1 and 2, to satisfy management direction as described in the Salem Resource Management Plan (RMP, p. 21).

Material of this size that is in more advanced stages of decay is summarized as well, since this material is valuable habitat for such species as Oregon slender salamander, and will contribute to forest floor wildlife habitat conditions for some decades.

Throughout the project areas, CWD in a less decayed condition (class 1 and 2) is primarily limited to smaller diameter material than would be considered adequate to meet RMP management direction. CWD in more advanced stages of decay (classes 3-5) are usually remnants of old-growth "cull" trees that were not removed after harvest, and are often in larger diameter classes. These logs provide valuable habitat for a whole host of CWD associated wildlife species (O'Niell et.al. 2001), and they persist for many decades before passing through advanced decay classes to become unrecognizable as down logs.

The less-decayed logs in smaller size classes are mostly the result of recent self-thinning in crowded overstocked stands. These small logs are much less useful to forest floor-associated animal species for cover because they have less volume, and persist for shorter time spans (usually less than two decades) than the larger material, thus they are less useful for wildlife.

There are no known residual old-growth trees present in the proposed Lost Lulay units but there is a large tree component in T.10S., R.1E., sections 21; and T.10S., R.2E., section 19. CWD that would meet RMP management direction (240+ linear feet per acre of material in decay classes 1 or 2, at least 20" in diameter at the large end, and 20 feet in length) is currently lacking in all of the units proposed for thinning (RMP, p. 21). CWD in decay classes 3-5 is also lacking, with the exception of the units in 10S-1E-21, 10S-1E-25, and 10S-2E-19 where it is generally abundant (240+ linear feet/acre), and is large enough to last for at least several decades.

There are small wet areas with seasonal ponds adjacent to unit 10S-1E-29 unit A. These features will be buffered and posted outside of the unit boundaries.

Table 7: Special habitats, remnants, and coarse woody debris (CWD) present by project unit

Unit Identifier	Location	Seral Stage	Remnant Old Growth	Special Habitats*	CWD**
25A	10S-1W-25	Early Mid	No	No	0+/160’
25B	10S-1W-25	Early Mid	No	No	0+/<60’
21A	10S-1E-21	Late Mid	No	No	120/240’+
23A&B	10S-1E-23	Mid	No	No	0+/>60’
25	10S-1E-25	Mid	No	No	>60’+/240’+
29A&B	10S-1E-29	Early Mid	No	Yes#	0’/<60’
19A	10S-2E-19	Mid	No	No	<60’/240’+
5A&B	11S-1E-5	Mid	No	No	<60’+/ 60’

Seral Stage Age Classes (years) based on Stand Exam data: Early Seral = 0-30; Early Mid Seral = 30-40; Mid Seral = 40 – 60; Late Mid Seral = 60 -80; Early Mature Seral = 80 - 120; Mature = 120 - 200; Old Growth =200+

* Special habitats within the units include: wet and dry meadows, talus, cliffs & rock outcrops.

** Linear ft/acre >19” diameter & >20’ long, hard (decay classes 1-2)/soft (decay classes 3-5) logs.

Presence of adjacent special habitat, wetland, pond adequately protected with no treatment buffer.

Snags and Snag-Associated and Cavity Nesting Species

Table 8 summarizes the number of snags necessary to meet management direction in the RMP (p. 21) for five cavity-excavating woodpecker species which are referred to in Neitro et al (1985). Table 9 summarizes the snags present prior to thinning. A diameter of 15+ inches was used because most wildlife species that utilize snags are associated with snags greater than 14.2 inches (Rose et.al., 2001). The presence of snags and standing dead material is based on stand exam data and field review by specialists. Stand exam data is based on a statistical sample from plots. Low numbers of snags may be present, but the sampling may not have picked up any on the plots. The use of 0+ in the table denotes when there are trace numbers of snags present that may not have shown up on the plots.

The hairy woodpecker, red-breasted sapsucker and pileated woodpecker are species associated with conifer stands in the western Cascades Mountains, and are present in the Lost Lulay Project Area. Northern Flicker and Downy woodpecker are not typically associated with closed-canopy conifer-dominated stands in the western Cascades, though both species are found in or around the project area.

Snag habitat does not meet the 40 percent of maximum population densities requirement for the five woodpecker species throughout most of the project areas (RMP, p.21). Most of the snags and CWD material that are present are small (less than 20” diameter) and/or highly decayed. Trees that could have developed into large snags and down logs were removed by past timber management treatments. In general stands throughout the project areas are in a condition in which there is a near-term (less than three decades) snag deficit (RMP, p. 21).

Table 8: Minimum number of snags necessary to support species of cavity nesting birds at 40 percent of potential population levels (RMP p. 21, as per Neitro et al, 1985)

Diameter Class (Inches dbh)	Snag Decay Stage		Total by diameter class (per 100 acres)
	Hard 2-3	Soft 4-5	
11+		Downy woodpecker (6)	6
15+	Red-breasted sapsucker (18)	Hairy woodpecker (77)	95
17+		Northern flicker (19)	19
25+	Pileated woodpecker (2)		2
Total – all diameter and decay classes			122

Table 9: Summary of snags currently available by project unit

Snags at least 15' tall/100 acres						
Section (all units)	Hard snags 15-25"	Soft snags 15-25"	Hard snags 25"+	Soft snags 25"+	Total hard snags 15"+	Total soft snags 15"+
10S-1W-25	0+	0	0	20	0+	20
10S-1E-21	0+	0+	0	0+	0+	0+
10S-1E-23	0+	240	0	0	0+	240
10S-1E-25	0+	0	0	80	0+	80
10S-1E-29	0	0	0	0	0	0
10S-2E-19	0	0	0	150	0	150
11S-1E-5	50	0+	0	0	50	0+

Special Status, Survey and Manage, and other Species of Concern

Vegetation surveys (stand exam data) indicate that most of the stands proposed for thinning are lacking in habitat elements that support diverse populations of wildlife species, especially CWD, snags, deciduous understory and ground cover vegetation, or deep accumulation of leaf litter. Habitat, range data, and previous surveys for mollusks and amphibians conducted over 9000 acres on the Cascades Resource Area since 1991 indicate that no Bureau Sensitive mollusk species are likely to be present in the proposed thinning units.

Federally Listed Species (Endangered Species Act (ESA) - Northern Spotted Owl

The proposed thinning units provide 544 acres of dispersal habitat in the Thomas and Crabtree Watersheds. There are two historic known spotted owl sites in the vicinity of the Lost Lulay Project Area. These sites were located during the early 1990s, and have been surveyed consistently since that time. Unit 10S-2E-19 A is within the provincial home range (1.2 mile radius) of the North Fork Neal Creek known spotted owl site, which was last occupied by a nesting pair in 1994.

The last pair response was in 2005, and the last single response was in 2007. Units 10S-1E-21 A, 10S-1E-29 A and B are within the provincial home range of the Lulay known spotted owl site, which was last occupied by a nesting pair in 1993. The last response from a pair was in 1999, and the last response from a single bird was in 2002. There were barred owl responses at Lulay in 1992, 1993, 1996, 1998, 1999, 2000, 2001 and 2006. No suitable nesting, foraging and roosting habitat is proposed for thinning inside or outside the provincial home range of any known spotted owl sites. None of the units are located in Critical Habitat and or unmapped Late Successional Reserves (LSRs) which are 100 acre core areas of known spotted owls as of January 1994. However there are two unmapped LSRs in the vicinity.

The unmapped LSR for the Lulay site is located in 10S-1E-29 adjacent to unit A, and the unmapped LSR for North Fork Neal Creek is located in 10S-2E-19 south of unit A.

Bureau Sensitive – Oregon Slender Salamander

Oregon slender salamander, a Bureau Sensitive Species, is expected to occur in portions of the project areas where CWD of adequate size (RMP requirements >20" diameter at the large end, >20' in length) occurs. Oregon slender salamander has been found throughout the Cascades Resource Area in stands across the full range of seral stages. Its distribution on BLM lands within the Cascades Resource Area appears to be limited by dry conditions at low elevations along the Willamette Valley floor, and by cold conditions at higher elevations (Dowlan, unpublished 2006).

Habitat is generally described as conifer stands dominated by Douglas-fir with large amounts of large rotten (decay class 3 to 5) Douglas-fir down logs. Old logs, stumps and large woody material piles around stumps, and exfoliated tree bark on the ground are used for cover, feeding and breeding. Larger material that can hold moisture through summer drought is generally considered to be most important in maintaining moderate subsurface microclimate conditions. Optimal habitat for these animals is generally described as late-successional forest conditions with cool, moist microclimates and large down wood. The Oregon slender salamander, a Bureau Sensitive species, was found in T.10S., R.1E., sections 21 and 29; and T.11S., R.1E., section 5, but they are highly likely and assumed to be present in all other sections of the project area.

Survey and Manage – Red Tree Vole and Certain Mollusk Species

The red tree vole is an arboreal vole associated with conifer forests west of the Cascades summit, below about 3,500 to 4,500 feet in elevation. The project area is within the "Northern Mesic Zone" of the range identified for the species.

Current policy with regard to Survey and Manage species is described in EA section 1.3.1. None of the stands proposed for thinning in the Lost Lulay Project Area are over 80 years of age, thus surveys for red tree voles and Survey and Manage mollusks are not required. In addition, none of the stands currently proposed for thinning meet the stand-level criteria as described in (Biswell et al 2002), including 10S-1E-29 units A and B; and 11S-1E-05 unit A where red tree voles were found during 2003 surveys. These units have average mean diameters of less than 14 inches and are less than 40 years of age.

Bats

Four bat species of concern are suspected to occur in the Lost Lulay Area (silver-haired bat, long-eared myotis, long-legged myotis, and Yuma myotis). These species are associated with caves and mines, bridges, buildings, cliff habitat, or decadent live trees and large snags with sloughing bark. Decadent live trees and large snags, particularly ones with bark attached that extend above the tree canopy, are used variously as solitary roosts, maternity roosts, and hibernacula by these species, and other bat species associated with Douglas-fir forests (Christy and West 1993, Weller and Zabel 2001, Waldien et.al. 2000). Although roost sites are poorly characterized in Pacific Northwest forests, existing information indicates that old-growth forests provide higher quality roost sites than younger forests and that many species prefer older forests (Thomas and West 1991, Perkins and Cross 1988). Old-growth and tall snags with sloughing bark are rare in the project areas (Tables 1 and 3), and these species are likely to be present in low numbers.

Migratory and Resident Bird Species

About 125 bird species are known or suspected to breed in the Cascades Resource Area (Wildlife Report Appendix A based on Altman and Hagar 2007, Altman 2008, Marshall et.al. 2003). Of these species, 80 have at least a low probability of breeding in the Lost Lulay Project Area. There are 54 bird species that nest in the Cascades Resource Area that are priority bird species of conservation concern identified by bird conservation partners (Appendix B). Of these species, 33 have at least a low probability of breeding in the Lost Lulay Project Area. The proposed thinnings are located in the Western Oregon Cascades Physiographic region. Bird species richness at the stand level has been correlated in some recent studies with habitat patchiness, densities of snags, and density by size-class of conifers (Hagar, McComb, and Emmingham 1996, Hansen et al. 2003). Even-aged conifer stands provide habitat for a relatively high abundance of a few bird species, many of which feed on insects gleaned from conifer foliage. The most common species include chestnut-backed chickadee, Pacific-slope flycatcher, hermit warbler, golden-crowned kinglet, varied thrush, winter wren, red-breasted nuthatch, and Swainson's thrush, however, these species are also common or more abundant in mature conifer stands as well (Hansen et.al., 1995).

The proposed thinning areas are in mid seral stands in the stem exclusion stage. These forest conditions are structurally simple and characterized by an even-aged, single-layered, closed-canopy with poor understory development, and are low in landbird species richness. The light-limited understory of unthinned stands does not provide for a diverse community of shrub and ground cover plant species that are important in providing insect and plant food resources for bird species which rely on living deciduous trees, shrubs, and leaf litter (Hagar 2004). Abundance of arthropod prey species has been correlated with understory and midstory vegetation, particularly tall shrubs and hardwoods. These habitat elements are lacking or poorly-developed in the stands proposed for thinning.

Big Game

Big game species that are found in the project areas include Roosevelt elk (*Cervus elaphus roosevelti*) and black-tailed deer (*Odocoileus hemionus*). The project areas are in mid seral stands which provide hiding and low quality thermal cover. Early seral communities and mid seral stands are abundant on adjacent private lands surrounding the project areas. The Salem District Record of Decision and Resource Management Plan (RMP) approved May 1995, identifies no critical winter or summer range in the project areas (RMP p.26).

Environmental Effects

3.3.5.1 Proposed Action

General Habitat

Overall, short term (less than 5 years) canopy cover reduction, disturbance, and reduction of understories and ground vegetation would occur due to thinning. The long term (more than 5 years) effects would be to increase structural complexity and improve habitat quality for wildlife.

Research that has occurred since the 1980s has determined that it is possible to develop desired structural and compositional diversity in young managed stands through specific actions (Bailey and Tappeiner 1997, Chan et.al.2006).

Thinning forest stands produces what has been described as "cascading ecological effects" (Hayes, Weikel and Huso, 2003) that result from reduced competition between overstory trees and increased availability of solar radiation to the forest floor. Growth, size, branch diameter, and crown ratio of the remaining trees is increased, and development of understory and ground cover vegetation is stimulated. These changes effectively increase structural complexity and alter habitat quality. The increase in structural diversity would improve wildlife habitat by providing more opportunities for foraging; nesting/breeding activities; and resting, hiding and escape cover/habitat for a variety of species in the forest environment, including invertebrates, songbirds, and small mammal species. These changes are considered to be beneficial since there is an abundance of simplified structure habitats in the vicinity of the project area (TCWA, pp. 29-32; CCWA Chp. 5, pp.4-6).

Proposed road construction and renovation and skid trails under the proposed action would create or maintain narrow linear openings through the vegetation, disturbing, reducing or removing ground vegetation and creating breaks in the canopy, which allow more light to reach the forest floor. The effects on wildlife habitat would be a short term (less than 5 years) disturbance and reduction in ground vegetation and canopy closure that would increase access to the stand by certain wildlife species, specifically larger mammals such as big game, coyotes, and avian predators. In the long term (more than 5 years) and ground vegetation would become re-established due to increased light to the forest floor and the breaks in the canopy would close.

Riparian Reserves and associated Wildlife Species

The age classes proposed for thinning provide the greatest opportunities for acceleration of tree diameter growth and understory development through thinning and density management (CCWA, Chapter 7, p. 6). It is anticipated that thinning would improve habitat conditions in the Riparian Reserves for wildlife by accelerating development of late seral forest stand characteristics. Desirable late seral forest stand characteristics include larger trees for a large green tree component and recruitment of large standing dead and down CWD in future stands, multi-layered stands with well developed understories, and multiple species that include hardwoods and other minor species (TCWA, p. 99; CCWA, Chp. 7, p. 4).

At the landscape level, connectivity for species such as the spotted owl is expected to improve as late successional conditions develop in the Riparian Reserves. Other species which would benefit from the development of older forests in the Riparian Reserves include many species of mollusks, amphibians, bats, the red tree vole, blue grouse, red-breasted sapsucker, pileated woodpecker, Cooper's hawk, Pacific-slope flycatcher, Swainson's thrush, black-throated gray warbler, and black-headed grosbeak, olive-sided flycatcher, brown creeper, and hermit warbler.

Snags and Coarse Woody Debris (CWD)

Thinning these stands would reduce the number of small diameter (less than 15 inches DBH) snags over the next 20 years because thinning from below removes the smaller suppressed and intermediate trees that would be most likely to die from suppression mortality and become snags within that time period. Within thinning units, most existing snags in all sizes over 15 inches diameter would be retained. It is anticipated that 90+ percent of these snags would remain standing after treatment. This would effectively reserve the best existing habitat features for primary excavators (woodpeckers), and secondary cavity users, such as songbirds, bats and small mammals.

The remaining 10 percent or less of these snags may need to be felled for safety, road construction, or skid roads, or would fall incidental to logging operations. More of the smaller diameter/taller snags (<12 inches diameter and >25 feet tall), would be felled for safety reasons, or fall incidental to thinning operations. These snags are less important for wildlife species than the larger material over 15 inches (Rose et. al., 2001). Any snag that falls for any reason as a result of thinning operations would remain on-site as CWD, providing important habitat for a different, but also, key group of dead-wood associated species, including the Oregon slender salamander, a Bureau Sensitive species. All dead wood that is on-site when timber marking takes place would remain on-site after thinning, either in the form or standing snags or as down logs.

Management direction for the Matrix LUA includes providing a renewable supply of snags and down logs well-distributed across the landscape (RMP p. 21). Most units throughout the project areas are expected to remain in a snag deficit condition (RMP, p. 21) for one to three decades, until live trees become large enough (at least 20" diameter) to provide for recruitment of large snags and CWD which will meet RMP requirements. As a result of thinning, growth of residual live trees would be accelerated, so that larger trees would be available sooner than without thinning to contribute additional large snags and CWD in the future stand. Thinning captures mortality by removing the smaller trees which would be the first to die as a result of competition for light, water and nutrients (suppression mortality), resulting in fewer small-diameter (<15 inches) snags during the next one to three decades. Untreated portions of the Riparian Reserve would continue to provide small-diameter snags through suppression mortality. The RMP guidelines for snags (40 percent maximum population densities) and CWD (240+ linear feet per acre of material in decay classes 1 or 2, at least 20" in diameter at the large end, and 20 feet in length), could be met in one to three decades. Large diameter CWD in more advanced decay conditions would persist and contribute to forest floor wildlife habitat conditions for many decades before passing through decay class five to become unrecognizable as down logs.

It is anticipated that less than ten percent of existing CWD would be directly impacted by logging. Less than ten percent of the thinning area would be directly impacted by skidding, which is the operation with the highest potential impact to existing CWD. BLM oversight of skid trail locations would ensure that skid trails were located to avoid impact to high value CWD whenever feasible, reducing the anticipated impacts below the ten percent level that would be expected from locating skid trails without concern for CWD. The same principles generally apply to snag retention.

Special Status and Survey and Manage Species

Federally Listed Species - Northern Spotted Owl

Refer to Table 10 for a summary of the Lost Lulay project and its effects on spotted owl habitat and definition of terms. In the short term, 367 acres of dispersal habitat in the Thomas Creek Watershed and 177 acres of dispersal habitat in the Crabtree Watershed would be altered as a result of thinning. Available scientific literature provides support for the finding that forest stands can be altered in a manner that is not necessarily expected to change the habitat function for spotted owls (Forsman et al. 1984, USFWS 2007c). Examples of silvicultural activities that may fall into this category are light to moderate thinning, down salvage, individual tree removal, and prescribed burning.

In the short-term, seasonal restrictions on habitat modification activities (felling, yarding, burning, and road building) would minimize the risk of disturbance to any unknown northern spotted owls during the critical nesting season and delay habitat modification activities later into the nesting season when spotted owls are less sensitive to disturbance. Disturbance associated with thinning (logging, road-building, etc,) may have temporary effects on the presence or movement of spotted owls. However, thinning would maintain dispersal habitat, therefore maintaining the ability of the habitat to accommodate movement of birds after thinning is completed.

In the long term, thinning would accelerate the development of suitable habitat characteristics, especially in Riparian Reserves. As thinned stands mature, habitat conditions are expected to improve. Canopy cover would increase and these stands would attain suitable habitat conditions within 10 to 50 years. These stands would develop foraging and nesting structure and residual trees will increase in size and be available for recruitment of snags, culls and CWD for prey species and nesting opportunities for spotted owls.

No suitable habitat would be downgraded or altered as a result of thinning. No suitable habitat would be altered or downgraded within the provincial home range radius of any known spotted owl sites. Overall habitat conditions with the provincial home range of two historic spotted owl sites would not change as a result of thinning. None of the proposed units are located in LSR or Critical Habitat for the Northern spotted owl. Current habitat conditions for the spotted owl would be maintained in all of the proposed thinning units after treatment. "Maintain" habitat means light to moderate thinning in which forest stand characteristics are altered but the components of spotted owl habitat are maintained such that spotted owl life history requirements are supported. As a result, the functionality of the habitat used by spotted owls remains intact post treatment. For spotted owl dispersal-only habitat a canopy cover of >40 percent along with other habitat elements (e.g. including snags, down wood, tree-height class-diversity, and older hardwoods) will be maintained post treatment to adequately provide for spotted owl dispersal. Such treatments can have long-term benefits to spotted owls by encouraging late-successional characteristics to occur more rapidly (BA p. 9, LOC p. 15).

Table 10: Spotted Owl Habitat Modification by Treatment type[A], Land Use Allocation[B], Pre/Post Treatment Habitat Type[C], Habitat Modification Type [D], and Effect Determination[E]

5th. Field Watershed	Township Range-Section#	Proposed Treatment[A]	Acres	Land Use Allocation [B]	Pre/Post Treatment Habitat Type[C]	Habitat Modification[D]	Effect[E]
Thomas	10S-1W-25A (part), 10S-1E-21, 23, 29A, B (part)	Light to moderate thin	195	GFMA/ RR	Dispersal/ Dispersal	Maintain	NLAA
	10S-1E-25; 10S-2E-19		172	CONN/ RR			
Crabtree	10S1W-25A (part) B 10S-1E-29 B (part) 11S-1E-5	Light to moderate thin	177	GFMA/ RR	Dispersal/ Dispersal	Maintain	NLAA

Notes and definitions for Table 10 (BA, pp. 3, 4-5; LOC, pp. 10-11).

