United States Department of Agriculture | **Forest Service** | **Umpqua National Forest**

Umpqua National Forest
2900 NW Stewart Parkway
Roseburg, Oregon 97470
(541) 672-6601 FAX 957-3495

File Code: 1950
Date: June 19, 2008

Dear Interested Citizen:

Enclosed is a copy of the Emile Project Environmental Assessment (EA). The North Umpqua Ranger District is giving notice of the opportunity to comment on Alternative 4 of the EA. Alternative 4 proposes to commercially thin about 1,835 acres of second growth forests generating about 26 million board feet of timber. Associated fuels treatments, new temporary road construction (1.0 miles), road reconstruction, road maintenance, and other connected actions would also occur. The proposal includes a project-level Forest Plan amendment. The planning area includes all or portions of T26S, R1E, R1W and R2W; T27S, R1E, R1W and R2W; and T28S R2W, Willamette Meridian, Douglas County, Oregon. Additional copies of the Environmental Assessment are available by calling the North Umpqua Ranger District at the number listed below.

Reviewers should provide the Forest Service with their comments during the 30-day comment period. Comments must be submitted to Forest Supervisor Clifford J. Dils, Umpqua National Forest Supervisor's Office, 2900 NW Stewart Parkway, Roseburg, OR 97470, (541)-672-6601, fax (541)-957-3495. The Supervisor's Office is open from 8:00 am until 4:30 pm, Monday through Friday, excluding legal holidays. Electronic comments must be submitted to: comments-pacificnorthwest-umpqua@fs.fed.us. As the Responsible Official, I will accept oral, electronic, and written comments during the comment period, which ends 30 days from the date this notice is published in the Roseburg News Review, the official newspaper of record. This decision is subject to appeal pursuant to Forest Service regulations at 36 CFR 215.11. Appeals must meet the content requirements of 36 CFR 215.14. Individuals or organizations who submitted comments or expressed an interest in the project during the comment period may appeal. Comments submitted anonymously will be accepted and considered; however, those who only submit anonymous comments will not have standing to appeal the subsequent decision under 36 CFR Part 215.

Additionally, pursuant to 7 CFR 1.27(d), any person may request the agency to withhold a submission from the public record by showing how the Freedom of Information Act (FOIA) permits such confidentiality. Persons requesting such confidentiality should be aware that, under the FOIA, confidentiality may be granted in only very limited circumstances, such as to protect trade secrets. The Forest Service will inform the requester of the agency's decision regarding the request for confidentiality, and where the request is denied, the agency will return the submission and notify the requester that the comments may be resubmitted with or without names and addresses.

Additional information and/or copies of the proposal can be obtained from Sherri Chambers, (541)-496-3532, email schambers@fs.fed.us at the North Umpqua Ranger District, 18782 North Umpqua Highway, Glide, OR 97443; the Ranger District office is open from 8:00 am until 4:30 pm, Monday through Friday, excluding legal holidays.

I want to encourage you to review and comment on this project. If you have questions regarding this project, please contact me or Sherri Chambers, Project Coordinator, at the numbers listed above. Thank you for your continued interest in the Emile Timber Sale Project.

Sincerely,

/s/Clifford J. Dils

Clifford J. Dils
Forest Supervisor

Enclosure

Emile Timber Sale Project

Umpqua National Forest

North Umpqua Ranger District

June 2008

United States Department of Agriculture

Forest Service

Pacific Northwest Region

This page intentionally left blank.

EMILE TIMBER SALE PROJECT

ENVIRONMENTAL ASSESSMENT

Douglas County Oregon

June 2008

Lead Agency: USDA Forest Service, Umpqua National Forest

Responsible Official: Clifford J. Dils, Forest Supervisor
Umpqua National Forest
2900 Northwest Stewart Parkway
Roseburg OR 97470
Phone: (541)-672-6601

For More Information Contact: Sherri L. Chambers, Team Leader
North Umpqua Ranger District
18782 North Umpqua Highway
Glide, OR 97443
Phone: (541)-496-3532
email:schambers@fs.fed.us

Electronic comments can be mailed to: comments-pacificnorthwest-umpqua-northumpqua@fs.fed.us.

Abstract:

This Environmental Assessment (EA) documents three action alternatives and the no action alternative considered for commercially harvesting timber, treating activity generated fuels, conducting road improvement, road construction/reconstruction and road maintenance and implementing connected actions within the Adaptive Management Area, Matrix and Riparian Reserve land allocations of the Little River and Middle North Umpqua watersheds on the Umpqua National Forest, North Umpqua Ranger District. Alternative 4 has been identified as the preferred alternative.

CONTENTS

Page

TABLES

Page

FIGURES

Page

CHAPTER 1

PURPOSE AND NEED FOR ACTION

INTRODUCTION AND ENVIRONMENTAL SETTING

This Environmental Assessment (EA) documents the analysis of a range of alternatives, including the proposed action for timber harvest and associated activities in portions of the Little River and Middle North Umpqua 5th field watersheds located on the North Umpqua Ranger District of the Umpqua National Forest.

Chapter 1 describes the purpose and need for action and the proposed action for the Emile Timber Sale Project. The chapter also identifies the project area, outlines applicable management direction, addresses the scope of the decision, summarizes the scoping process, and lists the issues identified during scoping.

The 35,482-acre Emile planning area is located in the Little River vicinity on the North Umpqua Ranger District, Umpqua National Forest (UNF), approximately 14 road miles southeast of Glide, Oregon (Figure 1). There are about 7,794 acres of privately owned land and 1,172 acres of Bureau of Land Management (BLM) land within the planning area boundary. The Emile planning area encompasses four 6th field subwatersheds-Emile Creek, Little River Headwaters and Upper Little River within the Little River watershed, and Williams Facial in the Middle North Umpqua watershed. The planning area includes all or portions of T26S, R1E, R1W and R2W; T27S, R1E, R1W and R2W; and T28S R2W, Willamette Meridian, Douglas County, Oregon.

RELATIONSHIP TO OTHER PLANNING DOCUMENTS AND ANALYSES

The 1990 Umpqua National Forest Land and Resource Management Plan (LRMP) and its amendments to date, including the 1994 Record of Decision (ROD) for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl, provide broad management direction for the Emile project. The planning and analysis areas are within Management Areas[1] 10 (MA 10) and MA 11, as established in the 1990 LRMP. The northern portion of the planning area contains the Cougar Bluff Inventoried Roadless area; however, no management actions will be proposed in this area in this EA.

Under the 1994 Northwest Forest Plan, the majority of the planning area is allocated as an Adaptive Management Area (AMA). Objectives for AMA's are to develop and test new management approaches to integrate and achieve ecological and economic health and other social objectives. Emphasis for the Little River AMA is the development and testing of approaches to integration of intensive timber production with restoration and maintenance of high quality riparian habitat. The remainder of the planning area lies in the Matrix land allocation, where the majority of timber harvest and silviculture

[1] The 1990 Umpqua LRMP describes the focus of MA 10, which is to produce timber on a cost-efficient sustainable basis consistent with other resource objectives; MA 11 is to provide big game winter range habitat and timber production consistent with other resource objectives. In 1994, the NWFP ROD overlaid additional land allocations of AMA, Matrix, and Riparian Reserves for this planning area.

treatments are to occur and in the Riparian Reserve land allocation where riparian dependant resources receive primary emphasis.

This analysis tiers to the Final Environmental Impact Statement (FEIS) of the 1990 Umpqua National Forest LRMP, as amended and the 2005 Final Environmental Impact Statement for the Pacific Northwest Region Invasive Plant Program. It also incorporates by reference the recommendations and analysis in the 1995 Little River and 2001 Middle North Umpqua Watershed Analyses (WA's) and the 2001 Little River Watershed Total Maximum Daily Load (TMDL) Appendix C Federal Water Quality Restoration Plan.

Project Record

This Environmental Assessment (EA) hereby incorporates by reference the Project Record (40 CFR 1502.21). Chapter 3 provides a summary of the specialists input in adequate detail to support the rationale for the decisions and the appendices provide supporting documentation. The Project Record contains supplemental information and other technical documentation used to support the analysis and conclusions in this EA. This information includes summaries or reports for Silviculture, Hydrology, Fish, Wildlife, Botany, Logging Systems, Economics, Soils and Cultural Resources. Incorporating this information helps implement the CEQ Regulations provision that agencies should reduce NEPA paperwork (40 CFR 1500.4), that environmental documents shall be "analytic rather than encyclopedic, and shall be kept concise and no longer than absolutely necessary (40 CFR 1502.2)". The objective is to furnish adequate site-specific information to demonstrate a reasoned consideration of the environmental impacts of the alternatives and how these impacts can be mitigated, without repeating detailed analysis and background information available elsewhere. The Project Record is available for review at the North Umpqua Ranger District Office, 18782 North Umpqua Highway, Glide, OR 97443.

Watershed Analyses and Landscape Objectives

Both the Middle North Umpqua Watershed Analysis (2001) and the Little River Watershed Analysis (1995) are relevant for this project and both recommend thinning in uplands and Riparian Reserves, in order to move landscape patterns back toward reference conditions (or within the natural range of variability for the watershed). These and other management recommendations for achieving desired future conditions were based on landscape areas and the associated landscape analysis. The subwatersheds that comprise the Emile planning area have multiple broad landscape areas based on relationships between forest vegetation, climate, and physiography[2] (Figure 2). The delineations in Figure 2 each represent broad areas of land that tend to have similar disturbance processes. Inclusions of landforms that differ from this rule can be found at this broad scale of mapping.

[2] Both the Little River and Middle North Umpqua WA's used Geographic Information System's (GIS) to model, map and provide a framework to demonstrate how landform (i.e. topography, elevation, water), climate, vegetation, and disturbance interact to shape aquatic and terrestrial ecosystems in the watersheds. Management recommendations were generated based on these maps and concepts. The landscape area map in Figure 2 represents the current version of these earlier mapping efforts, with a site-specific modification that describes the unique Willow Flats area.

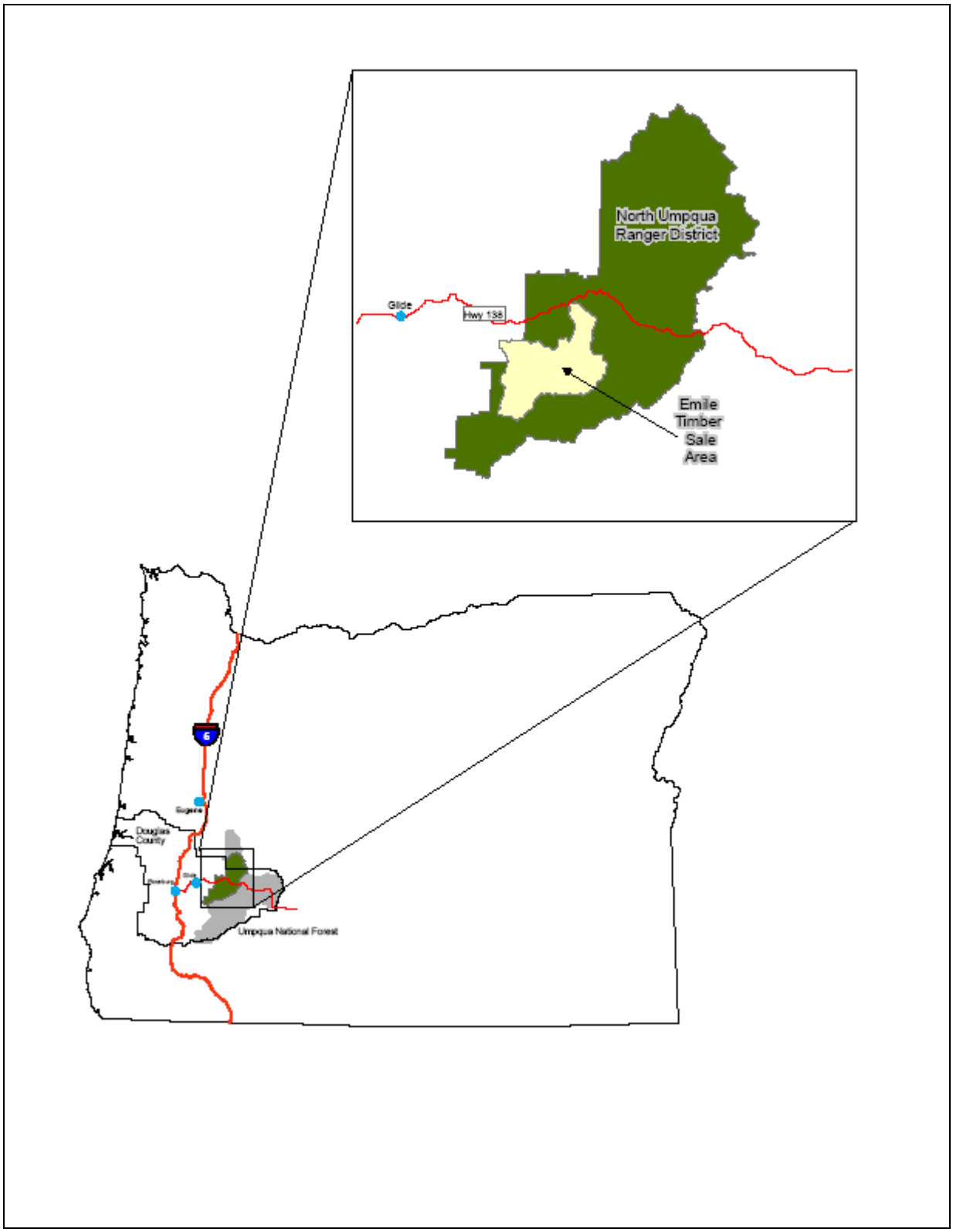


Figure 1. Location of the Emile Planning Area on the North Umpqua RD, Umpqua NF.

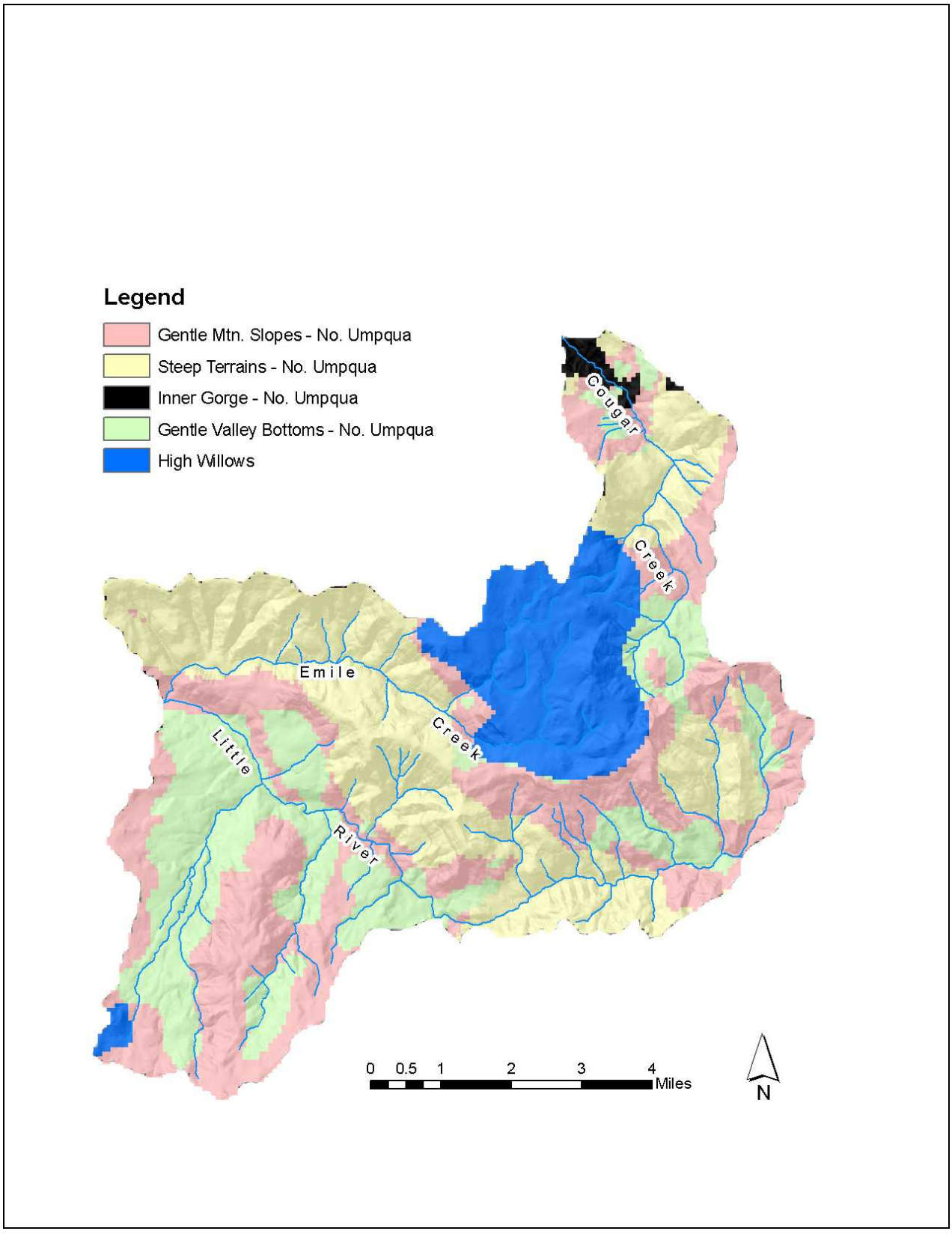


Figure 2. Landscape Areas in the Emile planning area.

The units in the Emile Timber Sale Project fall into four of the landscape areas – gentle valley bottom landscape area, gentle mountain slope landscape area, the steep landscape area, and the "Cascade or High Willows" area.

The gentle valley bottom and Cascades willows landscape areas are the most likely areas to be refuges from frequent fire, due to their gentle topography and high moisture levels through the growing season. Historically, surface fire dominated with limited amounts of crown fire. The gentle mountain slope areas are upper slope areas with lower moisture levels, fewer barriers to fire spread, and historic evidence of larger patches of stand replacement fire compared to the gentle valley bottoms. The steep landscape area is dominated by steep slopes where fire intensity is generally greater and stand replacement fire is more frequent than in the other landscape areas.

Knowledge of landscape scale disturbance and vegetation patterns is useful in developing management strategies that consider disturbance processes. This approach is based on the principle that when an ecosystem element moves outside its historic range, the element, and those elements depending upon it, may not be sustained. This is in keeping with the Aquatic Conservation Strategy of restoring disturbance regimes and managing landscape-scale features.

Four overarching recommendations from the Little River and Middle North Umpqua WA's are relevant for the Emile project and are conceptually summarized below:

- Both WA's recommend a focus on thinning in overstocked managed, mid-successional (stem exclusion) stands with thinning prescriptions based on the concept of landscape areas and natural disturbance regimes[3] (Mid NUMP WA-pg. 123; Little River WA-pg. Recommendations-6,8).

  Many of the stem exclusion stands are in the Cascades willows and gentle valley bottom landscape areas where it is desirable to advance late-successional conditions.

  Some of the stem exclusion stands are located in the gentle mountain slope and steeper terrains where partial stand replacement and stand replacement fire played a more active role and where treatments may somewhat lower risks of large scale stand replacement fires, by reducing ladder fuels and crown bulk densities.

- Both WA's recommend thinning in riparian areas of managed stands to meet watershed restoration objectives such as large trees for stream shading and down wood (Mid Nump WA pg. 135; Little River WA-pg. Recommendations-8, 16).

- Both WA's recommend thinning to promote the health and survival of pine trees (Mid Nump WA pg. 124; Little River WA-pg. Recommendations-4).

- Both WA's acknowledge that a primary objective for Matrix and AMA land allocations is the production of timber based on a scientifically sound and ecologically credible plan and recommend commercial thinning in managed mid-successional stands as a focal area for timber harvest in the watersheds (Mid Nump WA pg. 114, 118-119,123; Little River WA-pgs. Recommendations 8).

[3] Landscape areas are referred to as "land units" in the Little River WA and as landscape areas in the Middle North Umpqua WA.

Additional WA recommendations relevant to the Emile project are listed throughout Chapter 3.

Not every project will implement all watershed analysis recommendations and desired conditions may not be reached with one project alone. The Emile project focuses primarily on the watershed analysis recommendations for stands of second growth timber in the stem exclusion stage of development.

Roads Analyses

An Umpqua Forest-Scale Roads Analysis (USDA, Umpqua NF, 2003) evaluated access issues for key road systems across the forest and recommended further evaluations at the watershed and project scale. The Little River WA (1995) and its appendices contain roads analysis more specific to the Emile planning area; however, the Emile Creek Vicinity was not considered a high priority for further transportation system assessment and planning efforts related to closure or decommissioning of roads in the watershed (Little River WA-pgs. Answers-3). The Little River Watershed TMDL (DEQ 2001) notes that there are road-related restorative opportunities in the watershed, but also acknowledges that because Little River was not identified as a key watershed in the NWFP, that it is not currently a top priority for restoration at the Umpqua National Forest and Roseburg District BLM level. Roads were not a focal point in Emile project development. However, road work needed to accomplish harvest and haul are included and road work needed to mitigate soil compaction or erosion concerns are identified as connected actions.

NEED FOR ACTION

The purpose of the project is to reduce tree density in second-growth stands, in a cost-effective manner, in order to: increase growth, health, and vigor of the leave trees remaining in the stand; restore stand density, and species and structural diversity to those considered characteristic under a natural disturbance regime; and provide wood products to the local economy. A reduction in some natural and activity-generated fuels is an additional beneficial outcome associated with the project.

Previous clearcutting and planting of Douglas-fir in these watersheds, along with the exclusion of fire over the last several decades has created dense, second-growth forest stands in both uplands and riparian areas that are now in the stem exclusion[4] stage of development. Such second growth stands lack the structural and species diversity they would otherwise have if exposed to natural successional pathways, such as fires (Zenner, 2005). Historically, sugar pine trees were naturally abundant on south and west aspects in the planning area and were maintained by the fire regime. Sugar pine trees are currently low in numbers and declining due to heavy previous planting of Douglas-fir, fire exclusion, and occurrence of white pine blister rust.

Dense stand stocking also leads to low growth rates and retards the timely development of some desired riparian habitat characteristics, such as large diameter trees that ultimately provide large down wood to streams. Additionally, dense stocking reduces a

[4] The stem exclusion stage occurs in 20 to 80 year old stands where new species do not appear and some present species are dying from competition. The average tree diameter is about 10" DBH and canopy closure is ≥53%. Thinning accelerates stand development out of this stage.

stand's resistance to wind and fire damage (Poage and Tappeiner, 2002). Densely stocked stands may contain large amounts of vertical fuels, referred to as "ladder fuels" that can carry a surface fire into the canopy, creating a crown fire that greatly increases fire severity and lowers a landscape's resiliency to fire (USDA/USDI, 1998; USDA, Umpqua NF 1997 and 1999).

As described above, the Middle North Umpqua (USDA, 2001) and Little River Watersheds Analysis (USDA, 1995) which encompass the Emile planning area, both document an overabundance of densely-stocked second growth stands in the area and recommend the use of thinning and prescribed fire in these managed stands to move landscape patterns back toward desired reference conditions. The difference between the existing conditions and the desired conditions in the planning area defines the need for action in terms of elements that can be measured. These elements are:

Element 1: Stand Health, Density and Diversity

Currently, the 40-60 year old stands in both upland and riparian areas in the Emile planning area are densely-stocked and dominated by Douglas-fir trees of the same age class. Some of the stands were planted after harvest with species such as ponderosa pine that would not naturally occur on the site. Conversely, sugar pine which occurred historically in stands with south and west aspects is currently absent or is only a minor stand component. In the stands that were pre-commercially thinned, shade tolerant conifers and hardwoods were routinely cut leaving most of today's stands in simplified conditions. Stands are stocked at high levels with densities exceeding 500 trees per acre (total). Most stands lack natural canopy gaps and associated understory diversity.

The desired condition for both upland and riparian second-growth stands is to move the stands toward conditions that approximate those that would typically exist under the natural disturbance regime for the landscape area they are positioned on. Within the gentle and moist landscape areas, the desired stand conditions are multi-layered, late seral stands existing where they likely persisted under the historical fire regime. Within steep and dry landscape areas, desired conditions are those typical of landscapes that experienced frequent fire; single or two-storied stands with a sugar pine component.

Specific to riparian areas, the desired condition is that Riparian Reserves within the stands continue to serve their existing aquatic ecosystem protection functions (effective stream shade, bank stabilization, provision of wood and leaf litter to the stream channel, etc.) at short-term, lower tree densities, but are on a trajectory to provide high quality, sustainable, future late seral riparian habitat in the shortest possible time frame. Future Riparian Reserves would be restored corridors of healthy riparian forests both in species composition and structural diversity of plant communities and would provide adequate summer and winter thermal regulation, nutrient filtering, and more natural rates of surface erosion, bank erosion, and channel migration than currently exist.

Removing some of the standing trees in both upland and riparian portions of the stands would increase growth, health and vigor of the leave trees, reduce stand density and canopy closure, opening up the stands and allowing the development of understory layers and increasing species diversity in some stands (through natural seeding and some planting), and improving stand fire resiliency (to withstand stand replacement fire) in drier locations.

Element 1 would be measured by:

- *Acres thinned to enhance the health and vigor of residual trees and to restore stand density, and species and structural diversity to those considered characteristic under a natural disturbance regime.*
- *Acres of sugar pine trees planted to increase species diversity and restore the pine component of stands.*
- *Acres of Riparian Reserves thinned to accelerate development of desired riparian conditions.*

Element 2: Timber Production

With the exception of the Riparian Reserves where riparian dependant resources receive primary emphasis, the second growth stands in the Emile planning area are located in land allocations where timber production is emphasized. The majority of the stands are in the AMA land allocation. Emphasis for the Little River AMA is the development and testing of approaches to integration of intensive timber production with restoration and maintenance of high quality riparian habitat. The rest of the stands are in the Matrix land allocation, where the majority of timber harvest and silviculture treatments are to occur. The stands are also in MA 10 of the LRMP where timber production on a cost-efficient, sustainable basis is a major goal and MA 11, which emphasizes big game winter range habitat and timber production consistent with other resource objectives.

The desired condition is sustainable, cost-efficient timber production to support current and future economies. In order to produce a sustained yield of timber from these land allocations, harvest needs to occur on a regular basis. This is particularly true in stem exclusion stands where salvaging the predicted suppression mortality improves the growth potential of the leave trees. If left untreated, the unnaturally dense condition of these stem exclusion stands would continue on a track of increased suppression mortality, growth declines, and lost economic opportunities.

Element 2 would be measured by:

- *Board feet of timber produced by commercial thinning.*
- *Cost-efficient thinning measured by benefit/cost ratio and return to the Treasury.*

PROPOSED ACTION

The proposed action (Alternative 2) was designed to meet the purpose and need of reducing tree density in second-growth stands, in a cost-effective manner, in order to: increase growth, health, and vigor of the leave trees remaining in the stand; restore stand density, and species and structural diversity to those considered characteristic under a natural disturbance regime; and provide wood products to the local economy. A reduction in some natural and activity-generated fuels is an additional beneficial outcome associated with the project.

Applicable Standards and Guidelines were applied in deriving the proposed action and alternatives to the proposed action. The most relevant Standards and Guidelines are listed in Chapter 3, but to avoid duplication, all are incorporated by reference.

Alternative 2 is thoroughly detailed in Chapter 2. Terms used in this description are defined at the end of the Alternatives descriptions in Chapter 2. Alternative 2 includes the following:

- Commercial thinning of about 1,835 acres of timber stands using helicopter, ground-based, and skyline logging systems in AMA, Matrix and Riparian Reserve[5] land allocations generating about 25 million board feet of timber.
- Implementing a project-level amendment to the 1990 Forest Plan that would allow thinning within 150 feet of some natural meadows and rock outcrops. Thinning adjacent to these areas would not normally occur under Standards and Guidelines for unique habitats (Wildlife Prescription C5-1, LRMP IV-200), but is considered beneficial for maintaining natural openings and enhancing development of desired stand conditions.
- Planting and pruning rust resistant sugar pine within 29 one-acre gaps[6].
- Treating activity created fuels on 1,171 acres by underburning, crushing, machine piling, pruning/chipping, or handpile burning.
- Using 6 existing landings or rock pits for helicopter logging[7].
- Building a total of approximately 1.0 mile of new temporary spur roads to access thinning areas then obliterating them (subsoiling as necessary, and pulling displaced soil and woody debris over the surface) after use.
- Constructing/reconstructing 7.3 miles of temporary spur roads located on existing old abandoned roads (unclassified roads), skid trails, or firelines to access thinning areas; then obliterating the roads after use.
- Reconstructing 7.0 miles of system roads and repairing 14 additional sites to facilitate hauling logs, including: the placement or replacement of surface rock, the replacement of several undersized or deteriorated stream crossings, armoring culvert outlets, replacing asphalt, stabilizing road fills and road shoulders, reshaping road beds, and the reconstruction of ditches as needed in portions of the roads.

---

[5] Thinning and low intensity fire would be prescribed in outer portions of Riparian Reserves, as needed to move stands toward the desired future condition. The following are the general buffer width guidelines that would be applied to ensure protection of streams and streamside habitats: perennial streams-60 foot buffers; intermittent streams with erosion issues-50 foot buffers; intermittent streams with erosion concerns that are very gently sloped that would not benefit substantially from larger buffers due to topography-25 foot buffers; intermittent streams with steeper side slopes that do not currently demonstrate erosion, but could potentially be impacted by harvesting due to topography-25 foot buffers; Small intermittent channels that are gently sloped with no evidence of erosion problems or anticipated concerns due to harvesting- no buffers; wet unique habitats-150 foot buffers unless roads separate wet area from buffer or as desired to mimic stand conditions occurring under natural disturbance regimes. Burning within the riparian zone to reduce fuel hazard near stream channels would be carefully controlled by allowing fire to back into the no-cut buffers (not started within the no-cut buffers), to minimize fire intensity and mortality of low fire-resistant species such as hemlock, cedar, and true fir.