[A] **Treatment Type:**

Light to moderate thinning in dispersal or suitable habitat can be for forest health or to improve the structural characteristics of a stand or to provide commodity.

Such treatments may be described as commercial thinning, density management, selective cut, partial cut, or mortality (standing) salvage. Such thinnings maintain a minimum of 40 percent average canopy cover. Light to moderate thinnings can have long-term benefits to spotted owls by encouraging late-successional characteristics to occur more rapidly.

[B] **Land Use Allocations: GFMA**=General Forest Management Area Matrix; **CONN**= Connectivity Matrix **RR**=Riparian Reserve.

[C] **Habitat Types:** No Suitable habitat is proposed for thinning.

Capable habitat consists of habitat which is not currently dispersal or suitable habitat, but has the capability to become dispersal and/or suitable habitat in the future.

Dispersal habitat consists of conifer and mixed mature conifer-hardwood habitats with a canopy cover greater than or equal to 40 percent and conifer trees greater than or equal to 11 inches average diameter at breast height (DBH). Generally, spotted owls use dispersal habitat to move between blocks of suitable habitat, roost, forage and survive until they can establish a nest territory. Juvenile owls also use dispersal habitat to move from natal areas. Dispersal habitat lacks the optimal structural characteristics needed for nesting.

[D] **Habitat Modifications:** Maintain habitat means to alter forest stand characteristics but maintain the components of spotted owl habitat within the stand such that spotted owl life history requirements are supported (i.e. the functionality of the habitat used by spotted owls remains intact post treatment). For spotted owl dispersal-only habitat a canopy cover of >40 percent along with other habitat elements (e.g. including snags, down wood, tree-height class-diversity, and older hardwoods) will be maintained post treatment to adequately provide for spotted owl dispersal.

[E] **Effect:** NE=No effect; NLAA=May affect, but not likely to adversely affect; LAA=May affect and likely to adversely affect.

Bureau Sensitive – Oregon Slender Salamander

It is not expected that thinning these stands would result in significant effects to Oregon slender salamanders or their habitat. Post-thinning treatment surveys in the Keel Mountain Density Management Study Area indicate that Oregon slender salamanders are not significantly affected by thinning (Rundio and Olson 2007). Oregon slender salamanders would be expected to persist at sites within stands where CWD of adequate size (RMP requirements >20" diameter at the large end, >20' in length) currently exists. The CWD currently on-site prior to thinning and in untreated areas (especially in the Riparian Reserve) would continue to provide refuge for terrestrial salamanders many years after treatment (*Table 7*).

These results are consistent with survey results elsewhere in Cascades Resource Area from stands that had been subjected to timber harvest in the past (Dowlan, unpublished 2006). Stands in similar age classes had been subjected to regeneration harvest with no green tree retention, similar to the proposed thinning units. Logging practices of the time resulted in heavy concentrations of large logs, or "culls" which were cut, but not removed from the site. This large woody material lasts for many decades, and provides moderating microclimates in which Oregon slender salamanders can persist.

In the short term, direct effects (disruption or mortality) to Oregon slender salamanders may occur during logging operations. Ground based logging would result in the most impact due to higher ground disturbance.

Design features common to all projects would minimize disturbance to existing CWD. Ground disturbance from tractor skidding trails and other ground-based logging equipment would be limited to ten percent of project unit areas, and therefore, no more than ten percent of potential Oregon slender salamander habitat within any unit.

Survey and Manage – Red Tree Vole

In the short-term, undetected nests within marginal habitat (habitat less than 80 years of age) could be destroyed or disturbed during thinning. After thinning is completed, stands would acquire older forest characteristics sooner than without thinning. No habitat is being removed as a result of this proposal, and habitat conditions for red tree voles would gradually become more suitable after thinning as the stands continue to mature and develop older forest characteristics.

Bats

Old-growth forests provide higher quality roost sites than younger forests and many species prefer older forests (Thomas and West 1991, Perkins and Cross 1988). No older forests are proposed for thinning. Bat species which use snags would be affected due to a loss of 10 percent or less of the standing dead material within the thinning units. Most existing snags in all sizes over 15 inches diameter would be retained. It is anticipated that 90+ percent of these snags would remain standing after treatment. The remaining 10 percent or less of these snags may need to be felled for safety, road construction, skid roads, or would fall incidental to logging operations. Bat activity appears to be higher in thinned versus unthinned stands. Structural changes in stands caused by thinning may benefit bats by creating habitat structure in young stands that bats are able to use more effectively (Humes, Hayes, Collopy 1999).

Bat species which are more closely associated with buildings, bridges, mines, cliff crevices and caves than snag habitat would not be affected. None of these features are present in the Lost Lulay Project Area.

Migratory and Resident Birds

The effects of thinning on priority bird species with at least a low probability of nesting in the Lost Lulay Thinning Project Area are shown in the Wildlife Report, Table 7. The following is a summary of the project's effects on migratory and resident birds. Disturbance of nests, eggs, nestlings and nesting failure would be highly likely if harvest operations occur during active nesting periods. However, the impacts would be short term (during one nesting season), and would not reduce the persistence of any bird species in the watershed or populations at the regional scale. In the western Oregon Cascades there is temporal variability of breeding bird species and individuals of the same species in forested habitats.

For example some owls and woodpeckers begin breeding in February or March while some flycatchers do not finish breeding until August. The majority of birds in the Pacific Northwest complete their breeding cycle within the April 15 to July 31 time period (Altman, Hagar 2007).

Changes in habitat structure are expected to have immediate effects on bird communities in thinned stands. Thinning densely-stocked conifer stands would be expected to immediately enhance habitat suitability for species which prefer a less dense conifer canopy, and reduce habitat suitability for species that prefer continuous conifer canopies.

Reducing the canopy cover and opening up stands is expected to have short term negative effects on the brown creeper, golden-crowned kinglet, hermit warbler, Pacific-slope flycatcher and varied thrush however, these species are also common or more abundant in mature conifer stands as well (Hansen et.al., 1995). The thinning would have no effects or even positive long term effects on this same set of species. In the short term, individuals of some species may be displaced during harvest operations in the project area due to disturbance. Adjacent untreated areas and areas where active operations are not occurring would provide refuge and nesting habitat, which would help minimize short term disturbance.

Overall bird species richness (a combination of species diversity and abundance) would be expected to gradually increase for up to 20 years as hardwood components of stand structure develop, plant species composition becomes more complex, and hardwood shrub layers, epiphyte cover, and snag density become more prominent within the stands.

The future development of hardwood/deciduous tree/bush components and canopy layers would favor species such as the band-tailed pigeon, ruffed grouse, red-breasted sapsucker, Wilson's warbler, Hutton's Vireo and black-throated gray warbler.

Big Game

Big game species would be temporarily disturbed during the implementation of the proposed action. Logging equipment noise and human presence may cause animals to avoid or disperse from the project areas temporarily. Thermal and hiding cover would be maintained after harvest. Thermal and hiding cover quality would decrease in the short-term as a result of thinning, opening new roads, renovating roads and road improvements (Cole, et al. 1997, Trombulak and Frissell 1999, USDA (PNW) 2006). Vegetative forage such as saplings, shrubs, grasses and forbs would increase as a result of thinning and road closures after thinning. As a result of increased light, forage quantity would increase and attract early successional species such as elk and deer to the thinned areas. In the long term (5+ years), thermal and hiding cover quality would increase and vegetative forage such as saplings, shrubs, grasses and forbs would gradually decrease as a result of canopy closure decreasing the amount of light reaching the forest floor.

3.3.5.2 Cumulative Effects

Residual Old Growth Trees, Snags and CWD

Regardless of the scale for assessing cumulative effects, design features would retain existing CWD, residual old growth trees, and snags 15+ inches diameter. It is expected that 90+ percent of these snags would remain standing after treatment. Some snags, especially smaller diameter/taller snags (<12 inches diameter and >25 feet tall), would be felled for safety reasons, or fall incidental to thinning operations. Any snag that falls for any reason as a result of thinning operations would remain on-site to become CWD, providing important habitat for a different, but also, key group of dead-wood associated species (Aubry 2000, Bowman et.al. 2000, Butts and McComb 2000), including the Oregon slender salamander, a Bureau Sensitive species.

Beneficial cumulative effects to CWD, snag habitat and associated species may occur as a result of implementing the projects, since larger trees would be available sooner than without thinning to contribute additional large snags and CWD recruitment in future stands.

Northern Spotted Owl

The scale for cumulative effects for the northern spotted owl is the provincial home range of known spotted owl sites, which is 1.2 miles for the Cascades of Western Oregon (BA, p. 3; LOC, p. 11) and the location of the project in relationship to adjacent known spotted owl sites and Late Successional Reserves (LSRs). The scale was chosen because the Northwest Forest Plan (NWFP) goal for conservation and recovery for spotted owls is to maintain suitable owl habitat within LSRs and the provincial home range of known owl sites; and maintain dispersal habitat between LSRs and known owl sites. Cumulative effects to spotted owls and their habitat were analyzed thoroughly at multiple scales in the BA, including the current Environmental Baseline (BA pp.11-20), and Cumulative Habitat Effects Summary (BA pp. 38).

Unit Specific Data, including the environmental baseline and effects of proposed projects that are not likely to adversely affect spotted owls, are summarized by Administrative Units in the Willamette Province (BA pp. 43-105), including the Cascades Resource Area where the Lost Lulay Project is located (BA pp. 51-59). The LOC issued by the USFWS concurred with the analysis in the BA that the combined effects to spotted owl habitat and populations of all of the actions proposed in the Willamette Province (including the Lost Lulay Project) would not be significant because they would not reduce the landscape's ability to function as dispersal habitat for spotted owls (LOC p. 29), and would not likely diminish the effectiveness of the conservation program established under the NWFP to protect the spotted owl and its habitat (LOC p. 29-31).

The proposed project would not contribute to cumulative effects to spotted owls because dispersal habitat within and between known owl sites would be maintained, and no suitable habitat would be removed or downgraded within known owl sites. Overall habitat conditions within the provincial home range of the two historic spotted owl sites would not change as a result of thinning. Silvicultural prescriptions that promote multi-aged and multi-storied stands may increase the quality of spotted owl habitat over time (LOC pp. 19).

Other BLM Special Status Species and Survey and Manage

The proposed action would not contribute to cumulative effects to the Oregon slender salamander and other CWD associated species. Suitable habitat conditions would be maintained in the short term in the project areas, providing refugia for low-mobility amphibians and invertebrates. In the long term, larger trees would be available sooner than without thinning to contribute additional large CWD in future stands. Implementation of the project would not eliminate connectivity between proposed units or adjacent untreated stands under BLM management.

No adverse cumulative effect to red tree vole habitat is expected because:

- Red tree vole is considered to be a late successional associate. No late successional habitat over 80 years of age would be lost or altered;
- The thinned stands would attain older forest conditions sooner as a result of the density management thinning project, particularly in Riparian Reserves.
- Undisturbed habitat in the same or similar age class with connectivity to the thinning units exists within the project area, elsewhere within the affected sections.

Thinning in the project areas, either individually or collectively, would not be expected to contribute to the need to list any Bureau Sensitive species under the Endangered Species Act (BLM 6840) because habitat for the species that is known to occur in the project areas would be not be eliminated, habitat connectivity would not be changed, any habitat alteration would have only short-term negative effects, and long-term effects would be beneficial.

Migratory and Resident Birds

The proposed action would not reduce the persistence of any bird species in the watershed or populations at the regional scale. Habitat changes resulting from the proposed action would not eliminate any forest cover type, change any habitat or patch size, and therefore would not contribute to fragmentation of bird habitat. Thinning would not contribute to a fundamental change in the species composition of existing bird communities within the watershed. Therefore, no adverse cumulative effects would occur to migratory birds.

Big Game

No adverse cumulative effects to big game species populations are expected. The proposed action would not fundamentally change or eliminate any forest cover type or change any habitat patch size. Therefore, thermal and hiding cover present before treatment would be maintained after harvest.

3.3.5.3 No Action Alternative

Habitat Structure, Residual Old Growth Trees, Snags and Coarse Woody Debris

Overcrowded stands with low vigor and small crowns would grow more slowly compared to thinned stands. Self thinning (suppression mortality) would occur, but diameter growth would not accelerate as fast as in thinned stands. Snags and CWD created by self thinning would be small diameter - not large enough to provide high quality habitat or to meet RMP standards - until later in the life of the stand (approximately 20 to 60 years) when suppressed co-dominates achieve these diameters before dying. Understory and ground cover development would take longer than if these stands were thinned. Without management intervention, stands would take longer to develop late successional habitat conditions and remain less diverse for a longer period of time.

BLM Special Status Species and Survey and Manage

Federally Listed Species: Northern Spotted Owl

There would be no immediate change in spotted owl habitat and no effect to spotted owls caused by management action. Habitat conditions would remain as described in the Affected Environment, and would continue to develop slowly over time for reasons stated above. In unthinned areas, it would take approximately 20 to 60 years to develop suitable habitat conditions if left untreated.

Other Special Status and Survey and Manage Species

In the short term (<10 years), there would be no immediate change in current habitat conditions for Survey and Manage and BLM Special Status Species. In the long term (20 to 60 years):

- Trees will grow more slowly, and material available for CWD recruitment would average smaller in diameter than if thinning were to occur. Development of Oregon slender salamander habitat conditions would likely be delayed without the addition of new large woody material to replace existing well-decayed material that will eventually disappear.
- Since no new disturbance to the conifer canopy would occur, no undetected red tree vole nests would be affected. Optimal red tree vole habitat conditions, presumed to be older forest conditions, would develop more slowly without thinning.

Migratory and Resident Birds

Habitat conditions would remain as described in the Affected Environment, and would continue to develop slowly over time. Species richness of bird communities would reflect the simple single storied mid seral stages for a longer period of time, and overall bird species richness would be less than if these stands were thinned. Bird species richness may not noticeably increase, and legacy features in the future stand would likely be smaller and less persistent, especially those that provide habitat for cavity-nesting species.

Big Game

In the short term (less than 5 years), there would be no disturbance effects due to the proposed action. Thermal and hiding cover quality would remain the same as current conditions. There would be no increase in vegetative forage due to increased light to the forest floor. In the long term (5+ years), thermal and hiding cover quality would gradually decrease as overstocked stands mature hindering mobility. Forage quantity would continue to decrease over time as less light reaches the forest floor.

3.3.6 Air Quality and Fire Hazard/Risk

Source Incorporated by Reference: *Lost Lulay Thinning Project Air Quality and Fire Hazard/Risk Specialist Report. 2009, Raible (Fuels Report)*

Affected Environment

Air Quality

The air quality in the Lost Lulay project area is good. Burning of slash accumulations (piles) at landing sites, along property lines and open roads would be done under the Oregon Smoke Management Plan Revision, December 2007. This law regulates prescribed burning for compliance with air quality standards.

The Lost Lulay project area is located approximately 18 miles east of the Albany area near the edge of the Willamette Valley, which is a smoke sensitive receptor area (SSRA). It is far to the west of any wilderness areas. Burning is regulated to prevent any smoke intrusion into SSRAs and prevent any visibility issues in wilderness areas.

Fire History

The oak savannah/prairie ecosystem in the Willamette Valley portion of these watersheds was influenced by Native American burning. Native Americans recognized the benefits of fire and became accomplished practitioners of prescribed fire.

The Kalapuya Indians burned the Willamette Valley for thousands of years prior to Euro-settlement. Native Americans used fire to manipulate the ecosystem to provide safety from warring tribes, better game forage for game management, to maintain traditional food sources and ease of travel. This use of fire extended up major river drainages such as the Santiam and Mckenzie rivers and extended into the foothills of the Cascades and Coast Range (Boyd 1999). This influenced the ecology of the foothill forests and valley floor. This burning most likely extended into the Townships 10S1W, 10S1E and 11S1E. Since the early 1820s this practice diminished as settlement occurred.

At the same time fire occurred naturally, primarily from lightning. Fire history research shows that fire has occurred more often than earlier believed and has not been as severe on the landscape as previously thought (old-growth stands have multiple age classes that are not easily discernable). Fires have tended to be more of a light intensity mixed severity. The Crabtree Watershed has the Carolyn's Crown area which has some of the oldest trees in the watershed and it has been determined that they exist because their location was missed by any of the fires in the past centuries.

A map of the State of Oregon compiled by A.J. Johnson in 1900 from information obtained from Gilbert Thompson shows two quarter township size areas (~6000 ac) in the Lost Lulay area that had been burnt. Another map of the State of Oregon compiled by the PNW Forest Experiment Station in 1936 shows 4 smaller burned areas (<600 acres) in T10S1E and T11S1E. More recently, in the last ten years there were 6 reported small fires that were managed by ODF in the project area. Recent larger fires in the area include the Middle Fork Fire (1200 acres) in 2005 in the Quartzville drainage which was one of a series of fires which occurred following a lighting storm.

Landscape Vegetation Patterns

Modeling has been completed for measuring the overall landscape departure or deviation of both process (fire frequency/severity) and effects (succession class or vegetation/fuel condition class (CC)). The national fire regimes condition classes (FRCC) are designed as a landscape analysis since fire operates at that scale. This interpretation is done at the watershed level (Thomas Creek and Crabtree Creek) which encompass the project area. For this area the Rapid Assessment Reference Condition Models percentages were:

Rapid Assessment Reference Condition Model	% of Thomas Creek and Crabtree Creek Watersheds
Douglas-fir Hemlock – wet mesic	21%
Douglas-fir Hemlock – dry mesic	33%
Pacific silver fir – high elevation	5%
Douglas-fir Willamette Valley	6%
Un-vegetated – farmlands, residential	30%
Others – other silver fir, oak woodlands, oak savanna	<5%

Douglas-fir Hemlock – wet mesic *(Table 11)***:** Fire plays a major role in infrequently resetting landscapes within this vegetation model with intervals ranging roughly from 300 to 800 years. Mixed severity fires occur less frequently than in the Douglas-fir Hemlock dry regime. Insects, pathogens and windthrow occur in this type at variable intervals creating fine scale variability on the landscape.

Table 11: Historic Vegetation Class Representation in the Thomas Creek and Crabtree Watersheds, Douglas-fir Hemlock – wet mesic

Vegetation Class	Historic watershed representation	Present vegetation class comparison to historical amounts
A- Early Post-stand replacement with shrubs, herbs, and seedlings	5%	46% - Abundant
B – Closed canopy young stands with trees up to 20" dbh.	15%	37% - Over represented
C – Young forest stands opened up by mixed severity fire with trees up to 20" dbh.	5%	2% - trace
D – Mature to old-growth forest stands that have been opened by mixed-severity fire with trees greater than 20" dbh.	15%	4% - trace
E – mature to old growth forest stand stands dominated by large tress with an understory of western hemlock	60%	11% - trace
Fire Regime is Group 3 – 25% of all fires are high severity stand replacement at 250-500 year intervals and 75 % are mixed severity at 50-150 year intervals		

Douglas-fir Hemlock – dry mesic *(Table 12)***:** Fire is the major disturbance process Mixed Severity fires are more common than stand replacing events, occurring at 50-150 year frequencies. Stand replacement fires that reset large landscapes occur at 250-500 year frequencies. This fire regime is largely responsible for the dominance of Douglas-fire in these landscapes. Insects, pathogens and windthrow also occur in this type at variable intervals, often interacting with drought and other extreme weather conditions. These disturbances affect smaller areas than fire.

Table 12: Historic Vegetation Class Representation in the Thomas Creek and Crabtree Watersheds, Douglas-fir Hemlock – dry mesic

Vegetation Class	Historic watershed representation	Present vegetation class comparison to historical amounts.
A- Early Post-stand replacement with shrubs, herbs and seedlings	5%	49% - abundant
B – Closed canopy young stands with trees up to 20" dbh.	15%	28% - over represented
C – Young forest stands opened up by mixed severity fire with trees up to 20" dbh.	1%	3% - over represented
D – Mature to old-growth forest stands that have been opened by mixed-severity fire with trees greater than 20" dbh.	4%	4% - similar
E – mature to old growth forest stand stands dominated by large tress with an understory of western hemlock	75%	15% - trace

Vegetation Class	Historic watershed representation	Present vegetation class comparison to historical amounts.
Fire Regime is Group 5 – 71% of all fires are high severity stand replacement at 400 year intervals and 28 % are mixed severity at 1000 year intervals		

On the watershed scale, both the wet mesic and dry mesic Douglas-fir Hemlock vegetation class B lands are overrepresented. Thinning vegetation classes B and C would move these stands on a successional trajectory towards filling the older forest vegetation classes D and E.

Class A types which are abundant now would grow and fill the class B and C lands that are thinned. (http://www.reo.gov/ecoshare/news-issues/index-issues.asp)

Table 13: Fire Regimes and Fire Return Interval

Reference Condition Model	Terrain features	Fire Return Interval	Severity
Douglas-fir Hemlock Wet Mesic	NW-NE facing slopes	300 + years	High Stand replacement
Douglas-fir Hemlock Dry Mesic	SE-SW facing slopes, flat areas (ridges, benches)	50-150 years	Mixed

Fire Regime Condition Class

Fire regime condition classes offer another approach to evaluating potential fire conditions and again are most useful at the watershed and larger scales. A stratum level condition class assessment looks at the compositional makeup of all the seral stages within a terrain feature of the watershed while a stand level condition class provides insights as to which seral classes are contributing to a departure in the overall landscape's condition class.

Fire Hazard Rating, Fire Risk and Values at Risk

Fire hazard ratings provide an index of resistance to control a wildfire and are based on vegetation, fuel arrangement and volume, condition and location. All are determinants of the potential for spread of a fire and difficulty of suppression. Fuel loading, risk of a fire start and the resistance to control a fire, would all increase at the sites as a result of the proposed action. The fuel model on the site is now a Model 8 / 10 (closed timber litter / timber litter and understory).

Fire risk reflects the probability of ignition in a given area. There are predictions that climate change would result in more frequent and larger fires (Westerling et al 2006; Swetland 2006; Whitlock et al 2003). There are two primary sources of fire ignitions: lightning and humans.

Values at risk provide an index of resource and human values that could be affected by wildfire. The proximity of many of these units to the valley and the nearby residence which would be given a high value means that these areas need to be managed for logging residue at least along boundaries.

Wildland / Urban Interface

Wildland / Urban Interface (WUI) is a term used to describe the area where developed lands meet undeveloped lands. The developed lands can be homes, businesses or agricultural lands. Under the Healthy Forest Restoration Act of 2003 the term "at risk community" means either the interface community defined in the notice of 2001[25] or a group of homes and other structures with basic infrastructure and service (such as utilities and collectively maintained transportation routes). All units are within the WUI.

Fire Behavior

The physical setting for the Cascades has major west-east lying mountain drainages. This allows for the creation of strong up-canyon winds in the afternoon during the late spring, summer and early fall. The west to east oriented drainages also provide funneling to strong, dry East winds that can occur unpredictably. During the summer and fall seasons, these dry, warm winds reach velocities of 30 to 40 miles per hour, with stronger gusts over the higher ridges and down east-to-west oriented drainages. East winds are important because they often occur when fuel moistures are at critically low levels. Large wildland fires igniting on the lower and middle thirds of slopes may spread to ridgelines before safe suppression action can be taken. (NWOR FMP, p.41)

In temperate ecosystems like the Pacific Northwest, biomass accumulates faster than it decomposes. New studies have linked occurrence of wildfire with global weather changes such as El Niño/La Niña and global warming. Virtually all climate-model projections indicate that warmer springs and summers would occur over the region in coming decades. The trends would reinforce the tendency toward early spring snowmelt and longer fire seasons which would accentuate conditions favorable to the occurrence of large wildfires (Westerling et al 2006; Swetnam 2002).

Environmental Effects

3.3.6.1 Proposed Action

Air Quality

Locally within ¼ - ½ mile of the piles to be burned there may be some very short term (a few hours) increase in smoke after piles are ignited resulting from drift smoke. Transport winds affecting the area would keep the air shed scoured out preventing a buildup of particulate matter and provide atmospheric mixing to prevent any intrusions or visibility.

The total amount of slash debris expected to be piled for burning is estimated to be between 2500 and 5000 tons over an extended period of 1 to 4 years. Burning between 500 and 1500 tons of dry, cured, piled fuels under favorable atmospheric conditions each year in the project area is not expected to result in any long term negative effects to air quality in the air shed. When the dry fuels in covered piles are ignited the fire intensity generally builds rapidly to a point where the fuels burn cleanly and produce very little smoke. The strong convection column produced carries the smoke and gases well up into the atmosphere where it is diluted and carried away in the air mass.

[25] "Wildland Urban Interface Communities Within the Vicinity of Federal Lands That Are at High Risk From Wildfire" Title V, Dept. of the Interior and Related Agencies Appropriations Act, 2001 (114 Stat. 1009) (66 Fed Reg. 753, January 4, 2001)

After a few hours, as the piles burn down and the intensity subsides, additional smoke may be produced due to lower temperatures and less efficient combustion. Depending on size, arrangement, type and moisture content of the remaining fuel, the smoke would diminish over several hours or days as the piles cool and burn out (sooner if rain develops).

Generally this smoke only affects the immediate area (¼- ½ mile or less) around the pile. If a temperature inversion develops over the area during the night time hours, smoke may be trapped under the inversion and accumulate, resulting in a short term impact to the local air quality. The accumulated smoke generally clears out by mid-morning as the inversion lifts. Due to the location of this project and only burning when west winds prevail it is unlikely that inversions would present a problem.

Burning of slash would always be coordinated with ODF and conducted in accordance with the Oregon State Smoke Management Plan. This serves to coordinate all forest burning activities on a regional scale to prevent negative impacts to local and regional air sheds.

Fire Hazard Rating, Fire Risk and Values at Risk

Slash created from timber harvest would add an estimated 10-15 tons per acre of dead fuel to the thinned areas (PNW-105 series: 1-DF-2, 2-DF-2-PC and PNW-GTR -258 series: 1-DFWH-PRE-01-03). The fuel arrangement would tend to be continuous with patches of low fuels. Fuel models are selected to represent the forest stand before the thinning and after the thinning to predict fire behavior characteristics if a fire started. The fuel model would shift from fuel model TL3(183) Moderate Load Conifer Litter model to a fuel model SB2(202) Moderate Load Activity Fuel model. These models predict the rate of fire spread changing from very low (132-400 ft/hr) to moderate (3300 to 9240 ft/hr) and the flame length changing from low (1-2 ft) to moderate (10-17 ft) with the project. (Scott and Burgan, RMRS-GTR-153, 2005, pp 59,68).

Forest thinning projects result in increased fire risk potential for 1 to 3 years because of the increased dead fine fuels (1 and 10 hour fuels)[26]. Larger 100 to 1000 hour fuels persist much longer and remain a factor contributing to resistance to control because they contribute to fire intensity and duration. As previously stated, fuel treatments (51% of the area) are based on the need to reduce the potential fire behavior from fire starts in the thinned areas to the prethinning level or less.

The thinning from below itself reduces fire risk by removing ladder fuels which can move ground fire into the tree canopy and removing small diameter trees which can ignite easier. Reducing the amount of slash left from the thinning also results in more efficient and quicker fire suppression, less risk for fire fighters and less resource damage if a fire occurred after any treatment.

[26] Forest fuels are classified according to how long it takes their moisture content to equalize with the surrounding air, also referred to as timelag classes. A timelag is the midpoint of this response time, i.e. 1-hour fuels respond in less than 2 hours, 10-hour fuels respond in 2 to 20 hours, etc. Grass and twigs less than ¼ inch diameter are one hour fuels and are also referred to as "fine fuels". Twigs ¼ to 1 inch diameter are 10 hour fuels. Dead limbs and stems 1 to 3 inches diameter are 100 hour fuels. Logs larger than 3 inches diameter are 1000 hour fuels. Different time-lag classes burn differently: 1-hour fuels (needle litter, hardwood leaves) ignite quickly and combust at rapid rates. Progressively larger particles (10-, 100-, 1000-hour and larger fuels) require more heat for ignition and burn longer if they do ignite. Fires usually start and spread in dead fines fuels (< ¼ in. diameter), which ignite increasingly larger size classes of fuels. If fine fuels are reduced or missing, a fire may not ignite or spread.

Machine treatment would reduce the risk by turning logging slash into all 10 hour fuels which would decay more rapidly, take on moisture more quickly with humidity changes and make accomplishment of any fire suppression more successful.

As noted previously, portion of the project area would receive some slash reduction treatment to reduce fire risk, while the rest of the project (49%) would have no surface treatment of the thinning slash. Fuel loading, risk of a fire start and the resistance to control a fire, would all increase at the untreated sites as a result of this action.

Fire hazard in the untreated slash would be greatest during the first season following cutting, - the period when needles dry out but remain attached. These highly flammable "red needles" generally fall off within one year and risk of a fire start greatly diminishes.

A study of precommercial thinning's effects on fine fuels (<1" in diameter) showed a decrease by 50 percent in loading (tons/ac) and in fuel bed depth in less than two years. This study also looked at blowdown which typically has high levels of fuel at the start. Fine fuels essentially fall to background levels in to two to four years. Larger branch fuels and 1000-hour fuels persist for longer periods with the conversion of sound 1000-hr fuels to rotten 1000-hr fuels is a gradual process of about 80 years (Christiansen, 1991).

Fire risk would continue to diminish as the area "greens up" with under story vegetation, and as the fine twigs and branches in the slash begin to break off and collect on the soil surface. Past experience, in the geographic area of this proposed action, has shown that, in approximately 15 years, untreated slash would generally decompose to the point where it no longer contributes significantly to increased fire risk. Depending on the amount of large, down wood left on site from logging, the resistance to control would also decrease over time but more slowly. This is what is expected to occur for the areas considered in this proposed action where the slash created would be left in place, untreated.

The resulting total residual dead fuel loading would vary throughout the site ranging from 5-30 tons per acre. It is expected that about half of the dead fuel tonnage to be left on site following treatment would be in the form of down logs and pieces in the 10 inch and larger size class. The decision to leave the slash untreated under this proposed action is based on a number of factors:

- Historically, the number of fires that have occurred in this area has been very low and it is unlikely that this additional slash away from the known values at risk would result in a fire occurring in the area.
- The cost to treat all the slash would be fairly high (>$500 per acre) with limited benefit.
- If a fire did occur, most of the timber value would be salvageable.
- Most of the roads leading into the units would be blocked or have limited access that controls entry to much of the site by the public, but can be opened for fire control access.
- The continued existence of a tree canopy to shade the fuels would maintain cooler temperatures and higher humidity on the site reducing the risk of a fire start.

3.3.6.2 Cumulative Effects

Current trends in human activity and related potential for fire starts would be expected to remain the same because access control (gates) reduces the potential for human caused fires and most of the project area is behind locked gates. The cumulative potential for wildfire start and growth would increase in the short term (1-3 years) as a result of the proposed action because fuel loading on the ground would increase as a result of harvest.

Cumulative potential for wildfire start and growth would decrease in the longer term (1-2 decades) compared to unmanaged stands as the logging slash decays and because the natural heavy fuel loading from suppression mortality (trees dying) would not be present after treatment.

3.3.6.3 No Action Alternative

Air Quality

For air quality the No Action alternative means no effect on air quality from burning, although the potential risk from more intensive wildfires would produce a large quantity of smoke in a short period of time.

Fire Risk

Current trends in human activity and related potential for fire starts would be expected to remain the same or increase as population and WUI increases. Severity and the potential for a crown fire will be higher for dense stands with accumulating surface fuels in the long term (one to several decades). Fuel loading would likely change to TL5 High Load Conifer Litter or TL7 Large Down Logs (See 40 Fuels Model descriptions, Scott and Burgan, 2005) with similar fire behavior characteristics for rate of spread or flame length as the current conditions.

The major change would be that surface fires would be long duration due more down wood and the potential for a crown fire to occur would increase due to increased ladder fuels and canopy closure.

The potential risk can change annually with weather conditions and possibly increase faster in the long term with predicted climate change. If a wildfire were to occur the effects may include: 1) total tree mortality, 2) elimination of the duff and litter layers, 3) reduction of the downed woody component, especially logs in later stages of decay, 4) increased erosion and sedimentation of water courses, and 5) formation of snags.

3.3.7 Carbon Storage, Carbon Emissions, and Climate Change

***Sources Incorporated by Reference**: Lost Lulay Carbon Calculation (LL Carbon Calc), 2008 FEIS: Volume I, Pages 220-224; Volume II, Pages 537-543, and Volume III, Appendices, Pages 28-30, USGS May 14 Memo on Carbon Emissions and Climate Change, and Memo on Carbon in Harvested Wood.*

Resource Specific Methodology

On July 16, 2009, the U.S. Department of the Interior withdrew the Records of Decision (2008 ROD) for the Western Oregon Plan Revision. The information contained in the Final Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management (2008 FEIS) is relevant since it examined recent and applicable science regarding climate change and carbon (C) storage.

That analysis concluded that effects of forest management on carbon storage could be analyzed by quantifying the change in carbon storage in live trees, storage in forests other than live trees, and storage in harvested wood. The discussion on Volume I, Pages 220-224; Volume II, Pages 537-543, and Volume III, Appendices, Pages 28-30 are relevant to the effects analysis for this project and are incorporated by reference. Additional methodology is described below.

Context for Analysis

Greenhouse Gases, Climate Change and the Spatial Scale for Analysis

Uncertainty about the nature, effects and magnitude of the greenhouse gases and global climate change interrelationship is evident in a wide range of conclusions and recommendations in the literature reviewed.

The U.S. Geological Survey, in a May 14, 2008 memorandum to the U.S. Fish and Wildlife Service, summarized the latest science on greenhouse gases and concluded that it is currently beyond the scope of existing science to identify a specific source of greenhouse gas emissions or sequestration and designate it as the cause of specific climate impacts at a specific location. This defines the spatial scale for analysis as global, not local, regional or continental. That memorandum is incorporated here by reference. Based on the BLM's review of statutes, regulations, policy, plans and literature, the BLM accepts the conclusions above as appropriate context for a reasoned choice among alternatives.

Temporal Scale for Analysis

This analysis will assess short-term and long-term effects on carbon storage and carbon emissions. The BLM has selected 0-10 years as the analysis period for short-term effects on carbon storage and carbon emissions, because this time period would encompass the duration of the direct emissions from the proposed thinning.

The BLM has selected 11-30 years as the analysis period for long-term effects on carbon storage and carbon emissions for this project. In 20-30 years the BLM would assess the stands in the Lost Lulay project area to determine whether further management activities are needed to achieve the resource management plan objectives in place at that time. This time period is when the thinned stands are expected to have grown to the point where trees are again competing for site resources of light, nutrients and water so that growth would again be suppressed and the understory would decline due to lack of light penetrating the canopy to the forest floor.

Under current management plans:

- In the Matrix LUA the BLM would assess whether additional density management or regeneration harvest would meet the RMP timber management objectives.
- In the Riparian Reserve LUA the BLM would assess whether additional treatments would increase development of late-successional habitat conditions and meet Aquatic Conservation Strategy objectives.

Therefore the 30-year period would be expected to encompass the duration of both the direct and indirect effects on carbon storage and carbon emissions from thinning in the Lost Lulay project area because anticipated management activities at that time would change the carbon cycle dynamics again.

Calculations of Carbon Storage and Carbon in Greenhouse Gas Emissions, Project Area Scale

The purpose of the calculation of carbon storage is to provide a basis for evaluating the significance of carbon storage relative to the temporal and spatial scale.

The BLM calculated estimates of existing carbon stores, of carbon to be removed by the proposed thinning, of storage of removed carbon, and of future carbon storage in the remaining trees in the stand. The Lost Lulay Carbon Calculations (LL Carbon Calc) are incorporated here by reference.

The BLM used site specific data from stand exams as input to the Forest Vegetation Simulator (FVS - a forest stand model) to determine stand growth over the analysis period. The specific stand selected for modeling has tree sizes and density near the average for the stands in the project. With the Lost Lulay stand growth data, the BLM calculated carbon in the live trees and other than live tree pools using the methodology described in the 2008 FEIS Appendix C, pp. 28-29.

The analysis of carbon stored in harvested wood in the 2008 FEIS used a factor for converting board feet of harvest wood to mass of carbon from Smith et al. 2006, p. 35. Based on information developed after the 2008 FEIS, this factor has been refined to better account for regionally-specific conditions and the fraction of harvested volume that is typically milled into solid wood products and into processed wood products. Harvest volumes were converted to cubic feet, converted to pounds of biomass, and then to carbon content, yielding an overall conversion factor of 1,000 board feet = 1.326 tonnes of carbon.

Of this total amount of carbon in harvested wood, 63.8% of harvest volume is considered as sawlogs and 36.2% as pulpwood (GTR RM-199, Table B-6), for evaluation using the storage rates over time from Smith et al. 2006, p. 27. The improved conversion factor is used in this analysis to evaluate the amount of carbon stored in harvested wood. Information on the development of this conversion factor is on file in the BLM office and is available for review upon request and is incorporated here by reference (R. Hardt, personal communication, 11/6/09, on file in the Salem BLM Office). The effect of the 2008 FEIS alternatives on carbon storage has been reanalyzed based on this improved conversion factor. This re-analysis revealed a slight increase in the amount of carbon storage over time for all alternatives and less difference among the alternatives than described in the 2008 FEIS, pp. 537-543. Overall, this re-analysis revealed no change in the magnitude or trend of effects on carbon storage from that described in the 2008 FEIS.

Carbon emissions from equipment used in harvest operations were calculated based on BLM staff interviews with purchasers who buy timber sales in the local area, fuel consumption specifications from equipment manufacturers' published information, and field observations by BLM personnel. The BLM fuels specialist calculated the carbon associated with the burning of harvest generated fuels.

Affected Environment

Climate Change

The *Final Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management* (2008) described current information on predicted changes in regional climate (pp. 488-490) and is incorporated here by reference. That description concluded that the regional climate has become warmer and wetter with reduced snowpack, and continued change is likely.

That description also concluded that changes in resource impacts as a result of climate change would be highly sensitive to specific changes in the amount and timing of precipitation, but specific changes in the amount and timing of precipitation are too uncertain to predict at this time.

Because of this uncertainty about changes in precipitation, it is not possible to predict changes in vegetation types and condition, wildfire frequency and intensity, streamflow, and wildlife habitat.

In addition, The U.S. Geological Survey, May 14, 2008 memorandum to the U.S. Fish and Wildlife Service (incorporated here by reference), summarized the latest science on greenhouse gases and concluded that it is currently beyond the scope of existing science to identify a specific source of greenhouse gas emissions or sequestration and designate it as the cause of specific climate impacts at a specific location.

Carbon Storage

The following show total quantities of carbon in forest ecosystem vegetation[27] worldwide, in the United States, the Pacific Northwest and in the Lost Lulay project area.

- Total carbon, forest ecosystem vegetation, Worldwide) = 132-457 Gt[28] (Matthews et al, 2000, p. 58
- Total carbon, forest ecosystem vegetation, United States = 27 Gt (US EPA, 2009)
- Total carbon, forest ecosystem vegetation, Pacific Northwest, Cascades Range =1.5-1.7 Gt (Hudiburg, et al., 2009)
- Total carbon, forest ecosystem vegetation, Lost Lulay proposed thinning units = 66,700 tonnes (0.00007 Gt), which consists of live tree carbon (49,000 tonnes) and other than live tree carbon (17,700 tonnes).
- The annual accumulation of carbon from forest management in the United States is 191 million tonnes (191,000,000 tonnes, or 0.191 Gt), and 1.69 million tonnes (0.00169 Gt) from current management on BLM-managed lands in western Oregon (2008 FEIS, p. 4-537).

Environmental Effects

3.3.7.1 The Proposed Action

Total carbon in forest ecosystem vegetation can be divided into three pools: live trees (foliage, branches, stems, bark and live roots of trees), forest carbon other than live trees (dead wood and roots, non-tree vegetation, litter and soil organic matter) and harvested wood products. As a result of thinning, BLM carbon calculations show that the overall on-site forest ecosystem vegetation carbon storage would decrease from 66,7000 tonnes C to 52,100 tonnes C. The proposed thinning would cause direct effects on greenhouse gas levels by emitting carbon from harvest operations and fuel treatment.

[27] Carbon contained in both above ground and below ground parts of trees and forest vegetation, and downed wood, litter and duff. It does not include mineral carbon in soil, nor fossil fuels.

[28] Metric tons are referred to in this document as tonnes. A Giga-tonne (Gt) is one billion tonnes.

Short-term Effects (0-10 years after timber harvest):

Harvest Operations

Harvest operations would emit carbon as greenhouse gases. Using the methodology described in the beginning of EA section 3.3.8, BLM staff calculated an average fuel consumption of 2.75 gallons per MBF (timber volume) from standing timber on site to the sawmill. Fuel consumption for harvest operations for the Lost Lulay timber sale would total an estimated 12,500 gallons. This represents total emissions of approximately 33 tonnes of carbon.

Live Trees Pool

Thinning would directly affect the live trees pool because the project would remove live trees. The proposed thinning would remove approximately 14,600 tonnes of carbon from the live trees pool. Table 14 shows that approximately 34,400 tonnes of carbon would be retained in the live trees pool available for future growth and carbon storage, from the pre-treatment levels of 49,000 tonnes of carbon.

Harvested Wood Products Pool

Some of the carbon in harvested trees is stored in various forms; some is emitted to provide energy; and some is emitted without energy capture. Harvested saw log gross volume at Lost Lulay of 4,600 MBF would contain 6,000 tonnes C (1 MBF = approximately 1.3 tonnes C). Much of the emissions from harvested wood would occur shortly after harvest. In the first 10 years after harvest, approximately 1,400 tonnes of carbon (23 % of the total carbon in sawlogs) would be emitted as a result of the proposed project.

Forest Carbon Other Than Live Trees Pool

The remaining 8,600 tonnes C harvested from the live trees pool would be converted to forest carbon other than live trees - dead material that would remain on-site. Pile burning approximately 3,100 tonnes of biomass from 281 acres would emit a total of approximately 1,400 tonnes of carbon as greenhouse gases (LL Carbon Calc).