[6] Based on past experience and the professional opinion of the project silviculturist, canopy gaps that are one acre in size or larger create site conditions conducive to the successful survival, growth and health of young sugar pine seedlings which would be planted in these sites. A clump of 5 trees would be retained within these gaps and subsequently killed with fire to provide snag habitat.

[7] All helicopter landings would be retained following use, but where feasible, landings would be planted with grasses and shrubs to reduce erosion and provide big game forage. No revegetation would occur in rock quarries that are used as helicopter landings.

- Maintaining about 57.5 miles of existing roads including the grading and shaping of existing road surfaces, dust abatement, constructing water bars, cleaning asphalt, ditch maintenance as needed, opening and re-closing existing closed roads, and the cutting of intruding vegetation along roadsides. Asphalt repair and patching would also occur on Road 27 and 4714-330.
- Utilizing the existing Limpy, Coolwater, and Gobbler rock pits, along with several rock stockpile sites as the rock source for the road work, and as disposal areas for material cleaned from ditches, road surfaces and excess excavation.

DECISION TO BE MADE

Based on the analysis documented in this environmental assessment, the Forest Supervisor of the Umpqua National Forest will decide the following:

- To implement the project as proposed; to implement a modified version of the project (an alternative) that addresses unresolved issues; or to not implement the project at this time (no action).
- If the project is implemented, which mitigation measures, project design features, monitoring, and water quality best management practices are necessary to achieve resource goals, objectives, and the desired future condition.
- Whether to amend the Forest Plan as proposed.
- Whether there is a significant effect on the human environment that would require preparation of an Environmental Impact Statement.

SCOPING

Formal scoping (a process used to surface issues) began after the proposed action was developed when the project was first listed in the July 2007 Umpqua National Forest Quarterly Schedule of Proposed Actions (SOPA). A scoping notice describing the project components and soliciting interest in a field trip was sent to the public in October of 2007 with the intent of introducing the proposed action and soliciting issues. Douglas County joined as a Cooperating Agency on the project on November 21, 2007. The Emile project record contains a detailed scoping summary that describes Forest Service outreach efforts, the scoping comments received for the project, and how the Forest Service addressed scoping comments in the Emile EA.

ISSUES

Significant issues associated with a proposed action are the focus of an environmental assessment because they provide the basis for formulating and comparing alternatives to the proposed action (40 CFR 1502.14). Significant issues may also be used to prescribe mitigation and monitoring measures, or they may be used for analyzing environmental effects. Significant issues are based on unresolved conflicts concerning alternative uses of available resources. An issue is a point of disagreement, debate, or dispute about the proposed action based on effects identified through scoping. Scoping identified a number of issues and concerns (non-issues) related to the proposed thinning in the planning area.

The following significant issues were used to develop alternatives to the proposed action:

Issue 1: New Temporary Road Building

Members of several conservation groups believe that building approximately 1.0 miles of new temporary spur roads may cause environmental impacts including long-term affects to aquatic ecosystems, cutbanks, erosion, channeling water, and spreading noxious weeds. Due to these concerns, they requested that new temporary road building be minimized or eliminated. To help quantify and track this issue through the analysis the following indicators were developed:

- Miles of new temporary road construction
- Total acres of thinning accessed by new temporary road construction

Issue 2: Big Game Forage Enhancement

American Forest Resource Council (AFRC) is concerned that the proposed twenty-nine, 1 acre canopy gaps will not create a large enough canopy opening to increase foraging opportunities for big game. They do not believe typical thinning treatments provide the quantity and quality of forage that would be sufficient to sustain wild ungulate populations. AFRC suggests increasing the multiple small patch cut sizes (up to 2-4 acres in size) to provide early successional habitat for species such as Columbian black-tailed deer and Roosevelt Elk. To help quantify and track this issue through the analysis the following indicators were developed:

- Acres of early successional habitat created
- Acres seeded with big game forage mix
- Number of 2-3 acre gaps created

ISSUES THAT DID NOT DRIVE ALTERNATIVES

Several other issues or concerns raised by the public were resolved by clarifying the proposed action (including providing ecological rationale for gap size, additional information about the snag creation strategy, and describing the fate of helicopter landings); these will not be discussed further. One issue was resolved by investigating a suggestion to analyze an instream fish habitat enhancement project as a connected action to the proposed action (see scoping summary). Some issues raised were resolved by developing mitigation measures to address them or by adding contract specifications where appropriate. Other points of debate raised by the public requested full disclosure of the effects of the actions described under the alternatives so that they could fully understand the impacts of the proposal; these points are fully disclosed in Chapter 3 of the EA. As such these issues did not drive the development of an alternative to the proposed action. These are discussed below by category:

Issues Resolved Through Project Design and the Development of Mitigation Measures:

Impacts to Old-growth/Legacy Structures:

Oregon Wild requested that the Forest Service protect any remnant large snags and down logs in the units, and design landings and road construction/reconstruction to avoid the need to remove legacy features. These comments are addressed through

project design and by including mitigation measures in Chapter 2 of the EA. The disclosure of effects regarding this issue is under the Terrestrial Environment portion of Chapter 3 under the topics of Coarse Woody Debris and Threatened and Sensitive Wildlife Species (Northern Spotted Owl).

Umpqua Watersheds noted that there is a tree approximately 100" DBH in the vicinity of Emile Unit 37 and that reconstruction of an old logging road is proposed near this tree. Umpqua Watersheds requested that that the Forest Service do everything necessary to protect any old growth trees within the project area, including protecting roots of old growth trees near road reconstruction activities. They also requested that the Forest Service protect large trees from guy-line damage. These comments are addressed through project design and by including mitigation measures in Chapter 2 of the EA, The disclosure of effects regarding this issue is under the Terrestrial Environment portion of Chapter 3 primarily under the topic of Threatened and Sensitive Wildlife Species (Northern Spotted Owl).

Issues Resolved through Silviculture Prescription and/or Contract Administration

Variable Density Thinning

Several conservation groups requested that the Forest Service use the principals of variable density thinning in the silvicultural prescriptions for harvested stands. Oregon Wild was specifically concerned that prescriptions be designed to retain and restore habitat structures and conditions that would support dispersing owls and their prey. These comments are addressed through the silvicultural prescriptions under the proposed action.

Specifically, the desired future conditions for stands proposed for harvest are based on landtype association. Landtype association defines natural disturbance regimes based on slope, aspect, elevation, geology, and plant association. Two primary desired future conditions were outlined for proposed harvest units. Within the gentle/moist landtype, where late-seral refugia may have persisted under the natural disturbance regime, the desired future condition is a multi-storied stand with high tree density and high levels of standing and down dead wood. Within the steep/dry landtype, where fires burned more frequently, the desired future condition is a two-storied stand with low to moderate tree density and low to moderate levels of standing and down dead wood. Thinning designed to achieve these different desired future conditions would contribute to the diversity of stand structure at the landscape scale. Other factors outlined in the prescription that add to the diversity of stand structure and density include varying the leave tree density between stands and adding one-acre gaps on south/west aspects to reintroduce native, rust resistant sugar pine.

Other proposed management actions would add diversity of stand structure and density within individual harvested stands in the short term. Snag creation, fuels treatment, and logging practices (landings, skid trails, skyline corridors) would create small gaps in the short term. In the long term, small scale natural disturbance processes (root disease, insects, blowdown, and fire) would create small gaps within stands. The disclosure of effects regarding maintenance of spotted owl dispersal habitat is under the Terrestrial Environment portion of Chapter 3 primarily under the topic of Threatened and Sensitive Wildlife Species (Northern Spotted Owl).

Retention of Remnant Old-Growth Trees

Oregon Wild requested that the Forest Service develop an alternative that uses a diameter limit or otherwise has protections for other old-growth trees and structures.

They want to ensure that all remnant old-growth trees are protected and also request protection for smaller trees that exhibit old-growth characteristics such as forked tops and "wolfy" limbs. These comments are addressed through the existing condition and the silvicultural prescription. Specifically, the stands proposed for commercial thinning were clear-cut harvested in 1949-1965, therefore there are very limited old growth remnants (i.e. Pacific yew) existing in the stands today. Additionally, in most cases under the proposed action, the largest dominant second growth trees would be retained through implementation of Designation by Description (DxD) contract specifications outlined in the silvicultural prescription, similar to a thinning from below. Trees with forked tops or wolfy limbs would not be singled out for harvest under DxD contract specifications. Minor species, other than Douglas-fir, would also be retained under the silvicultural prescription and these minor species trees often exhibit poor form and forked tops because of their crown position (suppressed and intermediate) within the surrounding canopy.

Retention of Minor Species

Cascadia Wildlands requested that silvicultural prescriptions and DxD specifications retain minor species in the harvested stand. Umpqua Watersheds also requested that silvicultural prescriptions protect and restore minor species within the project area. These comments are addressed by the silvicultural prescription under the proposed action which would include retention of minor species. Minor species would not be part of DxD contract spacing specifications. Additionally, proposed sugar pine planting would restore minor species in ecologically appropriate locations in treated stands.

Retention of Clumpiness

Cascadia Wildlands was concerned that thinning with DxD specifications would eliminate the 'clumpiness' found in some stands. Specifically, they noted that DXD does not allow for retention of a clump of Douglas-firs. Cascadia Wildlands requested that retention of some number of clumps/acre be retained in the harvested stands. These comments are addressed by the silvicultural prescription under the proposed action which identifies measures to add diversity of stand structure and density within individual harvested stands in the short-term. Measures that encourage clumping include retaining all minor species and retaining Douglas-fir in clumps if their boles are within two feet of each other at ground level. In the long-term, clumping would result from the growth and development of existing and future conifer understories.

Issues Through which Disclosure of Effects was Requested in Chapter 3 of the EA:

Economic Viability

AFRC was concerned that all Forest Service timber sales be economically viable. These comments are addressed by disclosure of benefit/cost ratios and return to the Treasury for all alternatives in the Social Environment portion of Chapter 3 under the topic of Economics.

Impacts of Helicopter Landings

Oregon Wild and Umpqua Watersheds were concerned that helicopter landings have the potential to remove large trees that otherwise would not be cut, leave huge piles of slash that could detrimentally affect soils when burned, and permanently compact soils. Oregon Wild requested that the Forest Service thoroughly analyze the impacts of the proposed new helicopter landing and the use of the existing ones and disclose the

impacts to vegetation, soil, water quality, and wildlife. Umpqua Watersheds requested that the Forest Service describe the impacts of the new helicopter landing construction along with all the other transportation effects and disclose if the one new landing would be permanent or temporary. These comments were addressed by dropping the helicopter landing that would require new construction and selecting an alternate location that would entail reconstruction of an existing landing. All other comments are addressed by fully disclosing impacts of helicopter landings in Chapter 3 of the EA.

Impacts of Roads:

Oregon Wild requested that the Forest Service consider whether benefits of road management outweigh negative impacts, including whether the degradation of soil is offset by long-term benefits brought about by the proposed action, and a stand by stand description of the road spur lengths and the acres each spur accesses for thinning. The acres accessed by spur roads analysis is displayed under the Social Environment under the topic of Access and the impacts to soils is disclosed under the Terrestrial Environment under the topics of Soil Productivity and Erosion.

Leonard Volland requested that the Forest Service address the following questions/concerns regarding road impacts and fish habitat: whether the road work and other structural upgrades potentially affect any salmon or steelhead spawning habitat within or adjacent to the project area. Whether there has been any slope or road failure since the last entry that dumped debris or mass wasting into the creeks. These questions are addressed under the Aquatic Environment under the topics of Stream Channels and Fisheries.

Impacts of Ground-based Logging

Oregon Wild requested that the Forest Service complete an analysis and disclose the impacts of over 1,000 acres of ground-based logging on soil, water, and vegetation resources. They also asked that if necessary, the Forest Service consider changing some areas from ground-based to skyline or helicopter yarding to minimize damage. These comments are addressed by fully disclosing impacts of ground-based logging in Chapter 3 of the EA and through multiple mitigation measures and project design features detailed in Chapter 2.

Impacts of Magnesium Chloride

Umpqua Watersheds is concerned about the proposed application of magnesium chloride salt to roads for dust abatement. They requested that the EA describe: why this chemical is necessary, how much will be applied, consider the effects of magnesium chloride on road-side vegetation; consider if salt moves into roadside ecosystems and has impacts on vegetation or water quality; and document the cumulative effects of chloride in the watershed, including the estimated amount used by non-federal landowners. These comments are addressed by providing additional information about magnesium chloride in the proposed action and through disclosure of effects in Chapter 3 of the EA.

Old-Growth Species Effects Analysis

Oregon Wild requested that the Forest Service describe potential impacts on old-growth species including an analysis of effects on such species as the Northern spotted owl, goshawk, bats, Canada Lynx, woodpeckers, Pine Marten, California Wolverine, Great Gray Owl, Pygmy Nuthatch or Bald Eagle, and other special status species listed in applicable management plans. These comments were addressed by completing effects

analysis for all relevant R6 Regional Forester Sensitive, Rare and Uncommon, Management Indicator Species and Landbirds in Chapter 3 of the EA under the Terrestrial Environment.

ACS Objectives:

Oregon Wild requested that the project analysis should separately discuss each of the Aquatic Conservation Strategy objectives (under the Northwest Forest Plan). This comment is addressed by discussing the nine ACS objectives in Chapter 3 of the EA.

Impacts to Water Quality and Riparian Reserves:

Oregon Wild requested that the Forest Service analyze and disclose impacts to Riparian Reserves and water quality from logging, yarding, and road management. The disclosure of effects regarding this issue is under the Aquatic Environment portion of Chapter 3 under the topics of Water Quality and Riparian Reserves.

Impacts to Recreation

Umpqua Watersheds noted that some of the roads proposed for timber haul pass the trailhead to two popular recreation areas, Grotto Falls and the Emile Big Tree. They requested that the EA describe impacts to the recreation use from the logging operation. For instance, if log trucks use the trail-head turn outs, would they visually degrade it? These comments are addressed in the EA under Specifically Required and Other Disclosures under the topic of Recreation.

Cumulative Effects

Oregon Wild and Umpqua Watersheds requested that the Forest Service consider the cumulative impacts to the watershed from the nearby Roseburg Bureau of Land Management Emile Timber Sale. These comments are addressed through confirmation with the BLM that this sale has been withdrawn from consideration indefinitely.

Non-significant issues

One issue raised during scoping was dismissed as a non-significant issue. Non-significant issues include those that are outside the scope of the proposed action, are already decided by law, regulation, Forest Plan, or other higher level decision.

Road Decommissioning and Obliteration

Several conservation groups requested that the Forest Service include road decommissioning/obliteration in the project. This issue was determined to be non-significant because road-based restoration was not identified in the purpose and need for the Emile project and as such decommissioning of system roads is considered to be outside the scope of the project. However, through the obliteration of unclassified roads, this project would reduce the footprint of roads on the landscape and result in a net decrease in existing roads in the project area.

PROJECT IMPLEMENTATION

Should an action alternative be selected as a result of this NEPA process, the Forest Service would implement most of the timber harvest, road construction and reconstruction through timber sale contracts. All action alternatives would likely result in 3-5 separate timber sale contracts.

The Forest Service may also choose to use a contracting tool, called stewardship contracting authorized by Congress and spelled out under the January 28, 2004 Forest

Service Washington Office Interim Directive (FSH 2409.19, Chapter 60). Stewardship contracting is a tool used to accomplish resource management projects, in collaboration with interested publics, where goods are exchanged for services. Service contracts or construction contracts can also be used to accomplish some of the connected actions, which can be funded by other sources.

In the course of implementing complex projects with many acres of harvest, fuel treatment, and several connected actions, minor changes may be needed during implementation to better meet on-site resource management and protection objectives. For example, fuels prescriptions may be modified if site conditions dictate and if other resource objectives can be met. Minor adjustments to unit boundaries may be needed during final layout for resource protection, to improve logging system efficiency, and to better meet the intent of the resource prescriptions. Changes in aspects of logging systems, including locations of temporary spur roads may be required to better facilitate logging systems and provide for resource protection. Many of these minor changes would not present sufficient potential impacts to require any specific documentation or action to comply with applicable laws.

In determining whether and what kind of further NEPA action is required to document any changes, the criteria for whether to supplement an existing Environmental Assessment (FSH 1909.15, sec. 18) would be followed.

CHAPTER 2

ALTERNATIVES, INCLUDING THE PROPOSED ACTION

INTRODUCTION

The National Environmental Policy Act (NEPA) requires analysis of a proposed action and other reasonable alternatives, including no action. The no action alternative provides a baseline for estimating environmental effects. Four alternatives, including no action, for the Emile Timber Sale Project are considered in detail. The proposed action was developed to meet the purpose and need established by the District Ranger and Alternatives 3 and 4 were developed in response to significant issues identified during scoping. No other alternatives were considered, but eliminated from detailed study.

ALTERNATIVE 1 – NO ACTION

Under Alternative 1, no thinning, fuel treatment, road construction, reconstruction, or maintenance, or other connected activities, including tree planting, pruning, pre-commercial thinning and associated slash treatments, erosion control, stream channel stabilization, subsoiling, noxious weed treatments or revegetation of bare ground would take place. No ground-disturbing activities would take place and no timber would be offered for sale. On-going activities, including road maintenance, recreation use, and noxious weed control would continue to occur (Table 8, Chapter 3). Future activities, such as those described in Table 9 (Chapter 3) would also occur.

ALTERNATIVE 2 - PROPOSED ACTION (FIGURE 3, TABLE 1)

This alternative is the proposed action used in the scoping process. The proposed action was developed to meet the purpose and need. It includes the following:

- Commercial thinning of about 1,835 acres of timber stands using helicopter, ground-based, and skyline logging systems in AMA, Matrix and Riparian Reserve land allocations generating about 25 million board feet of timber.
- Implementing a project-level amendment to the 1990 Forest Plan that would allow thinning within 150 feet of some natural meadows and rock outcrops. Thinning adjacent to these areas would not normally occur under Standards and Guidelines for unique habitats (Wildlife Prescription C5-1, LRMP IV-200), but is considered beneficial for maintaining natural openings and enhancing development of desired stand conditions.
- Planting and pruning rust resistant sugar pine within 29 one-acre gaps[8].
- Treating activity created fuels on 1,171 acres by underburning, crushing, machine piling, pruning/chipping, or handpile burning.
- Using 6 existing landings or rock pits for helicopter logging[9].

[8] Based on past experience and the professional opinion of the project silviculturist canopy gaps that are one acre in size or larger create site conditions conducive to the successful survival, growth and health of young sugar pine seedlings which would be planted in these sites. A clump of 5 trees would be retained within these gaps and subsequently killed with fire to provide snag habitat.

- Building a total of 1.0 miles of new temporary spur roads to access thinning areas then obliterating them (subsoiling as necessary, and pulling displaced soil and woody debris over the surface) after use.
- Constructing/reconstructing 7.3 miles of temporary spur roads located on existing old abandoned roads (unclassified roads), skid trails, or firelines to access thinning areas; then obliterating the roads after use.
- Reconstructing 7.0 miles and 14 sites of system roads to facilitate hauling logs including the placement or replacement of surface rock, the replacement of several undersized or deteriorated stream crossings, armoring culvert outlets, replacing asphalt, stabilizing road fills and road shoulders, reshaping road beds, and the reconstruction of ditches as needed in portions of the roads.
- Maintaining about 57.5 miles of existing roads including the grading and shaping of existing road surfaces, dust abatement, constructing water bars, cleaning asphalt, ditch maintenance as needed, opening and re-closing existing closed roads, and the cutting of intruding vegetation along roadsides. Asphalt repair and patching would also occur on Road 27 and 4714-330.
- Utilizing the existing Limpy, Coolwater, and Gobbler rock pits, along with several rock stockpile sites as the rock source for the road work, and as disposal areas for material cleaned from ditches, road surfaces and excess excavation.

[9] All helicopter landings would be retained following use, but where feasible, landings would be planted with grasses and shrubs to reduce erosion and provide big game forage. No revegetation would occur in rock quarries that are used as helicopter landings.

Figure 3. Alternative 2 – Proposed Action

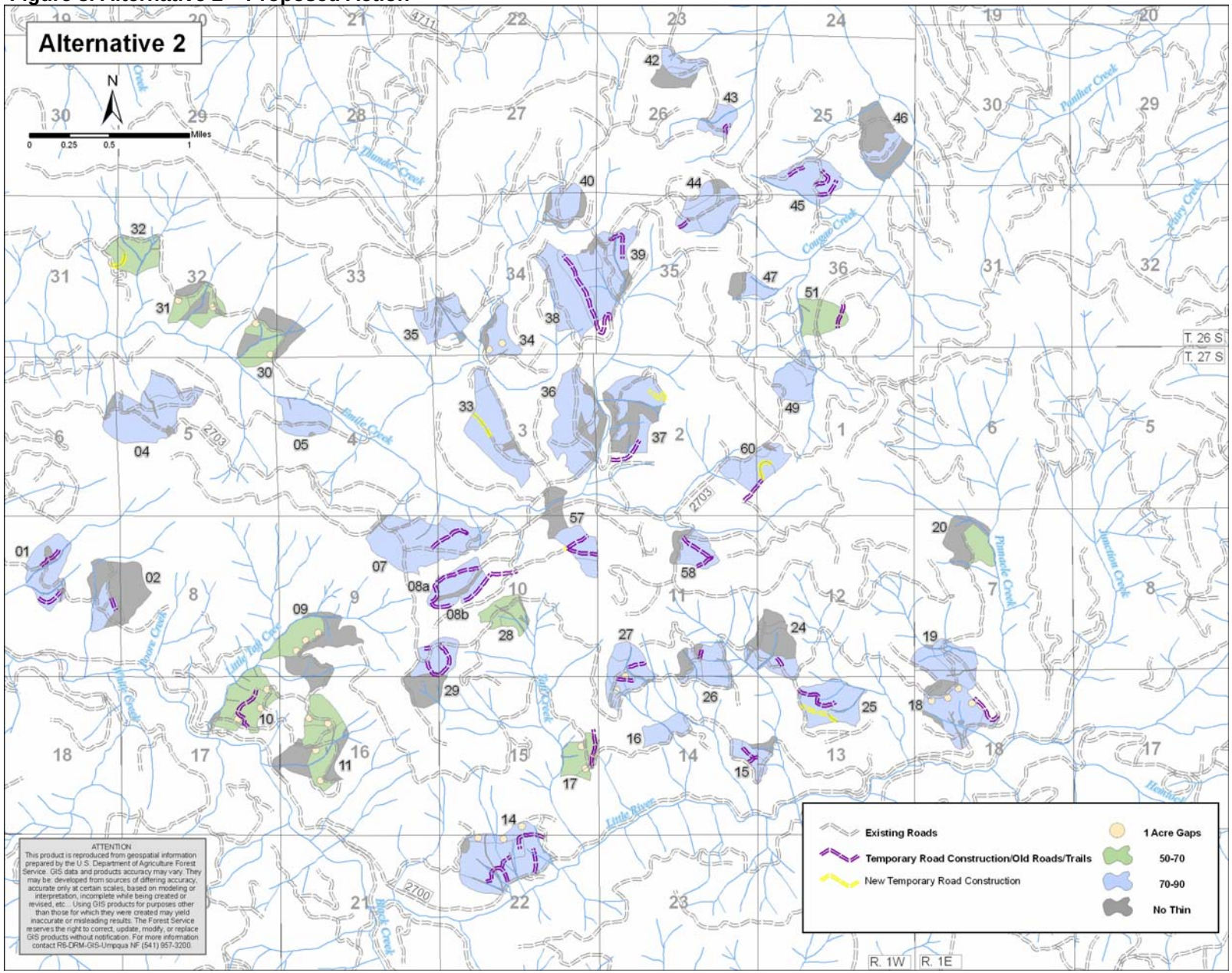


Table 1. Alternative 2 unit summary.

Unit #	Total Acres in Unit	Thinned Acres in Unit	Unthinned Acres in Unit	Harvest Prescription[10] (trees per acre retained)	Volume Removed (thousand board feet)	Fuels Treatment Acres[11]		Logging Systems Acres[12]		
						Acres treated	Acres not Treated	Ground Based	Skyline	Heli-copter
1	56	44	12	70-90	528	44	0	36	8	0
2	81	18	63	70-90	216	18	0	7	11	0
4	102	94	8	70-90	1410	94	0	55	39	0
5	40	37	3	70-90	555	16	21	13	24	0
7	114	110	4	70-90	1650	110	0	90	20	0
8a	31	26	5	70-90	312	0	26	26	0	0
8b	14	14	0	70-90	168	0	14	0	14	0
9*	88	31	57	50-70	465	31	0	0	31	0
10*	61	56	5	50-70	840	56	0	3	53	0
11*	94	56	38	50-70	840	56	0	22	34	0
14*	112	98	14	70-90	1470	98	0	61	12	25
15	26	20	6	70-90	300	20	0	8	12	0
16	24	22	2	70-90	330	22	0	10	0	12
17*	30	27	3	50-70	405	27	0	2	25	0
18*	68	52	16	70-90	520	52	0	11	41	0
19	53	45	8	70-90	675	45	0	18	27	0
20	50	20	30	50-70	300	0	20	0	20	0
24	61	18	43	70-90	270	18	0	11	7	0
25	59	54	5	70-90	810	19	35	18	36	0
26	48	35	13	70-90	525	7	28	19	16	0
27*	50	45	5	70-90	675	45	0	14	24	7
28	31	24	7	50-70	288	24	0	10	5	9
29	59	32	27	70-90	320	32	0	32	0	0
30*	60	26	34	50-70	390	26	0	0	26	0

[10]The prescriptions were applied to each unit depending on slope, aspect, and landtype association and are intended to increase growth, health, and vigor of the leave trees. The 70-90 TPA prescription is intended to develop multi-layered, late seral habitat within gentle/moist landtypes, where it may have persisted under the historical fire regime; the 50-70 TPA prescription is intended to develop single or two-storied stand conditions within steep/dry landtypes, typical of the historical fire regime.

[11] Fuel treatments may include: GP – Grapple Pile Burn, UB – Underburn, HP – Handpile Burn, Roadside Grapple - GPR and Handpile - HPR) for 100 feet, Prune and Chip and NT – No Treatment..

[12] Logging Systems include ground based (loader, mechanized, and cut-to-length); skyline (yoader skyline, multispan skyline, and downhill skyline); and helicopter.

Unit #	Total Acres in Unit	Thinned Acres in Unit	Unthinned Acres in Unit	Harvest Prescription[10] (trees per acre retained)	Volume Removed (thousand board feet)	Fuels Treatment Acres[11]		Logging Systems Acres[12]		
						Acres treated	Acres not Treated	Ground Based	Skyline	Heli-copter
31*	44	28	16	50-70	336	28	0	2	26	0
32	40	32	8	50-70	320	32	0	7	25	0
33	83	78	5	70-90	1014	10	68	46	32	0
34*	31	26	5	70-90	390	4	22	26	0	0
35	46	39	7	70-90	468	15	24	26	13	0
36	102	80	22	70-90	800	0	80	80	0	0
37	86	49	37	70-90	637	0	49	28	21	0
38	113	108	5	70-90	1620	15	93	76	32	0
39	47	35	12	70-90	420	29	6	26	9	0
40	35	26	9	70-90	390	26	0	26	0	0
42	34	19	15	70-90	228	0	19	16	3	0
43	21	17	4	70-90	170	5	12	6	11	0
44	58	52	6	70-90	520	15	37	18	34	0
45	53	51	2	70-90	612	51	0	51	0	0
46	63	14	49	70-90	168	14	0	9	5	0
47	22	10	12	70-90	150	2	8	0	10	0
49	38	35	3	70-90	525	14	21	35	0	0
51	35	32	3	50-70	480	9	23	3	29	0
57	53	30	23	70-90	450	30	0	4	19	7
58	34	26	8	70-90	260	6	20	3	23	0
60	46	44	2	70-90	660	6	38	19	25	0
Tot	**2,496**	**1,835**	**661**		**24,880**	**1,171**	**664**	**973**	**802**	**60**

*These units contain one-acre "gaps" where all but five trees will be removed and sugar pine will be planted. The five retained trees will be killed with fire to provide snag habitat.
NOTE: Acres in all categories and volume estimates were rounded; column totals may not exactly add up, but are within +/- 10% variance.

Proposed Road Work

New Temporary Road Construction/Obliteration

The 1.0 miles of new temporary road to be constructed under Alternative 2 would provide access into units 25, 32, 33, 37, 57, and 60. These would be native surface roads, with rock added to limited locations where soil moisture requires the use of rock to effectively pass log trucks. Temporary roads are typically constructed with a tractor. After logging they would be obliterated with an excavator equipped with a "winged ripper" to decompact soil as needed. Any excavated material, including soil and woody

material, would be pulled back over the road to re-establish the original contour as much as feasible.

Temporary Road Construction/Reconstruction on Existing Abandoned Roads, Skid Roads/Trails and Firelines and Obliteration after Use

The 7.3 miles of temporary spur road to be constructed/reconstructed would provide access into units 1, 2, 7, 8, 10, 14,15,17,18, 24-27, 37-39, 43-45, 51, 52, 57, 60. These temporary roads are located on: existing abandoned or unclassified roads[13] that were built 40 to 50 years ago to provide logging access to the original clearcuts; existing old skid roads and trails used in previous timber harvest; or on the footprint of old firelines accessing the units. All of the 7.3 miles of temporary road would be obliterated following the thinning operation as described above.

System Road Reconstruction

Alternative 2 would include the reconstruction of 7.0 miles of existing system road[14] and repair of an additional 14 sites on the haul route, to meet standards and guidelines of the Northwest Forest Plan in order to accommodate flood flows, minimize the disruption of natural water flow pathways, and lessen risk of erosion (ROD C 32-33), while providing for safe, cost-effective timber haul. About 1.8 miles of roads proposed for reconstruction are existing closed roads (maintenance level 1 roads[15]) that would be opened for log haul and then reclosed after use; the remainder is existing open roads that would remain open after use.

Reconstruction activities would include: placement or replacement of surface rock, the replacement of several undersized or deteriorated stream crossings, armoring culvert outlets, replacing asphalt, stabilizing road fills and road shoulders, reshaping road beds, and the reconstruction of ditches as needed in portions of the roads. Road reconstruction would be done using heavy equipment such as an excavator, backhoe, road grader, dump truck, and a water truck.

Rock for these reconstruction activities would be generated from the existing Limpy, Coolwater and Gobbler rock quarries. Work at these existing quarries would include drilling, blasting, rock crushing, hauling, and removal of second growth trees in order to access additional rock faces for use. Other existing rock stockpiles in the watershed would also be used, but no ground disturbance at these sites would be necessary other than the haul of the rock on existing roads.

Road maintenance

Alternative 2 would include road maintenance on 57.5 miles of existing system roads where timber haul would occur. This work would be done by timber sale purchasers using a variety of equipment such as a road grader, dump truck, backhoe, water truck,

---

[13] An unclassified road is not constructed, maintained, or intended for long-term use.

[14] System roads are constructed or maintained for long-term use. They can be open for use or closed depending on their maintenance level and the original objective for which the road was built.

[15] Maintenance level 1 roads are system roads that are blocked year-round. Though part of the long-term road system, they are not available for use due to the road surface (native surface), or degree of maintenance, or other considerations. Maintenance level 1 roads may be re-opened for a specific use such as timber harvest or fire control and then re-blocked following use.

and a street sweeper on paved sections. The road maintenance under Alternative 2 would include:

- •Opening and closing (upon completion of haul) currently closed roads;
- •Logging out (removing downed trees, large rocks, slides, etc.) roads;
- •Brushing roads and road sides;
- •Blading road beds, including ditches where needed;
- •Cleaning existing culverts at ditch relief and stream crossing locations as needed for proper drainage;
- •Constructing water bars on some existing system roads (both closed and open) as needed for proper drainage;
- •Asphalt repair and patching on Road 27 and 4714-330.
- •Applying magnesium chloride for dust abatement[16].
- •Hazard tree felling to meet OSHA requirements.

Winter Haul

Although opportunities are considered to be limited in the project area due to the elevation of the units, under Alternative 2 timber may be logged and hauled outside the normal operating season as long as road conditions and water quality would not be impacted.

Connected Actions

Connected actions are those actions that depend on the proposed action to be implemented, are mitigation or design features that may be required to implement the proposed action, and/or are located within the sale area boundary. Table 2 displays the connected actions and how they contribute to meeting the purpose and need.

Table 2. Connected Actions Under the Action Alternatives.

Action	Alt 2	Alt 3	Alt 4	Element of Purpose and Need Met or Rationale
Acres of Reforestation: • Planting sugar pine	29	29	47	Element 1 – increases diversity by re-introducing native species and increases sugar pine health by planting blister rust resistant stock.
Acres of pruning sugar pine to increase resistance to blister rust.	29	29	47	Element 1 – increases diversity by sustaining native species.
Acres of seeding with big game forage mix: • Seeding in gaps • Seeding on temporary roads, major skid trails, landings, appropriate helicopter landings, and selected areas of noxious weed treatment.	 0 49	 0 47	 47 49	Element 1 – increases diversity by sustaining native species and reducing weed spread

[16] Magnesium chloride would be applied at a rate of 19 tons per mile for a single application each operating season for roads that would have 3 mmbf of timber hauled over them. Estimated total miles of dust abatement for this project is 15 miles; 4 miles of FS Road 27 and 11 miles of FS Road 2703. (See Transportation System for additional information).

Action	Alt 2	Alt 3	Alt 4	Element of Purpose and Need Met or Rationale
Acres of precommercial thinning	1,751	1,751	1,751	Element 1 – increases diversity and health and vigor of managed stands.
Acres of precommercial thinning slash treatment by hand piling, pruning and or chipping.	700	700	700	Element 1 – improves stand resiliency to fire by reducing fuel loads.
• Acres of Subsoiling[17]	71	66	71	Element 1 – increases diversity; required to meet Standards and Guidelines.
• Snag Creation – number of snags created[18]	6,235	6,235	6,235	Element 1 – increases diversity; required to meet Standards and Guidelines.
Road Improvements for Erosion Control • Rolling-dips installed on erosion prone roads • Replacement of culverts with high erosion potential[19]	10-15 2	10-15 2	10-15 2	Element 1 – maintains and enhances stream/riparian function.
Addition of Large Wood for Stream Channel Stabilization • # of trees felled into streams within units	75	75	75	Element 1 – maintains and enhances stream/riparian function.
Noxious Weed Treatment: Year 1 • Acres of competitive planting[20] • Acres of weed control	49 184	47 175	96 184	Element 1 – maintains diversity by reducing weed spread.
Noxious Weed Treatment: Year 2: • Acres of weed control	128	123	128	Element 1 – maintains diversity by reducing weed spread.
Acres of Revegetation of Bare Ground	10	10	10	Element 1 – maintains diversity.

[17] Subsoiling is prescribed on skid trails and landings in some units as mitigation where the preexisting amount of soil compaction exceeds standards and guidelines and subsoiling would bring the levels of detrimental soil conditions within Forest Plan standards (approximately 44 acres). In other cases, subsoiling would be done in highly compacted areas outside unit boundaries but within the anticipated sale area boundary (approximately 27 acres).

[18] Snag creation as required mitigation would occur to meet DecAID 50% tolerance levels for units adjacent to spotted owl cores and in spotted owl Critical Habitat Units; this equates to creation of five snags per acre on approximately 1,247 acres. For the remaining areas (approximately 588 acres), snag habitat would be managed to meet DecAID 30% tolerance levels; this would require no additional active snag creation. Probable methods of active snag creation would include: (1) use of prescribed fire to create clumps of snags in all units that would be underburned; (2) use of prescribed fire to create clumps of 5 snags/acre within all sugar pine gaps; (3) use of prescribed fire to kill clumps of off-site ponderosa pine trees; and (4) fungal inoculation (preferred method), topping, or girdling to create clumps of snags where fire is not a practical/desired tool.

[19] One of the culverts would be replaced as required mitigation in association with Alternative 2 and one culvert is within the anticipated sale area boundary.

[20] These are the same acres described as big game forage seeding acres above.

ALTERNATIVE 3 (FIGURE 4, TABLE 3)

Alternative 3 was developed to meet the purpose and need and to respond to the issue of potential environmental impacts associated with the construction of new temporary roads. Alternative 3 responds to the issue of roads impacts by dropping 0.4 miles of new temporary road construction as compared to Alternative 2. Specifically, Alternative 3 would construct 0.6 miles of new temporary roads to provide thinning access to four units (as compared to 1.0 miles proposed under Alternative 2). Alternative 3 would also reduce temporary road reconstruction by approximately 0.2 miles, reduce system road maintenance by one mile, and lower the number of system road repair sites by four, as compared to Alternative 2.

As a result of eliminating new temporary road construction under this alternative, Alternative 3 drops unit 37 and portions of unit 33; and would thin 81 less acres than Alternative 2. The timber output of Alternative 3 would be about 4% less than Alternative 2, harvesting about 24 million board feet.

Alternative 3 includes the following:

- Commercial thinning of about 1,754 acres of timber stands using helicopter, ground-based, and skyline logging systems in AMA, Matrix and Riparian Reserve land allocations generating about 24 million board feet of timber.
- Implementing a project-level amendment to the 1990 Forest Plan that would allow thinning within 150 feet of some natural meadows and rock outcrops. Thinning adjacent to these areas would not normally occur under Standards and Guidelines for unique habitats (Wildlife Prescription C5-1, LRMP IV-200), but is considered beneficial for maintaining natural openings and enhancing development of desired stand conditions.
- Planting and pruning rust resistant sugar pine within 29 one-acre gaps[21].
- Treating activity created fuels on 1,171 acres by underburning, crushing, machine piling, pruning/chipping, or handpile burning.
- Using 6 existing landings or rock pits for helicopter logging[22].
- Building a total of 0.6 miles of new temporary spur roads to access thinning areas then obliterating them (subsoiling as necessary, and pulling displaced soil and woody debris over the surface) after use.
- Constructing/reconstructing 7.1 miles of temporary spur roads located on existing old abandoned roads (unclassified roads), skid trails, or firelines to access thinning areas; then obliterating the roads after use.
- Reconstructing 7.0 miles and 10 sites of system roads to facilitate hauling logs including the placement or replacement of surface rock, the replacement of

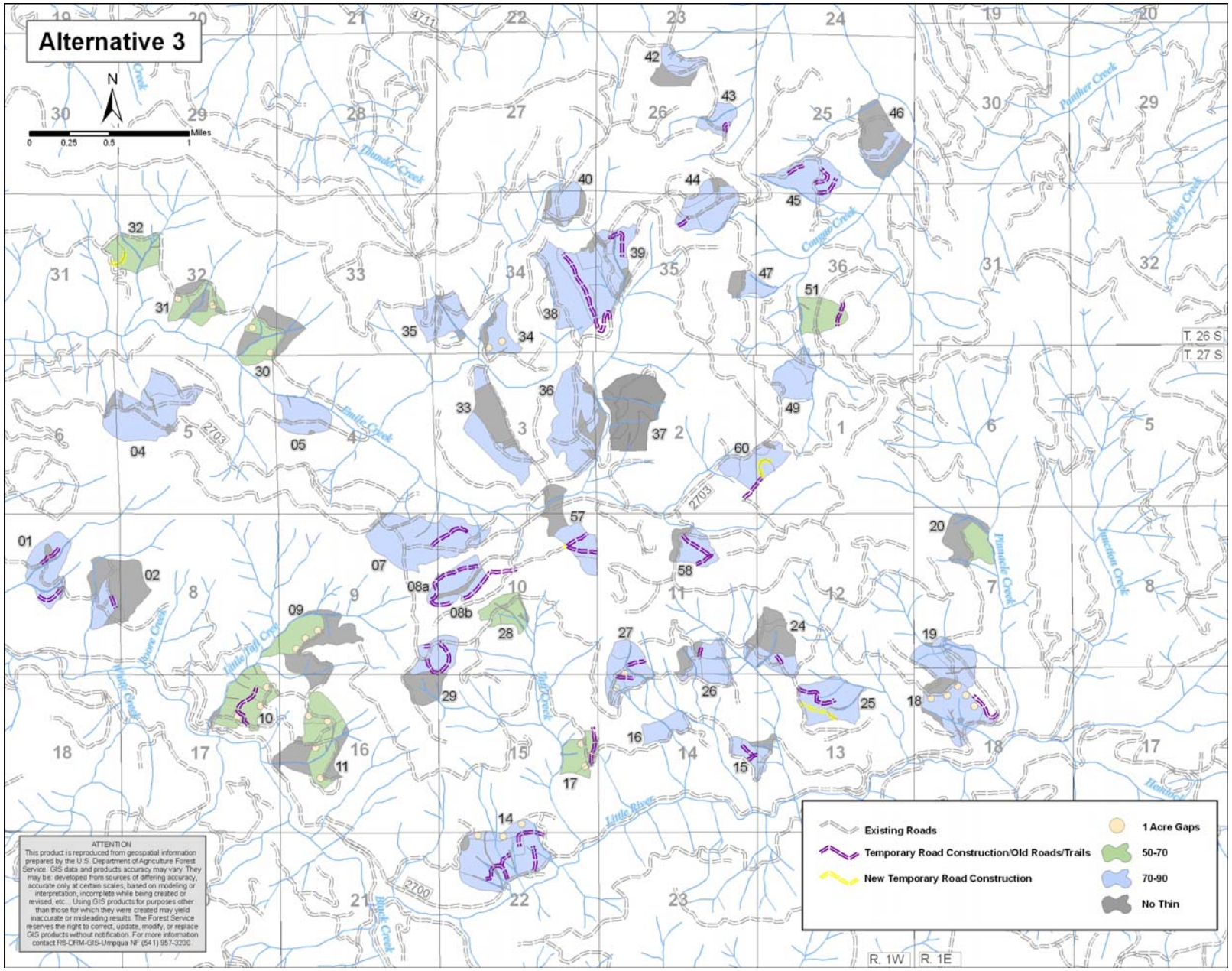
[21] Based on past experience and the professional opinion of the project silviculturist canopy gaps that are one acre in size or larger create site conditions conducive to the successful survival, growth and health of young sugar pine seedlings which would be planted in these sites. A clump of 5 trees would be retained within these gaps and subsequently killed with fire to provide snag habitat.

[22] All helicopter landings would be retained following use, but where feasible, landings would be planted with grasses and shrubs to reduce erosion and provide big game forage. No revegetation would occur in rock quarries that are used as helicopter landings.

several undersized or deteriorated stream crossings, armoring culvert outlets, replacing asphalt, stabilizing road fills and road shoulders, reshaping road beds, and the reconstruction of ditches as needed in portions of the roads.

- Maintaining about 56.5 miles of existing roads including the grading and shaping of existing road surfaces, dust abatement, constructing water bars, cleaning asphalt, ditch maintenance as needed, opening and re-closing existing closed roads, and the cutting of intruding vegetation along roadsides. Asphalt repair and patching would also occur on Road 27 and 4714-330.
- Utilizing the existing Limpy, Coolwater, and Gobbler rock pits, along with several rock stockpile sites as the rock source for the road work, and as disposal areas for material cleaned from ditches, road surfaces and excess excavation.

Figure 4. Alternative 3.



The various stand treatments on a unit-by-unit basis for Alternative 3 are as follows (Table 3).

Table 3. Alternative 3 unit summary.

Unit #	Total Acres in Unit	Thinned Acres in Unit	Unthinned Acres in Unit	Harvest Prescription[23] (trees per acre retained)	Volume Removed (thousand board feet)	Fuels Treatment Acres[24]		Logging Systems Acres[25]		
						Acres treated	Acres not Treated	Ground Based	Skyline	Heli-copter
1	56	44	12	70-90	528	44	0	36	8	0
2	81	18	63	70-90	216	18	0	7	11	0
4	102	94	8	70-90	1410	94	0	55	39	0
5	40	37	3	70-90	555	16	21	13	24	0
7	114	110	4	70-90	1650	110	0	90	20	0
8a	31	26	5	70-90	312	0	26	26	0	0
8b	14	14	0	70-90	168	0	14	0	14	0
9*	88	31	57	50-70	465	31	0	0	31	0
10*	61	56	5	50-70	840	56	0	3	53	0
11*	94	56	38	50-70	840	56	0	22	34	0
14*	112	98	14	70-90	1470	98	0	61	12	25
15	26	20	6	70-90	300	20	0	8	12	0
16	24	22	2	70-90	330	22	0	10	0	12
17*	30	27	3	50-70	405	27	0	2	25	0
18*	68	52	16	70-90	520	52	0	11	41	0
19	53	45	8	70-90	675	45	0	18	27	0
20	50	20	30	50-70	300	0	20	0	20	0
24	61	18	43	70-90	270	18	0	11	7	0
25	59	54	5	70-90	810	19	35	18	36	0
26	48	35	13	70-90	525	7	28	19	16	0
27*	50	45	5	70-90	675	45	0	14	24	7
28	31	24	7	50-70	288	24	0	10	5	9
29	59	32	27	70-90	320	32	0	32	0	0

[23]The prescriptions were applied to each unit depending on slope, aspect, and landtype association and are intended to increase growth, health, and vigor of the leave trees. The 70-90 TPA prescription is intended to develop multi-layered, late seral habitat within gentle/moist landtypes, where it may have persisted under the historical fire regime; the 50-70 TPA prescription is intended to develop single or two-storied stand conditions within steep/dry landtypes, typical of the historical fire regime.

[24] Fuel treatments may include: GP – Grapple Pile Burn, UB – Underburn, HP – Handpile Burn, Roadside Grapple - GPR and Handpile - HPR) for 100 feet, Prune and Chip and NT – No Treatment.

[25] Logging Systems include ground based (loader, mechanized, and cut-to-length); skyline (yoader skyline, multispan skyline, and downhill skyline); and helicopter.

Unit #	Total Acres in Unit	Thinned Acres in Unit	Unthinned Acres in Unit	Harvest Prescription[23] (trees per acre retained)	Volume Removed (thousand board feet)	Fuels Treatment Acres[24]		Logging Systems Acres[25]		
						Acres treated	Acres not Treated	Ground Based	Skyline	Heli-copter
30*	60	26	34	50-70	390	26	0	0	26	0
31*	44	28	16	50-70	336	28	0	2	26	0
32	40	32	8	50-70	320	32	0	7	25	0
33	83	46	37	70-90	598	10	36	46	0	0
34*	31	26	5	70-90	390	4	22	26	0	0
35	46	39	7	70-90	468	15	24	26	13	0
36	102	80	22	70-90	800	0	80	80	0	0
37	86	0	86	70-90	0	0	0	0	0	0
38	113	108	5	70-90	1620	15	93	76	32	0
39	47	35	12	70-90	420	29	6	26	9	0
40	35	26	9	70-90	390	26	0	26	0	0
42	34	19	15	70-90	228	0	19	16	3	0
43	21	17	4	70-90	170	5	12	6	11	0
44	58	52	6	70-90	520	15	37	18	34	0
45	53	51	2	70-90	612	51	0	51	0	0
46	63	14	49	70-90	168	14	0	9	5	0
47	22	10	12	70-90	150	2	8	0	10	0
49	38	35	3	70-90	525	14	21	35	0	0
51	35	32	3	50-70	480	9	23	3	29	0
57	53	30	23	70-90	450	30	0	4	19	7
58	34	26	8	70-90	260	6	20	3	23	0
60	46	44	2	70-90	660	6	38	19	25	0
Tot	**2,496**	**1,754**	**742**		**23,827**	**1,171**	**583**	**945**	**749**	**60**

*These units contain one-acre "gaps" where all but five trees will be removed and sugar pine will be planted. The five retained trees will be killed with fire to provide snag habitat.

NOTE: Acres in all categories and volume estimates were rounded; column totals may not exactly add up, but are within +/- 10% variance.

Proposed Road Work

New Temporary Road Construction/Obliteration

The 0.6 miles of new temporary road to be constructed under Alternative 3 would provide access into units 25, 32, 57, and 60. These would be native surface roads, with rock added to limited locations where soil moisture requires the use of rock to effectively pass log trucks. Temporary roads are typically constructed with a tractor. After logging they would be obliterated with an excavator equipped with a "winged ripper" to decompact soil as needed. Any excavated material, including soil

and woody material, would be pulled back over the road to re-establish the original contour as much as feasible.

Temporary Road Construction/Reconstruction on Existing Abandoned Roads, Skid Roads/Trails and Firelines and Obliteration after Use

The 7.1 miles of temporary spur road to be constructed/reconstructed would provide access into units 1, 2, 7, 8, 10, 14,15,17,18, 24-27, 38-39, 43-45, 51, 52, 57, 60. These temporary roads are located on: existing abandoned or unclassified roads[26] that were built 40 to 50 years ago to provide logging access to the original clearcuts; existing old skid roads and trails used in previous timber harvest; or on the footprint of old firelines accessing the units. All of the 7.1 miles of temporary road would be obliterated following the thinning operation as described above.

System Road Reconstruction

Alternative 3 would include the reconstruction of 7.0 miles of existing system road[27] and repair of an additional 10 sites on the haul route, to meet standards and guidelines of the Northwest Forest Plan in order to accommodate flood flows, minimize the disruption of natural water flow pathways, and lessen risk of erosion (ROD C 32-33), while providing for safe, cost-effective timber haul. About 1.8 miles of roads proposed for reconstruction are existing closed roads (maintenance level 1 roads[28]) that would be opened for log haul and then reclosed after use; the remainder is existing open roads that would remain open after use.

Reconstruction activities would include: placement or replacement of surface rock, the replacement of several undersized or deteriorated stream crossings, armoring culvert outlets, replacing asphalt, stabilizing road fills and road shoulders, reshaping road beds, and the reconstruction of ditches as needed in portions of the roads. Road reconstruction would be done using heavy equipment such as an excavator, backhoe, road grader, dump truck, and a water truck.

Rock for these reconstruction activities would be generated from the existing Limpy, Coolwater and Gobbler rock quarries. Work at these existing quarries would include drilling, blasting, rock crushing, hauling, and removal of second growth trees in order to access additional rock faces for use. Other existing rock stockpiles in the watershed would also be used, but no ground disturbance at these sites would be necessary other than the haul of the rock on existing roads.

Road maintenance

Alternative 3 would include road maintenance on 56.5 miles of existing system roads where timber haul would occur. This work would be done by timber sale purchasers using a variety of equipment such as a road grader, dump truck, backhoe, water truck,

---

[26] An unclassified road is not constructed, maintained, or intended for long-term use.

[27] System roads are constructed or maintained for long-term use. They can be open for use or closed depending on their maintenance level and the original objective for which the road was built.

[28] Maintenance level 1 roads are system roads that are blocked year-round. Though part of the long-term road system, they are not available for use due to the road surface (native surface), or degree of maintenance, or other considerations. Maintenance level 1 roads may be re-opened for a specific use such as timber harvest or fire control and then re-blocked following use.

and a street sweeper on paved sections. The road maintenance under Alternative 3 would include:

- •Opening and closing (upon completion of haul) currently closed roads;
- •Logging out (removing downed trees, large rocks, slides, etc.) roads;
- •Brushing roads and road sides;
- •Blading road beds, including ditches where needed;
- •Cleaning existing culverts at ditch relief and stream crossing locations as needed for proper drainage;
- •Constructing water bars on some existing system roads (both closed and open) as needed for proper drainage;
- •Asphalt repair and patching on Road 27 and 4714-330.
- •Applying magnesium chloride for dust abatement[29].
- •Hazard tree felling to meet OSHA requirements.

Winter Haul

Although opportunities are considered to be limited in the project area due to the elevation of the units, under Alternative 3 timber may be logged and hauled outside the normal operating season as long as road conditions and water quality would not be impacted.

Connected actions for Alternative 3 are listed in Table 2.

ALTERNATIVE 4 (FIGURE 5, TABLE 4)

Alternative 4 was developed to meet the purpose and need and to respond to the issue of providing additional foraging habitat for deer and elk in the planning area. Alternative 4 responds to the big game forage issue through the creation of larger sized canopy gaps than those proposed under Alternative 2.

Specifically, Alternative 4 would result in the creation of 18 additional acres of early successional habitat (forage) in big game winter range as compared to Alternative 2. Alternative 4 would create a total of 47 acres of canopy gaps that would be planted with sugar pine seedlings and seeded with a native big game forage mix. While Alternatives 2 and 3 would create 29 one-acre gaps, Alternative 4 would create: eight, one-acre gaps; eighteen, two-acre gaps; and one, three-acre gap.

With the exception of the gap creation described above, activities proposed under Alternative 4 are the same as those proposed under Alternative 2. However, the timber output of Alternative 4 would be about 4% greater than Alternative 2 as a result of the increased size of canopy gaps. Alternative 4 would harvest about 26 million board feet of timber.

Alternative 4 includes the following:

[29] Magnesium chloride would be applied at a rate of 19 tons per mile for a single application each operating season for roads that would have 3 mmbf of timber hauled over them. Estimated total miles of dust abatement for this project is 15 miles; 4 miles of FS Road 27 and 11 miles of FS Road 2703. (See Transportation System for additional information).

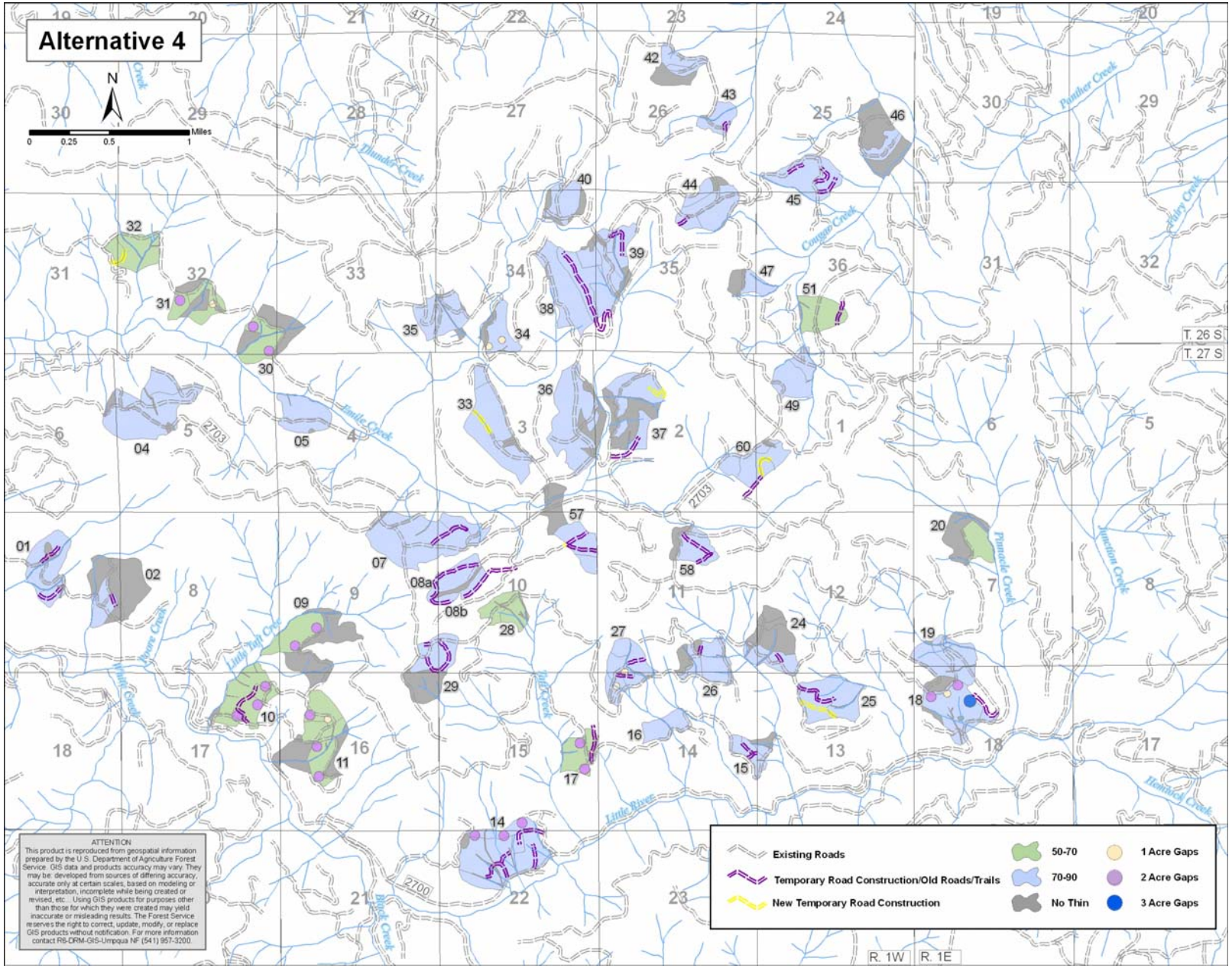
- Commercial thinning of about 1,835 acres of timber stands using helicopter, ground-based, and skyline logging systems in AMA, Matrix and Riparian Reserve land allocations generating about 26 million board feet of timber.
- Implementing a project-level amendment to the 1990 Forest Plan that would allow thinning within 150 feet of some natural meadows and rock outcrops. Thinning adjacent to these areas would not normally occur under Standards and Guidelines for unique habitats (Wildlife Prescription C5-1, LRMP IV-200), but is considered beneficial for maintaining natural openings and enhancing development of desired stand conditions.
- Planting and pruning rust resistant sugar pine and seeding with native big game forage mix within: eight, one-acre gaps; eighteen, two-acre gaps; and one, three-acre gap[30].
- Treating activity created fuels on 1,171 acres by underburning, crushing, machine piling, pruning/chipping, or handpile burning.
- Using 6 existing landings or rock pits for helicopter logging[31].
- Building a total of 1.0 miles of new temporary spur roads to access thinning areas then obliterating them (subsoiling as necessary, and pulling displaced soil and woody debris over the surface) after use.
- Constructing/reconstructing 7.3 miles of temporary spur roads located on existing old abandoned roads (unclassified roads), skid trails, or firelines to access thinning areas; then obliterating the roads after use.
- Reconstructing 7.0 miles and 14 sites of system roads to facilitate hauling logs including the placement or replacement of surface rock, the replacement of several undersized or deteriorated stream crossings, armoring culvert outlets, replacing asphalt, stabilizing road fills and road shoulders, reshaping road beds, and the reconstruction of ditches as needed in portions of the roads.
- Maintaining about 57.5 miles of existing roads including the grading and shaping of existing road surfaces, dust abatement, constructing water bars, cleaning asphalt, ditch maintenance as needed, opening and re-closing existing closed roads, and the cutting of intruding vegetation along roadsides. Asphalt repair and patching would also occur on Road 27 and 4714-330.
- Utilizing the existing Limpy, Coolwater, and Gobbler rock pits, along with several rock stockpile sites as the rock source for the road work, and as disposal areas for material cleaned from ditches, road surfaces and excess excavation.

---

[30] Based on past experience and the professional opinion of the project silviculturist canopy gaps that are one acre in size or larger create site conditions conducive to the successful survival, growth and health of young sugar pine seedlings which would be planted in these sites. A clump of 5 trees/acre would be retained within these gaps and subsequently killed with fire to provide snag habitat.

[31] All helicopter landings would be retained following use, but where feasible, landings would be planted with grasses and shrubs to reduce erosion and provide big game forage. No revegetation would occur in rock quarries that are used as helicopter landings.

Figure 5. Alternative 4



The various stand treatments on a unit-by-unit basis for Alternative 4 are as follows (Table 4):

Table 4. Alternative 4 unit summary.