The remainder of the on-site dead material would decay over time. In all alternatives, including the No Action alternative, the decay of dead material (dead wood and roots, non-tree vegetation and litter) would result in some portion of carbon emitted and some portion of the carbon entering into long-term storage as soil carbon. The rate of emissions from decay of dead material is unknown. Furthermore, it is not known whether the rate of emissions from decay of dead material, or the amount of dead material would differ between the proposed action and the No Action alternative. Therefore, emissions from decay of dead material are not quantified in this analysis.

Long-term Effects (11-30 years after timber harvest):

Live Trees Pool:

Following thinning, approximately 80-100 of the largest trees per acre would remain on site (Table 18). These trees would store carbon as they grow. Table 14 shows, live tree carbon would increase to 40,900 tonnes after 30 years of growth, an increase of 6,500 tonnes from the post harvest level of 34,400 tonnes.

Thirty years after thinning, there would be an overall decrease in live tree carbon of 8,100 tonnes from pre-harvest levels (short term change in live tree pool + long term change in live tree pool).

Harvested Wood Products Pool

From 11-30 years after harvest an additional approximately 400 tonnes of carbon (6 % of the total carbon in sawlogs) would be emitted from harvested wood. Approximately 4,300 tonnes (29% of the total harvested carbon) of the carbon would remain stored in wood products still in use, in landfills, or emitted with energy capture (2008 FEIS, pp. 540-541; Appendices, p. 30).

Summary of Changes in Carbon Storage

Table 14: Summary of Carbon Storage and Carbon in Greenhouse Gas Emissions (LL Carbon Notes)

Source	Tonnes Carbon (C)		Notes
	Proposed Action	No Action Alternative	
#1. C Storage in live trees pool 2010 (current conditions)	49,000	49,000	
Carbon Storage			
#2. C Storage in live trees pool (after thinning) 2010	34,400	49,000	
#3. Increase, C Storage in live trees pool, Growth Period (30 years)	6,500	6,400	#4 - #2
#4. C Storage in live trees pool, 2040	40,900	55,400	#2 + #3
#5. C Storage in harvested wood after 30 years	4,300	0	29% of C in harvested wood products (14,600 tonnes C)
#6. Total Carbon Storage, Analysis Period (2010-2040)	45,200	55,400	#4 + #5
Carbon Emissions			
Short Term Emissions (0-10 years)			
#7. Harvested wood	1,400	0	
#8. Harvest operations	33	0	
#9. Fuel treatment (burning)	1,400	0	
#10. Total Short term emissions	2,833	0	
#11. **Long term emissions from harvested wood (11-30 years)**	400	0	
#12. Total Carbon Emissions, Analysis Period (2010-2040)	3,233	0	
Net Carbon Storage			
#13. Net Carbon Storage, Analysis Period (2010-2040)	41,967	55,400	#6 - #12

Source	Tonnes Carbon (C)		Notes
	Proposed Action	No Action Alternative	
#14. Net Change - Carbon Storage, Analysis Period (2010-2040)	(-7,033)	6,400	#13 - #1
#15. Net Increase - C Storage in live trees pool, Analysis Period (2010-2040)	(-8,100)	6,400	#4 - #1

Table 14 shows that during the 30 year analysis period the effects of the proposed thinning would be a net decrease in carbon storage of 7,033 tonnes C.

3.3.7.2 Cumulative Effects

The proposed thinning would contribute to cumulative effects to carbon storage and carbon emissions. Table 14 shows that carbon emissions resulting from the proposed thinning over the next 10 years would total 2,833 tonnes of carbon or 10,400 tonnes of carbon dioxide (tonnes C*3.67) (0.00001 Gt). Current annual global emissions of carbon dioxide total 25 billion tonnes (25 Gt) of carbon dioxide, (IPCC 2007, p. 513), and current annual U.S. emissions of carbon dioxide total 6 billion tonnes (6 Gt) (EPA 2007, p 2-3). Global emissions over 10 years total 250 billion tonnes of carbon dioxide and U.S. emissions of carbon dioxide total 60 billion tonnes. Therefore, the short-term emissions from the proposed thinning would constitute 0.00004 percent of current global emissions and 0.0002 percent of current U.S. emissions, for the 10 year period. This emission would be so small that its incremental contribution to global and national emissions would be not be measurable at the level of precision of the global and national emissions.

3.3.7.3 No Action Alternative

Under the No Action alternative, no carbon as greenhouse gases would be emitted from harvest operations or fuels treatments. Carbon stored in live trees would not be converted to the harvested wood carbon pool, and would be converted to the other than live tree pool through ongoing processes of tree mortality. Table 14 shows live tree carbon would increase to 55,400 tonnes after 30 years of growth, an increase of 6,400 tonnes from the 2010 levels (49,000 tonnes). The No Action alternative would result in net carbon storage at the end of the 30 year analysis period of approximately 13,343 tonnes more than for the proposed action.

No net difference in carbon cycling in the Pacific Northwest would be expected when comparing the No Action alternative to the proposed action because it is reasonable to assume that the demand for wood products would be met by harvesting trees in other Pacific Northwest region forests.

3.3.7.4 Cumulative Effects, No Action Alternative

The increase of 6,400 tonnes of live tree carbon associated with the No Action alternative would contribute to an annual average of 200 tonnes, or 0.0001 percent, to the U.S. annual accumulation of carbon from forest management of 191 million tonnes; or 0.01 percent of the annual accumulation of 1.69 million tonnes of carbon as a result of current implementation on BLM-managed lands in western Oregon. (2008 FEIS, p. 4-537).

3.3.8 Recreation, Visual Resources and Rural Interface (including Public Safety)

Source incorporated by reference: *Lost Lulay Recreation/Rural Interface Area/Visual Resources Specialist Report, Meredith 2009 (Rec/RIA/Vis Report)*

Affected Environment

Access

Access to the proposed units is variable. Units in sections 23 and 25, 10S2E have direct access from the Neal Creek Access Road, a BLM road. Units in section 25, 10S1W are accessed by logging roads which are closed to public vehicle access by a gate. The remaining units are accessed by gated private logging roads which are closed to public vehicle access.

Recreation

The project areas are within a forest setting accessed by gravel roads. Evidence of man-made modifications (roads, timber harvest activities, utilities, buildings, houses) is visible from both private and public lands within or near the project areas. The project area is dispersed recreation with no developed recreation sites. The closest developed recreation site is Larwood County Park located along Roaring River, near the southwest edge of the watershed boundary. Larwood County Park is a popular day-use area. There is a Boy Scout facility called Camp Morrison along Neal Creek in Township 10 South, Range 1 East Section 25 and within a quarter mile of the project area. There is also a Linn County Mounted Rescue Team training camp in Township 10 South, Range 2 East, Section 8. Katherine Freer Wilderness Program is located in Township 10 South, Range 1 East section 24 near the project area and off the haul route.

Several of the access roads to private industrial forest lands are gated, limiting much of the recreational use to BLM-administered lands. With no developed recreation sites in the watershed, recreational activities are dispersed in nature, including camping, target shooting, hunting, and off-highway vehicle use. Recreational use on public lands in the watershed occurs mostly in the Neal Creek and Snow Peak areas. Evidence of dispersed camping such as fire rings, gun shells and other recreational litter, were found at several old logging landings at the end of gravel spur roads leading off of Neal Creek Road.

Off-highway vehicle (OHV) usage of the area is restricted to existing roads and designated trails. No designated trails exist in the project area. Any trail in the vicinity is unauthorized and trails within project area boundaries would be obliterated by thinning and road maintenance operations. Indications of low to moderate levels of OHV use are observable, on and off existing roads, especially in the Neal Creek and Snow Peak areas. As private lands in the vicinity of the project area are closed and as more gates are installed and roads blocked, increased demand and pressure for OHV use on public lands would be expected.

Visual Resources

All of the proposed units either fall within Visual Resource Management (VRM) class 3 or 4. VRM class 3 consists of 426 acres and 118 acres of VRM class 4. On VRM 4 lands, the level of change to the characteristic landscape can be high. The objective is to allow management activities which require major modification of the existing character of the landscape. Activities may dominate the view and may be the focus of viewer attention.

Rural Interface Areas (RIAs)

The proposed project area is within a rural interface zone as defined in the Salem District Resource Management Plan page 39. Rural interface zones are BLM-administered lands where they intersect a created half-mile buffer around county zoning. The BLM must take into account the large number of homes located near the proposed project units. Units 19A_10S2E, 21A_10S1E, 23A_10S1E, 23B_10S1E, 25_10S1E, 29B_10S1E, 25A_10S1E, 25B_10S1E, and 5B_11S1E are within rural interface areas.

In general, the concerns of property owners near timber harvest and hauling activities tend to be associated with noise, traffic, and dust from logging and hauling activities, effect to scenic, water and wildlife values, increased public access that may lead to problems with fire hazard, garbage, dumping, and vandalism. Roads surrounding these proposed units have historically experienced log truck traffic.

Environmental Effects

3.3.8.1 The Proposed Action

Recreation, Public Safety and Visual Resources

Dispersed recreation use within the proposed units would be restricted in the short-term during timber management activities and return upon completion of harvest. Public use of the proposed thinning units for hiking, biking, horse riding, and mushroom harvesting and unidentified dispersed activities would be restricted for weeks to months during active thinning activities, but similar recreational opportunities are available on other nearby public and private lands.

Visual Resources

After thinning, a forested setting would still be maintained throughout the project area. Changes to landscape character are expected to be low and primarily associated with disturbance to understory vegetation. Understory vegetation would be expected to exceed current levels within two to five years.

Public Safety / Rural Interface Areas (RIA's)

There would be no increase in public access to the project area where there are gates. Those gates would continue to be locked except during the hours of active logging and hauling operations and watchmen and/or other security measures would be provided by the operator (a standard practice for security and fire prevention) to prevent unauthorized access. Therefore, there would be no increase in garbage dumping and vandalism associated with public access.

The project is within a rural interface zone, however residences along the haul route and in close proximity to timber harvest activities have had other harvest activities occur on non-BLM-administered lands and hear equipment harvesting trees, noise from log truck traffic, experience dust from gravel road traffic, and experience delays for safety during those harvest activities.

3.3.8.2 Cumulative Effects Analysis

Rural Interface Areas (RIAs)

Timber harvest would temporarily interrupt recreation activities and continue upon completion of activities. Along county roads there would be small short term (weeks to months) cumulative increase in log truck hauling to overall traffic near residences along county roads accessing the units. Because a forested setting would be maintained, the cumulative impacts would be minimal. Additional road closures may occur upon completion of harvest activities. Motorized dispersed recreation in the area has declined with each gate installation.

3.3.8.3 No Action Alternative

- With the exception of unplanned changes (i.e. wildfire, disease etc.) no modifications to the landscape character of the proposed units would be expected to occur.
- No changes to current recreation opportunities would occur.
- There would be no change to current use patterns. Logging and hauling would continue to be frequent activities since much of the surrounding land is private industrial forest land where timber management is a common practice.

3.3.9 Cultural Resources

Sources Incorporated by Reference: *Cultural Resource Inventory Reports, Lost Lulay Thinning Timber Sale Pre-project Surveys, Beckman 2009 (Cultural Report)*

Resource Specific Methodology

The BLM Cultural Resources specialist reviewed BLM records to identify previously recorded cultural resource sites and examined additional historical references and aerial photographs to identify field locations of referenced sites and determine areas of potential cultural resource site occurrences.

Under the direction of the District Cultural Resource Specialist, Cultural Resource assistants then surveyed the project area, focusing on previously recorded sites and on areas as having potential to contain cultural resources. In addition they examined other areas noticed during surveys that had potential for human activity (such as flat areas suitable for camping or cabins).

Affected Environment

The cultural resources found in the project area and vicinity are interesting, but they are not unique, do not provide new or significant information about forest use or domestic life in the early to mid 20th century, are too scattered, deteriorated and incomplete to lend themselves to public interpretation, and are not eligible for listing on the National Register of Historic Places. No prehistoric sites have been found. No mitigation, beyond recording and mapping sites and railroad routes, is recommended by the District Archaeologist.

Railroad grades and associated features for logging and transporting logs to the sawmill were found in the project area. The routes have been mapped. An old mining claim and a settlers trail was also documented and delineated.

The collapsed remains of small cabin structures were found in the project area. Scattered planks, shakes and fence remnants are what is left of the cabin sites. The sites are recorded, but do not yield information beyond casual interest. No prehistoric sites have been found, and none were expected because the entire area was so heavily disturbed by logging operations in the 1920's and 1930s. Most of the ground in the project area is covered by a layer of litter and duff that obscures the ground.

Environmental Effects

3.3.9.1 The Proposed Action

Some of the old railroad grades and truck roads would be used as truck roads and skid trails, which would preserve their location and general form, but would change the appearance from rustic/overgrown to currently useable roads. Traces of old ties in these locations would be removed. Some decaying piles of collapsed small structures, timbers and rough-cut lumber may be broken up and removed. No cultural resources with values exceeding casual interest would be damaged and the existing material would remain on site.

3.3.9.2 No Action Alternative

Cultural resources in the area would continue to deteriorate as wood decays and metal parts rust. Durable materials such as ceramic and glass fragments and metal would continue to be covered by duff and litter accumulation.

3.3.10 Review of Elements of the Environment Based On Authorities and Management Direction

Table 15: Elements of the Environment Review based on Authorities and Management Direction

Element of the Environment /Authority	Remarks/Effects
Air Quality (Clean Air Act as amended (42 USC 7401 et seq.)	This project is in compliance with this direction because air quality impacts would be of short duration (one burn period during implementation of fuel treatments). Burning could temporarily reduce air quality until the gases and particulates that make up smoke are dissipated or dispersed in the atmosphere. Addressed in Text (*EA Section 3.3.6*).
Cultural Resources (National Historic Preservation Act, as amended (16 USC 470) [40 CFR 1508.27(b)(3)], [40 CFR 1508.27(b)(8)]	This project is in compliance with this direction because cultural resource inventories of the affected area would precede management actions that include any ground disturbing activities that could potentially damage cultural resources.
Ecologically critical areas [40 CFR 1508.27(b)(3)]	This project would have no effect on this element because there are no ecologically critical areas present within the project area.
Energy Policy (Executive Order 13212)	This project is in compliance with this direction because this project would not interfere with the Energy Policy (Executive Order 13212).
Environmental Justice (E.O. 12898, "Environmental Justice" February 11, 1994)	This project is in compliance with this direction because project would have no effect on low income populations.

Element of the Environment /Authority	Remarks/Effects
Fish Habitat, Essential (Magnuson-Stevens Act Provision: Essential Fish Habitat (EFH): Final Rule (50 CFR Part 600; 67 FR 2376, January 17, 2002)	This project is in compliance with this direction as no Essential Fish Habitat (EFH) exists within the project area and because timber harvest and connected actions in the project area would have no effect on EFH located downstream of the project area. Addressed in Text (*EA Section 3.3.3*).
Farm Lands, Prime [40 CFR 1508.27(b)(3)]	The project would have no effect on this element because no prime farm lands are present on BLM land within the Cascades RA.
Floodplains (E.O. 11988, as amended, Floodplain Management, 5/24/77)	This project is in compliance with this direction because the proposed treatments would not change or affect floodplain functions.
Hazardous or Solid Wastes (Resource Conservation and Recovery Act of 1976 (43 USC 6901 et seq.) Comprehensive Environmental Repose Compensation, and Liability Act of 1980, as amended (43 USC 9615)	The project would have no effect on this element because no pesticides or any hazardous or solid wastes would be used or disposed of in the project area as a result of this project.
Healthy Forests Restoration Act (Healthy Forests Restoration Act of 2003 (P.L. 108-148))	This project is in compliance with this direction and the project would have no effect on this element because treatments would decrease the risk of fire and help restore forests to healthy functioning habitat (*EA Section 3.3.6*)
Migratory Birds (Migratory Bird Act of 1918, as amended (16 USC 703 et seq))	This project is in compliance with this direction because treatments would restore natural resources that could degrade habitat for migratory birds. Addressed in text (*EA Sections 3.3.5, 3.4*).
Native American Religious Concerns (American Indian Religious Freedom Act of 1978 (42 USC 1996)	This project is in compliance with this direction because no Native American religious concerns were identified during the scoping period (*EA section 5.2*).
Noxious weed or Invasive Species (Federal Noxious Weed Control Act and Executive Order 13112)	This project is in compliance with this direction because the project would not result in the spread of current populations of weeds/invasive species and would not result in introducing additional species to the project area. Addressed in text (*EA Sections 2.3.4, 3.3.1*)
Park lands [40 CFR 1508.27(b)(3)]	The project would have no effect on this element because the only developed recreation site potentially affected by the project is more than 3 road miles from the project area and is on a route commonly used by log trucks. (*EA section 3.3.8*)
Public Health and Safety [40 CFR 1508.27(b)(2)]	The project would have no effect on this element because gates that control access to much of the project area and design features implemented to provide for public safety would prevent members of the public from being in dangerous places. The haul routes near homes and public access areas are commonly used for log truck traffic without incident. Addressed in text (*EA 2.3.4, 3.3.8*)

Element of the Environment /Authority	Remarks/Effects
Threatened or Endangered Species (Endangered Species Act of 1983, as amended (16 USC 1531)	This project is in compliance with this direction because there would be no adverse effects on Threatened or Endangered Species (*EA Sections 2.3.4, 3.3.3, 3.3.5*).
Water Quality –Drinking, Ground (Safe Drinking Water Act, as amended (43 USC 300f et seq.) Clean Water Act of 1977 (33 USC 1251 et seq.)	This project is in compliance with this direction because it would not result in degrading water quality. Addressed in text (*EA Sections 2.3.4, 3.3.2, 3.3.4, 3.4*)
Wetlands (E.O. 11990 Protection of Wetlands 5/24/77) [40 CFR 1508.27(b)(3)]	This project is in compliance with this direction because it would not change the water table and because all wetlands larger than 1 acre are excluded from the project area. Addressed in text. (*EA Sections 2.3.4, 3.3.2*)
Wild and Scenic Rivers (Wild and Scenic Rivers Act, as amended (16 USC 1271) [40 CFR 1508.27(b)(3)]	This project is in compliance with this direction because no wild and scenic rivers are in or adjacent to the project area.
Wilderness (Federal Land Policy and Management Act of 1976 (43 USC 1701 et seq.); Wilderness Act of 1964 (16 USC 1131 et seq.)	This project is in compliance with this direction because there are no Wilderness Areas or areas under consideration for wilderness status in or adjacent to the project area.

3.4 Compliance with the Aquatic Conservation Strategy

Based on the environmental analysis described in the previous sections of the EA, Cascades Resource Area Staff have determined that the project complies with the ACS on the project (site) scale. The project complies with the four components of the Aquatic Conservation Strategy, as follows:

ACS Component 1 - Riparian Reserve: The project would comply with Component 1 by maintaining canopy cover along all streams and wetlands, which protect stream bank stability and water temperature. Stream Protection Zones (SPZ) would protect streams from direct disturbance from logging. Road and landing locations have been minimized in Riparian Reserves. Addressed in text (*EA sections 3.3.2-3.3.3*)

ACS Component 2 - Key Watershed: The project would comply with Component 2 by establishing that the Lost Lulay project is not within a Key watershed. (RMP p. 7)

ACS Component 3 - Watershed Analysis: The project would comply with Component 3 by incorporating the following recommendations from the Crabtree Watershed Analysis [July 200] and Thomas Creek Watershed Analysis [December 1996].

- *Terrestrial Recommendation 1:* Density Management/Thinnings in Riparian Reserve to develop and maintain late seral stand characteristics. Commercial thinning in this project is designed to develop the large tree component faster, leading to earlier potential for recruiting CWD, LWD, snag and large tree habitat and to develop understory vegetation. Maintains a minimum of 50% average crown closure in Riparian Reserve. Low-density areas enhance spatial variation and provide for development of opening/shrub/edge habitat for 10-20 years. Untreated areas provide additional range of species and density mix.(CCWA 7-4,5,6 and TCWA 7-99,100)

- *Terrestrial Recommendation 2:* Develop standing dead and down LWD by leaving enough trees for future recruitment if needed. Thinning would leave many times the recommended retention to develop large trees for future recruitment. This goal would be achieved over time.(CCWA 7-7,8 and TCWA 7-100,101)
- *Terrestrial Recommendation 5**:*** Noxious weeds. Equipment washing required. Vegetation Management EIS provides further guidance. (CCWA 7-9)
- *Aquatic Recommendation 1 and 2:* Riparian Condition and LWD on Federal Lands, accelerate growth for recruitment of LWD for stream structure. Thinning is designed to accelerate growth. Suitable large trees would be available years to decades sooner than without treatment.
- *Aquatic Recommendations 3-6:* Stream flows, water quality, ODEQ 303(d), and stream temperatures. The project would not contribute to detectable changes in these elements. (CCWA 7-11,12)
- *Aquatic Recommendation 7 and 11:* Soils, Slope Stability and Mass Wasting: Project design avoids erosion. There are no slides or bare slopes identified in the project area. (CCWA 7-12,13)
- *Human Uses Recommendation 1:* Timber Management in the Matrix Land Use Allocation. Provide timber sales that are marketable, provide a balance between wood volume/quality/value, and maintain a healthy forest ecosystem. The project was designed so that the proposed action would achieve these objectives.

ACS Component 4 - Watershed Restoration: The project would comply with Component 4 by the combination of thinning and unthinned areas in Riparian Reserves, which would further enhance terrestrial habitat complexity in the long and short term. Thinning in all LUAs would be expected to result in long-term restoration of large conifers and the potential for material that would contribute to in-stream habitat complexity in the long-term.

Cascades Resource Area Staff have reviewed this project against the ACS objectives at the project or site scale with the following results. The No Action alternative does not retard or prevent the attainment of any of the nine ACS objectives because this alternative would maintain current conditions. The proposed action does not retard or prevent the attainment of any of the nine ACS objectives for the following reasons.

- **ACSO 1: Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.** Addressed in Text (*EA sections 3.3.1, 3.3.5*). In summary:

  No Action Alternative: The No Action alternative would maintain the development of the existing vegetation and associated stand structure at its present rate. The current distribution, diversity and complexity of watershed and landscape-scale features would be maintained. Faster restoration of distribution, diversity, and complexity of watershed and landscape features would not occur.

Proposed Action: The proposed combination of thinning from below, low-density thinning and unthinned areas in the Riparian Reserve Land Use Allocation (RR) would result in forest stands that exhibit attributes typically associated with stands of a more advanced age and stand structural development (larger trees, a more developed understory, and an increase in the number, size and quality of snags and down logs) sooner than would result from the No Action alternative.

Since Riparian Reserve provides travel corridors and resources for aquatic, riparian dependant and other associated plants and animals, the increased structural and plant diversity would ensure protection of aquatic systems by maintaining and restoring the distribution, diversity and complexity of watershed and landscape features.

- **ACSO 2: Maintain and restore spatial and temporal connectivity within and between watersheds.** Addressed in Text *(EA sections 3.3.1, 3.3.5)* In summary:

  No Action Alternative: The No Action alternative would have little effect on connectivity except in the long term within the affected watersheds.

  Proposed Action: Long term connectivity of terrestrial watershed features would be improved by enhancing conditions for stand structure development. In time, the Riparian Reserve LUA would improve in functioning as refugia for late successional, aquatic and riparian associated and dependent species. Both terrestrial and aquatic connectivity would be maintained, and over the long-term, as the Riparian Reserve LUA develops late successional characteristics, lateral, longitudinal and drainage connectivity would be restored.

- **ACSO 3: Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.** Addressed in Text (*EA sections 2.3.4, 3.3.2, and 3.3.3*). In summary:

  No Action Alternative: It is assumed that the current condition of physical integrity would be maintained.

  Proposed Action: Physical integrity of channels at existing stream crossings would be altered for one to several years following removal of two existing log fill stream crossings. Within the road prism (estimated at 30 feet maximum width), the channel surface, banks, bed and vegetation would be disturbed or removed within the road prism, and the bed/banks would be reshaped and stabilized with woody debris and vegetation when the crossing is removed. Due to the stable nature of channels at these locations, little to no additional disturbance to channel morphology would be expected either upstream or downstream from the crossings. Less effect would be expected from installation and removal of logging slash for equipment crossing of one ephemeral channel.

- **ACSO 4: Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.** Addressed in Text (*EA sections 2.3.4, 3.3.2, and 3.3.3*). In summary:

  No Action Alternative: It is assumed that the current condition of the water quality would be maintained.

  Proposed Action: Stream Protection Zones (SPZs) in the Riparian Reserve LUA (RR) would be maintained. The proposed new and improved roads are on ridge top or upper-slope locations with no hydrologic connections or proximity to streams or riparian areas.

Overall, the proposed action would be unlikely to have any measurable effect on stream temperatures, pH, or dissolved oxygen. Sediment transport and turbidity in the affected watersheds is likely to increase over the short term as a direct result of road repair and construction, hauling and yarding in and around the RRs. Sediment increases would not be visible beyond 800 meters (0.5 mile) downstream from road/stream intersections and would not be expected to affect fish, aquatic species or habitat, or human uses. Over the long-term (beyond 3-5 years), current conditions and trends in turbidity and sediment yield would likely be maintained under the proposed action.

- **ACSO 5: Maintain and restore the sediment regime under which aquatic ecosystems evolved.** Addressed in Text (*EA sections 2.3.4, 3.3.2, and 3.3.3*). In summary:

  No Action Alternative: It is assumed that the current levels of sediment into streams would be maintained.

  Proposed Action: Stream protection Zones (SPZs) in RRs would be maintained (minimum of 60 feet on perennial streams and 30 feet on intermittent streams in treatment areas). Hauling restrictions and sediment control measures would minimize sediment delivery. Short-term localized increases in stream sediment can be expected during temporary culvert installation and removal, but BMPs and mitigation measures would be implemented to limit acceleration of sediment delivery to streams.

- **ACSO 6: Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing.** Addressed in Text (*EA sections 2.3.4, 3.3.2, and 3.3.3*). In summary:

  No Action Alternative: No change in in-streams flows would be anticipated.

  Proposed Action: A preliminary analysis for the risk of increases in peak flow as a result of forest harvest was conducted using the Oregon Watershed Assessment Manual watershed analysis methods for forest hydrology (OWEB, 1997). Because the proposed project would remove less than half the existing forest canopy and only a small fraction of the forest cover (roads and landings), it is unlikely to produce any measurable effect on stream flows. Within the Riparian Reserve, the riparian canopy would be retained intact within the primary shade zone and substantial portions of the canopy would be retained in the secondary shade zone, therefore maintaining riparian microclimate conditions and protecting streams from increases in temperature.

- **ACSO 7: Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.** Addressed in Text (*EA sections 2.3.4, 3.3.10*). In summary:

  No Action Alternative: The current condition of flood plains and their ability to sustain inundation and the water table elevations in meadows and wetlands is expected to be maintained.

  Proposed Action: There would be no alteration of any stream channel, wetland or pond morphological feature. All operations, equipment and disturbances are kept a minimum of 60 feet from all wetlands larger than 1 acre and perennial stream channels, 30 feet from all intermittent stream channels, and one row of trees from wetlands smaller than 1 acre. Thus, the current condition of floodplain inundation and water tables would be maintained.

- **ACSO 8: Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.** Addressed in Text (*EA sections 2.3.4, 3.3.1, 3.3.2, 3.3.3 and 3.3.5*). In summary:

  No Action Alternative: The current species composition and structural diversity of plant communities would continue along the current trajectory. Diversification would occur over a longer period of time.

  Proposed Action: SPZs would maintain the current species composition and structural diversity of plant communities in riparian areas and wetlands from 30 feet (intermittent streams) to 60 feet (perennial streams) in treatment areas. Thinning and low density in the Riparian Reserve LUA outside of the SPZs would help to restore diversity in species composition by allowing more understory development and help to restore structural diversity.

- **ACSO 9: Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.** Addressed in Text (*EA sections 2.3.4, 3.3.1, 3.3.2, 3.3.3 and 3.3.5*). In summary:

  No Action Alternative: Habitats would be maintained over the short-term and continue to develop over the long-term with no known impacts on species currently present.

  Proposed Action: The proposed action would have no adverse effect on riparian dependent species. Although thinning activities may affect some invertebrates within the treatment areas, adjacent non-thinned areas should provide adequate refugia for the species. In the long term, the treatments would restore elements of structural diversity to treatment areas in the Riparian Reserve LUA. These attributes would help to provide resources currently lacking or of low quality, and over the long-term, would benefit both aquatic and terrestrial species.

3.4.1 Comparison of Alternatives with regard to the Decision Factors

This section compares the alternatives with regard to the Decision Factors described in *EA section 1.2.3* and the project objectives in *EA section 1.2.2*.

1. Provide timber resources and revenue to the government from the sale of those resources (objectives 1 and 2);
2. Reduce the costs both short-term and long-term of managing the lands in the project area objectives 1 and 2); and
3. Provides safe, cost-effective access for logging operations, fuels management and fire suppression (objectives 2, 6, and 7):

   Decision Factors 1-3: The No Action alternative would not meet this factor since no timber sale would take place. The Proposed action would provide timber resources to the market and would be cost effective, providing revenue with reasonable logging costs associated with commonly used logging systems. (*EA section 2.5*).

4. Reduce competition-related mortality and wildfire risk, and increase tree vigor and growth (objectives 1 and 7):

   Decision Factor 4: The No Action alternative would not meet this decision factor. The proposed action would meet this factor. (*EA sections 3.3.1 and 3.3.6*).

5. Reduce erosion and subsequent sedimentation from roads (objectives 3 and 6):

   Decision Factor 5: Under the No Action alternative, there is no opportunity to remove and rehabilitate the roads being damaged by unauthorized OHV use. The proposed action meets this criterion. Under the proposed action roads would be maintained, reducing the risk of erosion and sedimentation associated with the existing road system. New road construction and improvement would not cause sedimentation. Stabilizing and closing new and some existing roads would prevent erosion, including existing erosion. (*EA sections 2.3.4, 3.3.2 and 3.3.3*)

6. Provide for the establishment and growth of conifer species while retaining structural and habitat components, such as large trees, snags, and coarse woody debris (objectives 4 and 5);
7. Promote the development of healthy late-successional characteristics in the Riparian Reserve land use allocation (objective 4);

   Decision Factors 6 and 7: Under the No Action alternative, **s**tand health and tree growth rates would decline if stands are not thinned. Competition would result in mortality of smaller trees and some co-dominant trees in the stands. This alternative retains existing elements, but does not enhance conditions to provide these elements for the future stand.

   Trees would continue to grow slowly until reaching suitable size for large woody debris, snags and late successional habitat (*EA sections 3.3.1, 3.3.5*)

   The proposed action would attain these objectives. Stand health and tree growth rates would be maintained as trees are released from competition. The alternative retains the elements described under "no action" on untreated areas of the stands in the project area and encourages development of larger diameter trees and more open stand conditions in treated areas. These conditions add an element of diversity to the landscape not currently available on BLM lands in the project area, and which are not provided under the No Action alternative. (*EA sections 3.3.1, 3.3.5*).

8. Establish a defensible area for use during extended fire suppression activities and possibly reduce the overall size of a wildfire (objective 7).
9. Reduce potential human sources of wildfire ignition by controlling access (objective 7).

   Decision Factors 8 and 9: Both alternatives meet these Decision Factors. See EA sections 2.3.4, 3.3.6 and 3.3.8. However, under the No Action alternative, dense forest stands with high crown densities are more susceptible to a high intensity, stand replacement wildfire that escapes initial attack and could threaten the public and other resources.

   Under the proposed action, managed, thinned forest stands are less prone to catastrophic wildfires than unhealthy overstocked stands. Fires that do start tend to be easier to control in actively managed stands. Maintaining logging roads provides faster access for suppression forces if a fire does start. The road systems into many parts of the Lost Lulay project area are currently gated, and controlled by private industrial land owners.

Under the proposed action, fuels would be treated adjacent to roads, further decreasing the risk of human-caused ignition, where public access is available. See *EA sections 2.3.4, 3.3.6 and 3.3.8.*

4.0 LIST OF PREPARERS

Table 16: List of Preparers

Resource	Name
Writer/Editor	Lisa Soo, Keith Walton
NEPA Review	Carolyn Sands
Botany	Terry Fennell
Cultural Resources	Fran Philipek, Brent Beckman
Engineering	Amy Herburger
Fire/Fuels	Barbara Raible
Fisheries	Bruce Zoellick
Hydrology/ Water Quality	Patrick Hawe
Logging Systems	Keith Walton
Recreation, Visual Resources Management and Rural Interface	Traci Meredith
Silviculture	Lisa Soo
Soils	Patrick Hawe
Wildlife	Jim England

5.0 CONTACTS AND CONSULTATION

5.1 Consultation

5.1.1 ESA Section 7 Consultation

5.1.1.1 US Fish and Wildlife Service

The timber sale was submitted for Informal Consultation with U.S. Fish and Wildlife Service (USFWS) as provided in Section 7 of the Endangered Species Act (ESA) of 1973 (16U.S.C. 1536 (a)(2) and (a)(4) as amended) during the FY2009/2010 consultation process. The *Biological Assessment of NLAA Projects with the Potential to Modify the Habitat of Northern Spotted Owls Willamette Planning Province - FY 2009-2010* (BA), was submitted in August 2008.

Using effect determination guidelines, the BA concluded that the Lost Lulay Thinning may affect, but is not likely to adversely affect the northern spotted owl due to the modification of dispersal habitat (BA, pp. 21-23).

The *Letter of Concurrence Regarding the Effects of Habitat Modification Activities within the Willamette Province, FY2009-2010* (LOC) associated with the Lost Lulay Project was issued in October 2008 (reference # 13420-2008-I-0140). The LOC concurred that the habitat modification activities described in the BA, including the Lost Lulay Thinning, are not likely to adversely affect spotted owls and are not likely to adversely affect spotted owl Critical Habitat (LOC, p. 31). Furthermore, the proposed action is not likely to diminish the effectiveness of the conservation program established under the NWFP to protect the spotted owl and its habitat on federal lands within its range including designated spotted owl critical habitat (LOC, p. 31).

The proposed thinning and connected actions described in this EA have incorporated the applicable General Standards that were described in the BA (p. 6-7) and LOC (LOC, pp. 12-14). This includes a seasonal restriction within disturbance distance of known spotted owl sites during the critical nesting season, and monitoring/reporting on the implementation of this project to the U.S. Fish and Wildlife Service.

5.1.1.2 Endangered Species Act (ESA) Determination of Effect for Listed Fish Species

The project would have an ESA determination of "No Effect" on UWR steelhead trout and UWR Chinook salmon (*Table 17* and *EA section 3.3.3*). Steelhead trout and Chinook salmon would not be affected because their suspected upstream limit of distribution ranges from 0.9 to 4.5 miles downstream of the project area (see Table 6), and the project would not impact sediment, temperature, or large wood levels in listed fish habitat (*EA section 3.3.3*).

Table 17: Endangered Species Act (ESA) Determinations of Effect for Upper Willamette River Steelhead trout and Upper Willamette River Chinook salmon.

Species	Project Area	Effect Call	Remarks
UWR steelhead trout	Lost Lulay	No Effect	See EA Section 3.3.3
UWR Chinook salmon	Lost Lulay	No Effect	See EA Section 3.3.3

The project would have no effect on Critical Habitat for the species listed above, and would have "no adverse effects" on Essential Fish Habitat (EFH) as designated under the Magnuson-Stevens Fishery Conservation Act.

5.1.2 Cultural Resources - Section 106 Consultation with State Historical Preservation Office:

5.1.2.1 Cultural Resources

Cultural resource surveys were conducted throughout the sale area between November 2007 and January 2008 (CRIR # C0801). As a result of these surveys, historic cultural features dating to between 1879 and 1970 were identified, no cultural sites were found. All sites were determined not eligible for the National Register of Historic Places and assessed as not having other values requiring conservation in place.

5.2 Public Scoping and Notification - Tribal Governments, Adjacent Landowners, General Public, and State County and local government offices

For information on project scoping, see *EA section 1.4*. The EA and FONSI will be made available for public review from March 31, 2010 to April 30,2010 and posted at the Salem District website at http://www.blm.gov/or/districts/salem/plans/index.php. The notice for public comment will be published in a legal notice in the *Stayton Mail* newspaper. Written comments should be addressed to Cindy Enstrom, Field Manager, Cascades Resource Area, 1717 Fabry Road S., Salem, Oregon 97306. Emailed comments may be sent to OR_Salem_Mail@blm.gov. Attention: Cindy Enstrom.

6.0 LIST OF INTERDISCIPLINARY TEAM REPORTS INCORPORATED BY REFERENCE

Interdisciplinary team reports can be found in the Lost Lulay Thinning EA project file and are available for review at the Salem District Office.

England, J., 2008. *2009 Lost Lulay Timber Sale Thinning EA – Wildlife Report* [Wildlife Report] Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Fennell, T., 2008. *2009 Lost Lulay Timber Sale Thinning EA - Botanical Report* [Botany Report] Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Hawe, P., 2008. *2009 Lost Lulay Timber Sale Thinning EA- Hydrology/Channels/Water quality Report* [Hydrology Report] Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Hawe, P., 2008. *2009 Lost Lulay Timber Sale Thinning EA Soils Report.* [Soils Report] Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Herburger, Amy., 2009. *2009 Lost Lulay Timber Sale Thinning EA- Road Report* [Road Report] Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Meredith, T., 2009. *2009 Lost Lulay Timber Sale Thinning EA - Recreation, Visual and Rural Interface Resources Report* [Recreation Report] Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Raible, B., 2008. *2009 Lost Lulay Timber Sale Thinning EA - Fuels Management /Fire Ecology Fuels and Air Quality Report* [Fuels Report] Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Soo, L., 2008. *2009 Lost Lulay Timber Sale Thinning EA- Silvicultural Report* [Silvicultural Prescription] Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Walton, Keith., 2009. *2009 Lost Lulay Timber Sale Thinning EA- Logging Sysytems Report* [Logging Report] Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

Zoellick, B., 2008. *2009 Timber Sale Thinning EA -Fisheries and Aquatic Habitat.* [Fisheries Report] Cascades Resource Area, Salem District, Bureau of Land Management. Salem, OR.

7.0 ADDITIONAL SUPPORTING DATA AND MAPS OF THE PROPOSED ACTION

7.1 Additional Tables

Table 18: Lost Lulay Vegetation Summary

T-R-S	FOI Unit #	Unit	Size in Acres	Current Stand Age class	Trees per acre before treatment	Trees per acre after treatment	Avg. DBH	Curtis Relative Density before treatment	Curtis Relative Density after treatment
10-1W-25	042	A	51	35	222	75-100	13.5	60	33-35
	040/ 070	B	34	32	237	75-100	12.8	59	33-35
10-1-21	040/ 050/ 020	A	50	69	121	100	19.7	58	35
10-1-23	090	A	13	39	184	86	14.9	58	33
	100/ 080	B	67	40	308	100	12.2	72	35
10-1-25	020	A	147	51	222	77	14.6	68	38
10-1-29	030	A	32	30	253	100	11.8	56	35
	031	B	33	30	257	100	12.3	61	35
10-2-19	010	A	25	47	176	77	16.8	66	38
11-1-5	040/ 050/ 030	A	65	38	227	77	13.2	59	38
	010	B	27	40	207	75-100	13.4	58	33-35
Total Acres			544						

Table 19: Special Status Wildlife Species for Lost Lulay, Cascades Resource Area (Bureau Sensitive, USFWS SOC and Federally Listed) (Wildlife Report Table 6)

Occurrence	Species & Status	Habitat Description
Invertebrates		
N	CALLOPHRYS JOHNSONI BS Johnson's Hairstreak	Cool, moist, old-growth conifer forests of the Pacific Northwest, primarily west of the Cascades Mountains at higher elevations. Feeds on dwarf mistletoe associated with Western hemlock and true firs. Known to occur in old-growth hemlock near Larch Mountain east of the Lost Lulay area. Not suspected to occur in Lost Lulay.