Unit #	Total Acres in Unit	Thinned Acres in Unit	Unthinned Acres in Unit	Harvest Prescription[32] (trees per acre retained)	Volume Removed (thousand board feet)	Fuels Treatment Acres[33]		Logging Systems Acres[34]		
						Acres treated	Acres not Treated	Ground Based	Skyline	Heli-copter
1	56	44	12	70-90	528	44	0	36	8	0
2	81	18	63	70-90	216	18	0	7	11	0
4	102	94	8	70-90	1410	94	0	55	39	0
5	40	37	3	70-90	555	16	21	13	24	0
7	114	110	4	70-90	1650	110	0	90	20	0
8a	31	26	5	70-90	312	0	26	26	0	0
8b	14	14	0	70-90	168	0	14	0	14	0
9*	88	31	57	50-70	527	31	0	0	31	0
10*	61	56	5	50-70	952	56	0	3	53	0
11*	94	56	38	50-70	952	56	0	22	34	0
14*	112	98	14	70-90	1666	98	0	61	12	25
15	26	20	6	70-90	300	20	0	8	12	0
16	24	22	2	70-90	330	22	0	10	0	12
17*	30	27	3	50-70	486	27	0	2	25	0
18*	68	52	16	70-90	676	52	0	11	41	0
19	53	45	8	70-90	675	45	0	18	27	0
20	50	20	30	50-70	300	0	20	0	20	0
24	61	18	43	70-90	270	18	0	11	7	0
25	59	54	5	70-90	810	19	35	18	36	0
26	48	35	13	70-90	525	7	28	19	16	0
27*	50	45	5	70-90	675	45	0	14	24	7

[32]The prescriptions were applied to each unit depending on slope, aspect, and landtype association and are intended to increase growth, health, and vigor of the leave trees. The 70-90 TPA prescription is intended to develop multi-layered, late seral habitat within gentle/moist landtypes, where it may have persisted under the historical fire regime; the 50-70 TPA prescription is intended to develop single or two-storied stand conditions within steep/dry landtypes, typical of the historical fire regime.

[33] Fuel treatments may include: GP – Grapple Pile Burn, UB – Underburn, HP – Handpile Burn, Roadside Grapple - GPR and Handpile - HPR) for 100 feet, Prune and Chip and NT – No Treatment..

[34] Logging Systems include ground based (loader, mechanized, and cut-to-length); skyline (yoader skyline, multispan skyline, and downhill skyline); and helicopter.

Unit #	Total Acres in Unit	Thinned Acres in Unit	Unthinned Acres in Unit	Harvest Prescription[32] (trees per acre retained)	Volume Removed (thousand board feet)	Fuels Treatment Acres[33]		Logging Systems Acres[34]		
						Acres treated	Acres not Treated	Ground Based	Skyline	Heli-copter
28	31	24	7	50-70	288	24	0	10	5	9
29	59	32	27	70-90	320	32	0	32	0	0
30*	60	26	34	50-70	442	26	0	0	26	0
31*	44	28	16	50-70	420	28	0	2	26	0
32	40	32	8	50-70	320	32	0	7	25	0
33	83	78	5	70-90	1014	10	68	46	32	0
34*	31	26	5	70-90	390	4	22	26	0	0
35	46	39	7	70-90	468	15	24	26	13	0
36	102	80	22	70-90	800	0	80	80	0	0
37	86	49	37	70-90	637	0	49	28	21	0
38	113	108	5	70-90	1620	15	93	76	32	0
39	47	35	12	70-90	420	29	6	26	9	0
40	35	26	9	70-90	390	26	0	26	0	0
42	34	19	15	70-90	228	0	19	16	3	0
43	21	17	4	70-90	170	5	12	6	11	0
44	58	52	6	70-90	520	15	37	18	34	0
45	53	51	2	70-90	612	51	0	51	0	0
46	63	14	49	70-90	168	14	0	9	5	0
47	22	10	12	70-90	150	2	8	0	10	0
49	38	35	3	70-90	525	14	21	35	0	0
51	35	32	3	50-70	480	9	23	3	29	0
57	53	30	23	70-90	450	30	0	4	19	7
58	34	26	8	70-90	260	6	20	3	23	0
60	46	44	2	70-90	660	6	38	19	25	0
Tot	**2,496**	**1,835**	**661**		**25,735**	**1,171**	**664**	**973**	**802**	**60**

*These units contain “gaps” where all but five trees/acre will be removed. Gaps are one, two, or three acres in size. Following logging within these gaps sugar pine will be planted and the area will be seeded with native big game forage mix. The five retained trees/acre will be killed with fire to provide snag habitat.
NOTE: Acres in all categories and volume estimates were rounded; column totals may not exactly add up, but are within +/- 10% variance.

Proposed Road Work

Road work proposed under Alternative 4 is identical to Alternative 2 (see pages 21-23 for a description).

Connected actions for Alternative 4 are listed in Table 2.

COMPARISON OF ALTERNATIVES

Table 5 compares the alternatives by the elements of the purpose and need, the issue indicators, and summarizes other activities, actions and effects that would occur.

Table 5. Comparison of Alternatives.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Element 1 – Stand Health, Density, Diversity				
• Acres thinned to enhance health and vigor of residual trees and restore stand density and structural diversity:	0	1,835	1,754	1,835
• Acres of sugar pine trees planted to increase diversity and restore pine component:	0	29	29	47
• Acres of Riparian Reserves thinned to accelerate development of desired riparian conditions:	0	425	414	425
Element 2 – Timber Production				
• Volume of timber harvested (thousand board feet)	0	24,880	23,827	25,735
• Return to Treasury	0	$667,359	$638,231	$685,846
• Benefit/Cost Ratio	0	1	1	1
Issue 1 – New Temporary Road Building				
• Miles of new temporary road constructed, then obliterated	0	1.0	0.6	1.0
• Total acres of thinning accessed by new temporary road construction	0	138	85	138
Issue 2 – Big Game Forage Enhancement				
• Acres of early successional habitat created	0	29	29	47
• Acres seeded with big game forage mix	0	49	47	96
• Number of 2-3 acre gaps created	0	0	0	19
Comparison of Activities				
Logging systems				
• Acres Skyline	0	802	749	802

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
• Acres Ground Based	0	973	945	973
• Acres Helicopter	0	60	60	60
Fuels Treatments (Activity Fuels)				
• Underburn	0	311	311	311
• Handpile (roadside)/Burn	0	300	300	300
• Machine Pile/Burn	0	560	560	560
TOTAL FUELS TREATMENT	0	1,171	1,171	1,171
• No fuel treatment on commercially thinned units	0 0	664	583	664
Operating Season Restrictions				
• Northern Spotted Owl (harvest /road construction- units 1, 2, 7, 20, 32); helicopter logging- units 14, 16, 27, 28, 57).	N/A	3/1-7/15	3/1-7/15	3/1-7/15
• Falcon: harvest-unit 20.	N/A	1/1 – 7/31	1/1 – 7/31	1/1 – 7/31
• Bark Slippage (waivers are possible for some units)	N/A	4/15 – 7/1	4/15 – 7/1	4/15 – 7/1

Best Management Practices, Mitigation Measures, Project Design Features, and Monitoring

The following measures apply to all action alternatives or as otherwise stated. These requirements will be implemented in order to meet laws, regulations, and policies. In most cases they have been designed to reduce potential environmental effects.

Mitigation measures are defined as actions that:

- avoid the impact all together (such as avoiding harvest on unstable land);
- minimize impacts by limiting the degree or magnitude of the action;
- rectify the impact by repairing, rehabilitation, or restoring;
- reduce the impact over time by applying maintenance operations (such as road maintenance).

General Water Quality Best Management Practices (BMPs), symbolized by a checkmark (✓), are mitigation measures prescribed to protect the beneficial uses of water and to address water quality objectives as required by the Federal Clean Water Act and the 1990 Umpqua National Forest LRMP, as amended. Each BMP is listed by the code used in the Pacific Northwest Regional Guide called General Best Management Practices (USDA, Forest Service, 1988). A complete BMP checklist is included in the Project Record.

Other mitigation not related to compliance with the Clean Water Act is indicated by a round bullet (•). Some of the items included in this list are not considered mitigation, but they are included in order to track project design features or prescriptive details. These are noted with the symbol (**Rx**). Monitoring is delineated by a lightning bolt (🗲).

Contract provisions are noted in parenthesis where they apply and Standards and Guidelines (S&Gs) from the Umpqua National Forest LRMP and Northwest Forest Plan are also listed.

LOGGING EROSION CONTROL MEASURES

BMPs T-3, T-8, T-13, T-14, T-16; Forest Plan S&Gs IV-60-5; IV-71-13, IV-72-16.

OBJECTIVE: Ensure any increase in sedimentation is minimized during and after logging or associated activities. Logging methods are described in the Project File.

ACTIONS:

✓ Identify areas with high erosion potential and adjust unit design. Completed during planning process and included in the 'No Thin' category.

✓ Stream course protection will be used on all stream classes (BT6.5).

✓ Erosion control measures will be identified where project areas have the potential to produce erosion/sedimentation that may affect water quality and beneficial uses in surface waters (CT6.6#). The installation/application of appropriate erosion control measures will be applied on designated soil gouges in skyline corridors and on ground based equipment skid trails that may reroute or concentrate runoff in order to spread water and allow for infiltration into the soil.

✓ Cut-and-fill slopes will have full erosion control work completed in the same operating season as constructed.

✓ All required erosion control work shall be completed before October 15th each year.

✓ Native seed shall be applied to areas that are prone to erosion and that have been disturbed by purchaser's operations in order to establish an adequate cover of grass or other herbaceous vegetation. Seeding should be kept current, preceding expected periods of rain. The seed mix to be used will be provided or agreed to by the Forest Service.

LOGGING PRACTICES

BMPs T-1, T-8, T-10,T-11, T-12, T-16; Forest Plan S&Gs IV-60-2, IV-60-5, IV-67-1, IV-68-2, IV-176, IV-188, IV-190.

OBJECTIVE: Minimize impacts to water quality and soil productivity from timber harvest to the extent practical through logging practices.

ACTIONS:

✓ To reduce the number of skyline corridors, corridors will average 100-150 feet apart from center to center.

✓ Cable corridors that extend through no-harvest stream buffers will be limited in number and width to the greatest extent practicable to minimize damage to riparian vegetation. If riparian vegetation needs to be cut to allow for the corridor, it will be felled and left in place. No log yarding will occur in cable corridors within no-harvest stream buffers.

✓ Location of all skid trails will be agreed to prior to felling, unless otherwise agreed to in writing (BT6.422) at an average of 100 feet apart. Skid trails will be located within the prism of mapped legacy skid trails (completed during the planning process) where possible.

✓ Locate landings so that timber can be yarded with minimal disturbance to riparian reserves. Landings will be located outside of the designated no-harvest stream buffers.

✓ Landing size should be no larger than needed for a safe, efficient yarding and loading operation (BT6.422).

✓ No yarding of logs across stream channels will occur and there will be no yarding corridors within no-harvest stream buffers. Ground disturbance and yarding within 75 feet of the stream channels will be minimized to the extent possible.

✓ Yarding within NWFP Riparian Reserves identified for thinning (outside of no-harvest stream buffers) will require at least one end suspension of the logs to the extent practical.

CONTROL OF PURCHASER OPERATIONS

BMPs T-5, T-10, T-13, T-14, T-15, T-18, T-19, T-21, T-22, R-3, R-9, R-19, R-20, W-4; VM-2, Forest Plan S&Gs IV-83-3, IV-82-5, IV-61-9.

OBJECTIVE: Enable the Forest Service to exercise control of operations to prevent impacts which could have detrimental results to water quality.

ACTIONS:

✓ Contract preparation and administration will include operating periods, modification language, and control and acceptance of purchaser work (BT6.1 and BT6.35).

✓ The Normal Operating Season (June 1 to October 31) for the sale area will be identified and applied, unless otherwise agreed to by the Forest Service. To prevent damage to water quality during the operating period, restriction of equipment shall be enforced through the use of appropriate Timber Sale Contract (TSC) provisions when conditions for timber harvest, road construction, or road use are such that excessive damage will result. The Umpqua Road Rules, which calls for suspending work when either road or environmental damage such as stream turbidity is predicted, will be enforced. The kind and intensity of erosion control work done by the purchaser shall be adjusted to ground and weather conditions and the need for controlling runoff. Waivers to operate outside this period may be granted upon approval of the Forest Service representative.

✓ Purchaser erosion control structures and maintenance work which must be inspected prior to acceptance by the Forest Service are to be specified in the TSC (CT6.6#).

✓ If weather conditions warrant, haul routes must be inspected weekly or more frequently by Forest Service personnel. Inspections will focus on road surface condition, drainage maintenance, and sources of soil erosion and sediment delivery to streams.

✓ Pollutants from logging or road reconstruction equipment will be kept from entering waterways during servicing or refueling by selecting areas at least 150 feet away from wet areas and surface water, and by using a berm around sites to contain spills. If the volume of fuel exceeds 660 gallons in a single container or a total on site storage of 1320 gallons, a Spill Prevention Control and Countermeasures (SPCC) Plan (BT6.341) is required and the necessary equipment will be on site during operations (BT6.34). The purchaser shall take appropriate preventative measures to ensure that any spill does not enter any stream. Any spill that occurs must be reported to the Contracting Officer.

✓ All landing locations will be approved by the Forest Service prior to landing construction and agreed upon plans for the landing shall insure water quality protection (BT6.422).

✓ No chemical dust abatement will be applied within 25 feet of perennial streams or any other stream crossing in which water is flowing during chemical application.

✓ No dust abatement chemicals will be applied within 1 foot of the outside edge of road ditch lines.

✓ Application of dust abatement will occur when streams are at their seasonal baseflow. Dust abatement will not be applied when raining and a 3-day forecast of clear weather shall follow any application of dust abatement.

• Any guy-line trees located outside of the harvest unit boundaries that need to be felled would not be included in the Timber Sale Contract; these guy line trees will be left on site. Guy-line trees for skyline logging will be trees of an adequate size to meet operational needs for a specific yarder and Oregon OSHA safety requirements. Whenever possible, selected guy-line trees will be among the smallest diameter trees, in order to maintain large diameter trees on the landscape.

RIPARIAN AREAS WITHIN OR ADJACENT TO CUTTING UNITS

BMPs T-4, T-7, T-8; Forest Plan S&Gs IV-60-1, IV-60-4, 5, 6; IV-33-5.

OBJECTIVE: Establish riparian area protection zones to minimize stream temperature increases, protect channel bank structure, and provide a debris filter for sediment and debris which could enter the channels, and maintain a source of large woody debris for continued stream channel stability and structural diversity.

ACTIONS:

✓ Stream courses and wetlands will be identified on sale area maps.

✓During ground-based logging, restrict equipment entry within 50 feet of streams and wet areas.

✓ For commercial thinning units, site-specific no-harvest buffers were developed for all streams located during field reconnaissance of Emile units. Buffers follow guidance in the Northwest Forest Plan Temperature TMDL Implementation Strategies (USDI/USDA 2005) to protect the primary shade zone of perennial streams from harvest and incorporate field reconnaissance and professional judgment. For any new streams identified in the commercial thinning units during project implementation, the district hydrologist or fish biologist will assign appropriate stream buffers.

The following are the general no-harvest buffer width guidelines that were applied to ensure protection of streams and streamside habitats in Emile: perennial streams-60 foot buffers; intermittent streams with erosion issues-50 foot buffers; intermittent streams with erosion concerns that are very gently sloped that would not benefit substantially from larger buffers due to topography-25 foot buffers; intermittent streams with steeper side slopes that do not currently demonstrate erosion, but could potentially be impacted by harvesting due to topography-25 foot buffers; Small intermittent channels that are gently sloped with no evidence of erosion problems or anticipated concerns due to harvesting- no buffers; wet unique habitats-150 foot buffers unless roads separate wet area from buffer or as desired to mimic stand conditions occurring under natural disturbance regimes.

✓ For precommercial thinning units (connected action), apply no-cut buffers to all perennial streams following guidance in the Northwest Forest Plan Temperature TMDL Implementation Strategies (USDI/USDA 2005) to protect the primary shade zone from harvest. The following buffer widths are from the TMDL implementation strategies:

Height of Tree	%Hill Slope <30	%Hill Slope 30 to 60	%Hill Slope >60
Trees < 20 feet	12' buffer	14' buffer	15' buffer

✓ Burning within the riparian zone to reduce fuel hazard near stream channels will be carefully controlled by allowing fire to back into the no-cut buffers (not started within the no-cut buffers), to minimize fire intensity and mortality of low fire-resistant species such as hemlock, cedar, and true fir.

✓ Apply the following to minimize potential damage to riparian vegetation from prescribed fire: no handpiles will be burned within 20 feet of the no-harvest stream buffers; no grapple piles will be constructed or burned within 50 feet of the no-harvest stream buffers.

✓ Protect all no-harvest stream buffers and streams with directional felling (C/CT6.41#), and waive debris cleanout of streams (B/BT6.5).

✓ Trees that are in no-harvest stream buffers and are damaged during timber harvest or road activities will be left on site.

TEMPORARY and SYSTEM ROAD CONSTRUCTION, ROAD RECONSTRUCTION, AND ROAD MAINTENANCE

BMPs R-2, R-3, R4, R5, R-6, R-7, R-9, R-15, R-23; Forest Plan S&G IV-83-6.

OBJECTIVE: To minimize sedimentation, the effects of water concentration on roadbeds, cut slopes or fill slopes, and subsequent production of sediment associated with temporary road construction and road reconstruction.

ACTIONS:

✓ All new temporary road construction will be done using outslope designs, with drain dips and grade sags as needed, so that no new ditchlines will be built.

✓ Road construction or reconstruction operations (including culvert replacements) will occur during minimal runoff periods.

✓ Roadwork contractors will have spill prevention and recovery equipment on site during all road construction operations as agreed to by the Forest Service

✓ Under the timber sale contract, native-surfaced system roads will have water bars installed and road barriers placed to prevent damage after commercial use is complete, as appropriate. Level 1 aggregate surfaced system roads to be closed following use will be barricaded and treated with water bars if needed to prevent drainage problems.

✓ Avoid blading ditches that are vegetated, functioning and effectively draining.

✓ During construction and reconstruction activities, waste material shall be placed in Forest Service approved waste sites (Limpy, Coolwater, and Gobbler rock pits).

✓Instream work would occur between July 1 and September 15 unless a waiver to work outside this window is first approved by the District Fisheries Biologist or Hydrologist.

✓ Aggregate will be placed on access roads into water sources to reduce sedimentation to streams, as needed.

✓Haul on native surfaced roads should not occur during the wet season. Surface rock placement may be done outside the normal operating season as weather and road conditions permit, but no surface rock can be added to extend the season of haul on any of the abandoned roads that are to be obliterated after use.

✓ Relief culvert locations will be located, flagged, and approved by the Forest Service before installation to ensure that water is routed only onto stable soil/vegetation.

✓ Cut-and-fill slopes will have required erosion control treatments completed the same year they are constructed even if they are not completed to final acceptance specifications. If the same area requires further disturbance to complete the road construction, it will be re-vegetated as needed to insure surface soil protection.

✓ Construction activities that may expose new soil (including clearing, grubbing, excavating, and fill placement) will be limited to the normal operating season (June 1 to October 31). However, construction activities may be suspended anytime during wet weather to protect water quality of affected streams. Construction sites will be re-vegetated as needed to insure surface soil protection.

✓ Water bars sufficient to disperse water shall be designated by the Forest Service to prevent future traffic and disperse subsurface water on all maintenance level 1 system roads that are re-opened and subsequently blocked.

✓ Obliteration of temporary roads (new or legacy) shall meet specifications of the Forest Service, for depth of treatment and use of effective ground cover on treatment area.

✓ A soil scientist shall review all temporary roads prior to treatment to initiate and finalize the treatment prescription; the effectiveness of the temporary road restoration prescription in preventing erosion and providing suitable plant habitat shall be monitored.

• Hazard trees will be identified along the haul routes and felled as needed to meet OSHA requirements. Hazard trees will be left on site outside of harvest units.

FISHERIES/WATERSHED

BMP R-14

ACTIONS:

✓ Road work at perennial streams, to be done under the timber sale contract, will be completed during low flow conditions when the potential for delivery of construction-related sediment can be minimized. During construction, stream water will be diverted around the work site and back into the channel.

✓ Instream wood placement will occur between July 1 and September 15 unless a waiver to work outside this window is first approved by the District Fisheries Biologist or Hydrologist.

✓ Trees selected for falling as instream wood (connected action) will be subdominant trees located at least 25 feet from the stream.

✓ Hoses used for drafting water from fishbearing streams must be equipped with a 5/32” mesh screen. Pumping of water for use in road maintenance must allow for the retention of at least 90% of the original stream flow below the pumping site.

SOIL AND SITE PRODUCTIVITY

BMP T-9, T-12; Forest Plan S&Gs IV-67-1, 2, 3, IV-68-2; IV-71-12

ACTIONS:

✓ All new landings and temporary roads used by the purchaser will be subsoiled to increase water infiltration and reduce surface water runoff to streams. Subsoiling will occur to a depth of 20 inches using an excavator with winged subsoiler attachments. An exception may be given to areas where the sale administrator determines slash concentrations are too high to allow for subsoiling.

✓ Under the timber sale contract the purchaser will be required to subsoil between 66 and 71 acres of temporary roads, skid trails, and landings used by the purchaser in units listed in the Table 6, to mitigate for existing legacy disturbances to meet standards and guidelines for soil disturbance and long-term site productivity.

Table 6. Required subsoiling acres by alternative.

Unit	Alt 2 & 4 Subsoiling Acres	Alt 3 Subsoiling Acres
4	3.3	3.2
7	3.6	3.6
8a	5.5	5.5
8b	3.1	3.1
14	1.7	1.7
15	0.3	0.3
24	4.0	3.8
29	0.6	0.6
33	0.0	2.7
34	3.0	3.0
36	6.7	6.7
37	7.2	0.0
39	5.8	5.7
40	2.6	2.6
45	4.3	4.3
46	5.0	5.0
47	7.8	7.7
49	3.2	3.2
58	3.3	3.3
Total	71	66

✓ Following the close of the sale (under separate contract), machine piling and subsoiling would occur on 103 acres in units: 39 (26 ac), 40 (30 ac), and 45 (51 ac).

Where subsoiling occurs, adequate slash will be used to cover the subsoiled roads as effective ground cover; this will also help to minimize erosion. Slash loading will not be to a depth that will prohibit forage grass seed from germination and sprouting.

✓ Seed and ground cover (straw, chips, hydromulch, etc.) shall be applied to bare soil and drainage areas around landings. Seeding should be kept current, preceding expected periods of rain. The seed mix to be used will be provided or agreed to by the Forest Service.

✓ Slash piles created by the purchaser around landings would be placed on compacted work areas, away from waterways and ditches.

✓ During the rainy season (generally November 1 - May 30), no more than ½ acre of exposed soil (S&G#13, LRMP pp. IV-71), including landings, skid trails, and temporary roads would exist at any time without erosion control that is effective in preventing sediment from reaching streams or any concentrated surface flow in excess of 1.0 cfs. Note: silt fencing is not effective at flows in excess of 1.0 cfs (Brown et al. 1986).

✓ Designate and locate skid trails to minimize the area affected by logging operations; use pre-existing skid trails at the discretion of the sale administrator and to the extent feasible.

✓ Locate skid trails away from areas identified as having sensitive soils (such as wetlands and conditionally unsuitable soils as mapped in the Project File – Soils)

✓ Restrict ground based logging to lands less than 35% slope.

✓ Maintain at least 45%-65% effective ground cover in order to maintain soil productivity and prevent soil erosion.

• The levels of effective ground cover will be monitored, as funding allows. If monitoring determines that effective ground cover goals are not met then site specific recommendations will be developed by a soil scientist and the fire management officer. Monitoring will include representative samples of each yarding method, fuels treatment, subsoiling mitigation, and tree mortality along treatment areas to determine if soil management objectives are being met (S&G#11, LRMP IV-71).

Rx In order to minimize effects to soils, where practical, slash piles will be placed on new and existing skid trails that have been previously obliterated. When machines are used to pile slash, soil restoration and piling operations would be implemented together in a single pass with equipment that is suited for both operations (i.e. excavator with a combination subsoiler and brush-rake attachment).

FUEL MANAGEMENT and AIR QUALITY

General Water Quality BMP's F-1, F-2, F-3; UNF LRMP S&G's IV-68-2, 3 & 4; IV-92-4, 7, 8; NWFP S&G's C-35 & 36, FM-1, FM-4.

OBJECTIVE: Meet air quality regulations and reduce water quality degradation and soil erosion caused by prescribed fire and other types of fuel treatments. Minimize soil compaction, soil displacement and damage to trees remaining after harvest. Create snags with burning in selected units.

ACTIONS:

✓ Burn plans will include water quality objectives.

• Burn plans will be prepared in advance of ignition and approved by the appropriate line officer for each prescribed fire.

• Air quality will be emphasized during prescribed fire planning. Mitigating measures will be considered including extending the burning season to spread emissions throughout the year. All burning will be planned and conducted to comply with applicable air quality laws and regulations and coordinated with appropriate air quality regulatory agencies.

• Burning will be conducted to meet air quality standards as outlined by Oregon DEQ, and air quality monitoring will be conducted in conjunction with the DEQ.

✓ Fire line construction will avoid sensitive areas like unique habitats and locations where water could be channeled into areas of instability, headwalls, or streams. As needed, fire lines will require water bars at slopes greater than 30%. Fire line water bars will deflect surface run-off from the trail down slope onto stable material such as rock surface cover. Fire lines will be constructed in portions of units: 9, 10, 11, 16, 17, 27, 30, 31 and 32.

✓ Fuel monitoring plots are set up in Emile units: 7, 10, 26, 18, 36 and 38. Post-harvest Brown's Fuel Transects will be re-run along the same fuel transects to compare the pre-harvest fuel levels to the predicted post-harvest fuel levels, as funding allows.

• Grapple piles will be constructed to the following specifications: All slash from 2 inches in diameter up to 6 inches in diameter and exceeding 3 feet in length shall be piled. Exclude/remove from pile any piece greater than 9 inches in diameter on the small end and greater than 6 feet in length. Piles will be constructed compactly with minimal soil in the piles and covered to shed water so they remain dry for burning during the fall or winter; height will be at least 6 feet and no greater than 12 feet; width will be at least 6 feet and no greater than 10 feet. Piles will be evenly spaced between trees and snags left after harvest. Piles will be placed on temporary roads or designated equipment trails when possible. Piles will be placed at least 50 feet away from the outside edges of the no-harvest stream buffers.

• Where the volume of landing and roadside slash exceeds the ability to create piles and meet pile size and location specifications above, slash will be returned to temporary roads and designated forwarding corridors for piling or dispersal after subsoiling, if needed.

• Handpiles will be located a minimum of 10 feet from the base of any tree or snag (where possible) and a minimum of 20 feet from the outside edges of no-harvest streams buffers. Piles will not be placed on or in close proximity to stumps or large down logs.

• Burning will be carried out when fuel moistures are sufficient to help retain existing snags and down wood to the extent feasible.

• Handpiles will generally be constructed about 6x6 feet in size and not more than 5-feet high with slash material less than 4" on the large end and not more than 6 feet in length. They should also be covered with plastic sheeting to facilitate pile burning.

•Equipment used to pile slash will be track mounted with ground pressure not to exceed 7 psi and will meet the following specifications: capability of reaching 35 feet; climbing ability up to 35% slope; pivot-operator cab, engine, and arm shall be able to swing 360 degrees while tracks remain stationary; and machine shall be equipped with a brush grapple or articulating brush grapple mechanism.

↙ Equipment used to machine pile slash will use legacy skid trails, and temporary and permanent roads on slopes less than 35%. This applies to Emile units: 1, 2, 4, 5, 7, 14, 15, 18, 19, 24, 25, 29, 39, 40, 45, and 46.

WILDLIFE MANAGEMENT

• To protect nesting spotted owls, prohibit helicopter logging from March 1 to July 15. This restriction applies to Units 14, 16, 27, 28, and 57 and to the use of the six proposed landings.

• To protect nesting spotted owls, prohibit timber harvest (tree felling, bucking, and yarding) and temporary road construction/reconstruction from March 1 to July 15. This restriction applies to Units 1, 2, 7, 20, and 32.

• To protect nesting spotted owls, for proposed and connected actions that create above-ambient noise levels (i.e. road maintenance, brushing, precommercial thinning, subsoiling, etc.), abide by the terms and conditions in the programmatic Biological Opinion (FWS-1-15-03-F-0454). When possible, do not schedule these activities to occur between March 1 to July 15.

• To protect nesting peregrine falcons, prohibit timber harvest operations from Jan 1 to July 31. This seasonal restriction applies to Unit 20 and may be applied to other units and activities, if new falcon eyries are established during the lifetime of the project.

• To reduce impacts to nesting landbirds, burning of hand piles and machine piles will occur in the fall/winter months and not in spring or summer.

• Retain and protect (during harvest and burning) existing large down wood (>6 inch diameter) and snags (>9 inch dbh) to the extent practical and safe. Avoid mechanical impacts and movement of large down wood and leave felled snags on site.

• To mitigate for some snag loss and a decreased rate of snag recruitment caused by the thinning, and to achieve moderate levels of snags, retain 5 trees/acre (>15 inch dbh or largest trees available) for snag creation. This applies to all or portions of Units 1, 2, 4, 5, 7, 8a, 8b, 9, 10, 11, 14-17, 19, 20, 24-32, 35,40, 42-46, 57, 58. See Project Record for additional details.

Rx Following use of these areas, utilize a native big game forage mix to seed temporary roads, major skid trails, landings, appropriate helicopter landings, and selected areas of noxious weed treatment. This applies under all action alternatives. For Alternative 4, use native big game forage mix to seed sugar pine gaps.

SILVICULTURE AND VEGETATION MANAGEMENT

BMP T-20

OBJECTIVE: To manage and protect desired vegetation and to reforest all suitable land within five years after harvesting.

ACTIONS:

↙ The silviculturist will review marking guides with the timber contract appraiser prior to contract preparation. The timber sale contract will contain provisions for monitoring the Designation by Description (DxD) specifications to ensure the silvicultural prescription will be implemented as planned.

Rx Rust resistant sugar pine will be planted @50 trees per acre, and pruned within 10 years after planting, on 29 acres (47 acres Alternative 4) in the 1 acre canopy gaps (1-3 acre gaps in Alternative 4) located in Units 9-11, 14,17, 18, 27, 30, 31, and 34.