Occurrence	Species & Status	Habitat Description
N	COLLIGYRUS SP. BS Columbia Duskysnail	A Columbia Gorge endemic, found on both sides from east and south of Portland to Hood River, Oregon. Most sites are in Gorge tributaries; a few other sites occur in drainages originating from near Mount Hood, Oregon, to Mount St. Helens, Washington. Lost Lulay is outside this range.
N	CRYPTOMASTIX DEVIA BS Puget Oregonian (snail)	Mature and old growth forests, typically under hardwood logs and leaf litter, rocks and talus, in litter under sword ferns growing under hardwood trees and shrubs, and under moss growing on big leaf maple trunks. No mature or old-growth forest habitat is proposed for thinning. None were found during purposive surveys conducted in the Cascades Resource area in 2006.
N	DEROCERUS HESPERIUM BS Evening fieldslug	Occurs in wet meadows in forested situations in a variety of low vegetation, litter, debris and rocks. Search area limited to within 30 meters of perennial wetlands, springs, seeps and riparian areas. This habitat is not present in the Lost Lulay area.
N	GLIABATES OREGONIUS BS Salamander slug	Type locality is in leaf litter under bushes in mature conifer forest at elevation of 600' in east side of the Oregon Coast Range. Has been found at 11 sites in the Cascades Resource Area, ranging from unharvested or unthinned late-successional forest, to a 45 year old stand that originated after regeneration harvest. There are no salamander slug sites in the Lost Lulay area.
N	GONIDEA ANGULATA BS Western ridged mussel	Substrates of lakes, streams, and rivers that range in size from gravel to firm mud with the presence of at least some fine material (e.g. sand, silt or clay). Preferred sites generally have constant flow, rather shallow water (typically < 3 m in depth), and well-oxygenated substrates, especially when occurring in finer sediments.
HERPETOFAUNA		
N	ACTINEMYS MARMORATA MARMORATA BS/SOC/ SC Northern Pacific pond turtle	Marshes, ponds, lakes, slow rivers and streams, usually with an abundance of aquatic vegetation and emergent logs or boulders for basking. Associated with Willamette Valley. Lost Lulay is located in the Cascades Mountains and no suitable habitat is present.
S	ASCAPHUS TRUEI SOC/SV Tailed frog	Cold, fast-flowing permanent springs and streams in forested areas. Has a very narrow temperature tolerance. *Likely to occur in the Lost Lulay area.*
D	BATRACHOSEPS WRIGHTORUM BS/SOC/SU Oregon slender salamander	West slope of Cascades. Prefers down logs and woody material in more advanced stages of decay. Most common in mature and old-growth conifer forests. *Known to occur in Lost Lulay area. Addressed in text.*

Occurrence	Species & Status	Habitat Description
N	CHRYSEMYS PICTA BS/SC Painted turtle	Marshes, ponds, lakes, slow rivers and streams, usually with an abundance of aquatic vegetation and emergent logs or boulders for basking. Associated with the Willamette River and its major tributaries in the Willamette Valley. Lost Lulay is located in the Cascades Mountains and no suitable habitat is present.
N	DICAMPTODON COPEI BS/SU Cope's giant salamander	Larvae in streams or occasionally (in Washington) in ponds and lakes, sea level to 4,400 feet. Very few sites in Oregon. Possible in Sandy River sub-basins. Lost Lulay is outside this range.
N	PLETHODON LARSELII BS/SV Larch Mountain salamander	Associated with rocky, talus areas on steep slopes and coarse woody debris in older forests close to the Columbia River Gorge. Lost Lulay is outside this range. There are no known sites on Salem BLM lands. None were found during purposive surveys conducted in the Cascades Resource area in 2006.
D	RANA AURORA **SOC/SU** Red-legged frog	Common in marshes, ponds, and streams with little or no flow, from the valley floor to about 2,500 feet in mountain forests. Can occur in seasonal waters if wet until late May or June. *Documented to occur in the Lost Lulay area.*
N	RANA BOYLEI BS/SOC/SV Foothill yellow-legged frog	Permanent rivers with rocky, gravelly and sandy substrates in the south half of the Resource Area. There is no suitable habitat in the Lost Lulay Area.
N	RANA CASCADAE **SOC/SV** Cascades frog	Found in higher elevation bogs, ponds and stream edges associated with moist meadows above 3500 feet. Lost Lulay is located at lower elevations and no suitable habitat is present.
BIRDS		
D	ACCIPITER GENTILIS SOC/SC Northern goshawk	Rare Summer resident in Cascades. Prefers mature or old-growth forests with dense canopy cover at higher elevations. Winters at lower elevations. Stands in Lost Lulay are young and located at lower elevations, however, goshawks have been seen in the Lost Lulay Area in 10S-1E-29. *Addressed in Table 7 of the Wildlife report.*
S	CONTOPUS COOPERI **SOC/SV** Olive-sided flycatcher	Remnant large trees/snags in forest openings/edges and open forests, high contrast old/young edges. Migratory, arrive late May, leave late August. *Suitable habitat is present in Lost Lulay. Addressed in Table 7 of the Wildlife report.* .
S	EMPIDONAX TRAILLII BRESTERI **SOC/SV** Little willow flycatcher	Dense shrub and early seral stages, prefers the wet sites/ riparian zones. Migratory, arriving in mid May 15, most leave early September. *Suitable habitat is present in Lost Lulay. Addressed in Table 7 of the Wildlife report.*
N	FALCO PEREGRINUS ANATUM BS/SE American peregrine falcon	Rare during the nesting season. Usually occurs as a transient/migrant and winter visitor. Found in a variety of open habitats near cliffs or mountains. Prefers areas near larger bodies of water and rivers. No suitable habitat is present in the Lost Lulay area.

Occurrence	Species & Status	Habitat Description
N	HALIAEETUS LEUCOCEPHALUS BS Bald eagle	Rare summer resident in Cascades. Uncommon winter resident in Willamette Valley. For nesting and perching, prefers large old-growth trees near major bodies of water and rivers. No suitable habitat is present in the Lost Lulay area.
N	HISTRIONICUS HISTRIONICUS BS/SOC/SU Harlequin duck	An uncommon summer resident found in whitewater mountain rivers and streams during nesting season. Winters on rocky coasts. No suitable habitat is present in the Lost Lulay area.
N	ICTERIA VIRENS SOC/SC yellow-breasted chat (Willamette Valley)	Formerly common in dense riparian thickets along the Willamette Valley floor. Will use brushy young stands after regeneration harvest, blackberry thickets, and dense scotch broom stands. Possible in any young, brushy valley-edge elevation stand. Migratory. Lost Lulay is located in the Cascades Mountains and no suitable habitat is present.
N	MELANERPES FORMICIVORUS SOC Acorn Woodpecker	Nests in colonies in cavities in mature/old-growth oak groves in the Willamette Valley. Most common to the south in the Umpqua, Rogue Valleys and California. No suitable habitat is present in the Lost Lulay area.
N	MELANERPES LEWIS BS/SOC/SC Lewis' woodpecker	Formerly a common summer resident and uncommon winter visitor in Willamette Valley. Oak woodlands and hardwood forests. Transient on Salem District in fall along high divides. No suitable habitat is present in the Lost Lulay area.
D	PATAGIOENAS FASCIATA SOC Band-tailed pigeon	Nests in closed-canopy forest; forages in open-canopy forest. Keys in on mineral sites and berry producing plants. Migratory, most arrive in March, leave in October. *Suitable habitat is present in Lost Lulay. Addressed in Table 7 of the Wildlife report.*
N	POOECETES GRAMINEUS AFFINIS BS/SOC/SC Oregon vesper sparrow	Rare and local summer resident in Willamette Valley. Very rare in winter. Dry, grassy areas. Western Oregon interior valley breeding population is of concern. Lost Lulay is located in the Cascades Mountains and no suitable habitat is present.
N	PROGNE SUBIS BS/SOC/SC Purple martin	Rare summer resident. Typically occurs along rivers and other water bodies. Nests colonially in cavities in old buildings, abandoned woodpecker holes, and nest boxes. No suitable habitat is present in or adjacent to the Lost Lulay BLM parcels. Very low probability of occurrence in the Lost Lulay area. *Addressed in Table 7 of the Wildlife report.*
D	STRIX OCCIDENTALIS CAURINA LT/ST Northern spotted owl	Permanent resident. Prefers mature and old-growth conifer forests with large down logs, standing snags in various stages of decay, high canopy closure and a high degree of vertical stand structure. *Portions of the Lost Lulay Project Area are located within the provincial home range of two historic known spotted owl sites. Addressed in text.*
MAMMALS		

Occurrence	Species & Status	Habitat Description
N	ANTROZUS PALLIDUS BS/SOC/SV Pallid bat	Occurs sporadically in w. Oregon. Associated with arid habitats, generally drier interior valleys of Southwestern Oregon. Found in caves, under bridges, cracks in rocks, hollow trees, old buildings, other secluded and protected places. No suitable habitat is present in the Lost Lulay area.
D	ARBORIMUS LONGICAUDUS SOC Oregon red tree vole	Survey and Manage Species. The red tree vole is an arboreal vole of conifer forests below about 3,500 to 4,500 feet in elevation. Optimum habitat is older forests, but it is found in younger stands. *Known to be present in the Lost Lulay area. Addressed in text.*
N	CORYNORHINUS TOWNSENDII BS/SOC/SC Townsend's big-eared bat	Feeds on flying insects in a variety of habitats in forested areas. Primary habitat is caves, bridges, buildings and mines. No suitable habitat is present in the Lost Lulay Area.
S	LASIONYCTERIS NOCTIVAGANS **SOC** silver-haired bat	Associated with buildings, snags, loose bark and cliff/cave habitat. Prefers older forests. Forages in a variety of forest habitats and riparian areas. *Addressed in text.*
S	MYOTIS EVOTIS **SOC/SU** Long-eared myotis	Associated with snags, loose bark, buildings and cliff/cave habitat. Prefers older forests. Forages over water and riparian areas. *Addressed in text.*
N	MYOTIS THYSANODES BS/SOC/SV Fringed myotis	Associated with buildings, bridges, mines, snags and cliff/cave habitat. Likely in the north half of the Resource Area, at lower elevations closer to the Willamette Valley. Prefers older forests. Forages over water and riparian areas. Lost Lulay is in the south half of the Resource Area.
S	MYOTIS VOLANS SOC/SU Long-legged myotis	Associated with snags, loose bark, buildings, bridges and cliff/cave habitat. Prefers older forests. Forages over water and riparian areas. Addressed in text.
S	MYOTIS YUMANENSIS SOC Yuma myotis	Associated with buildings, bridges, snags and cliff/cave habitat. More closely associated with riparian areas than the other myotis. Prefers older forests. Forages over water and riparian areas. *Addressed in text.*

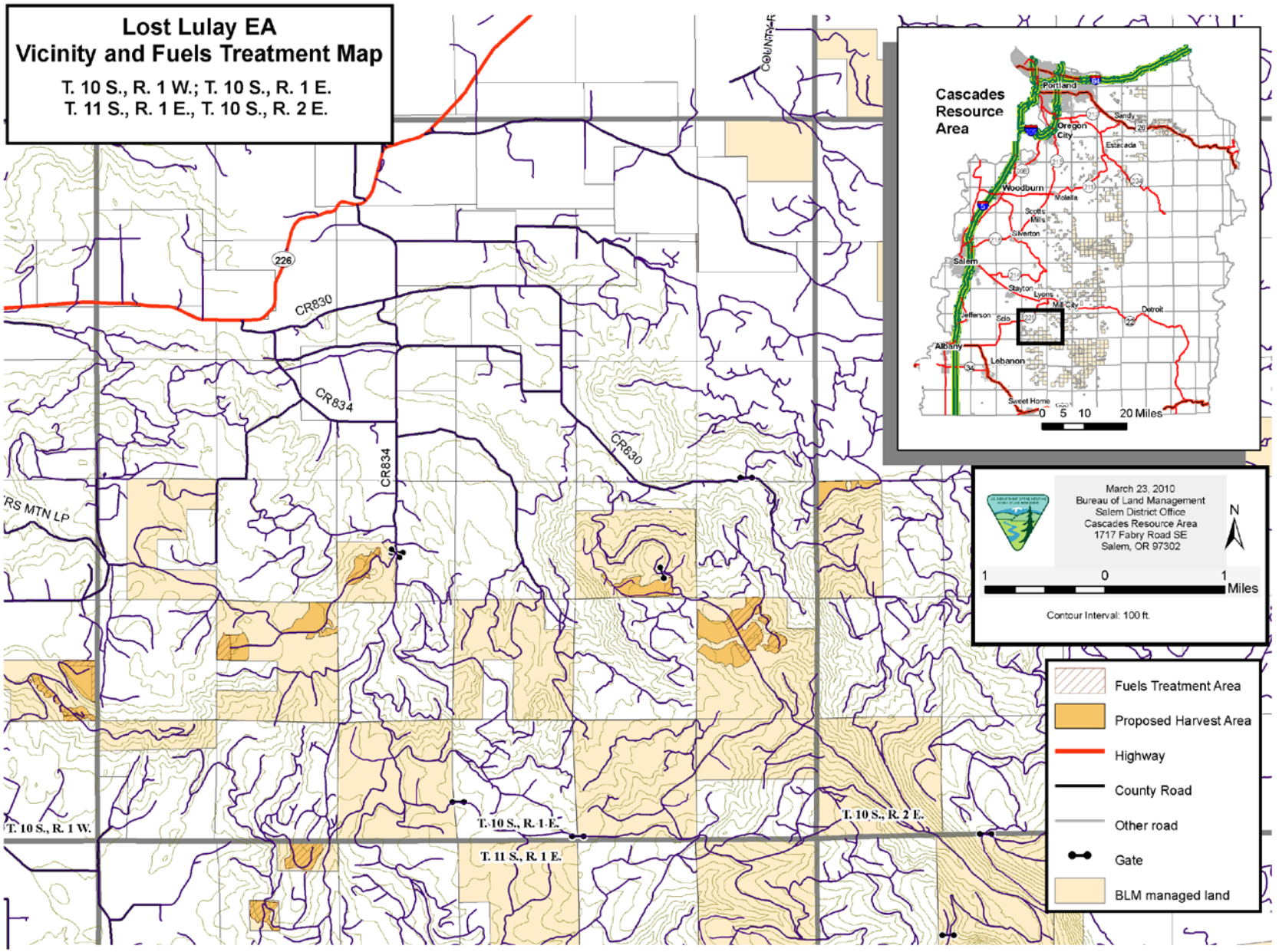
KEY

Occurrence:
N = Not Likely to Occur
S = Suspected (highly likely to occur)
D = Documented to occur

Status:
LE = Federal Endangered
LT = Federal Threatened
SOC = Species of Concern
BS = Bureau Sensitive
SE = State Endangered
ST = State Threatened
SC = State Critical
SV = State Vulnerable
SU = State Uncertain
SP = State Peripheral

7.2 Maps of the Proposed Action

7.2.1 Vicinity and Fuels Treatment



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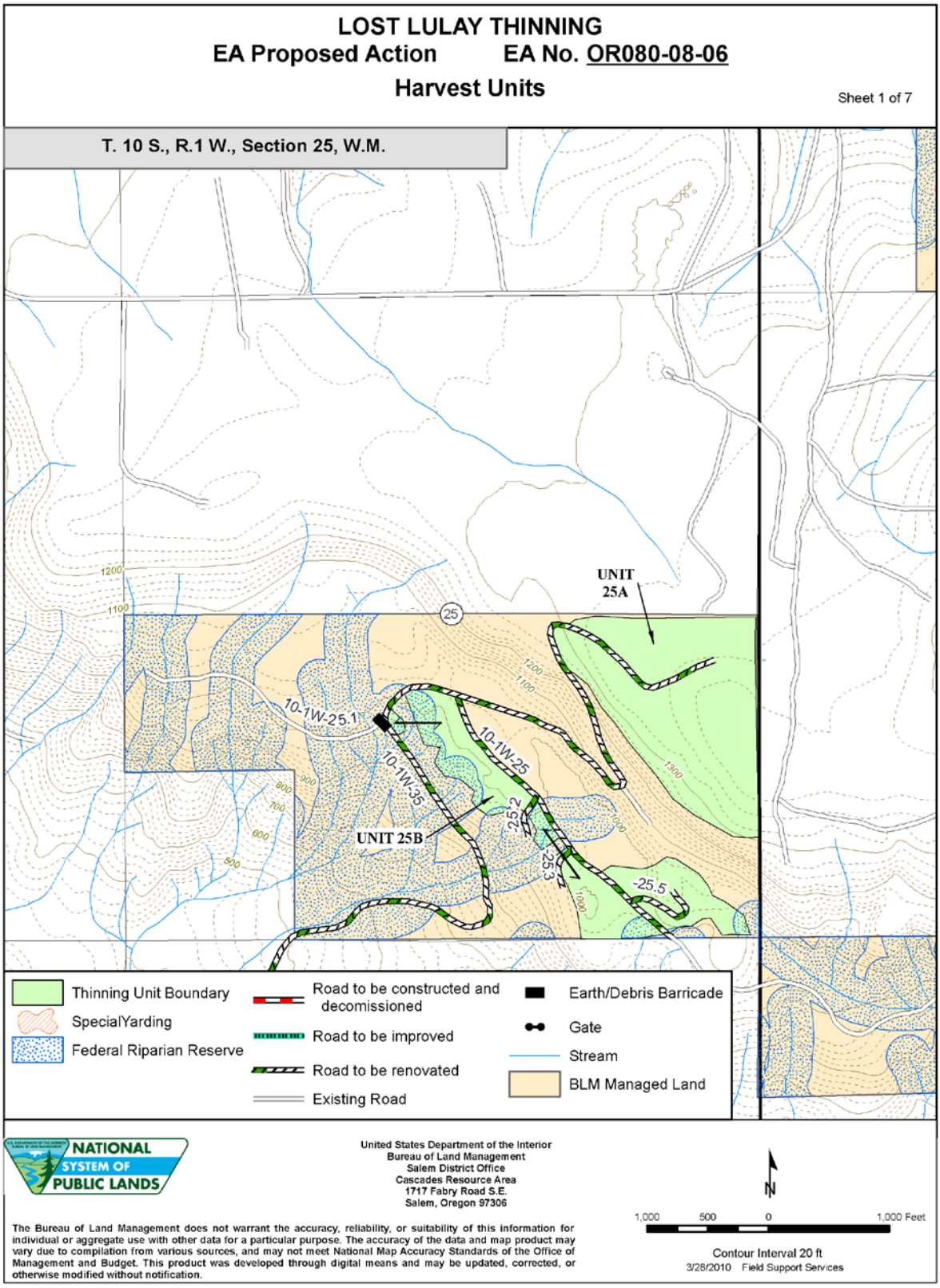
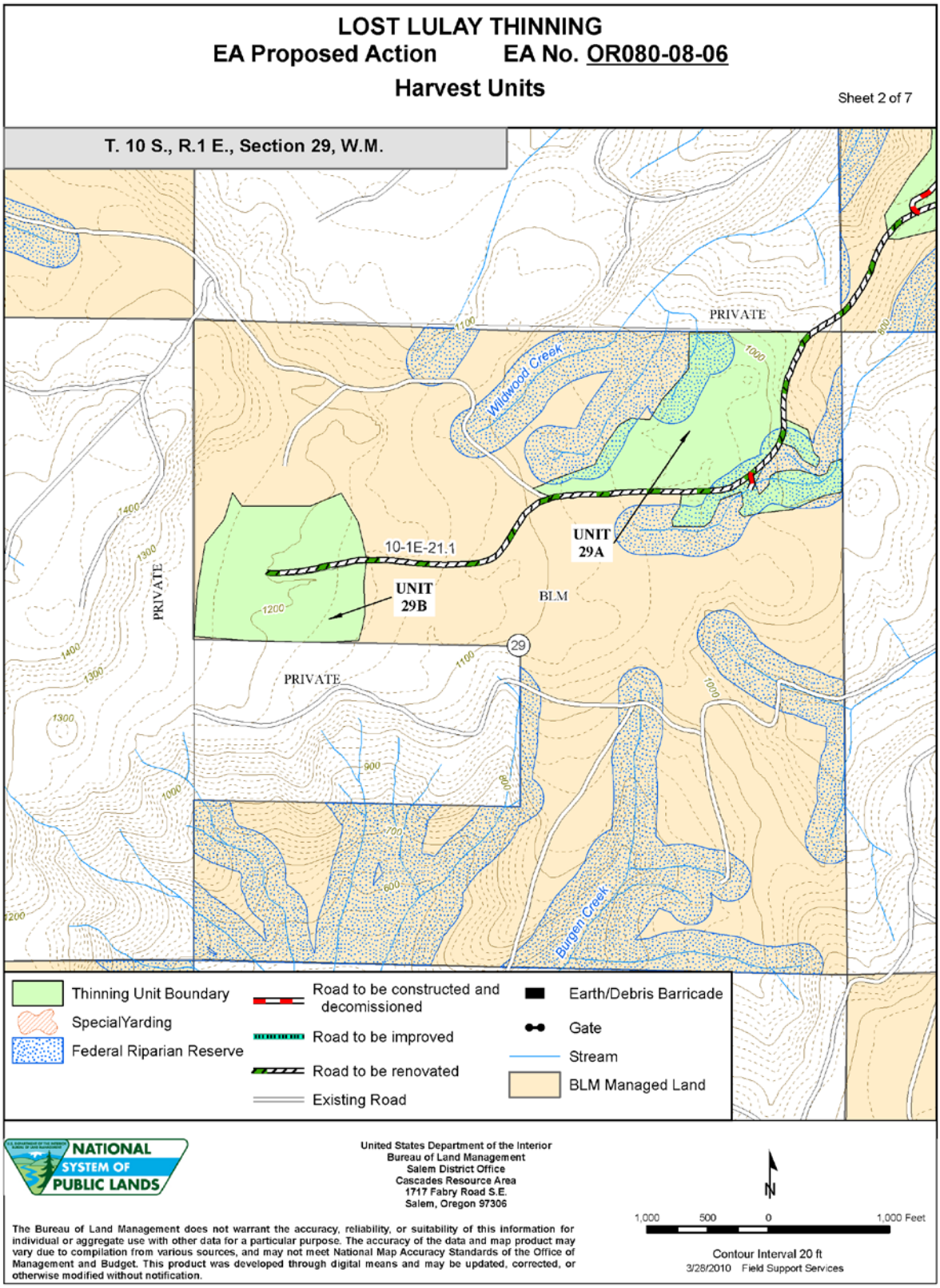
7.2.2 Proposed Action