Rx If necessary, planted sugar pine will be mulched to reduce competition from forage grass seeding.

Rx Bare root stock will be inoculated with mycorrhizal fungi spores mixed with water and a material such as Terrasorb right before outplanting.

Rx Tree handling will meet Regional standards.

• KV funds or other funding sources will be pursued to pre-commercial thin overstocked existing plantations within the sale area.

• Limit logging operations during the bark slippage season from April 15 to July 1. Where purchasers can demonstrate adequate mitigation, this limitation can be waived.

Rx Where possible, hardwoods, Pacific yew, and old growth remnant snags or live trees will be left standing in harvest areas.

Rx Minor conifer species will be left in units located in the gentle/moist landscape areas and not factored in on the DxD spacing specification. In most cases these are shade tolerant species such as western hemlock and western redcedar.

• Mortality of merchantable leave trees from slash burning operations should not exceed 5% in pile-and-burn areas and 10% in underburn areas (includes snag creation), except in sugar pine reforestation areas (1-3 acre gaps) where the intent is to create 5 snags/acre with prescribed fire.

BOTANY

R-6 Invasive Plan FEIS S&Gs 2, 3, 7, & 13; Forest Plan S&G's IV-200 (C5-I); Contract Provision B/BT6.35.

ACTIONS:

• Establish 100-foot no-entry buffers around two Pacific Felt Lichen locations occurring in Units 5 and10.

• Establish a 150-foot no-harvest buffer (Forest Plan S&G's IV-200 [C5-I]) around unique habitats (as located on the unit shapefile) to minimize potential impacts. Unique habitats identified for protections are located in, or adjacent, to Units 1, 9, 16, 24, 27, 29, 33, 37, 39, 40, 45, 46, 47, and 57.

• In Units 1, 9, 16, 29, 33, 37, 39, 45, 46, and 47, harvest activities will occur within the 150-foot buffer of some unique habitats, but will not enter into the unique habitats; and trees will be directionally felled away from unique habitats. (See Forest Plan Amendment).

• Treat known sites of Scotch broom and selected sites (as directed by a district or forest noxious weed coordinator) of Himalayan blackberry, and Forest Rated "A" noxious weeds (listed in chapter 3) as necessary and funded, on haul roads, landings, and skid roads prior to logging activities. Higher priority would be given to sites where there is a threat of moving seed from contaminated to uncontaminated areas. Treatments would be based on the Forest Integrated Weed Management Decision Notice and Finding of

No Significant Impact signed in June 2003. The Forest Service will flag noxious weed sites to be avoided in the higher priority sites, prior to work commencing. Infested sites to be avoided will be marked with florescent orange flagging and labeled "NOXIOUS WEEDS" with black lettering. Forest Service will provide the contractor with a map indicating where the known infestations of Forest Rated "A" noxious weeds and other invasive weeds of concern are located. Contractor will avoid ground-disturbing activities in the flagged and/or staked areas unless otherwise directed by the Forest Service.

• Actions conducted or authorized by written permit by the Forest Service that will operate outside the limits of the road prism (including public works and service contracts), require the cleaning of all heavy equipment (bulldozers, skidders, graders, backhoes, dump trucks, etc.) prior to entering National Forest System Lands (Prevention Standard 2—Regional Invasive Plants FEIS and B/BT6.35).

• A District or Forest weed specialist will inspect active gravel, fill, sand stockpiles, quarry sites and borrow material for invasive plants before use and transport. Use only gravel, fill, sand, and rock that is judged to be weed free by District or Forest weed specialists (including material from commercial sites) (Prevention Standard 7 - Regional Invasive Plants FEIS).

• Treat or require treatment of infested sources before any use of pit material (Prevention Standard 7 - Regional Invasive Plants FEIS). Starting with the highest slopes that have invasive vegetation growing in previously disturbed areas scrape off the top several inches of soil and rock to remove all of the seed bank. Stockpile this material in a location at the quarry where it would not be disturbed, i.e. no machinery should drive over the pile. This contaminated material would be monitored and covered as necessary to ensure it does not become a future source of weeds at the quarry.

• All personnel, contractors, etc. working on the project will be made aware of the high priority "A" weeds (specifically Scotch broom) that could be found during activities; any high priority noxious weeds found should be reported to the Forest Service.

• Use signs such as "logging use only" to discourage public access to active road construction sites by establishing road closures. Allowing only vehicles involved with construction on the site will help limit introduction of noxious weed seed.

• After harvest, treat remaining or new infestations of noxious weeds for up to three years following sale closure.

• Wherever possible, use native re-vegetation techniques to reestablish native plants on sites where weeds are removed as well as in areas where exposed mineral soil provides optimal conditions for weeds to colonize. Native plant materials are the first choice in re-vegetation for restoration and rehabilitation where timely natural regeneration of the native plant community is not likely to occur. Non-native, non-invasive plant species may be used in any of the following situations: 1) when needed in emergency conditions to protect basic resource values (e.g., soil stability, water quality and to help prevent the establishment of invasive species); 2) as an interim, non-persistent measure designed to aid in the re-establishment of native plants; 3) if native plant materials are not available; or 4) in permanently altered plant communities. Under no circumstances will non-native invasive plant species be used for revegetation (Prevention Standard 13 - Regional Invasive Plants FEIS).

• Maintain desirable roadside native vegetation. If desirable vegetation is removed to bare mineral soil during blading or other ground disturbing activities, that area must be revegetated.

• Conduct road blading, brushing and ditch cleaning in areas with high concentrations of invasive plants in consultation with District or Forest-level invasive plant specialists; incorporate invasive plant prevention practices as appropriate (Prevention Standard 8 - Regional Invasive Plants FEIS). Scotch broom infested sites will be marked with florescent orange flagging and labeled "NOXIOUS WEEDS" with black lettering. Forest Service will provide the contractor with a map indicating where the known infestations of Forest Rated "A" noxious weeds and other invasive weeds of concern are located. Contractor will avoid ground-disturbing activities in the flagged and/or staked areas unless otherwise directed by the COR/FSR. Whenever possible, roadside brushing will be accomplished prior to seed setting of noxious weed species (approximately late June) in noxious weed flagged areas. The intent of this is to stop and/or prevent noxious weed spread and establishment.

• After harvest, armor or apply weed-free mulch (3-8" deep) to areas in need of cover if revegetation has or would likely fail.

• Firelines will be rehabilitated and revegetated as feasible and necessary as determined by a District or Forest weed specialist, to restore the soil/duff and vegetation layer in order to prevent the introduction and/or the proliferation of noxious weeds. This applies to Units 9, 10, 11, 16, 17, 27, 30, 31, and 32.

• If needed, use weed-free straw and mulch for all projects, conducted or authorized by the Forest Service, on National Forest System Lands. If State certified straw and/or mulch are not available, then it must be certified, all states, noxious weed-free (Prevention Standard 3 - Regional Invasive Plants FEIS). Note: because of the aquatic nature of rice, the harvested straw is already considered weed-seed free. The District or Forest weed specialist may approve the use of rice straw for some applications.

RECREATION and HERITAGE RESOURCES

• Heritage resources were discovered during project inventory. Following Stipulation IIIB.2(C) of the PA the Forest Archaeologist has determined the following protection measures for a determination of Historic Properties Avoided as described in the PA under Standard Case-by-Case Review. The protection measures outlined in the Feb 7, 2007 memo from the Forest Archaeologist will be implemented.

• In the event that an unknown historic or prehistoric site is discovered in the course of the project, the activity will be stopped and the appropriate measures will be taken to stop any adverse effects to the site resulting from the activity (BT6.24). Any adverse effects, should they occur, shall be mitigated.

• Safety signs will be maintained on the main travel routes during logging operations.

Description of terms used in the above Alternative summaries and throughout the document:

Thinning

- Thinning is the harvest of a portion of the trees in a stand in order to release the remaining trees from competition to allow for improved growth and development of understory vegetation. Heavy thinning would leave an average of 50-70 trees per acre averaged over the area of a unit. Moderate thinning would leave an average of 70-90 trees per acre averaged over the area of a unit.

Fuel treatments

- Machine piling is done by a small excavator that picks up and piles slash in large piles, which are later burned during moist conditions.
- Handpile burning is accomplished with hand crews where slash is piled in relatively small piles and burned under moist conditions.
- Underburning and jackpot burning is the burning of logging slash after a thinning where slash is burned in place rather than being redistributed by machines or hand crews. Underburning is done on continuous fuel beds and a fireline is hand-dug around the area to contain the fire. Jackpot burning is applied to concentrations of fuel where no handline is needed to contain the fire.

Logging Systems

- Ground based logging involves either loader logging or the use of mechanized systems. Loader logging uses 1 piece of equipment - a log loader works on a grid of straight skid roads to transport hand-felled trees to landings along roads, within or outside of the unit. Slash is piled or hauled away and later burned. Mechanized logging uses 3 pieces of equipment - a fellerbuncher which fells trees and a grapple skidder or tractor to transport the logs to the landing, and a delimber which removes limbs and cuts the trees into log lengths. Most of the work is done within the unit on the forwarding trails. Slash is crushed on forwarding trails and not further treated or burned.
- Skyline logging is accomplished generally on steeper ground where cables bring logs uphill to landings using a carriage/cable system attached to a tower to help suspend logs off the ground.
- Helicopter logging is accomplished where no immediate road access exists or where resource concerns override use of ground-based or skyline equipment. Helicopters fly logs to nearby road and landings.

Roads

- System roads are roads that are needed over the long term to provide access for future stand management. Open system roads have different levels of maintenance depending on whether they are managed for passenger vehicles or high clearance vehicles. Maintenance level (ML) 1 roads are closed roads that are used intermittently and that may require basic custodial maintenance focused on the maintenance of drainage facilities and runoff patterns; ML 2 roads are open roads that are maintained to only accommodate high clearance vehicles; ML 3 roads are open roads that are maintained for travel by a standard passenger cars; and ML 4 roads are maintained to provide a moderate degree of user comfort and convenience at moderate travel speeds.
- Unclassified roads are roads that were typically built several decades ago during logging, and that have been left unattended. Typically under today's standards many such roads would have been planned as temporary roads and obliterated following use.
- Temporary roads are built only for a short-term use such as logging, and are not considered part of the long-term transportation system. They are native surface roads (no rock added) that are obliterated following use. The timber sale purchasers are required to obliterate the road under the timber sale contract. This involves subsoiling the road as appropriate, and pulling displaced soil and duff back over the

road surface. Logging slash is also often pulled over the top of the road to provide additional ground cover and bare soil protection.

- Road reconstruction activities are implemented on existing roads to reduce risk of resource damage and/or improve traffic safety. Treatments to address aquatic resources problems typically include the addition of cross drains (ditch-relief) culverts; drivable 'rolling grades' structures and out-sloping the road, if practical; increasing the capacity of the culvert to meet a 100-year storm event; reducing plugging potential from excessive accumulation of sediment and woody debris (adding a side-tapered inlet or trash rack); eliminating diversion potential (constructing a 'drivable rolling grade', if road grade allows); reducing the size (height) of the fill where overtopping-type failure may occur; stabilizing or armoring fill slopes with riprap (rock blanket); dissipating stream outflow energy with riprap; dispersing water ('dewater') before reaching affected failure site (add cross drain on upgrade); and pull-back of the 'oversteepened' fill slopes.
- Road inactivation includes reconstruction activities that prevent vehicular use of a road for an indefinite (temporary) period of time for the purpose of reducing risk of resource damage. An 'open road' may be closed as a result of inactivation, or a currently closed road may receive further treatment to reduce the risk of resource damage. The road remains on the Forest road system, though anticipated maintenance needs are minimal to none.
- Road decommissioning is intended to remove or substantially reduce the potential for resource damage attributed to the road, and results in the permanent closure of the road and its removal from the Forest system of maintained roads. Decommissioning implies that there is no reasonable expectation for use of the road in the foreseeable future, given presently available information and direction. Work typically includes removal of drainage structures (culverts) and reestablishing stream channel beds and banks, pullback of unstable road shoulders or landings, subsoiling the road surface, and various levels of revegetation.

This page intentionally left blank.

CHAPTER 3

AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

INTRODUCTION

This chapter describes the components and scope of the human environment that may be affected by implementation of the alternatives outlined in Chapter 2 and discloses the potential consequences of implementing each alternative including the mitigation measures, watershed best management practices and management requirements associated with each alternative. A complete description of each alternative is found in Chapter 2.

This chapter presents the scientific and analytic basis for the comparison of alternatives. The effects are discussed in terms of social and environmental changes from the current condition and include quantitative assessments where possible as well as qualitative assessments. All discussions are tiered to the Final Environmental Impact Statement (FEIS) of the 1990 Umpqua National Forest LRMP, as amended and the 2005 Final Environmental Impact Statement for the Pacific Northwest Region Invasive Plant Program. It also incorporates by reference the recommendations and analysis in the 1995 Little River and 2001 Middle North Umpqua Watershed Analyses (WA's) and the 2001 Little River Watershed Total Maximum Daily Load (TMDL) Appendix C Federal Water Quality Restoration Plan. This chapter also incorporates by reference all reports and analysis prepared by resource specialists, which are summarized in this chapter.

ACTIVITIES THAT MAY CONTRIBUTE TO CUMULATIVE EFFECTS

Tables 7-9 document the relevant past, present, and reasonably foreseeable activities that may contribute to cumulative effects for the Emile project. Recently, the Council on Environmental Quality issued a memo stating that agencies are not required to "catalogue or exhaustively list and analyze all individual past actions" (CEQ memo, June 24, 2005). Instead, agencies should use scoping to focus on relevant past actions and discuss their relevance in terms of the cause and effect they had on a resource. This direction is followed in the Emile project; the following tables are displayed to summarize information known about the subwatersheds that constitute the Emile planning area. Discussion of these activities occurs throughout this chapter, where relevant.

Table 7. Past Activities that May Contribute to Cumulative Effects in the Emile Planning Area.

Activity	Decade	Acres/Miles	Comments
Regeneration Harvest Forest Service	1940's 1950's 1960's 1970's 1980's 1990's 2000's	785 3,326 1,378 2,290 3,115 644 0	Regeneration harvest primarily through ground based and skyline logging.

Activity	Decade	Acres/Miles	Comments
		11,538	**TOTAL ACRES**
Final Overstory Removal	1970's 1980's 1990's	128 810 94 **1,032**	Overstory removal primarily through ground based and skyline logging. **TOTAL ACRES**
Commercial Thinning/Partial Harvest	1960's 1970's 1980's 1990's	40 196 15 793 **1,044**	Commercial thinning used primarily ground based and skyline logging with a small amount of helicopter logging in the 1990's. **TOTAL ACRES**
Pre-commercial Thinning (PCT)	1960's 1970's 1980's 1990's 2000's	278 1,664 2,507 4,406 104 **8,959**	PCT was accomplished using hand carried chain saws. **TOTAL ACRES**
Reforestation	1940's 1950's 1960's 1970's 1980's 1990's 2,000's	290 2,881 1,737 2,085 2,516 2,120 396 **12,025**	Reforestation was accomplished using shovels, hoedads, and other planting implements. **TOTAL ACRES**
Animal Damage Control	1980's 2,000's	75 288 **363**	Netting repellants/tubing/ **TOTAL ACRES**
Release	1960's 1970's 1980's 1990's 2,000's	1,313 632 273 4,335 20 **6,573**	Release included brushing or spot herbicide application around young trees to promote growth. **TOTAL ACRES**
Fertilization	1960's 1970's 1980's 1990's	47 271 3,691 143 **4,152**	Fertilization included both hand and aerial application. **TOTAL ACRES**
Burning	1940's 1950's 1960's 1970's 1980's 1990's	566 3,344 1,350 2,044 3,607 1,456 **12,367**	Broadcast/Slash Burning in clearcut harvest units. **TOTAL ACRES**
Salvage	1940's 1990's	292 403 **695**	Salvage harvest of burned stands. **TOTAL**

Activity	Decade	Acres/Miles	Comments
Road Building	1930's 1940's 1950's 1960's 1970's 1980's 1990's 2000's	4 6 53 54 48 36 2 3 **206 miles**	Building of system roads for logging and transportation purposes. Includes ML 1, 2, 3, and 4 roads. **TOTAL MILES**
Road Decommissioning	? 2001	3.3 miles 2.1 miles	No associated data available. Alpine Loop Road (2703-015 and associated spurs) decommissioning through road closure, decompacting road beds, seeding and water barring. Big game enhancement objective.
Instream Fish Habitat Enhancement	2000's	2.5 miles	Placement of large wood in Negro Creek (0.5 miles) and White Creek (2.0 miles).
Noxious Weed Treatments	2007	30 acres	Pulling of known population of Scotch Broom on roads in the Emile Planning Area.

Table 8. Present and On-going Activities that May Contribute to Cumulative Effects in the Emile Planning Area.

Activity Type	Total Acres/Miles	Location
Road Work	About 25 miles	Blading, ditch clean out, and maintenance as budgeted. Focused on main roads within the planning area.
Noxious Weed Treatment	About 30 acres	Ongoing treatment of noxious weeds in the watershed.

Table 9. Reasonably Foreseeable Activities in Emile Planning Area.

Activity Type	Total Acres/Miles	Notes
BLM Emile Regeneration Harvest and Commercial Thinning	0 acres	Project Withdrawn Indefinitely (Per Al James BLM, 03-19-2008).
Road Maintenance	About 25 miles	Ongoing maintenance of road system in the watershed.
Noxious Weed Treatment	About 30 acres	Ongoing treatment of noxious weeds in the watershed.

Social Environment

ECONOMICS – TRACKED AS A DISCLOSURE ISSUE

During scoping, timber industry representatives (AFRC) expressed a concern that all Forest Service timber sales be economically viable. This issue is addressed through the disclosure of economic effects detailed in this section. The economic analysis focuses on the direct, indirect, and induced costs and benefits of the alternatives and the connected actions described in Chapter 2. Net present value and benefit/cost ratio are the primary criteria used to compare the direct effects of the alternatives to the Federal Government, termed economic efficiency analysis. Impacts to the general economy of the area are modeled using IMPLAN Professional, an input/output model developed by the Forest Service (IMPLAN 2000). Assumptions regarding the economic analysis are footnoted where appropriate.

Most timber sales from the North Umpqua Ranger District are purchased and operated by individuals and companies based in Douglas County. Total mill capacity in Douglas County in 2003 stood at 760 mmbf/year (Ragon 2003). There have been two permanent mill closings since then: one sawlog mill and one plywood mill. A figure of 700 mmbf is used to estimate the contribution of each alternative towards meeting demand. Final demand is assumed to be wood products ready for shipment at the mill yards.

Douglas County Economic Situation

Total employment in Douglas County is difficult to quantify exactly, as the Oregon Labor Market Information System (OLMIS), Census Bureau, and IMPLAN use different criteria to measure employment. Because of this, percentages and relative differences are used for analysis where possible instead of absolute numbers.

The county has diversified its economy in recent years, particularly the manufacturing sector, as the timber industry situation has declined. Still, the logging, forestry and wood products sectors provide 10.4% of Douglas County's employment, and 21.4% of the overall industrial output, according to the 2006 IMPLAN data.

The trends in employment in Douglas County continue to show a shift from logging and wood products manufacturing toward retail sales and service sectors (Stevenson 2003). Although overall employment is expected to grow by 13.6% between 2002 and 2012, logging occupations were expected to decline by 3.6%. IMPLAN data through 2006 show an 11.9% decrease in forestry, logging and wood products manufacturing from 2002. The average annual wages paid in the retail and service sectors ($21,913 and $24,915 respectively) are far less than the forestry, logging, and wood products manufacturing average wage ($46,014) based on the 2006 IMPLAN data.

Economic Efficiency Analysis

The direct economic effects of the alternatives are displayed in Table 10. The standard criterion for deciding whether a government program can be justified on economic principles is net present value (NPV) – the discounted[35] monetized [36]value of expected net benefits (OMB A-94).

---

[35] Discounting is the process of calculating the present value of a future amount of money. 4% is the standard discount rate for long-term projects (OMB A-94).

[36] Lit. "to give the character of money to." A cost or benefit is monetized when it is expressed in terms of money.

Table 10. Economic Efficiency Analysis.

	Alt 2	Alt 3	Alt 4
Timber Volume (MBF)[37]	24,880	23,827	25,735
Acres by Harvest Method			
Skyline	827	774	827
Ground-based	948	920	948
Helicopter	60	60	60
Total Acres (numbers are rounded)	1,835	1,754	1,835
Volume (MBF)/Acre	13.56	13.58	14.02
Total Present Value Benefits			
Gross Benefits	$9,752,591	$9,369,909	$10,107,185
Value/MBF[38]	$392	$393	$393
Value/Acre	$5,315	$5,342	$5,508
Total Present Value Costs			
FS Prep & Admin	$741,670	$708,821	$766,000
Logging	$6,341,960	$6,091,977	$6,574,772
Slash Disposal	$1,050,829	$1,050,959	$1,050,863
Road Work	$477,803	$448,234	$477,763
Reforestation	$3,733	$3,733	$6,050
Sale Area Improvements	$1,136,211	$1,066,158	$1,231,296
Potentially unfunded SA Improvements (not included in total cost)	$368,846	$433,223	$305,525
Total Cost	$9,752,206	$9,369,881	$10,106,746
Cost/MBF	$392	$393	$393
Cost/Acre	$5,315	$5,342	$5,508
Net Present Value[39]	$385	$28	$439
NPV/MBF	$0.02	$0.00	$0.02
NPV/Acre	$0.21	$0.02	$0.24
Stumpage (2007 dollars)	$2,056,776	$1,942,417	$2,193,768
Predicted Stumpage Price/MBF	$82.67	$81.52	$85.24
Potential Return to the Treasury	$667,359	$638,231	$685,846
B/C Ratio[40]	1.00	1.00	1.00

[37] MBF is thousand board feet. The Forest Service estimates MBF using east-side Scribner rules, therefore the volume as shown, is higher than if west-side, long log Scribner rules would be applied.
[38] West side delivered log prices have been adjusted to reflect equivalent east side values due to the differences in scaling rules.
[39] There is essentially no difference between the three action alternatives in terms of Net Present Values. Sale area improvements were reduced for each alternative until a positive value for Net Present Value was reached.

Forest Service planning costs are not included in the economic efficiency analysis since they are considered sunk (OMB A-94). It is estimated that this project has cost about $197,000 to plan over the last two fiscal years. Based on the expected return to the Federal government shown in Table 10, all alternatives are below cost, including Forest Service planning, sale preparation, and administration costs. Alternative 1 is considered below-cost since there would be no return to the U.S. Treasury with expenditures for planning.

The action alternatives would be marketed as two or more individual timber sales. These sales would be offered in a public auction to achieve the highest return possible[41]. It is anticipated that all post-sale mitigation requirements and most sale area improvement work would be paid for by stumpage[42] from the timber sales. Table 10 includes an estimate of sale area improvement work that may not be funded with KV from the timber sales. This work is primarily precommercial thinning and associated slash treatment.

All action alternatives show a net present value of essentially $0. These alternatives may be considered advantageous to the U.S. government from an economic standpoint, due to their ability to fund sale area improvements. Current low timber prices, small diameter timber, expensive logging, and mitigation make these alternatives break even at best.

Log prices fluctuate due to a variety of market forces, many of which are external to Douglas County and Oregon. The recent slowdown in nation-wide housing has caused the local log market to fall drastically. Figure 6 displays a composite log price average ($/mbf) for the local Douglas County market since 1990 using Oregon Department of Forestry log price information (ODF 2007). The data in Table 10 are not adjusted for inflation and are equated to west side long log Scribner scaling rules. The economic efficiency analysis displayed in Table 10 uses average local log prices from the most recent four quarters, adjusted for short log volume.

A further decline in local log prices could impact the timber sale viability of each action alternative. As prices decline, less money would be available for post-sale activities, and the value of the timber could reach a point where an individual sale may not be marketable. It is estimated that a decline of 5% or more from 1st quarter, 2008 local prices would result in no-bid sales. It would be speculative to predict the local markets at the time of sale offer or operation.

In terms of economic efficiency as described in Element 2 of the Need for Action in Chapter 1, all action alternatives are about equal. Alternative 4 has the potential to return the most money to the Federal Treasury. Alternative 4 has the highest predicted stumpage price, which would give it more of a cushion in this falling log market.

---

[40] B/C Ratio is the benefit/cost ratio, another standard criterion for economic efficiency. It is the product of the present value of benefits divided by the present value of costs.

[41] Individual timber sales would be appraised and offered at fair market value, or the minimum to cover reforestation costs and a $0.50/ccf return to the Treasury, whichever is higher.

[42] Stumpage is the value of the timber "on the stump." It is the timber sale contract minimum value and is determined by subtracting logging, road work, and slash disposal costs from the delivered log price. Timber sale purchasers may bid more in a competitive auction. The actual monetary return to the U.S. Treasury is determined by subtracting all post sale costs from the stumpage.

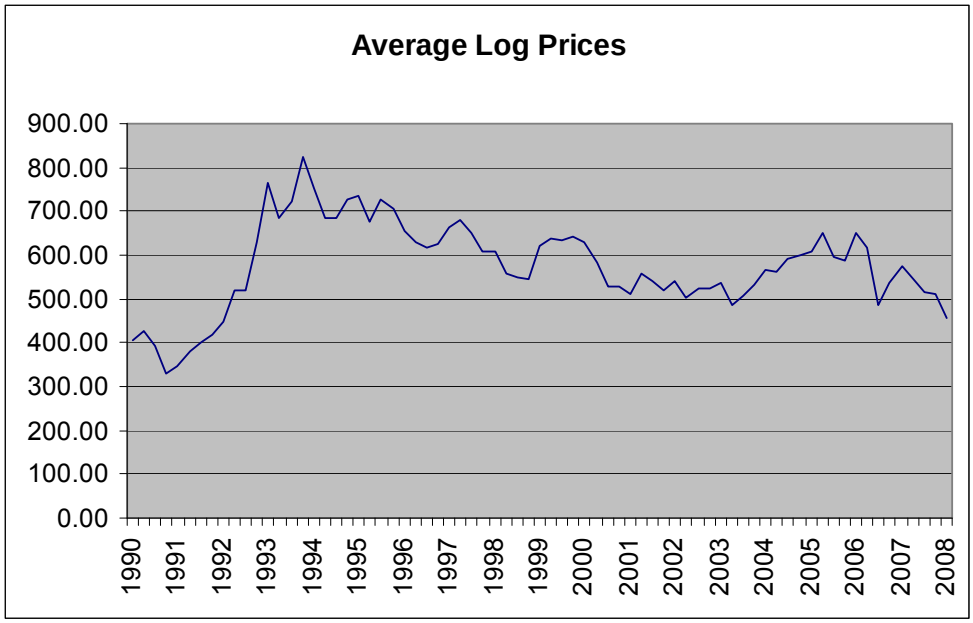


Figure 6. Average Composite Log Prices, Douglas County Market Area.

Economic Impact Analysis

The economic impact analysis using IMPLAN considers changes in employment and income due to changes in the economic activity of the county from each alternative. An individual timber sale may not substantially change the overall economic activity of the county, since the amount of timber volume represents a small percentage of the total demand. Over the last three years, Umpqua National Forest timber volume has been offered at a more consistent level, at about 45 mmbf per year. Timber sales from the National Forest are viewed as raw material available for the local industry, allowing production and support for jobs in the local economy to be sustained. Local National Forest timber would offset logs imported to the area, potentially reducing overall costs and increasing production.

Table 11 displays the results of the economic impact analysis by alternative. In general, the sale of timber from the National Forest would result in sustained or increased employment in the logging and wood products manufacturing sectors, in the forestry services (slash treatment, planting, etc.) and indirect and induced employment in many other sectors. Payments in lieu of taxes due to Douglas County from timber receipts are not included in these figures, as they are accounted for in the return to the Federal Treasury shown in Table 10.

Other direct, indirect, and induced benefits are derived from road construction, reconstruction, and other connected actions (Table 2) that may be funded by revenue from the timber sales or other funding sources. These work activities are treated as costs in the benefit/cost analysis since they reduce the revenue to the Federal Treasury, but they have economic benefits to the local community since most are contracted services. These benefits are included in the economic impact analysis and in the numbers reported in Table 11. The IMPLAN output files that document the complete analysis by sector are part of the Economic analysis file.

The numbers in Table 11 are not intended to be absolute. The analysis should be used to compare the relative differences among alternatives. The percentages listed are

percentage of the total Douglas county activity, including all sectors. The value of each activity included in the impact analysis was estimated from the cost and benefit analysis spreadsheets. An estimate was made of the percent of each activity's value that would be spent locally. The value to the wood products manufacturing sector was estimated to be 40% of the delivered log price, reflecting the difference between end product value and log cost to the mill. This difference can be widely variable based on mill efficiency and the choice of end products, but it approximates the value given for all of Oregon in 1998 (Gebert 2002). The percentage of value assigned to sawlog and veneer production is 95% and 5%, respectively, based on the small average diameter of harvested trees in this commercial thinning.

Table 11. Economic Impact Analysis

	Alt 2		Alt 3		Alt 4	
	Value*	**%**	**Value***	**%**	**Value ***	**%**
Timber Volume (MBF)	24,880	3.55	23,827	3.40	25,735	3.67
Change in Total Industrial Output	+$15,924	0.28	+$15,299	0.27	+$16,496	0.29
Change in Employment	+124	0.24	+119	0.23	+128	0.25
Change in Labor Income	+$4,832	0.26	+$4,649	0.25	+$5,007	0.27

* Dollar values are in thousands of dollars. Employment is number of jobs.

Direct, Indirect, and Cumulative Effects

Alternative 1 is not shown in Table 11 since by definition it would not change the conditions or level of economic activity in the County. This alternative may, however, contribute to a decline in the local timber industry, since it would keep federal timber from the market, at least in the short-term. No attempt was made to quantify that impact, as it would be speculative to estimate the current and reasonably foreseeable timber supply in the local area.

Alternative 4 would provide the highest level of beneficial, direct effects to the local economy. These effects are relatively small in terms of the percentage of Douglas County activity in each category, and the other action alternatives are very similar in the size of their effects. Implementation of any of the action alternatives would contribute to a beneficial cumulative effect to the local economy. This project, when combined with other federal timber sales from the Umpqua National Forest, would contribute to a beneficial cumulative effect of sustaining the wood products infrastructure in Douglas County.

ACCESS FOR MANAGEMENT AND THE TRANSPORTATION SYSTEM – COMPONENTS TRACKED AS A SIGNIFICANT ISSUE

During scoping, several conservation groups expressed concern over the construction of new temporary roads, stating that they cause numerous environmental impacts including erosion, channeling water, spreading noxious weeds, and reducing wildlife habitat. This significant issue was addressed in the development of Alternative 3. Oregon Wild also asked for a display of how many acres of thinning would be accessed by each segment of new temporary road. The environmental effects of roads are disclosed in numerous places in this Chapter including the sections on forest wildlife, botany, water quality, mass

wasting, surface erosion, riparian reserves, and fisheries. This section displays the analysis requested by Oregon Wild and the overall effects of the alternatives in terms of miles of roads, access, economics and other issues of interest to various members of the public (i.e. helicopter landings, winter haul, creation and decommissioning of roads, magnesium chloride).

To help quantify and track the issue of new temporary road construction the following indicators were developed:

- Miles of new temporary road constructed.
- Total acres of thinning accessed by new temporary road construction.

Existing Condition

The transportation system in the Emile planning area includes 202 miles of National Forest system roads. The planning area covers 55.4 square miles. The current total road density for the planning area is 3.7.miles/mile^2. There are currently 162 miles of road in the planning area open to public travel, which equates to an open road density of 2.9 miles/mile^2.

The transportation system provides access for recreationists and commercial users, including forest product harvesters. Recreation in this area focuses on hunting, hiking, camping, swimming and driving for pleasure.

The Little River WA (1995) and its appendices include a description of the current road system, and the risks associated with it. As stated in Chapter 1, the Emile area was not considered a high priority for further transportation system assessment and planning efforts related to closure or decommissioning of roads in the watershed (Little River WA-pgs. Answers-3). The Little River Watershed TMDL (DEQ 2001) notes that there are road-related restorative opportunities in the watershed, but also acknowledges that because Little River was not identified as a key watershed in the NWFP, that it is not currently a top priority for restoration at the Umpqua National Forest and Roseburg District BLM level.

Relevant Standards and Guidelines

Transportation System Standards and Guidelines are listed on pages IV-81 to IV-85 of the LRMP. Of particular note are the following:

- Road density should be the most economical system necessary to meet land management objectives. Evaluation of road development alternatives will be made for the planned uses considering safety, costs of transportation, and the effects upon lands and resources.
- Assure short-term (temporary) roads are closed within one year of when the timber purchaser has completed contractual requirements for the portion of the timber sale served by the road. Re-establish vegetation cover to put land back into production within ten years of contract, lease, or permit termination on roads not remaining a permanent part of the Forest transportation system.
- Forest development roads will generally be open to use by vehicles licensed for highway travel, except when closed for one of the following reasons:
    1. The mode of access causes unacceptable damage to, or negates adequate protection and management of Forest resources.
    2. Safety hazards to the road user exist.

3. Prescriptions in the Forest Plan recommend closures in elk winter range.
4. To provide security to contractors/cooperators, special use permittees, private land owners, and Forest Service administrative facilities.
5. Road maintenance costs to keep a road open are high compared to existing or expected use of the road.

- Roads closed for one of the above reasons may be closed either seasonally or year-around. Seasonal closures are preferred over year-around closures, wherever feasible, consistent with Forest Plan prescriptions, and if the objectives of the closure can be met.

Direct and Indirect Effects

None of the alternatives would create new system roads or close or decommission existing system roads. Thus, there would be no change in open road density or level of public access to the planning area under any alternative. All action alternatives include new temporary road construction, "existing" temporary road reconstruction, system road reconstruction and road maintenance described in detail in Chapter 2 and summarized below. Table 12 summarizes transportation system activities under each alternative.

Table 12. Summary of Transportation System Activities Associated with Each Alternative.

Activity	Alt 1	Alt 2	Alt 3	Alt 4
Miles of New Temporary Road Constructed and then Obliterated	0	1.0	0.6	1.0
Miles of Temporary Road Constructed/Reconstructed on existing old abandoned roads, skidtrails, or firelines; then obliterated	0	7.3	7.1	7.3
Miles and Sites Reconstructed on System Roads	0	7.0 miles 14 sites	7.0 miles 10 sites	7.0 miles 14 sites
Miles of Road Maintenance on System Roads	0	57.5	56.5	57.5
Number of existing landings or rock pits used as helicopter landings	0	6	6	6
Winter haul permitted if road conditions and water quality would not be impacted.	N/A	Yes	Yes	Yes

In response to scoping, an analysis of the thinning acres accessed by individual segments of new temporary road proposed under Alternative 2 was completed. Potential resource impacts associated with each road segment, as well as this analysis were used to help identify which temporary roads would be included in Alternative 3. Additional information regarding the IDT's temporary roads analysis is included in the Project Record. Tables 13 and 14 summarize data requested during scoping.

Table 13. Alternatives 2 and 4: Logging access data for new ground-disturbing temporary road construction.

Unit	New Temp Road Miles	Acres Accessed	Acres/ Mile	Volume/ Acre (mbf/ac)	Volume Accessed (mbf)	Volume/Mile (mbf/mi)
25	.25	19	76	15	285	1,140
32	.16	15	94	10	150	938
33	.18	32	178	13	416	2,311
37	.19	21	110	13	273	1,437
57	.02	30	1,550	15	450	22,500
60	.18	21	117	15	315	1,750
Totals	**1.0**	**138**			**1,889**	

Table 14. Alternative 3: Logging access data for new ground-disturbing temporary road construction.

Unit	Temp Road Miles	Acres Accessed	Acres/ Mile	Volume/ Acre (mbf/ac)	Volume Accessed (mbf)	Volume/Mile (mbf/mi)
25	.25	19	76	15	345	1,380
32	.16	15	94	10	190	1,188
57	.02	30	1,550	15	450	22,500
60	.18	21	117	15	315	1,750
Totals	**0.6**	**85**			**1,300**	

Alternatives 2 and 4 would construct about 1.0 miles of new temporary roads accessing 138 acres of commercial thinning. Alternative 3 would construct about 0.6 miles of new temporary roads accessing about 85 acres of thinning. In total, Alternative 3 would thin about 81 acres less than Alternatives 2 and 4; this is because all of unit 37 was dropped from Alternative 3 (not just the acres accessed by the new temporary roads) because the IDT determined that it would not be worth the economic and resource tradeoffs to thin remaining portions of the stand after dropping portions accessed by the new temporary road. As previously described, all proposed new temporary roads would be obliterated after use, thus there would be no differences between the alternatives effects relative to public access. The environmental effects of building, using, and obliterating these roads are described in this EA in the appropriate resource sections and the economic tradeoffs are described in the economics section.

All action alternatives would construct/reconstruct over seven miles of temporary roads on existing abandoned roads, old skid roads and trails, and old firelines accessing the proposed harvest units. These temporary roads would be obliterated following completion of the thinning operation. This would have the effect of erasing the footprint of the disturbed area from the landscape and would also remove the opportunity to use these

areas for future thinning access. Alternatives 2 and 4 would reconstruct and obliterate 7.3 miles of these temporary roads, as compared to 7.1 miles under Alternative 3.

Road reconstruction is generally intended to fix specific drainage concerns, perform deferred maintenance items, and bring the road surface to the design standard so it can facilitate timber haul. Reconstruction and maintenance work proposed under Alternatives 2, 3, and 4 would provide for safe and economical timber haul, as well as improved drainage capacity and lower risk of failure. There is no meaningful difference between the action alternatives.

Road maintenance is important for user comfort and safety, and protection of resources and the road facility. The Umpqua Forest-level Roads Analysis (USDA 2002) describes the current situation of declining budgets for road maintenance, the reduction in timber sale-related maintenance and the amount of maintenance that needs to be done on the Forest. Maintenance that would be performed by timber purchasers under Alternatives 2, 3, and 4 could provide a substantial portion of the total needs in the planning area for several years. Alternatives 2 and 4 would result in 57.5 miles of purchaser road maintenance over the period associated with the timber sales. Alternative 3 would result in slightly less purchaser maintenance, totaling 56.5 miles. Alternative 1 provides no purchaser maintenance. Improved road maintenance results in higher degrees of user comfort and safety, thus having a direct improvement in the quality of vehicle access. In addition, well-maintained roads reduce the risk of road failures and the resulting ecological and economic effects. Additionally, culvert replacements included as connected actions associated with all action alternatives would also result in improvements in the transportation system through reduced risk of erosion and road failures.

Effective dust abatement on certain roads within the planning area is necessary to maintain safe driving conditions during timber haul. Under all action alternatives, magnesium chloride would be applied at a rate of 19 tons per mile for a single application each operating season for roads that would have 3 mmbf of timber hauled over them. The estimated total miles of dust abatement for this project is 15 miles; 4 miles of FS Road 27 and 11 miles of FS Road 2703. Mitigations (see Chapter 2) would require that sections of roads within 25 feet of perennial stream crossings would not be treated with magnesium chloride. Magnesium chloride was chosen over water as the proposed method of dust abatement for the following reasons-water conservation, effectiveness, and economics. When magnesium chloride is used for dust abatement water is applied on the road once prior to application, so that the water on the road surface binds to the magnesium chloride. The water then seeps into the road surface taking the magnesium chloride with it. In the mornings when the humidity is higher than in the afternoon, the humidity moves some of the magnesium chloride up to the road surface to abate dust. Thus, only a single dust abatement application is usually required in a given operating season. When water is used for dust abatement, it goes down into the running surface and quickly evaporates. Dust gets abated by water for only a short period of time then it needs to be applied again. Log hauling typically requires multiple applications of water each day to abate dust and protect the running surface of the road, requiring thousands of gallons of water each day. Removal of large quantities of water each day from Little River and/or other perennial streams (particularly at low flows during dry summer months) was not considered desirable from an aquatic resources perspective. Additionally, because magnesium chloride need only be applied usually once a season (versus multiple times a day), it is substantially more cost-effective in terms of fossil fuel expenditure, as well as actual dollar costs (Pers. Com. Stu Carlson, 2008). Alternative 1 would not require or use either dust abatement option.

Alternatives 2, 3, and 4 would use and improve to the extent necessary to meet safety requirements, six existing landings or rock pits as helicopter landings. These helicopter landings would be retained as a component of the transportation system in the planning area following use. However, where feasible, landings would be planted with grasses and shrubs to reduce erosion and provide big game forage. No revegetation would occur in rock quarries that would be used as helicopter landings. Retention of functional helicopter landings represents a neutral or minor beneficial impact to the transportation system associated with all action alternatives. Alternative 1 would also retain existing helicopter landings, but not all would be in a safe and useable condition for future logging.

Cumulative Effects

Past road building (Table 7) resulted in vehicular access to the planning area that permits a variety of previously described commercial and recreational uses. None of the alternatives contribute to a cumulative effect on open road-density in the planning area. Given the beneficial effects from road maintenance and reconstruction under Alternatives 2, 3, and 4, these alternatives would result in a beneficial cumulative effect to user comfort when added to current (Table 8) and foreseeable road maintenance (Table 9) predicted to occur in the planning area (assuming funding to carry out this work becomes available). Alternatives 2 and 4 would contribute slightly more to this beneficial cumulative effect than Alternative 3, since they would maintain approximately one additional mile of road. Alternative 1 would make no beneficial contribution to user comfort since no additional road maintenance would occur as result of this alternative. None of the other connected actions affect access for management or the transportation system.

Following consideration of the incremental impacts of the project, when added to past, present, and reasonably foreseeable future actions in the planning area, it is determined that there are primarily minor beneficial and no meaningful adverse cumulative impacts to access or the transportation system associated with any of the action alternatives. Alternative 1 forgoes maintenance opportunities, but makes no consequential contribution to cumulative effects on access in the planning area.

Terrestrial Environment

A detailed description of the terrestrial environment can be found in the Little River (USDA 1995) and Middle North Umpqua (USDA 2001) Watershed Analyses. Site-specific field work and analysis for this project produced additional information, which is provided in the following sections.

Two spatial scales are used in many of the following discussions: (1) the landscape-scale; and, (2) the stand-scale. The landscape-scale focuses on larger-scale conditions such as forest vegetation patterns as seen from an airplane. The stand-scale refers to an area of 20 to 140 acres in size. Stand exam and other field data were used to characterize stand-scale conditions. Existing and future conditions were quantified and modeled using this stand exam data and the Forest Vegetation Simulator Model (Donnelly and Johnson 1997) and Fire and Fuels Extension to the Forest Vegetation Simulator Model (Reinhardt and Crookston 2003).

FOREST VEGETATION

Existing and Desired Landscape Conditions

Today, late-successional habitat occupies approximately 38% of the Emile planning area. It is composed of small patches compared to larger patches present in the 1930s. The

small patches and the abundance of the stem exclusion age-class reflect the pattern established by staggered small clearcuts that occurred from the 1940s through the 1980s. Approximately 25% of the planning area is currently in the stem exclusion stage. The action alternatives propose commercial thinning in the stem exclusion stage in areas of the landscape where the density of young stands is currently the highest.

Watershed Analysis recommendations, as described in Chapter 1, drove desired landscape conditions. As described in Chapter 1, the Emile planning area was stratified into four broad landscape areas based on relationships between forest vegetation, climate, and physiography (Figure 2). Since the gentle valley bottoms and high Cascades willow have greater moisture and lower slope location they are more likely to be a refuge from frequent fire, while mountain slopes and steep landscape areas have fewer barriers to fire spread. There is historic evidence of larger patches of stand replacement fire in gentle mountain slopes and steep terrain compared to the gentle valley bottoms.

Landscape areas help place individual stands into a broader context. Silvicultural prescriptions can then be designed to approximate disturbance processes that operate at the larger landscape scale. The use of landscape areas in designing vegetation treatments is in keeping with the Aquatic Conservation Strategy of restoring disturbance regimes. It is also consistent with ACS objective 1, which calls for the restoration of the distribution, diversity, and complexity of landscape scale features (such as vegetation patterns).

At the broad landscape scale, the stem exclusion vegetation stage covers proportionately much more of the gentle valley bottoms, Cascades high willow, and mountain slopes than it did during the 1930s. Areas adjacent to roads in gentle mountain slope, Cascades high willow, and gentle valley bottom landscape areas are now dominated by plantations in the stem exclusion stage. These landscape areas have been altered the most over 50+ years of management and contain the majority of proposed treatment areas.

The desired landscape condition would have larger age-class patches compared to today's pattern and would restore the late-successional forest to historic refugia in the gently-sloping areas of the landscape. Desired patch sizes would be larger to approximate historic fire disturbance that covered thousands of acres. Tree densities would vary across the landscape, based on the natural disturbance regime. The desired pattern of vegetation patches would align with a pattern produced by moderate severity fire effects in keeping with the WA recommendations and objective 1 of the Aquatic Conservation Strategy.

Existing Stand Conditions

Table 15 describes the current vegetative and geographic physical condition for the 44 managed stands being analyzed for the Emile Timber Sale Project. These plantations were clearcut harvests between 1949 and 1965 and planted heavily with Douglas-fir. Stands are stocked at high levels with densities exceeding 500 trees per acre (total). Most stands lack natural canopy gaps and associated understory diversity. In the stands that were pre-commercially thinned, shade tolerant conifers and hardwoods were routinely cut, leaving most of today's stands in simplified conditions. Overstories are dominated by Douglas-fir and stands vary between the stem exclusion and understory reinitiation stage of forest development, as described by Oliver 1996).

Tree species within the upland can include combinations of Douglas-fir, ponderosa pine, sugar pine, incense-cedar, western redcedar, dogwood, white fir, noble fir, western hemlock, golden chinquapin, Pacific madrone, and bigleaf maple. Ponderosa pine has

been artificially planted and is not evident in the surrounding natural stands[43]. Conversely, sugar pine which occurred historically in stands with south and west aspects is currently absent or is only a minor stand component. Tree species within riparian zones can include combinations of Douglas-fir, dogwood, white fir, western hemlock, red alder, willow, western redcedar, and bigleaf maple. Variability within stands occurs in terms of understory development, density, tree species, canopy closure, mean diameter, slope, aspect, and amount of riparian habitat. Understory development of shade tolerant conifers, including western redcedar, white fir, Pacific yew, and western hemlock, is primarily occurring within 20-60 feet of Class III streams within the steep landtype association and variably in the gentle valley, gentle mountain slope, and Cascade willow landtypes. The presence of snags is very low, with diameters usually less than 12 inches DBH. Decay class 3-5 large diameter (>20 inches) down logs, that are remnant culls from the past clearcut harvest, are widely scattered within both upland and riparian habitats. White pine blister rust is causing widely scattered mortality of sugar pine and there is low incidence of dwarf mistletoe and root disease. The growth potential ranges between Kings Productivity Class II and IV, and site indices between 110 and 170 (base 100, Curtis et al 1974). This represents a wide range of site productivity conditions from relatively poor to relatively high.

Riparian forests within the watersheds encompassing the Emile planning area were clearcut harvested without reserve trees from the 1940's until the 1980's. Currently, Riparian Reserves are fragmented throughout the landscape with large blocks of late-seral forest removed from the lower and middle reaches of main tributaries. Clearcut harvesting created young plantations along stream reaches that are now growing even-aged stands of Douglas-fir. These stands are not on trajectories for riparian diversity and function. Diversity of conifer, hardwood and shrub cover is lacking in many stream reaches and structural diversity of age classes would likely be delayed for 60-80 years without a disturbance event.

Desired Stand Conditions

The desired condition for both upland and riparian second-growth stands is to move the stands toward conditions that approximate those that would typically exist under the natural disturbance regime for their respective landscape areas, and manage for tree species that naturally persisted within the stands. Within the gentle/moist landscape areas, the desired stand conditions are those typical of late seral stands that experienced infrequent fire and therefore, persisted under the historical fire regime: multi-storied stands with 70-90 tolerant and intolerant overstory trees per acre and a shade tolerant understory (Figure 7). These sites are highly productive and can carry higher tree densities. Within mountain slopes and steep/dry landscape areas, desired conditions are those typical of landscapes that experienced frequent fire; single or two-storied stands with >1 acre gaps to promote sugar pine and 50-70 overstory trees per acre outside gaps after harvest (Figure 8).

With the exception of the Riparian Reserves where riparian dependant resources receive primary emphasis, the second growth stands in the Emile planning area are located in land allocations where timber production is emphasized. The desired condition is sustainable, cost-efficient timber production to support current and future economies. In order to produce a sustained yield of timber from these land allocations, harvest needs to

[43] A few natural ponderosa pine trees were located in the vicinity of Unit 1 but for the majority of the planning area ponderosa pine is "off-site" or artificial.

occur on a regular basis. This is particularly true in stem exclusion stands where salvaging the predicted suppression mortality improves the growth potential of the leave trees. If left untreated, the unnaturally dense condition of these stem exclusion stands would continue on a track of increased suppression mortality, growth declines, and lost economic opportunities. The target density, measured by square feet of basal area (BA), is between 100 and 160.

Specific to riparian areas, the desired condition is that Riparian Reserves within the stands continue to serve their existing aquatic ecosystem protection functions (effective stream shade, bank stabilization, provision of wood and leaf litter to the stream channel, etc.) at short-term, lower tree densities, but are on a trajectory to provide high quality, sustainable, future late seral riparian habitat in the shortest possible time frame. Future Riparian Reserves would be restored corridors of healthy riparian forests both in species composition and structural diversity of plant communities and would provide adequate summer and winter thermal regulation, nutrient filtering, and more natural rates of surface erosion, bank erosion, and channel migration than currently exist.

Tables 16 and 17 describe the desired stand conditions and actions prescribed to meet these desired conditions for the managed stands proposed for harvest, according to landscape area.

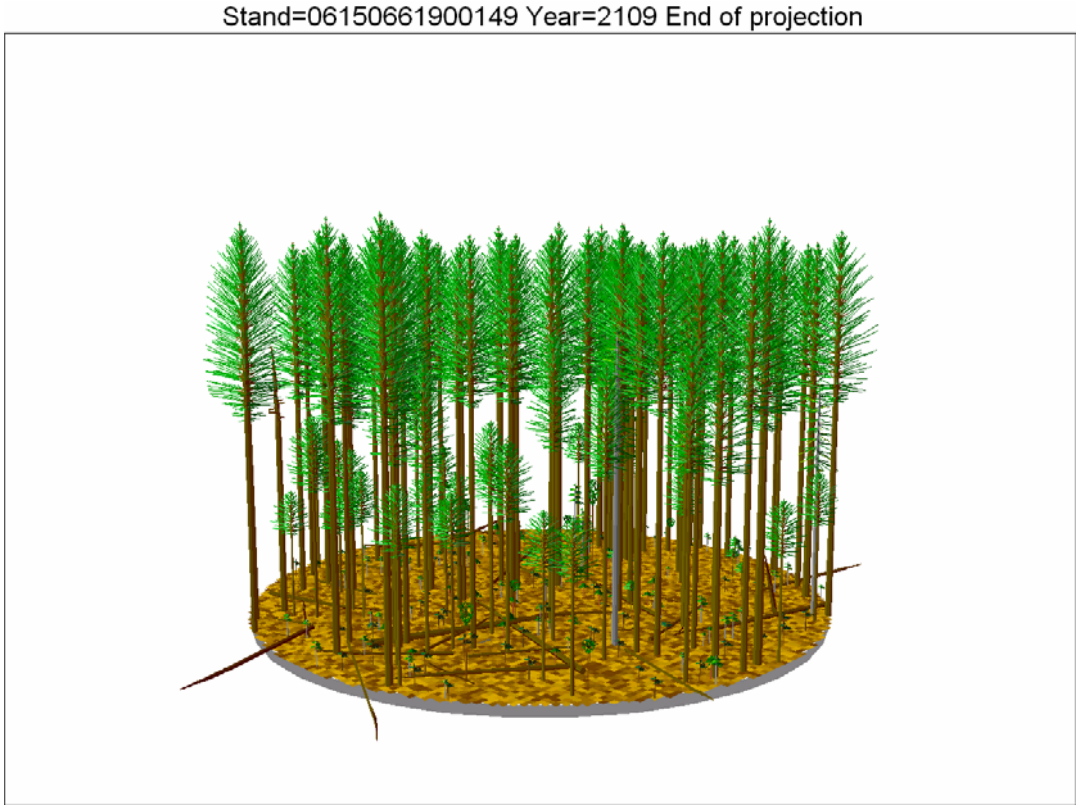


Figure 7 - Desired Condition for Gentle/Moist Landscape Areas.

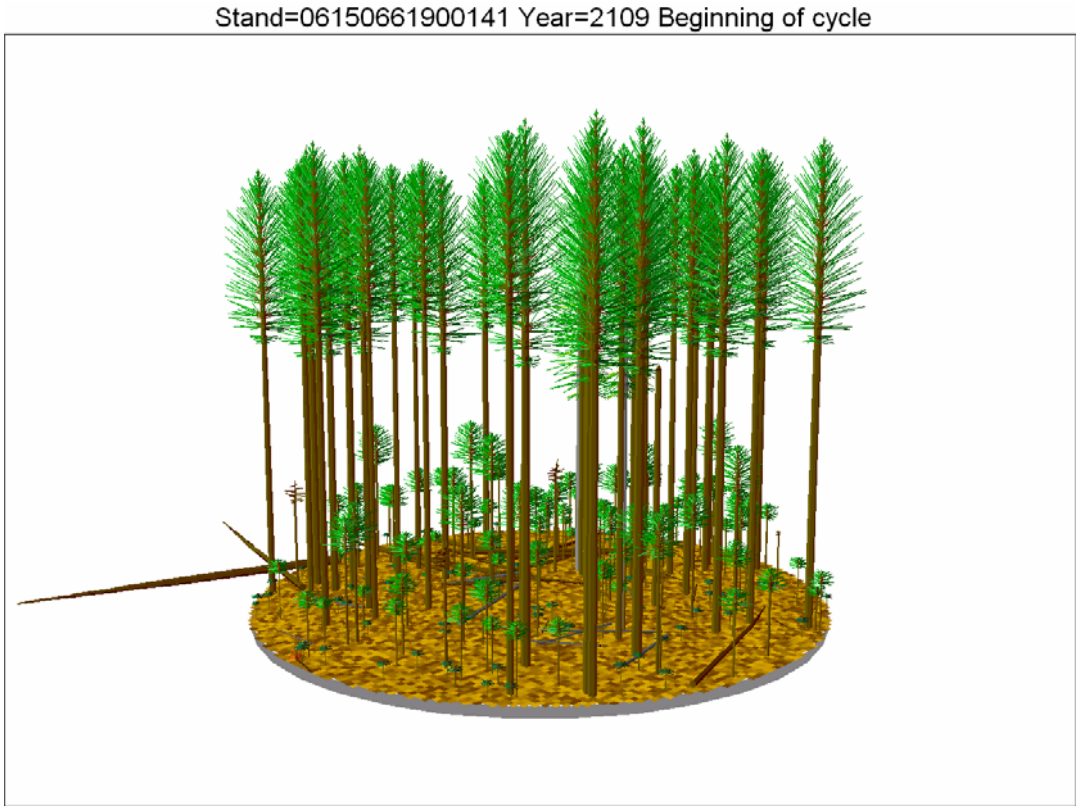


Figure 8 - Desired Condition for Steep/Dry Landscape Areas.

Table 15 - Existing Physical and Biological Stand Conditions.

Unit #	Landtype Association	Tree Species	Crown Ratio (%)	Canopy Closure %	DF Site Index (base 100)	Basal Area (ft^2)	Gross Volume mbf/ac	Slope	Aspect	Elevation (ft)
1	GV	DF,WF,PP,IC,M,BM,WH,RC,RW	20-50	85	140	280	38	G	S-SW	2040
2	GV/GMS	DF,WF,IC,BM,M,RC	20-50	85	140	280	38	G-M	W-SW	2040
4	GV/GMS	DF,RC,WH,BM	30-50	88	150	280	45	G	N	3200
5	GV/GMS	DF,RC,WH,BM	30-50	88	170	280	42	G-M	N	2800
7	GV/GMS	DF,WF,WH,RC,IC	35-70	85	150	280	42	G	NE	3840
8	GMS	DF,WF,WH,IC,PY	50-80	85	130	260	38	G	NE-NW	4120
9	ST	DF,WF,IC,BM,M	-	85	140	240	40	S	NW	2280
10	ST	DF,WF,IC,BM,M	-	85	140	240	40	S	SW-NW	2000
11	ST	DF,WF,IC,BM,M	-	85	140	240	40	M-S	S	2240
14	GV/GMS	DF,WH,RC,BM	20-50	88	140	280	42	G-M	SE	2120
15	GMS	DF,PP,IC,WH,M,GC	30-40	85	140	250	40	G-M	E-SE	2720
16	GMS	DF,WF,PP,IC,WH,M,GC	30-50	85	140	240	40	G-M	E-SE	3160
17	ST	DF,WF,PP,IC,WH,M,GC	30-50	86	140	260	40	M-S	W	2800
18	GV/GMS	DF,PP,IC,WF,WH,RC,GC	20-60	83	140	240	35	G-M	S-SE	2720
19	GV/GMS	DF,WH,PP,RC,WF,IC	30-60	85	160	260	40	G-M	NE,S	3000
20	ST	DF,WH,IC,RC	30-55	87	160	250	40	M-S	NE-SE	2960
24	GV/GMS	DF,PP,NF,WF,WH,IC	30-60	87	160	240	40	G-M	S-SW	3320
25	GV/GMS	DF,PP,WH,RC	40-60	90	130	330	45	G-M	NE-SE	3160
26	GV/GMS	DF,PP,NF,WF,WH,IC	30-60	85	160	240	40	G-M	E-SE	3600
27	GV/GMS	DF,PP,NF,WF,WH,IC	30-60	85	160	240	40	G-M	S-SE	3760
28	GMS/ST	DF,WF,WH,RC,BM	30-70	85	140	260	38	G-S	E-SE	3680
29	GMS	DF,WF,PP,WH,PY	40-80	84	110	220	35	G-M	E-SE	3960
30	ST	DF,RC,WH,WF,BM,M,IC	30-40	87	140	300	40	M-S	NW-SW	2640
31	ST	DF,RC,WH,WF,BM,M,IC	30-40	85	140	260	38	M-S	S-W	2600
32	ST	DF,RC,WH,WF,BM,M,IC	30-40	83	140	240	35	M-S	W,E-SE	2640
33	GV/GMS/CW	DF,WF,WH	40-65	74	120	210	43	G-M	NE	4040
34	GMS/CW	DF,WF,PY,BC	35-60	88	130	235	43	M	W-SW	4000
35	GV/CW	DF,WF,IC,WH,NF	40-70	80	120	220	38	G	E-SE	4120
36	GV/CW	DF,WF,WP,PP,WH	50-65	77	110	182	29	G	SE	4040
37	GV/GMS/CW	DF,WF,WH	40-60	80	130	213	41	G-M	NW-SW	4160
38	GV/GMS/CW	DF,WH,WF	40-60	88	140	260	42	G-M	SW,E	4200
39	GV/GMS/CW	DF,WF,WH	60-70	79	110	206	37	G-M	N-SE	4160
40	GV/CW	DF,WF,WH,BC	40-70	79	110	214	40	G	SE	4200

Unit #	Landtype Association	Tree Species	Crown Ratio (%)	Canopy Closure %	DF Site Index (base 100)	Basal Area (ft^2)	Gross Volume mbf/ac	Slope	Aspect	Elevation (ft)
42	GV/GMS/CW	DF,WF,RC,BC	40-60	79	110	218	40	G-M	NE	4160
43	GMS/CW	DF,WF,WH,PY,BC	60-70	80	130	190	31	M-S	NE-E	4080
44	GV/GMS	DF,WF,IC,WH,BC,WI	50-70	85	110	209	37	M	E-SE	4200
45	GMS	DF,WF,SP,PY,BM,BC	40-60	87	130	212	37	G-M	SE	3840
46	GMS	DF,WF,WH,PY,GC,RC,BC	30-60	88	140	300	38	G-M	SE	3680
47	GMS/CW	DF,WF,WH,PY,BC	40-75	85	120	245	45	M	E	4000
49	GMS/CW	DF,WF,WH,GC,PY	45-80	86	130	225	40	M-S	NE-E	3960
51	ST	DF,WF,WH,PY	50-65	75	160	216	46	M-S	W	3880
57	GV/GMS/CW	DF,WF,WH	40-70	82	140	226	43	M-S	N	4240
58	GMS/CW	DF,WH,PP,WF	50-80	82	130	220	35	G-M	N-NW	4240
60	GMS/CW	DF,WF,WH	30-60	73	130	213	45	M	N-NW	4240

Tree Species

DF-Douglas-fir
SP-sugar pine
IC-incense-cedar
PY-Pacific yew
NF-noble fir
WI-willow
BC-bitter cherry
WF-white fir
WH-western hemlock
RC-western red cedar
GC-golden chinquapin
BM-big leaf maple
M-Pacific madrone
PP-ponderosa pine

Landtype Association

GV-gentle valley
GMS-gentle mountain slopes
ST-steep terrain
CW-Cascades willow

Slope

G-gentle (0-35%)
M-moderate (35-60%)
S-steep (60+%)

Aspect

N-north
E-east
S-south
W-west

Table 16. Desired Stand Conditions and Prescribed Actions for the Mountain Slope and Steep/Dry Landscape Areas.