LOST LULAY THINNING
EA Proposed Action EA No. OR080-08-06
Harvest Units
Sheet 2 of 7
T. 10 S., R.1 E., Section 29, W.M.
PRIVATE
Wildwood Creek
UNIT 29A
10-1E-21.1
UNIT 29B
BLM
PRIVATE
PRIVATE
29
Burgen Creek
Thinning Unit Boundary
SpecialYarding
Federal Riparian Reserve
Road to be constructed and decomissioned
Road to be improved
Road to be renovated
Existing Road
Earth/Debris Barricade
Gate
Stream
BLM Managed Land
NATIONAL SYSTEM OF PUBLIC LANDS
United States Department of the Interior
Bureau of Land Management
Salem District Office
Cascades Resource Area
1717 Fabry Road S.E.
Salem, Oregon 97306
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N
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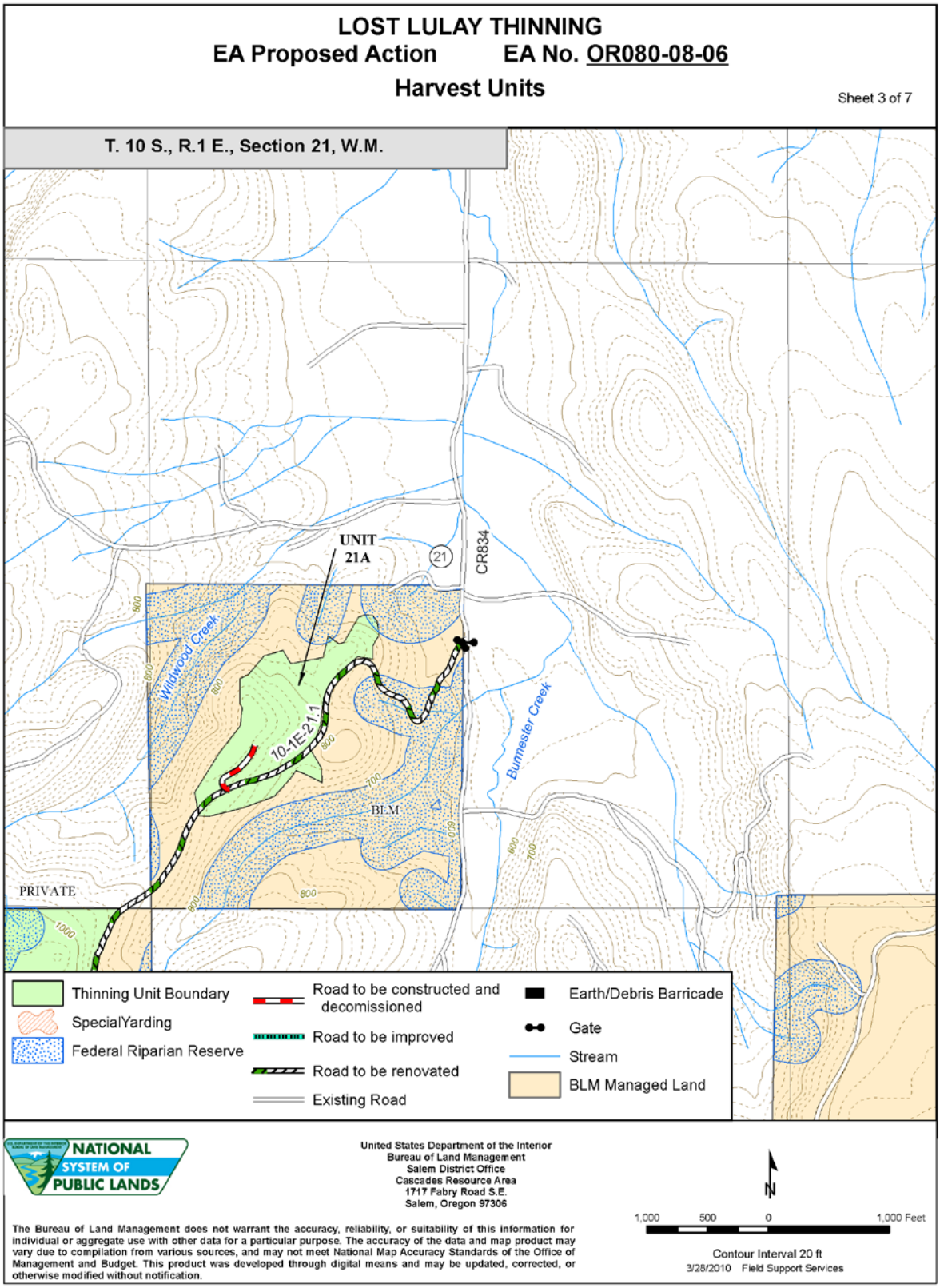
Contour Interval 20 ft
3/28/2010 Field Support Services


LOST LULAY THINNING
EA Proposed Action EA No. OR080-08-06
Harvest Units
Sheet 3 of 7
T. 10 S., R.1 E., Section 21, W.M.
UNIT 21A
21
CR834
Wildwood Creek
Burmester Creek
10-1E-21.1
BLM
PRIVATE
Thinning Unit Boundary
SpecialYarding
Federal Riparian Reserve
Road to be constructed and decomissioned
Road to be improved
Road to be renovated
Existing Road
Earth/Debris Barricade
Gate
Stream
BLM Managed Land
NATIONAL SYSTEM OF PUBLIC LANDS
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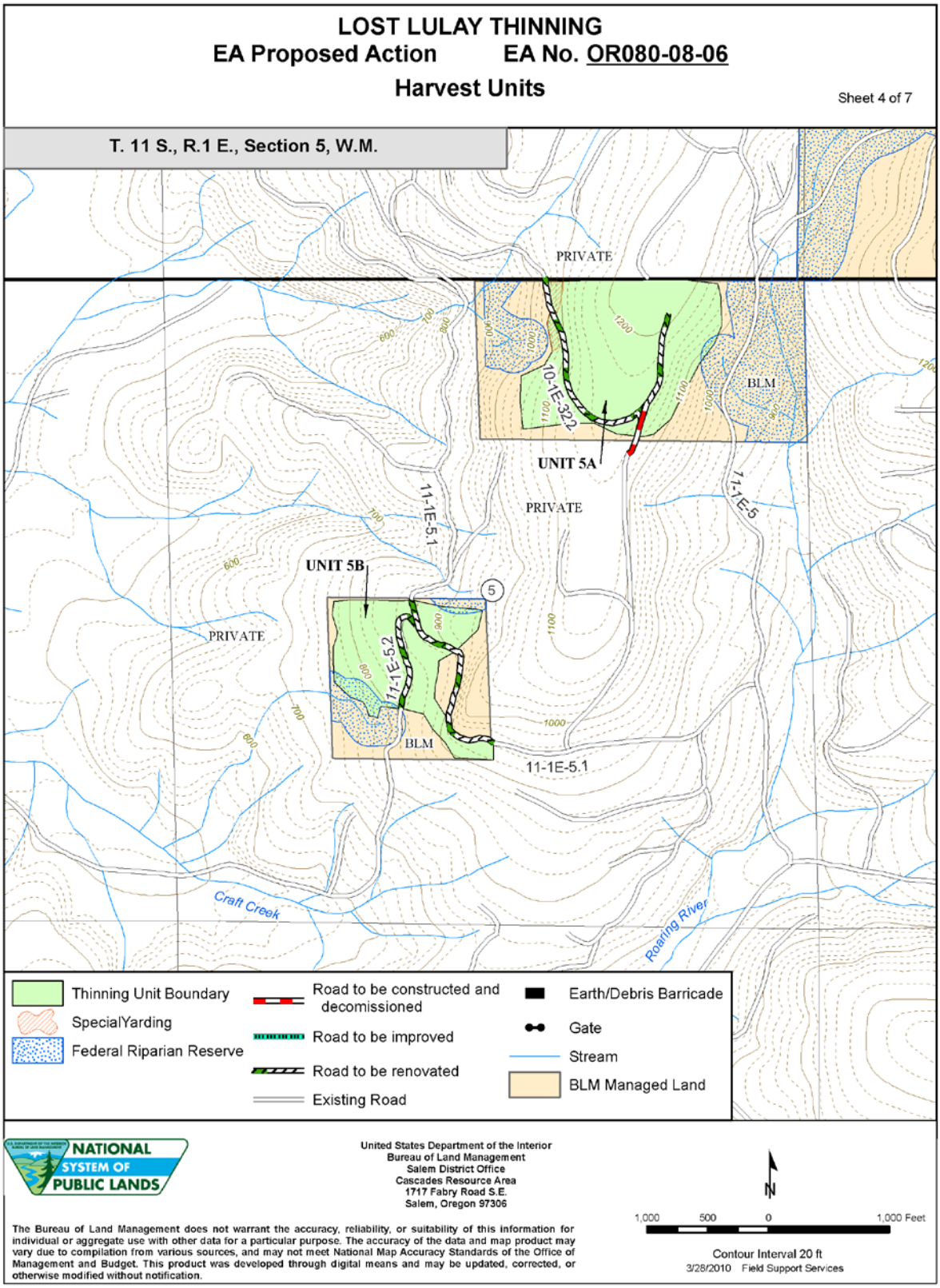
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EA Proposed Action EA No. OR080-08-06
Harvest Units
Sheet 4 of 7
T. 11 S., R.1 E., Section 5, W.M.
PRIVATE
BLM
UNIT 5A
10-1E-32.2
11-1E-5.1
11-1E-5
PRIVATE
UNIT 5B
5
PRIVATE
11-1E-5.2
BLM
11-1E-5.1
Craft Creek
Roaring River
Thinning Unit Boundary
SpecialYarding
Federal Riparian Reserve
Road to be constructed and decomissioned
Road to be improved
Road to be renovated
Existing Road
Earth/Debris Barricade
Gate
Stream
BLM Managed Land
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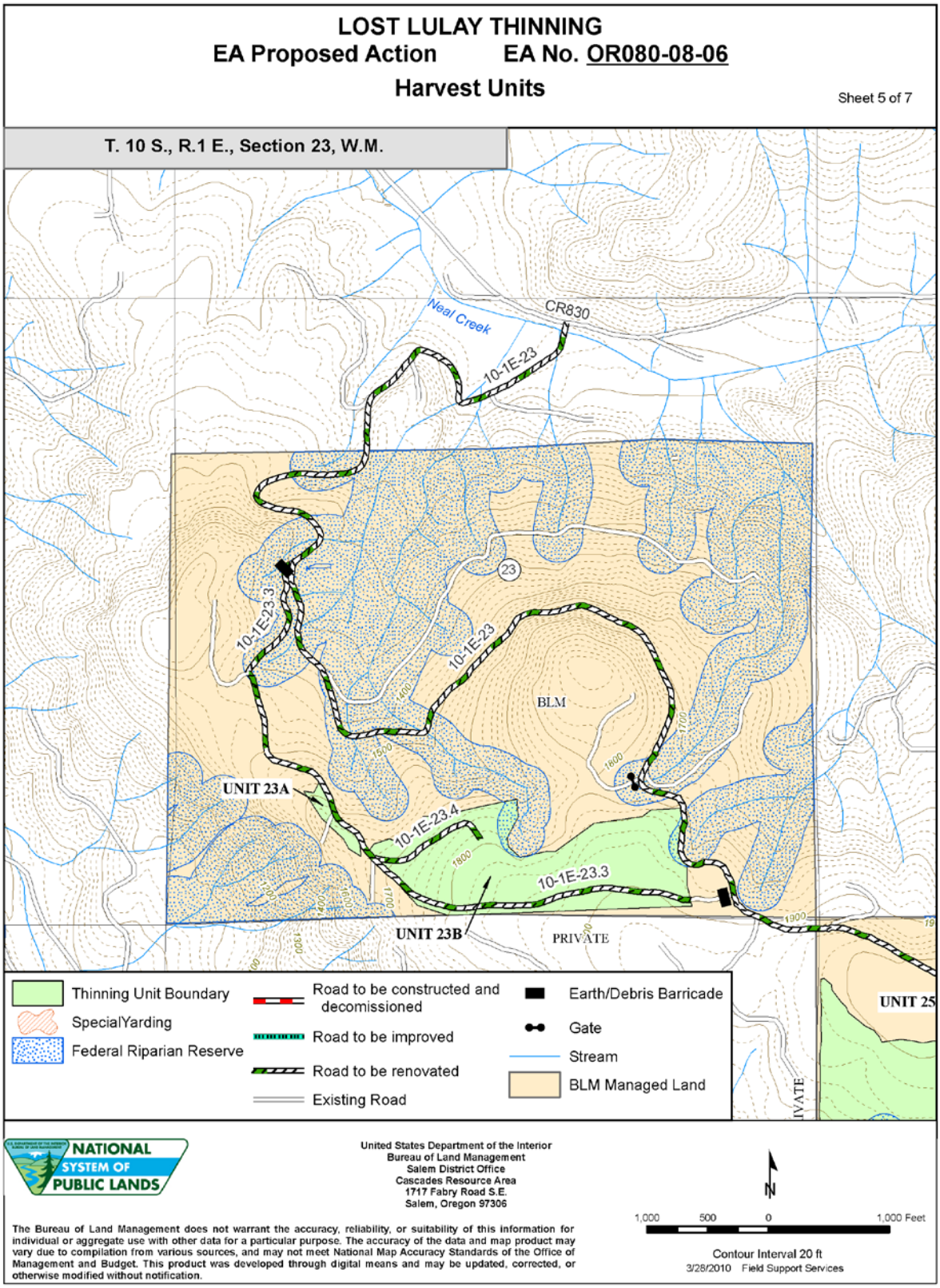
3/28/2010 Field Support Services


LOST LULAY THINNING
EA Proposed Action EA No. OR080-08-06
Harvest Units
Sheet 5 of 7
T. 10 S., R.1 E., Section 23, W.M.
Neal Creek
CR830
10-1E-23
10-1E-23.3
10-1E-23
23
BLM
UNIT 23A
10-1E-23.4
10-1E-23.3
UNIT 23B
PRIVATE
UNIT 25
Thinning Unit Boundary
SpecialYarding
Federal Riparian Reserve
Road to be constructed and decomissioned
Road to be improved
Road to be renovated
Existing Road
Earth/Debris Barricade
Gate
Stream
BLM Managed Land
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United States Department of the Interior
Bureau of Land Management
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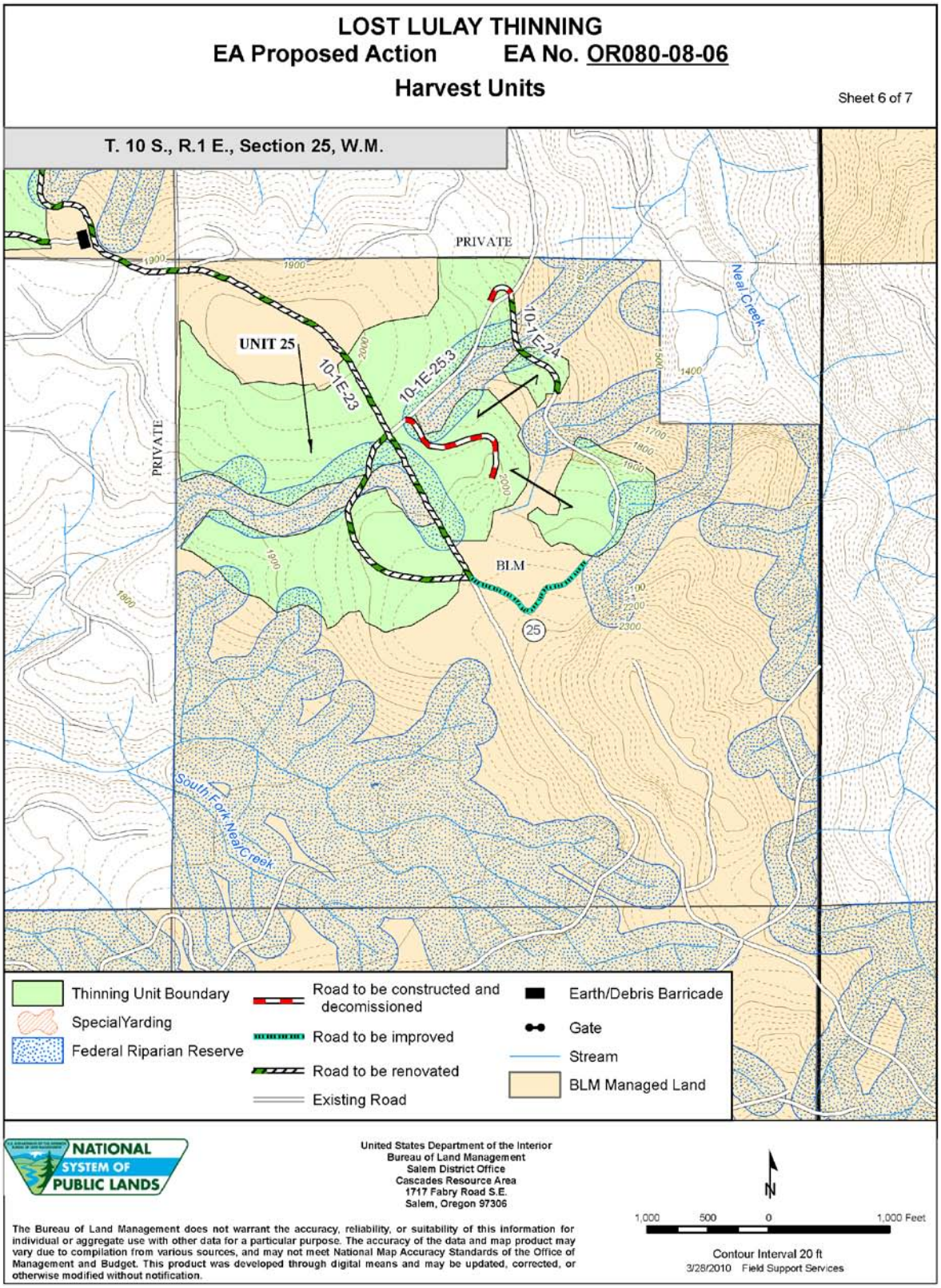
3/28/2010 Field Support Services


LOST LULAY THINNING
EA Proposed Action EA No. OR080-08-06
Harvest Units
Sheet 6 of 7
T. 10 S., R.1 E., Section 25, W.M.
PRIVATE
UNIT 25
10-1E-23
10-1E-25.3
10-1E-24
Neal Creek
PRIVATE
BLM
25
South Fork Neal Creek
Thinning Unit Boundary
SpecialYarding
Federal Riparian Reserve
Road to be constructed and decomissioned
Road to be improved
Road to be renovated
Existing Road
Earth/Debris Barricade
Gate
Stream
BLM Managed Land
NATIONAL SYSTEM OF PUBLIC LANDS
United States Department of the Interior
Bureau of Land Management
Salem District Office
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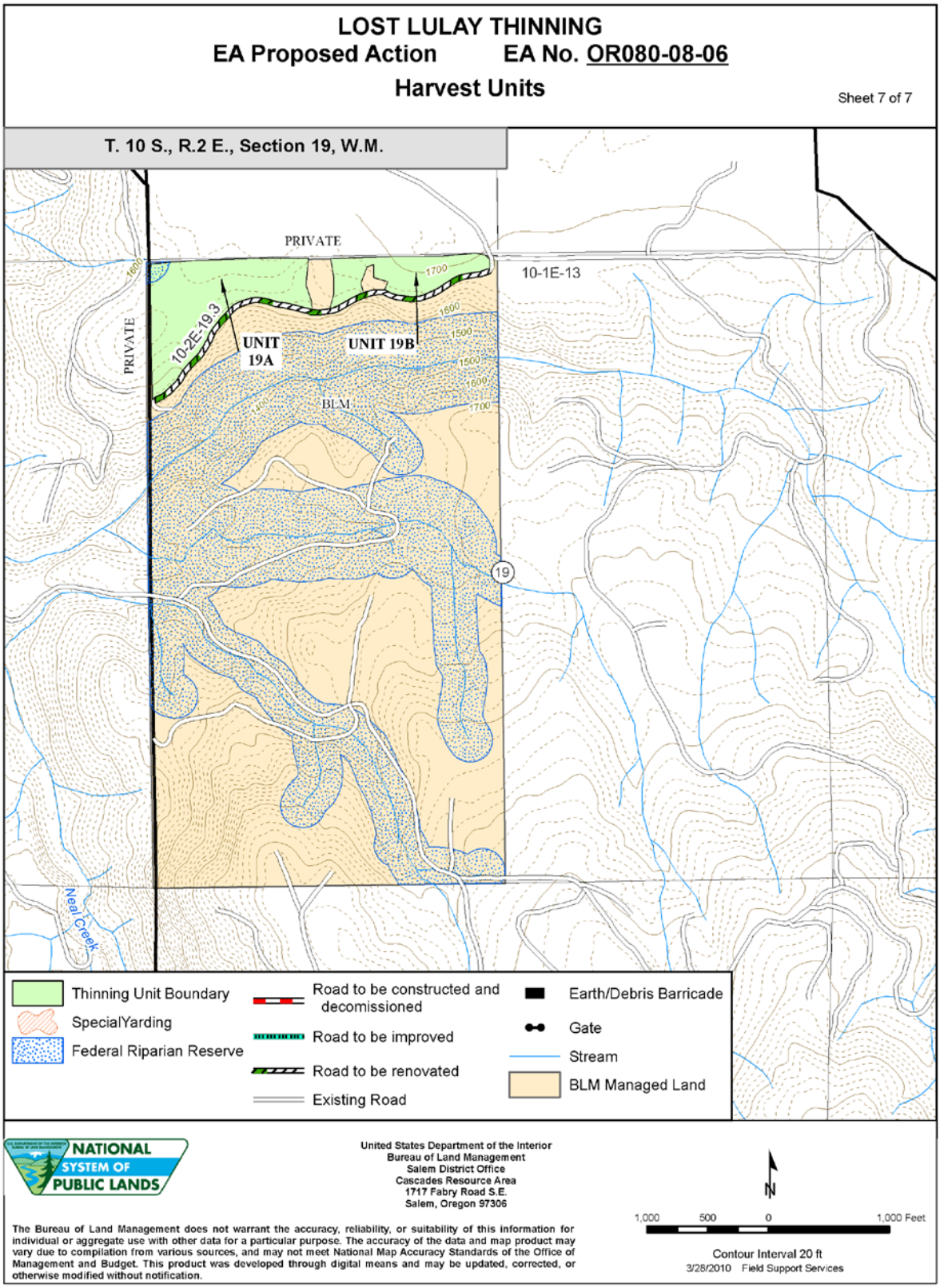
3/28/2010 Field Support Services


LOST LULAY THINNING
EA Proposed Action EA No. OR080-08-06
Harvest Units
Sheet 7 of 7
T. 10 S., R.2 E., Section 19, W.M.
PRIVATE
10-1E-13
PRIVATE
10-2E-19.3
UNIT 19A
UNIT 19B
BLM
19
Neal Creek
1600
1700
1500
1400
Thinning Unit Boundary
SpecialYarding
Federal Riparian Reserve
Road to be constructed and decomissioned
Road to be improved
Road to be renovated
Existing Road
Earth/Debris Barricade
Gate
Stream
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N
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Contour Interval 20 ft
3/28/2010 Field Support Services

8.0 GLOSSARY AND COMMON ACRONYMS

8.1 Glossary

303(d) Water Quality Listing - Impaired waters that do not meet water quality standards, identified by DEQ, as required by the Clean Water Act.

acre - A measure of surface land area in U.S.customary units that is 43,560 square feet, which is 1/640 of a square mile (or approximately 0.4 hectares).If square, it is nearly 209 feet on each side.

activity fuel - Debris (wood chips, bark, branches, limbs, logs, or stumps) left on the ground after management actions, such as logging, pruning, thinning, or brush cutting, versus debris left after storms or fires.

age class - A management classification using the age of a stand of trees

allowable sale quantity - The timber yield that a forest can produce continuously under the intensity of management outlined in the RMP from those lands allocated for permanent forest production.

alternative - One of several proposed management actions that have been studied and found to meet the goals and objectives of a project's purpose and need and, as a result, is suitable to aid decision-making.

anadromous fish - Fish that are born and reared in freshwater, move to the ocean to grow and mature, and return to freshwater to reproduce. Includes species such as salmon and steelhead. Also see *salmonid.*

analysis - The scientific evaluation of the environmental impacts of proposed planning decisions.

analytical assumption - A judgmental decision that is based on the science and relationships of natural systems assumed to be true and from which conclusions can be drawn to supply the missing values, relationships, or societal preferences needed for proceeding with an analysis of alternatives.