Desired Stand Conditions	Prescribed Actions
Increase populations of healthy sugar pine.	1-3 acre gaps on south/west aspects and ridgetops; plant 50 rust resistant sugar pine per acre within gaps; prune the lower 50% of the crown in the next 10 years after planting; favor sugar pine for leave trees in the DxD specifications.
50-70 shade intolerant overstory trees per acre; basal area < 140 $ft.^2$; single-storied or two-storied stand structure.	Favor Douglas-fir, incense-cedar, sugar pine for leave trees and include minor species in the DxD specs; use 18 or 19 feet for the DxD specifications; underburn after harvest.
Accelerate diameter and height growth of the overstory; overstory canopy closures < 55%.	Reduce tree densities and canopy closures through commercial thinning.
Reduce the incidence of ponderosa pine.	Favor other tree species for leave in the DxD specifications; 10+ inch diameter tree other than ponderosa pine will be favored over a larger diameter ponderosa pine. Use ponderosa pine for snag creation.

Table 17. Desired Stand Conditions and Prescribed Actions for the Gentle/Moist Landscape Areas.

Desired Stand Conditions	Prescribed Actions
Variable tree density, clumps.	Leave all minor species and don't factor them in the DxD spacing spec; use 15, 16, 17, and 18 feet for the DxD spacing spec.
70-90 shade tolerant and intolerant overstory trees per acre; basal area < 160 $ft.^2$; multi-storied stand structure.	Leave all minor species and don't factor them in the DxD spacing spec; use 15, 16, 17, and 18 feet for the DxD spacing specifications; no underburn after harvest; loader log to protect existing understories of western hemlock and western redcedar.
Accelerate diameter and height growth of the understory and overstory; overstory canopy closures < 60%.	Reduce tree densities and canopy closures through commercial thinning.
Reduce the incidence of ponderosa pine.	10+ inch diameter Douglas-fir or white fir will be favored over a larger diameter ponderosa pine. Use ponderosa pine for snag creation.

Table 18. Emile Residual Stand Condition After Harvest.

Unit #	Harvest Acres	Landtype Association	OS Leave Trees per acre	D x D Spec (ft)	D x D Tree Species	Pine groups (#/size)		Harvest Volume (mbf/ac)		Canopy Closure %		Basal Area (ft^2)
						Alt 2/3	Alt 4	Alt 2/3	Alt 4	Alt 2/3	Alt 4	
1	50	GV	70-90	17	DF,WF,PP			12	12	55	55	130
2	19	GV/GMS	70-90	17	DF,WF			12	12	55	55	135
4	97	GV/GMS	70-90	17	DF			15	15	55	55	140
5	39	GV/GMS	70-90	17	DF			15	15	55	55	135
7	113	GV/GMS	70-90	17	DF,WF			15	15	55	55	135
8A	26	GMS	70-90	17	DF,WF			12	12	55	55	130
8B	14	GMS	70-90	15	DF,WF,WH			12	12	59	59	150
9	34	ST	50-70	18	All	3/1ac	2/2ac	15	17	50	49	140
10	59	ST	50-70	18	All	3/1ac	3/2ac	15	17	52	49	140
11	61	ST	50-70	18	All	4/1ac	3/2ac;1/1ac	15	17	51	49	140
14	106	GV/GMS	70-90	17	DF	3/1ac	3/2ac	15	17	53	52	135
15	21	GMS	70-90	17	DF,PP			15	15	55	55	130
16	23	GMS	70-90	17	DF,PP			15	15	55	55	130
17	29	ST	50-70	18	All	3/1ac	2/2ac;1/1ac	15	18	49	46	140
18	55	GV/GMS	70-90	16	DF,PP	5/1ac	1/3ac;2/2ac;1/1ac	10	13	51	47	140
19	50	GV/GMS	70-90	17	DF,PP			15	15	55	55	130
20	20	ST	50-70	18	All			15	15	55	55	140
24	23	GV/GMS	70-90	17	DF,PP			15	15	55	55	135
25	58	GV/GMS	70-90	17	DF,PP			15	15	57	57	140
26	38	GV/GMS	70-90	17	DF,PP			15	15	52	52	135
27	48	GV/GMS	70-90	17	DF,PP	2/1ac	2/1ac	15	15	50	50	133
28	29	GMS/ST	50-70	19	DF,WF			12	12	52	52	120
29	32	GMS	70-90	17	DF,WF,PP			10	10	55	55	120
30	29	ST	50-70	18	All	2/1ac	2/2ac	15	17	51	47	140
31	28	ST	50-70	18	All	2/1ac	1/2ac;1/1ac	12	15	51	49	140
32	37	ST	50-70	18	All			10	10	55	55	140
33	80	GV/GMS/CW	70-90	17	DF,WF			13	13	54	54	137

Unit #	Harvest Acres	Landtype Association	OS Leave Trees per acre	D x D Spec (ft)	D x D Tree Species	Pine groups (#/size)		Harvest Volume (mbf/ac)		Canopy Closure %		Basal Area (ft^2)
						Alt 2/3	Alt 4	Alt 2/3	Alt 4	Alt 2/3	Alt 4	
34	26	GMS/CW	70-90	16	DF	2/1ac	2/1ac	15	15	54	54	147
35	42	GV/CW	70-90	17	DF,WF			12	12	55	55	130
36	84	GV/CW	70-90	17	DF,PP			10	10	52	52	120
37	50	GV/GMS/CW	70-90	15	DF,WF			13 (alt2 only)	13	57	57	138
38	110	GV/GMS/CW	70-90	18	DF			15	15	55	55	135
39	39	GV/GMS/CW	70-90	16	DF,WF			12	12	54	54	133
40	26	GV/CW	70-90	15	DF,WF			15	15	55	55	124
42	20	GV/GMS/CW	70-90	15	DF,WF			12	12	55	55	133
43	19	GMS/CW	70-90	15	DF,WF			10	10	54	54	100
44	53	GV/GMS	70-90	16	DF,WF			10	10	55	55	152
45	52	GMS	70-90	15	DF,WF			12	12	59	59	137
46	14	GMS	70-90	17	DF			12	12	55	55	135
47	12	GMS/CW	70-90	15	DF,WF			15	15	58	58	132
49	38	GMS/CW	70-90	18	DF,WF			15	15	56	56	124
51	34	ST	50-70	18	All			15	15	51	51	137
57	31	GV/GMS/CW	70-90	16	DF,WF			15	15	57	57	120
58	27	GMS/CW	70-90	16	DF,PP			10	10	55	55	130
60	44	GMS/CW	70-90	16	DF,WF			15	15	52	52	131

Tree Species
DF-Douglas-fir
WF-white fir
PP-ponderosa pine

Landtype Association
GV-gentle valley
GMS-gentle mountain slopes
ST-steep terrain
CW-Cascades willow

DxD-designation by description mbf-thousand board feet (-) no data ac-acre OS-Overstory

Proposed Thinning Treatments and Residual Stand Conditions

Commercial thinning in upland and riparian areas is proposed to meet the purpose and need (as described in Chapter 1), achieve desired conditions (as described above), and fulfill several watershed analysis recommendations. Four major types of treatments are proposed, based on landscape area and sugar pine health:

1) Thinning from below (50 to 70 TPA) in the steep/dry landscape area.

2) Thinning from below (50 to 70 TPA) with 1-3 acre gaps on south/west aspects within the steep/dry landscape area.

3) Thinning from below (70 to 90 TPA) within the gentle valley, gentle mountain slope, and Cascade willow landscape areas.

4) Thinning from below (70 to 90 TPA) with 1-3 acre gaps on south/west aspects within the gentle mountain slope landscape area.

A "no thin" prescription would apply to portions of harvest units to mitigate concerns for merchantability, heritage resources, riparian shade, unique habitats and slope instability. Unit areas that were eliminated today for merchantability concerns would not be thinned for at least a decade. Thus, for the foreseeable future, these areas would function as stem exclusion vegetation.

Table 18 displays the general prescription for each managed stand unit and the resultant residual stand condition after harvest. A more detailed prescription can be found in the Silvicultural Prescription, located in the Project Record.

Direct and Indirect Effects

Direct effects are those that are triggered immediately as a result of implementation at the stand scale. Indirect effects are those that would occur within the treatment areas and at the landscape-scale over a period of 3 to 5 decades, the timeframe required for canopy closure after proposed treatments (Table 19). The disclosure of effects below applies to both upland and riparian forests, including stands proposed for thinning within 150 feet of unique habitats.

Table 19. Summary of Direct and Indirect Effects to Vegetation.

Treatment	Vegetation Change	Primary Effect (Beneficial/ Adverse)	Duration (yrs)	Treatment Acres by Alternative			
				1	2	3	4
Commercial Thinning[44]	Lower stand densities & canopy closure / variable density in stands and landscape areas	Beneficial--improved species and structural diversity; increased growth and improved health and vigor of remaining overstory; improved stand fire resiliency in the long term	30-50	0	1,835 (29 acres in 1-acre gaps)	1,754 (29 acres in 1-acre gaps)	1,835 (47 acres in 1 to 3-acre gaps)

[44] Canopy gaps are included in commercial thinning acreage displayed in the table.

Treatment	Vegetation Change	Primary Effect (Beneficial/ Adverse)	Duration (yrs)	Treatment Acres by Alternative			
				1	2	3	4
	Lower amounts of snags and down wood / larger diameter trees	Adverse - loss of suppression-related mortality in smaller-sized trees Beneficial - large snags created / accelerated growth of larger leave trees	30	0	1,835	1,754	1,835
Pre-commercial thinning (planning area)	Lower tree density & less canopy closure	Beneficial--accelerated growth of retention trees and improved species diversity	30-50	0	1,751	1,751	1,751
Canopy gaps (1- 3-acre)	Rust resistant sugar pine planted and pruned	Beneficial—restore sugar pine within stands and across landscape	30-50	0	29	29	47
	Snags created in sugar pine areas	Beneficial--new source of coarse woody debris	30-50	0	29	29	47

The action alternatives would enhance the growth, health, and vigor of residual trees and restore stand density, and species and structural diversity similar to those considered characteristic under a natural disturbance regime, while establishing stand trajectories to meet desired conditions for upland and riparian forests. Table 18 displays the stand effects of commercial thinning on canopy closure, density (basal area), and harvest volume. These measures were developed using Suppose version 1.18 of the Forest Vegetation Simulator, Western Cascades variant. Resultant canopy closures ranged from 46 to 59 percent, with lower canopy closures occurring in stands prescribed for 50-70 trees per acre (tpa) with canopy gaps. Basal area ranged from 100 to 152 square feet. Harvest volume ranged from 10 to 18 mbf/acre, with higher volumes occurring in stands prescribed for 50-70 tpa.

Table 15 displays the stand effects of no action on canopy closure, density, and quadratic mean diameter. Canopy closures ranged from 73 to 90 percent. Basal area ranged from 182 to 330 square feet. Comparing the action alternatives to Alternative 1 (no action), canopy closures are reduced by an average of 30% and densities are reduced by an average of 130 square feet of basal area. On average, diameter growth rates of thinned stands under Alternatives 2, 3, and 4 are calculated to be 2.2 inches/decade, as opposed to 1.6 inches/decade for unthinned stands under Alternative 1.

The greatest benefit for sugar pine health at both the stand and landscape scales occurs under Alternative 4 because it has the largest number of acres planted to rust resistant sugar pine in 1-3 acre gaps. Alternatives 2 and 3 have the second greatest benefit, followed by Alternative 1 which has no benefit because no gaps are created for sugar pine planting. The greatest benefit for reducing the incidence of ponderosa pine occurs under the action alternatives. Under Alternative 1, ponderosa pine would remain a major component of some of the managed stands proposed for commercial thinning under the action alternatives.

As a whole, the long-term indirect effects of the action alternatives would be beneficial. While suppression mortality would be reduced by all treatments, the growth of the leave trees would be accelerated by thinning, stand structure would be diversified, and snags would be created with prescribed fire (Table 19). At the individual tree scale, thinning would develop large diameter branches, large deep crowns, and wind-firm stems. At the stand scale, understory growth and establishment would initiate the layering that is characteristic of late-successional structure within the gentle/moist landscape areas. Within the steep/dry landscape areas, underburning would retard the shade tolerant understory growth/layering, characteristic of the historical fire regime. Other management actions would add diversity of stand structure and density within individual harvested stands in the short term. Snag creation, fuels treatment, and logging practices (landings, skid trails, skyline corridors) would create small gaps in the short term. In the long term, small scale natural disturbance processes (root disease, insects, blowdown, and fire) would create small gaps within stands.

At the landscape scale, treatments would accelerate the development of late successional structures in the gentle/moist areas where they would more likely persist. The proposed treatments would also shift the vegetation pattern toward larger, late-successional patches. Western Oregon studies support the practice of thinning young stands to mimic the natural disturbance process or to accelerate the development of old forest structures (Tappeiner et al. 1997, Andrews et al. 2005, Lindh and Muir 2004, Garman et al 2003, and Muir et al. 2002).

The action alternatives would implement various combinations of treatments and no thinning across the landscape. The resulting mosaic would more closely approximate the natural pattern of forest structure as compared to Alternative 1. Each of the action alternative's treatment combinations would also accelerate the development of late-successional structure within the gentle/moist landscape areas as compared to Alternative 1.

Alternative 1 would not attain desired stand or landscape conditions or upland and riparian forests, nor would it meet element 1 of the purpose and need. Under Alternative 1, stands would remain densely stocked, with a high level of canopy closure. There would be little change in species composition or the distribution of live and dead vegetation in the near-term. Over the long-term, the rate of individual tree growth would continue to decline, and mortality would increase because the self-thinning phase of forest succession would persist for decades. Without management, the portion of the landscape in the stem exclusion stage would continue to increase as younger plantations enter this stage and as the Emile stands remain stalled in this stage.

Under the action alternatives, variability in stand density and structure would provide greater resilience to natural disturbances such as wildfire. Treatment variation would also create a less continuous pattern of live and dead fuels across the landscape. The

beneficial effects of the variation in fuel and canopy density resulting from thinning would be proportional to alternative thinning acreage.

The effects of pre-commercial thinning would be similar to commercial thinning treatments by reducing stand densities and increasing the growth, health, and vigor of the leave trees.

Cumulative Effects

The potential of the action alternatives to result in either adverse or beneficial cumulative effects to forest vegetation is addressed at the scale of the Emile planning area. The activities in Tables 7, 8, and 9 were taken into account in the analysis of vegetative age class distribution. The time frame for analyzing cumulative effects is 30 to 50 years, the period of time that thinning would most influence today's pattern of stand initiation and stem exclusion vegetation.

Forest age-classes that develop following wildfire or clearcutting are used to characterize forest conditions. Four such age-classes are commonly used:

1) Stand initiation - New stand with an open canopy. Stand age is generally less than 30 years, but can be older, especially in higher, colder elevations.

2) Stem exclusion - Stand where new species do not appear and some present species are dying from competition. Stand age is generally from 30 to 80 years, the average tree diameter is about 10" DBH and canopy closure is ≥53%.

3) Mature - Stand where trees reach their maximum height potential. Stand age is generally from 80 to 150 years, the average tree diameter is 10 to 19" DBH and canopy closure is ≥53%. It includes the "understory re-initiation stage" where the understory develops in response to small openings in the canopy (Oliver and Larson, 1990) and the "transition stage" defined in the Northwest Forest Plan as transitioning toward old-growth.

4) Old growth - Stand with overstory trees dying in an irregular fashion and understory trees are filling the gaps. Stand age is generally greater than 150 years, the average tree diameter is ≥20" DBH and conifer canopy closure is ≥70%. Includes the "shifting gap" stage as defined in the NWFP (USDA/USDI 1994).

The current distribution of age classes in the Emile planning area is displayed in Table 20. For this analysis, mature and old growth vegetation were combined into a late successional class. Late-successional stands are generally 80 years or older.
This existing condition represents a higher level of stem exclusion stands than under reference conditions due to past timber harvest.

Table 20. Current Distribution of Age Classes within the Emile Planning Area.

Seral Stage	Acres	% of planning area
Stand initiation (0-30 years)	12,511	35
Stem exclusion (30-80 years)	8,738	25
Late successional (80+ years)	13,621	38
Other (rock, meadows, water, roads)	612	2

Commercial thinning in the action alternatives would beneficially reduce the existing stem exclusion vegetation by approximately 6% within the planning area. As such,

thinning would help move stands toward maturity and out of the stem exclusion stage, helping to meet desired landscape conditions. Thus, when considered in the context of past, present, and foreseeable actions, it is determined that Alternatives 2, 3, and 4 would have no meaningful negative cumulative impacts and that the proposed activities and connected actions represent a positive contribution to vegetative conditions in the planning area. Alternative 1 would have no meaningful cumulative impacts on vegetation except in the context of foregone opportunities.

Aquatic Conservation Strategy

As disclosed above in this section on Forest Vegetation, the action alternatives would move landscape patterns and conditions toward those more typical under the natural fire regime. As such, the action alternatives are consistent with objective 1 of the Aquatic Conservation Strategy of restoring landscape-scale features such as landscape patterns.

COARSE WOODY DEBRIS

Coarse woody debris (CWD) is defined here as standing dead trees (snags) and large down woody debris (≥6" diameter). These forest components provide essential habitat for many species of wildlife, plants, fungi, liverworts, mosses, lichens, and ecological processes. Coarse wood helps provide for the maintenance and eventual recovery of late-successional organisms in the matrix land allocation (ROD B-7).

Relevant Standards and Guidelines

Mitigation measures in the LRMP were designed to provide a continuous supply of snags through time as well as providing snags on harvest areas in conjunction with timber harvest activities (USDA 1990, IV-78). The standards and guidelines and management area prescriptions for snags and down wood in the LRMP include:

> Wildlife S&G 1 - Woody material to provide wildlife cover will be retained on 10 percent of the area of all regeneration harvest units (D-22).
>
> Wildlife S&G 2 - Down, dead woody material (20 feet or more in length) and a minimum of 12 inches in diameter at the small end) will be left at the rate of two per acre on each unit that is regeneration harvested. Additional material will be left when logs have little or no commercial value and do not produce an unacceptable fire hazard (D-22).
>
> Wildlife S&G 18 - When possible, wildlife trees (snags and green culls) will be left standing in areas of timber harvest. This habitat will be in addition to that provided by implementing the snag habitat prescriptions (D-23).
>
> Management Area 10 - Focus is to produce timber on a cost-efficient sustainable basis consistent with other resource objectives for wildlife habitat, riparian habitat and water quality, visual quality, and recreation. Adequate snag habitat must be provided in this management area to meet the 60 percent potential population capability (PPC) for cavity nesters (FEIS IV-128).
>
> Modifications for snag habitat prescriptions (and down wood) were provided by the Northwest Forest Plan (1994), which led to watershed analyses (WA). These modifications are based on site specific information and the latest scientific information. The standards and guidelines in the Northwest Forest Plan were designed, in part, to maintain [through time] ecological components such as down logs, snags, and large trees (ROD B-2).

The Northwest Forest Plan requires site-specific analysis and application of models for computing down wood information (ROD C-40) and snag recruitment models (ROD C-46) to take into account tree species, diameters, falling rates, and decay rates, to determine appropriate tree and snag densities to achieve desired future conditions. The Fire and Fuels Extension to the Forest Vegetation Simulator model (FVS v6.21, revision 1/19/06) was used to analyze existing and future levels of snags and down wood for this project.

Recently, a new source for scientific information and management guidance on snags and down wood has become available. DecAID (Mellen et al. 2006) is a summary of the current knowledge and best available data on dead wood in Pacific Northwest ecosystems. The DecAID Advisor is a planning tool intended to advise and guide managers as they conserve and manage snags, partially dead trees, and down wood for biodiversity. DecAID was used to determine what levels would be ecologically appropriate for the specific habitat and structure types for the proposed Emile thinning units. For this project, the Westside Lowland Conifer-Hardwood Forest, Western Oregon Cascades, Small/Medium Trees Vegetation Condition was used. It categorizes three tolerance levels (30%, 50% and 80%) for snag and down wood sizes, densities and percent ground cover used by wildlife species. Tolerance levels indicate a level of assurance for providing habitat that meets the needs of the species. The higher the tolerance level for the species, the more individuals in the population are being provided habitat.

Existing Condition

The abundance of snags and logs varies substantially across forested landscapes in the Pacific Northwest (Ohmann and Waddell 2002). While the majority of the landscape usually supports moderate levels of snags and logs (Mellen et al. 2005), a fairly large portion (about one-third of the landscape in the Western Cascades of Oregon) can have little to no dead wood, while a smaller portion will have a great deal (White et al. 2002, Ohmann and Waddell 2002).

Within the proposed harvest units, stand exam data show current average snag densities between 3.0 to 8.8 snags/acre for snags ≥10 inch dbh and zero snags/acre for larger snags (≥ 20 inch dbh). Current average down wood levels are at 6.6 percent ground cover.

For the Emile Timber Sale, applicable CWD levels are summarized in Table 21. Snag and down log habitat would be managed to meet or exceed DecAID 50% tolerance levels for units adjacent to spotted owl cores and in spotted owl Critical Habitat Units (CHU) (approximately 1,247 acres). For the remaining units (approximately 588 acres), snag habitat and down log habitat would be managed to meet or exceed DecAID 30% tolerance levels.

Table 21. Coarse Woody Debris described for the 30% and 50% DecAID Tolerance Levels.

	Relevant DecAID Tolerance Levels	Range
Snags ≥10” dbh (snags/acre)	30% Tolerance Level	4 - 5
	50% Tolerance Level	10 - 18
Snags ≥20” dbh	30% Tolerance Level	0.1 - 5

	Relevant DecAID Tolerance Levels	Range
(snags/acre)	50% Tolerance Level	1 - 8
Down wood ≥6" diameter (% cover)	30% Tolerance Level	2 - 6
	50% Tolerance Level	3 - 10

Direct and Indirect Effects: The no action alternative would have no direct or indirect effect on CWD in the planning area because no timber harvest would occur. All action alternatives would affect CWD levels within harvest units, and there are no meaningful differences between the action alternatives with regard to CWD. The direct effects to CWD are the immediate changes that would occur and the indirect effects focus on how the alternatives would modify the stand CWD dynamics over the next 100 years, until the desired future stand condition is achieved. The actions that would have the largest effect on CWD are thinning and post harvest fuel reduction treatments. These actions cause a decrease in stand levels of snags and down wood caused by incidental falling of snags for logging or safety reasons and consumption of down wood during the fuels reduction treatments. Thinning would also reduce the amount of suppression mortality within the thinned portions of stands, indirectly affecting future recruitment of CWD.

New temporary road building/obliteration under all action alternatives would not have a measurable effect on CWD levels any more than the thinning. This is because the narrow width of such low impact roads would result in nearly the same level of tree removal as the thinning, with no real measurable effects over and above the thinning effects disclosed here.

The changes to levels of snags and down wood are shown in Figures 9-12. These graphs show how the action alternatives would change CWD trajectories over the next 100 years compared to Alternative 1 (using the latest models and assuming no future thinning entries). The changes vary with treatment type, and levels shown in these graphs are stand averages based on the percentage of each treatment within the stands being thinned.

Under all action alternatives, levels of CWD are not predicted to drop below the 30-50% tolerance level as advised in DecAID (Figures 9-12). The action alternatives would slightly delay the recruitment of large snags (≥20" DBH) at the 50% DecAID tolerance level (Figure 10). However, the action alternatives would provide other ecological benefits by allowing trees to grow larger, faster, and develop more suitable wildlife habitat characteristics (e.g., large limbs and deeper crowns) achieving the desired condition sooner than Alternative 1.

To mitigate for direct and indirect effects to CWD, all action alternatives would include creation of 5 snags per acre in spotted owl CHU's and adjacent to spotted owl cores (Figure 9). Probable methods of active snag creation would include: (1) use of prescribed fire to create clumps of snags in all units that would be underburned; (2) use of prescribed fire to create clumps of 5 snags/acre within all sugar pine gaps; (3) use of prescribed fire to kill clumps of off-site ponderosa pine trees; and (4) fungal inoculation[45]

[45] Trees would be inoculated with locally collected native heart rot fungus. Inoculated trees begin to develop heart rot within 5 years as they continue to grow (Duncan 1999), eventually producing larger trees with

(preferred method), topping, or girdling to create clumps of snags where fire is not a practical/desired tool.

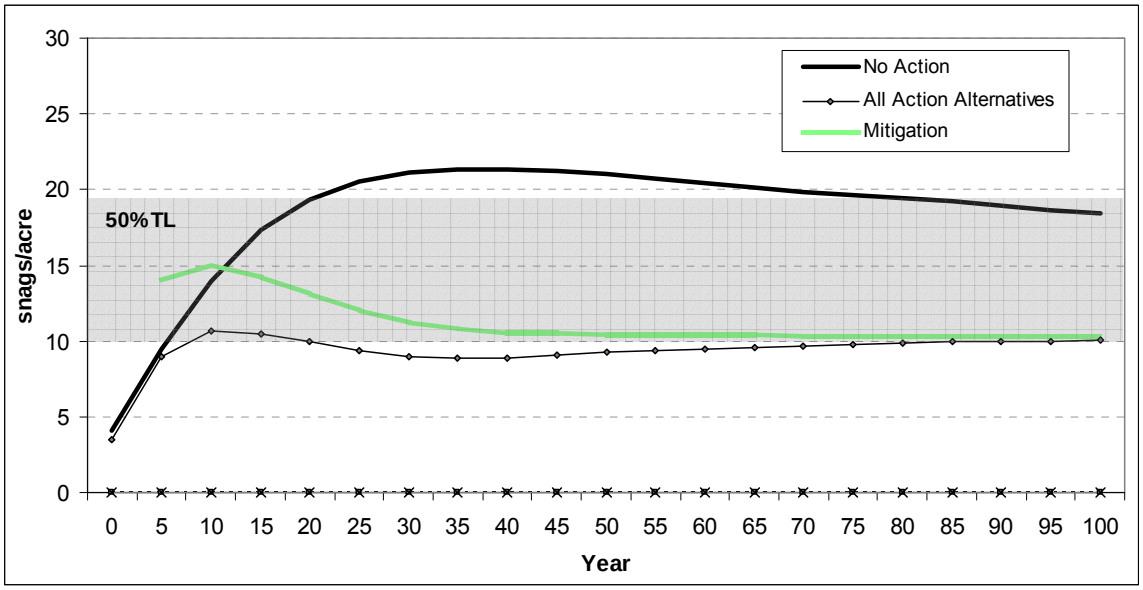


Figure 9. Existing conditions and short- and long-term changes to > 10"dbh snags. The gray area represents the 50% tolerance level (TL) from DecAID that would be used under all Emile Action Alternatives within spotted owl CHU's and adjacent to spotted owl cores. The green line indicates the effect of snag mitigation modeled at 5 trees/acre.

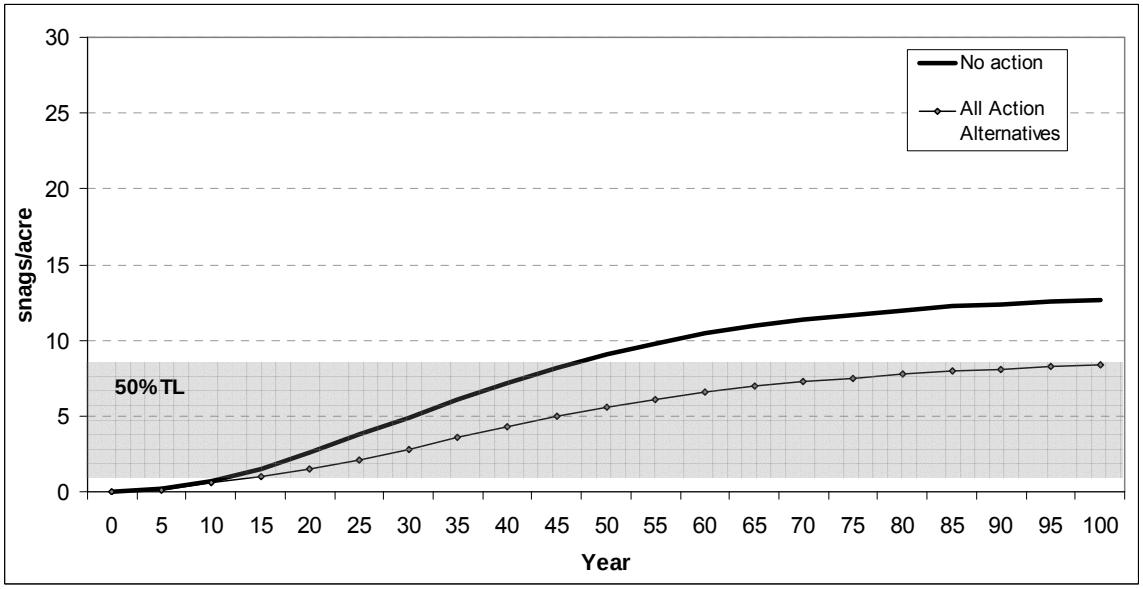


Figure 10. Existing conditions and short- and long-term changes to ≥ 20"dbh snags. The gray area represents the 50% tolerance level (TL) from DecAID. There would be a slight delay in attainment of large snags at the 50% TL under the action alternatives.