(ACS) Aquatic Conservation Strategy - A Northwest Forest Plan methodology designed to restore and maintain the ecological health of watersheds and aquatic ecosystems, consisting of four components: riparian reserves, key watersheds, watershed analysis, and watershed restoration.

aquatic habitat - Habitat for vertebrate and invertebrate wildlife species and vascular and non-vascular plants occurring in free water (e.g. lakes, ponds, streams, rivers, springs and seeps).

authority - The right and power to make decisions and give orders such as the United States Congress exerts when passing legislation (e.g. the O&C Act and the Endangered Species Act).

basal area - The cross-sectional area of a single stem, of all stems of a species in a stand, or of all plants in a stand (including the bark) that is measured at breast height (about 4.5 feet up from the ground) for larger plants (like trees) or measured at ground level for smaller plants.

baseline - The starting point for the analysis of environmental consequences, often referred to as the Affected Environment. This starting point may be the condition at a point in time (e.g., when inventory data is collected) or the average of a set of data collected over a specified number of years.

beneficial use - In water use law, such uses include, but are not limited to: instream, out of stream, and ground water uses; domestic, municipal, and industrial water supplies; mining, irrigation, and livestock watering; fish and aquatic life; wildlife watering; fishing and water contact recreation; aesthetics and scenic attraction; hydropower; and commercial navigation.

(BMPs) Best Management Practices - BMPs are defined as methods, measures, or practices selected on the basis of site-specific conditions to ensure that water quality will be maintained at its highest practicable level. BMPs include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (40 CFR 130.2, EPA Water Quality Standards Regulation). The term is also used generically by the IDT to refer to design features selected as the best way to achieve resource protection and management objectives.

biological assessment A biological assessment is a document that evaluates potential effects of a proposed action to listed and proposed species and designated and proposed critical habitat and determines whether any such species or habitats are likely to be adversely affected by the action.It is used in determining whether formal consultation or conferencing with the U.S.Fish and Wildlife Service or National Marine Fisheries Service is necessary (50 CFR 402.12[a])

(BO) biological opinion - An opinion by the U.S, Fish and Wildlife Service or the National Marine Fisheries Service as to whether or not a federal action is likely or not to jeopardize the continued existence of listed species, or would result in the destruction of or adverse modification of critical habitat.The opinion may contain reasonable and prudent alternatives, a statement of anticipated take of listed animals, and conservation recommendations for listed plants.

Bureau Strategic Species - A special status species category established by the Oregon/Washington BLM that includes animal, and plant species that are of concern in the two states. The special status species policy (BLM 6840) does not apply to these species, and no analysis of them is required in NEPA documents. Field units are required to collect occurrence field data and maintain records.Also see *Bureau sensitive species*.

Bureau Sensitive Species - A special status species category established by the BLM that includes those plant and animal species eligible for status as federally listed, federal candidate, state listed, or state candidate (plant) species; on List 1 of the Oregon Natural Heritage Database or approved for this category by the BLM state director; or included under agency species conservation policies. Also see *Bureau strategic species*.

canopy - The more or less continuous cover of branches and foliage formed collectively by adjacent trees and other woody species in a forest stand. Where significant height differences occur between trees within a stand, formation of a multiple canopy (multi-layered) condition can result.

canopy cover - The ground area covered by the crowns of trees or woody vegetation as delimited by the vertical projection of crown perimeter and commonly expressed as a percent of total ground area.

checkerboard land ownership pattern - A land ownership pattern in which square-mile sections of federal lands are typically intermixed, on the basis of alternating sections, with adjoining private lands. The O&C lands of western Oregon are an example of checkerboard ownership. This ownership pattern resulted from the revestment back to the federal government of lands granted by the federal government to early railroad companies.

The checkerboard ownership pattern of the O&C lands creates additional access, management, and perception issues.

(CWD) coarse woody debris - That portion of trees that has naturally fallen or been cut and left in the forest. Usually refers to pieces at least 20 inches in diameter. There are four classes used to describe coarse woody debris. The classes range from Class I (which has the least decay, intact bark, and a hard log) to Class IV (i.e., the coarse woody debris has decayed to the point of nearly being incorporated into the forest floor).

commercial thinning - Any type of thinning producing merchantable material at least equal to the value of the direct cost of harvesting.See *thinning*.

Consultation - A formal review between the U.S.Fish and Wildlife Service or National Marine fisheries Service and another federal agency when it is determined that an action by the agency may affect critical habitat or a species that has been listed as threatened or endangered to ensure that the agency's action does not jeopardize a listed species or destroy or adversely modify critical habitat. Critical habitat is an Endangered Species Act term denoting a specified geographic area occupied by a federally listed species, and on which the physical and biological features are found that are essential to the conservation and recovery of that species and that may require special management or protection.

crown - The upper part of a tree that has live branches and foliage.

crown fire - Fire that moves through the crowns of adjacent trees independent of any surface fire. Crown fires can often move faster and ahead of ground fires.

culmination of mean annual increment (CMAI) The age in the growth cycle of a tree or stand at which the *mean annual increment* (MAI) for volume is at its maximum.

cumulative effect - The impact on the environment that results from incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions regardless of which agency or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time.

design features (PDF) - specific actions, requirements, limitations, restrictions and operating methods selected by the IDT as the best ways to achieve resource protection and management objectives.

diameter at breast height (DBH) - The diameter of the stem of a tree measured at 4.5 feet above the ground level on the uphill side of the bole.

dispersal habitat (spotted owl) - Forest habitat that allows northern spotted owls to move (disperse) across the landscape; typically characterized by forest stands with average tree diameters of greater than 11 inches, and conifer overstory trees having closed canopies (greater than 40 percent canopy closure) with open space beneath the canopy to allow owls to fly.

dropped (e.g. some of the canopy gaps and the 117 year old stand) – dropped from this proposed action. The actions may be considered in the future and would be documented in an environmental analysis with a new decision. Dropping these areas does not constitute a change in land use allocations.

effective shade - The proportion of direct beam solar radiation reaching a stream surface to total daily solar radiation.

environmental effects - The direct, indirect and cumulative effects of a proposed action or alternative on existing conditions in the environment in which the action(s) would occur. Also see *baseline*.

fine sediment - Fine-grained soil material, less than 2mm in size, normally deposited by water, but in some cases by wind (aeolian) or gravity (dry ravel).

floodplain Level lowland bordering a stream or river onto which the flow spreads at flood stage.

Forest Operations Inventory (FOI) - An intensive inventory that provides managers with information regarding the age, species, stand location, size, silvicultural needs, and recommended treatment of stands based on individual stand conditions and productivity.

fuel loading - The dry weight of all accumulated live and dead woody and herbaceous material on the forest floor that is available for combustion, and which poses a fire hazard.

green tree - A live tree.

forest habitat - An area containing the forest vegetation with the age class, species composition, structure, sufficient area, and adequate food source to meet some or all of the life needs (such as foraging, roosting, nesting, breeding habitat for northern spotted owls) of specific species.

harvesting -The process of onsite cutting and removing of merchantable trees from a forested area.

Interdisciplinary Team (IDT) - The BLM resource specialists who develop the proposed action and alternatives for a project by evaluating the affected environment, select best management practices to achieve objectives, assess effects and monitor results of projects.

key watershed -A Northwest Forest Plan term that denotes a watershed that contains habitat for potentially threatened species, stocks of anadromous salmonids, or other potentially threatened fish, or is an area of high-quality water and fish habitat. Also see *watershed*.

land use allocation - A designation for a use that is allowed, restricted, or prohibited for a particular area of land, such as the matrix, adaptive management, late-successional reserve, or critical habitat land use allocations.

late-successional forest - A forest that is in its mature stage and contains a diversity of structural characteristics, such as live trees, snags, woody debris, and a patchy, multi-layered canopy.

long term - A period of time used as an analytical timeframe; starts more than 10 years after implementation of a project, depending on the resource being analyzed. Also see *short term*.

mass wasting - The sudden or slow dislodgement and downslope movement of rock, soil, and organic materials.

mature stage - Generally begins as tree growth rates stop increasing (after culmination of mean annual increment), and as tree mortality shifts from density-dependent mortality to density-independent mortality.

merchantable - Trees or stands having the size, quality and condition suitable for marketing under a given economic condition, even if not immediately accessible for logging

modeling - A scientific method that operates by a structured set of rules and procedures to simulate current conditions and predict future conditions. Also see *analysis*.

multi-layered canopy - Forest stands with two or more distinct tree layers in the *canopy*.

National Marine Fisheries Service - A federal agency under the United States Department of Commerce that is responsible for working with others to conserve, protect, and enhance anadromous fish and their habitats. NMFS is an agency in the National Oceanic Atmospheric Administration (National Marine Fisheries Service [NMFS] is now called NOAA Fisheries)

non-point source pollution - Water or air pollutants where the source of the pollutant is not readily identified and is diffuse, such as the runoff from urban areas, agricultural lands, or forest lands. Also see *point source*.

(NWFP) Northwest Forest Plan - Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Related Species within the Range of the Northern Spotted Owl (1994) (Northwest Forest Plan). A 1994 common management approach for the 19 national forests and 7 BLM districts located in the Pacific Northwest ecological region and jointly approved by the Secretary of Agriculture and the Secretary of the Interior.

nutrient cycling - Circulation of elements (such as carbon or nitrogen) between vegetation/organic material and soil, water and air.

old-growth forest - A forest stand usually at least 180-220 years old with moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground.

overstory - That portion of trees forming the uppermost canopy layer in a forest stand and that consists of more than one distinct layer.

plan conformance - The determination that a management action is consistent with the terms, conditions, decisions, and is within the anticipated environmental consequences, of an approved resource management plan.

point source - An origin of water or air pollutants that is readily identified, such as the discharge or runoff from an individual industrial plant or cattle feedlot. Also see *nonpoint source*.

relative density - A means of describing the level of competition among trees or site occupancy in a stand, relative to some theoretical maximum that is based on tree size and species composition. Relative density is determined mathematically by dividing the stand basal area by the square root of the quadratic mean diameter. Also see *basal area and quadratic mean diameter*.

(RMP) Resource Management Plan - Salem District Record of Decision and Resource Management Plan (1995). A BLM planning document, prepared in accordance with Section 202 of the Federal Land Policy and Management Act that presents systematic guidelines for making resource management decisions for a resource area. An RMP is based on an analysis of an area's resources, their existing management, and their capability for alternative uses. RMPs are issue oriented and developed by an interdisciplinary team with public participation.

rotation - The planned number of years between establishment of a forest stand and its regeneration harvest.

salmonid - Fish that are born and reared in freshwater, move to the ocean to grow and mature, and return to freshwater to reproduce. Includes species such as salmon and steelhead. Also see *anadromous fish.*

short term - A period of time used as an analytical timeframe and that is within the first 10 years of the implementation of a resource management plan. Also see *long term*.

silvicultural prescription - A planned series of treatments designed to change current stand structure to one that meets management goals.

snag - Any standing (upright) dead tree.

special forest products (SFP) - Those plant resources that are harvested, gathered, or collected by permit, and have social, economical, or spiritual value. Common examples include mushrooms, firewood, Christmas trees, tree burls, edibles and medicinals, mosses and lichens, floral and greenery, and seeds and cones, but not soil, rocks, fossils, insects, animal parts, or any timber products of commercial value.

special status species - Those species that are listed under the Endangered Species Act as threatened or endangered (including proposed and candidate species); listed by a state as threatened, endangered or candidate species; and listed by the BLM as sensitive species. Under the BLM Special Status Species policy (BLM 6840), the BLM State Director has created an additional category called Bureau Strategic Species (see glossary *Bureau strategic species*).

stand - An aggregation of trees occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition so that it is distinguishable from the forest in adjoining areas.

standards and guidelines - 1995 RMP rules for managing the different land use allocations.

stream, intermittent - Drainage feature with a dry period, normally for three months or more, where the action of flowing water forms a channel with well-defined bed and banks, supporting bed-forms showing annual scour or deposition, within a continuous channel network.

stream, perennial - Permanent channel drainage feature with varying but continuous year-round discharge, where the base level is at or below the water table.

structurally complex stage - Stage at which stands develop characteristics approximating "old-growth" stands.

thinning - A silvicultural treatment made to reduce the density of trees primarily to improve tree/stand growth and vigor, and/or recover potential mortality of trees, generally for commodity use.

timber - Forest crops or stands, or wood that is harvested from forests and is of a character and quality suitable for manufacture into lumber and other wood products rather than for use as fuel.

Timber Production Capability Classification (TPCC) - An analytical tool that inventories and identifies sites as capable of sustaining intensive timber management without it degrading their productive capacity. This tool evaluates a site's soil depth, available moisture, slope, drainage, and stability to determine site capacity for timber management activity. Sites that prove incapable of sustaining intensive timber management are typically not included in the harvest land base.

understory - Portion of trees or other woody vegetation that forms the lower layer in a forest stand, and that consists of more than one distinct layer.

(USFWS) United States Fish and Wildlife Service - A federal agency under the United States Department of the Interior that is responsible for working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats.

watershed - All of the land and water within the boundaries of a drainage area that are separated by land ridges from other drainage areas. Larger watersheds can contain smaller watersheds that all ultimately flow their surface water to a common point.

wetland - land with presence and duration of water, sufficient to support wetland vegetation

wildfire - Any nonstructural fire, other than prescribed burns, that occurs on wildland.

(WUI) wildland/urban interface- The area in which structures and other human development meet or intermingle with undeveloped wildland. The term used primarily for wildfire prevention and suppression. Rural/Urban Interface is used primarily for other recreation and forest management activities.

windthrow - A tree or trees uprooted or felled by the wind.

8.2 Additional Acronyms

BLM – Bureau of Land Management

BS – Bureau Sensitive, a category of species under the Oregon/Washington Special Status Species Policy

DBH – diameter at breast height

EA - Environmental Assessment

ESA – Endangered Species Act

FONSI – Finding of No Significant Impact

GFMA – General Forest Management Area land use allocation (Matrix)

NEPA – National Environmental Policy Act (1969)

ODEQ – Oregon Department of Environmental Quality

RIA – Rural-Urban Interface (recreation, visual and sociological issues)

RMP/FEIS – Salem District Proposed Resource Management Plan / Final Environmental

Impact Statement (1994)

ROW – right-of-way (roads)

RR – Riparian Reserve Land Use Allocation (Riparian Reserves)

SPZ – Stream Protection Zone (no-cut protection zone)

TMDL – total maximum daily load

USDI – United States Department of the Interior

USFS – United States Forest Service

9.0 Literature Cited

Curtis, R.O. 1982. A simple index of stand density for Douglas-fir. Forest Science. 28(1): 92-94

Denman, K.L., et al. 2007 (was IPCC 2007): Couplings Between Changes in the Climate System and Biogeochemistry. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter7.pdf

Forster, P, et al. 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group 1 to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Solomon, S. D., Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller, Eds. Cambridge University Press, U.K. and New York, N.Y. (pp. 129-234). http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter2.pdf

Hardt, R. 2009. Personal communication. Memo on Carbon in Harvested Wood. On file, Cascades Resource Area, Gordon Creek Analysis file.

Hann, Ritchie, Wang, Zumrawi. 2006. Oregon Growth Analysis and Projection System, Growth and Yield Project for Northwest Oregon Forests (ORGANON), NW Oregon Version Edition 8.2, College of Forestry, Oregon State University.

Hann, David W., Chao-huan Wang. 1990. Mortality equations for individual trees in the mixed-conifer zone of southwest Oregon. Corvallis, OR : Forest Research Lab, College of Forestry, Oregon State University

Hudiburg, T. Law, B. Turner, D. Campbel, J. Danato, D. and Duane, M. 2009. Carbon dynamics of Oregon and Northern California forests and potential land-based carbon storage. Ecological Applications, 2009: 163-180.

Kranabetter, J.M. and P. Kroeger. 2001. Ectomycorrhizal mushroom response to partial cutting in a hemlock-western redcedar forest. Canadian Journal of Forest Research 31:978-987.

Li, H.W., G.A. Lamberti, T.N. Pearsons, C.K. Tait, J.L. Li, and J.C. Buckhouse. 1994. Cumulative effects of riparian disturbances along high desert trout streams of the John Day basin, Oregon. Transactions of the American Fisheries Society 123:627-640.

Matthews, Emily, Richard Payne, Mark Rohweder, and Mark Murray. 2000. Pilot Analysis of Global Ecosystems: Forest Ecosystems. Washington D.C.: World Resources Institute 2000.

Miller, R.E., Colbert, S.R., and Morris, L.A. 2004. Effects of heavy equipment on physical properties of soils and on long-term productivity: a review of literature and current research. NCASI Technical Bulletin 887. NCASI, Research Triangle Park, N.C.

Miller, Richard E.; Smith, Jim; Adams, Paul W.; Anderson, Harry W. 2007. Growth of Douglas-fir near equipment trails used for commercial thinning in the Oregon Coast Range. Res. Pap. PNW-RP-574. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 33 p.

Perry, D.A., 1994. Forest Ecosystems. John Hopkins University Press, Baltimore, MD, 649 pp.

Power, W.E., Tausch, W.A.. 1987. Timber Production Capability Classification. TPCC Technical Guide. U.S.D.I. BLM Salem District. OR.

Rashin, E.B., C.J. Clishe, A.T. Loch, and J.M. Bell. 2006. Effectiveness of timber harvest practices for controlling sediment related water quality impacts. J. American Water Resources Association 42(5): 1307-1327

Roberts, Scott D., et al. 2007. Does Variable-Density Thinning Increase Wind Damage in Conifer Stands on the Olympic Peninsula?; West. J. Appl. For. 22 (4). p. 285-296.

Swetnam, T. W. 2002. Fire and climate history in the western Americas from tree rings. *PAGES* News 10(1): 6-8.

U.S. EPA Environmental Protection Agency. 2009. (was U.S. EPA 2007) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2007. U.S. EPA, Washington, D.C. http://www.epa.gov/climatechange/emissions/usinventoryreport.html

USDI – Bureau of Land Management, 2008. Final Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management. Vol. I-III. (2008 FEIS)

USDI. Bureau of Land Management. 1995. Salem District Record of Decision and Resource Management Plan. Salem, Oregon (RMP).

USDI – US Geological Service, 2008. May 14, 2008 Memorandum to the U.S. Fish and Wildlife Service: The Challenges of Linking Carbon Emissions, Atmospheric Greenhouse Gas Concentrations, Global Warming, and Consequential Impacts (Carbon Emissions and Climate Change)

Wilkerson, Ethel, J.M.Hagan, D.Siegel, and A.A. Whitman. 2006. The Effectiveness of Different Buffer Widths for Protecting Headwater Stream Temperature in Maine. Forest Science 52(3) 2006.