---

cavities and or broken tops, and eventually future snags. Inoculation is a management tool being used to offset the reduction of suppression mortality caused by thinning and to maintain a component of decadence within these managed stands.

For the remaining areas (approximately 588 acres), snag habitat would be managed to meet or exceed DecAID 30% tolerance levels; this would require no additional active snag creation. Small snag levels would remain above or very near the 50% tolerance level, but would be less abundant in these areas than under the no action alternative. However, ≥ 20"dbh snags would be on the same trajectory as represented above in Figure 10 (i.e. large snags meeting or exceeding 50%TL).

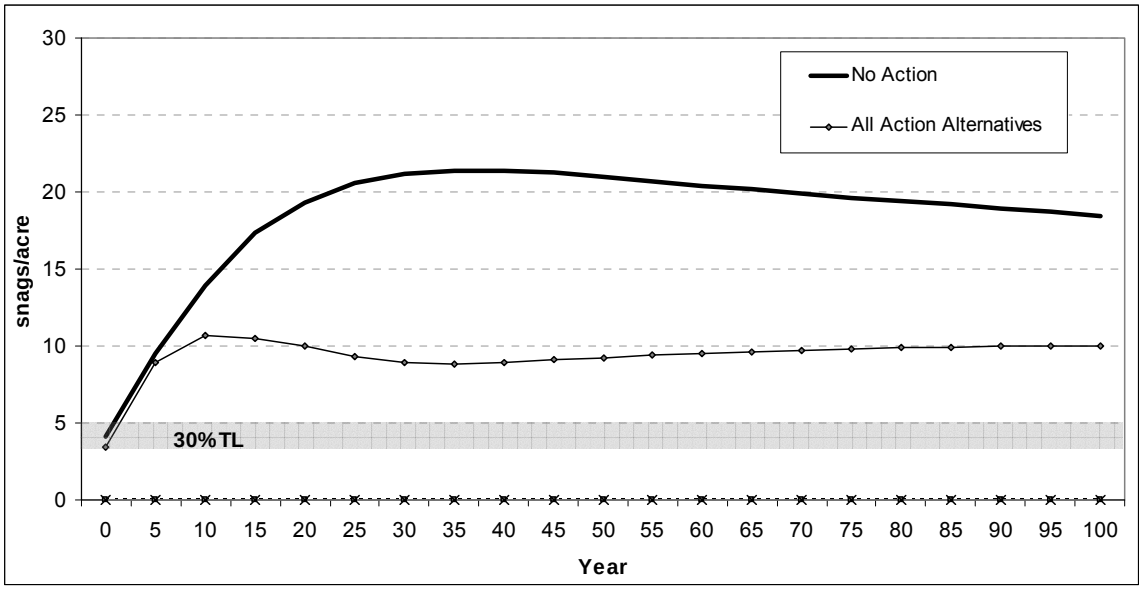


Figure 11. Existing conditions and short- and long-term changes to > 10"dbh snags. The gray area represents the 30% tolerance level (TL) from DecAID that would be used under all Emile Action Alternatives for areas outside of spotted owl CHU and adjacent to spotted owl cores. CWD levels on these units would remain well above the 30% TL and above or very near the 50% TL without active snag creation.

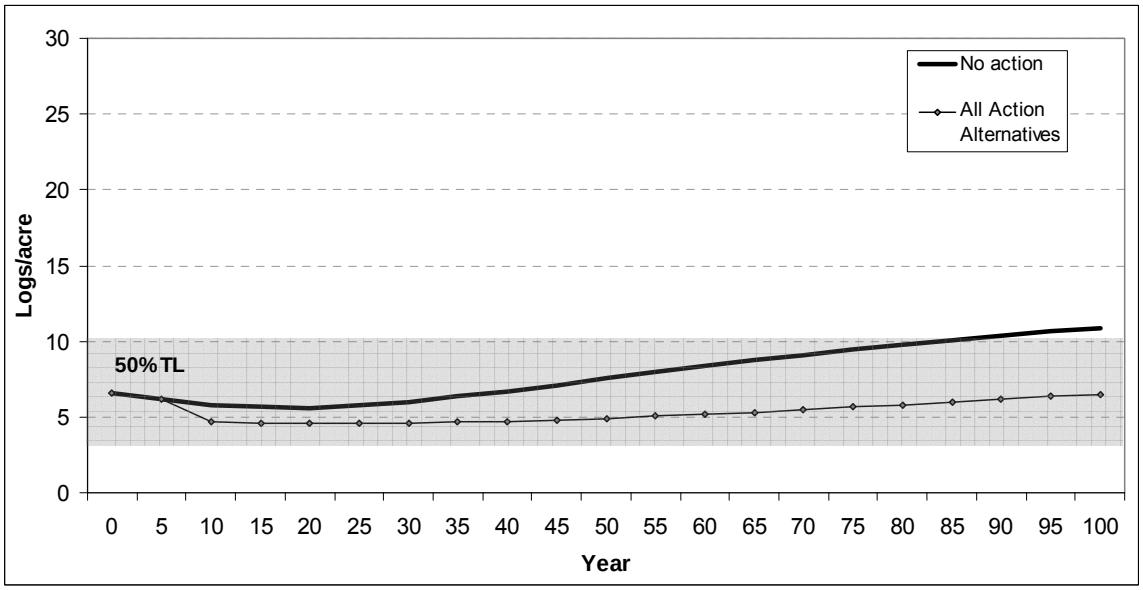


Figure 12. Existing conditions and short- and long-term changes to ≥ 6"diameter wood. The gray area represents the 50% tolerance level (TL) from DecAID. Down wood levels would remain below levels predicted under the No Action Alternative, but would remain within the 50% TL for all action alternatives.

Harvesting and fuels treatment under Alternatives 2, 3, and 4 would reduce down wood levels as compared to the no action alternative; however, down wood is expected to remain within the 50% TL under all action alternatives (Figure 12 above). Thus, no additional active down wood creation is required.

Cumulative Effects: Adverse impacts to levels of CWD at both the stand and planning area scale have resulted from past clearcut timber harvesting, road building, roadside salvage and fire exclusion (Table 7). Based on data contained in the Little River Watershed Analysis, there is an overabundance of land area with no snags and a deficiency of land areas with high snag densities (caused by fire exclusion). It would take several decades to restore CWD conditions to within the ranges advised for in DecAID at these two extreme ends of the range. However, current (Table 8) and foreseeable actions (Table 9) that would potentially contribute to a cumulative impact to the CWD resource in the planning area are limited in scale and would retain and create snags and down logs as mitigation (i.e. Felix Timber Sale). All action alternatives, as mitigated, represent limited impacts to the dead wood resource within natural ranges as described in DecAID, and overarching long-term ecological benefits (i.e. large trees, large limbs, deep crowns, etc.). Thus, when considered in the context of past, present, and reasonably foreseeable actions, the action alternatives would not be expected to result in a meaningful cumulative impact to the CWD resource.

FIRE AND FUELS

The Fire and Fuels Report for the Emile Timber Sale Project is part of the Project Record. Additional information regarding fire history and site-specific fuels treatments is included in the Fire and Fuels Report; important findings are summarized below.

Reference Conditions

In the project area vicinity, prior to early Euro-American settlement around 1850, fire shaped the forest ecosystem largely unimpeded. Anecdotal evidence indicates that Native Americans utilized fire in the region prior to Euro-American settlement but the frequency, extent and landscape effects are difficult to analyze, due primarily to ignition source differentiation (Burke 1979). A detailed fire history study of the Little River Watershed revealed a wide range of fire frequency and severity in and around the Emile project area. This research indicates periods of increased fire frequency and severity that closely correspond to climatic fluctuations dating back to the early 14th century (Agee 1993, Van Norman 1998). Studies indicate that fires occurred approximately every 10-50 years on some sites, whereas on other sites the frequency exceeded 500 years. Fire severity was likely as variable, with the majority of fires exhibiting low to moderate fire severity characteristics interrupted by less frequent high severity, stand replacement events. The estimated mean fire return interval for the Little River Watershed is 100 to 140 years (Van Norman 1998).

Generally, the reference Emile fuels landscape could be best characterized as having predominately light timber litter and understory fuels that supported slow moving, low to moderate intensity fires that pulsed to produce stand replacement patches in a matrix of late-successional forest (LRWA 1995). In higher elevations and on moist sites, fuel loading was likely higher due to longer fire return intervals. In areas that had experienced some type of recent landscape disturbance, such as insect or fungal mortality, blow down or wildfire, the fuel loading would be much higher and could have

supported higher severity fires under more typical weather conditions. Overall, this combination of fire effects shaped a landscape typical of a mixed severity fire regime, as defined by Agee (1993).

Existing and Desired Conditions

Fire exclusion and aggressive commercial timber harvest over the last century have interrupted the natural disturbance regimes within the Emile planning area. These activities have directly modified timber stand structure, composition and arrangement, ultimately reducing landscape fire resilience. The forest fuels profile across the planning area is diverse, ranging from multi-age managed stands, to relatively unmanaged meadows and late seral stands. There has been no substantial use of prescribed fire to manage forest fuels and fire suppression has been largely effective within the planning area. However, in the absence of natural or artificial mechanisms to maintain sustainable fuels conditions, fuel loading and stand densities have increased on a scale inconsistent with reference conditions. Higher fuel loading increases fire intensity and rates of fire spread, while multi-age plantations provide a fuel profile to initiate and sustain crown fires during high severity weather. The Emile planning area is likely on a trajectory to transition from a mixed/moderate severity fire regime to a high severity fire regime (LRWA 1995).

The desired conditions for the Emile planning area are best characterized by open late seral stands mosaiced with mixed severity disturbances. This landscape would be fire resilient, capable of hosting multiple uses and sustainable through efficient landscape scale management activities.

Fire Regime Condition Class

Prior to fire suppression and intensive timber harvesting, wildfire was the major disturbance shaping the forests of the western Oregon Cascades (Agee 1993, Morrison and Swanson 1990, Teensma 1997). The role wildfire plays in an ecosystem is described in terms of a fire regime. Fire regimes are classified at various scales often encompassing specific mountain ranges or similar climatic areas. They are a function of the frequency of fire occurrence and fire intensity (Irving 1971). Fire regimes are often based in terms of fire severity. As such, high severity fire regimes are defined as having infrequent high intensity fires (greater than 100 years between fires) that often kill most trees in a forest stand (Agee 1993). Moderate severity fire regimes have infrequent fires (greater than 25 years) that are often partial stand-replacement fires and include areas of high and low severity (Agee 1993). Figure 13 illustrates the fire regimes associated with Emile.

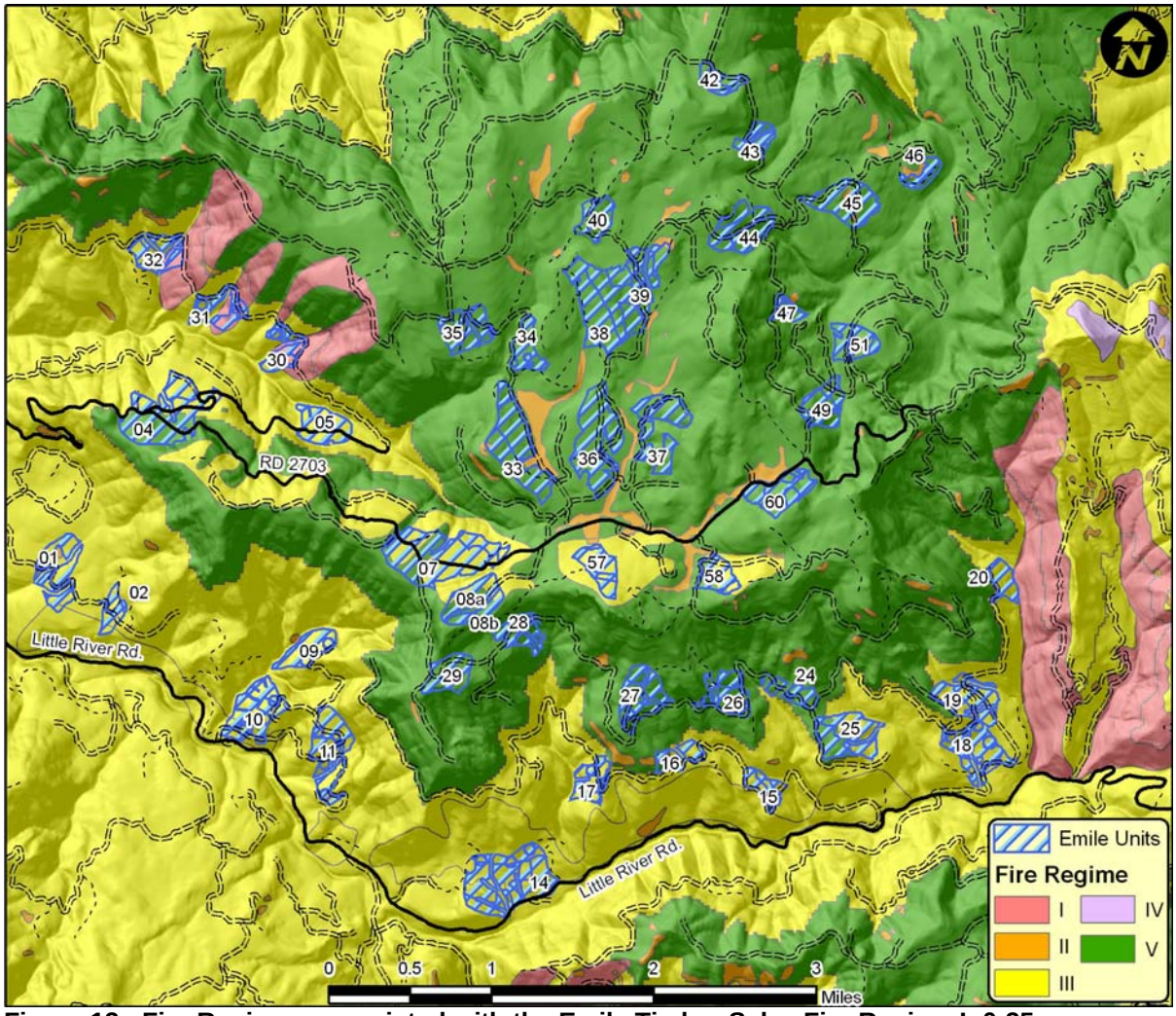


Figure 13: Fire Regimes associated with the Emile Timber Sale. Fire Regime I: 0-35 year frequency/low-mixed severity, Fire Regime II: 0-35 year frequency/high severity, Fire Regime III: 35-200+ year frequency/mixed severity, Fire Regime IV: 35-200+ year frequency/high severity, Fire Regime V: 200+ year frequency/high severity (USDA/USDI 2005).

Fire regime condition classes[46] (FRCC) are coarse-scale measures of the degree of departure from the natural fire regime (USDA/USDI 2005). This departure results in changes to one or more of the following ecological components: vegetation characteristics; fuel composition; fire frequency, fire severity and pattern; or other associated disturbances processes. Departure is measured in three broad classes: low (FRCC 1), moderate (FRCC 2) and high (FRCC 3) departure from the natural or historical regime. Low departure is considered to be within the natural range of variability, while moderate and high departures are outside of that range. In FRCC 2 and 3, one or more fire return intervals have typically been missed due to fire exclusion. Areas of high departure increase the risk of losing key ecosystem components due to fire effects.

[46] The use of FRCC in planning is a requirement of the 2003 Healthy Forest Restoration Act (HFRA); it allows agencies to compare landscapes based on a standardized nation-wide process.

The delineation of Fire Regime Condition Classes for the Emile planning area followed the process outlined in the Interagency Guidebook (2005). The landscape areas shown in Figure 2 were assigned one of the biophysical settings from the FRCC options. These standard classifications have a set of reference parameters that are used in determining the level of departure. It is important to note that the national process has limited biophysical settings to choose from that represent a moderate severity fire regime such as the Emile area; all biophysical settings chosen were considered to be the best available fit for each landscape area (Table 22, Figure 13).

Based on the assumptions underlying the biophysical settings applied to the landscape areas, there are high departure areas in the Emile planning area (Table 22), specifically the steep landscapes. Since fire has been essentially excluded from the planning area for several decades, most of the landscape areas were found to have a moderate to high level of departure for Fire Frequency/Severity (Figure 14).[47]

Table 22: Fire Regime Condition Classes for the Emile planning area based on Landscape Areas.

Landscape Area	Emile FRCC Setting w/Acres & % Planning Area	Emile Planning Area Units within the Landscape Area	Emile Planning Area Acres Thinned Under Alt. 2/4	Current FRCC Rating
Gentle Valley Bottom	Cedar/Hemlock 8,195 (23%)	1,2,4,5,7,14,18, 19,24,25,26,27, 33,35,36,37,38, 39,40,42,44,57	341	FRCC 1
Steep Terrains	Grand fir/ Douglas-fir 11,635 (33%)	9,10,11,17,28,30, 31,32,33,51	549	FRCC 2 FRCC 3
Gentle Mountain Slopes	Mixed Conifer 10,938 (31%)	2,4,5,7,8A,8B, 14,15,16,18,19, 24,25,26,27,28, 29,34,37,38,39, 42,43,44,45,46, 47,49,57,58,60	241	FRCC 1
High Elevation	Silver-fir/ Douglas-fir 4,717 (13%)	33,34,35,36,37, 38,39,40,42,43, 47,49,57,58,60	706	FRCC 2 FRCC 3

[47] *FRCC ratings are based on the following ranges: Low, (0-33); Moderate (33-65); High (65-100).

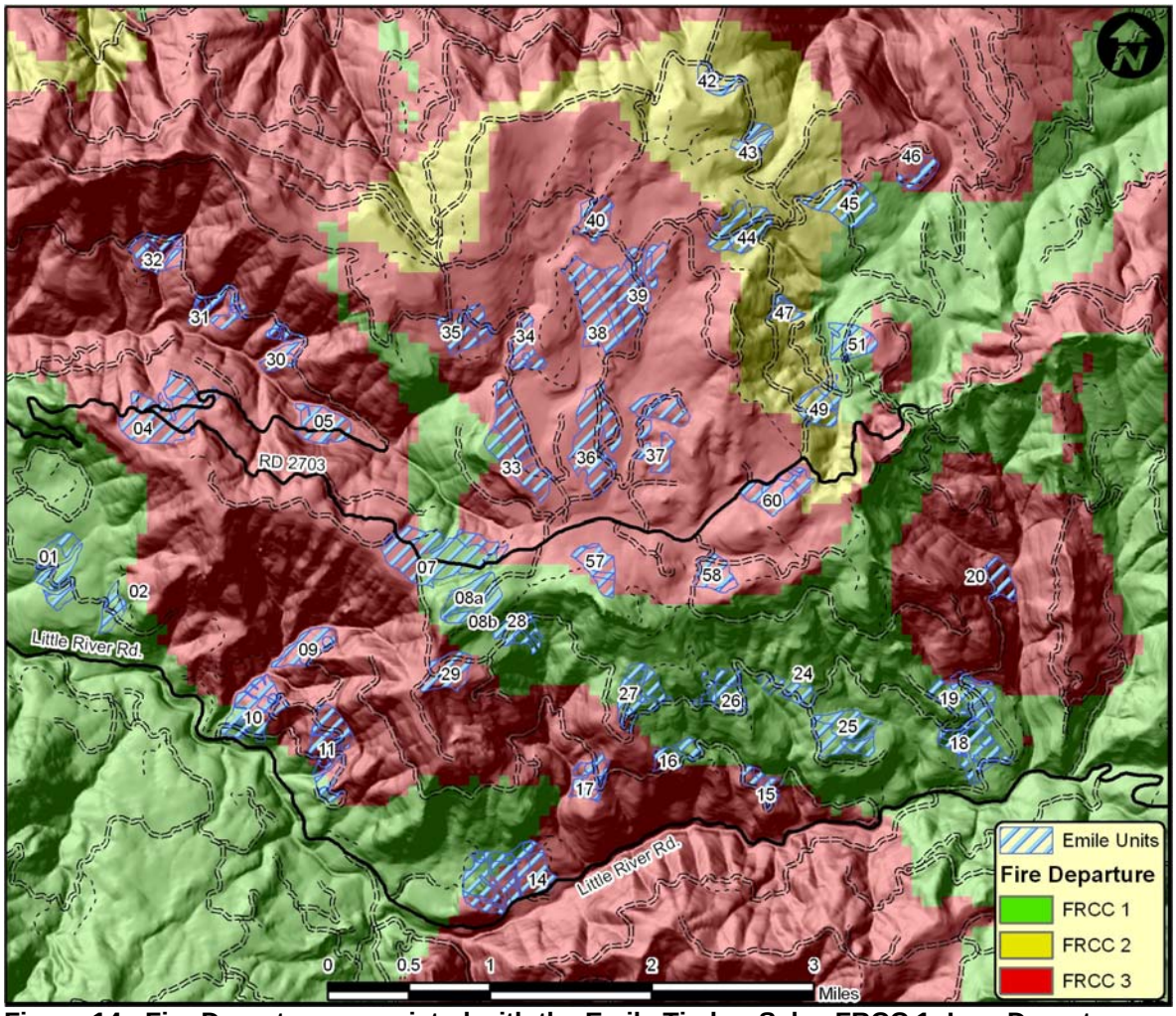


Figure 14: Fire Departure associated with the Emile Timber Sale. FRCC 1: Low Departure, FRCC2: Moderate Departure, FRCC3: High Departure.

Fuel Models

Fuels are classified by vegetation type, fuel size and loading, and potential fire behavior (Table 23). Fuel loading can be described using models that can help predict what the fire behavior of a certain area would be like. These models are called Fire Behavior Prediction System (FBPS) Fuel Models (FM) and are assigned numeric values. Of the six fuel models relevant to the Emile planning area, four are found in the stands proposed for thinning.[48] (Figure 15). Fire behavior predictions were developed based on existing fuel loading using BehavePlus v. 3.0.2. BehavePlus predicts fire behavior utilizing a given fuel model with weather and slope variables. Outputs are represented in flame length, intensity and rate of spread. Timber group model outputs indicated that if a wildfire did occur in a Fuel Model 8, fire behavior would not require mechanized equipment and could be successfully contained with hand crews. Fire behavior in Fuel Model 8 could be expected to produce 1 - 2' flame lengths and rates of spread from 1 to 7 chains per hour.

[48] FM 4 and 5 are shrub models that typify young plantations which are mixed with small conifer and hardwood trees along with shrubs, both deciduous and evergreen.

Table 23: Description & Associated Fire Behavior of Fuel Models in the Emile project area.

Fuel Model	Description and Associated Fire Behavior
Fuel Model 8 (Timber)	Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand. For the Little River watershed, representative conifer types would be Douglas-fir, western hemlock and grand fir or sugar pine. Slow-burning ground fires with low flame lengths are generally the case, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidity's, and high winds do these fuels pose fire hazards.
Fuel Model 10 (Timber)	Fires burn in the surface and ground fuels with greater fire intensity than the other timber litter models. Dead-down fuels include greater quantities of 3-inch or larger fuels or natural events that create a large load of dead material on the forest floor. Crowning out, spotting, and torching of individual trees are more frequent in this fuel situation, leading to potential fire control difficulties. Any forest type may be considered if heavy down material is present; examples are insect- or disease-ridden stands, windthrown stands, overmature situations with deadfall, and aged light thinning or partial-cut slash.
Fuel Model 11 (Slash – post harvest)	Fires are fairly active in the slash and herbaceous material intermixed with the slash. The spacing of the rather light fuel load, shading from overstory, or the aging of the fine fuels can contribute to limiting the fire potential. Light partial cuts or thinning operations in mixed conifer stands, hardwood stands, and pine harvests are considered. Clearcut operations generally produce more slash than represented here. The less-than-3-inch material load is less than 12 tons per acre. The greater-than-3-inch is represented by not more than 10 pieces, 4 inches in diameter, along a 50-foot transect.
Fuel Model 12 (Slash- post harvest)	Rapidly spreading fires with high intensities capable of generating firebrands can occur. When fire starts, it is generally sustained until a fuel break or change in fuels is encountered. The visual impression is dominated by slash and much of it is less than 3 inches in diameter. The fuels total less than 35 tons per acre and seem well distributed. Heavily thinned conifer stands, clearcuts, and medium or heavy partial cuts are represented. The material larger than 3 inches is represented by encountering 11 pieces, 6 inches in diameter, along a 50-foot transect.

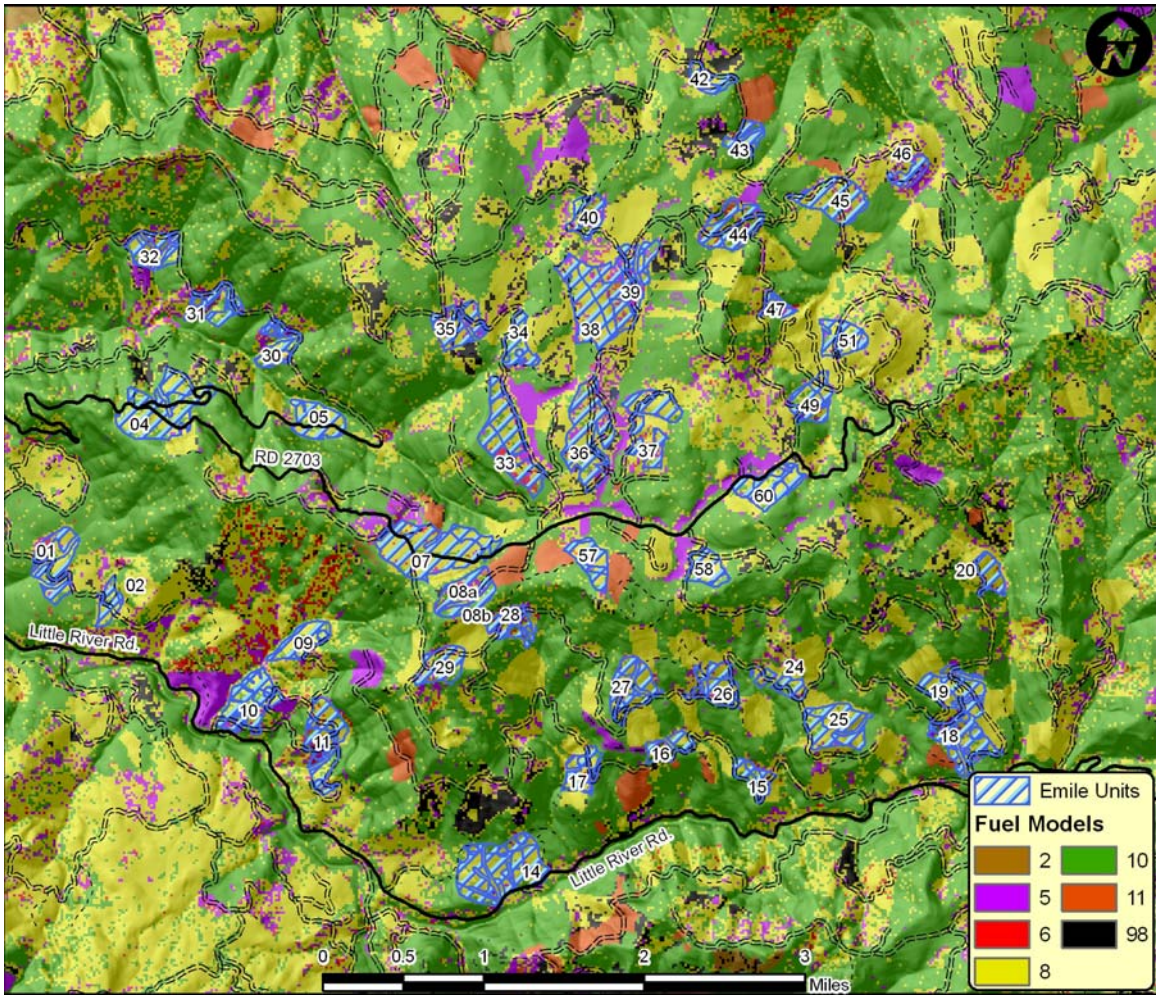


Figure 15: Fuel models associated with the Emile Timber Sale. Stands planned for harvest are dominated by FM 8 with minor FM 5/6 (shrub) and FM 10 components.

Initial attack suppression forces (two engines staffed with three person crews and a one hour time delay) would be inadequate to contain the fire in a Fuel Model 10; and fire behavior can be expected to be 8 to 15 chains per hour with flame lengths of 3 to 6 feet. Typically, hand crews do not engage in direct attack suppression when flame lengths exceed 4-feet in height. At the landscape scale, in reference conditions the main fuel model[49] (FM) was a FM 8 which covered in excess of 70% of the area and resulted in slow-burning surface fires[50] with low flame lengths. The majority of the remaining area was represented by FM 10, which resulted in surface fires burning with greater intensity

[49] Fuel Model (FM) 8 is defined as having < 5 tons/acre of 0-3" surface fuels and is the desired condition of second growth stands; FM 10 has between 5-12 tons/acre of 0-3" surface fuels and is the current condition of most stands in the planning area. FM 11 is defined as having < 11.5 tons/acre of 0-3" surface fuels, while FM 12 is defined as having < 34.6 tons/acre of 0-3" surface fuels; these two fuel models are representative of light to medium logging slash, which would occur in harvest areas that receive no slash treatment. FM 5 represents precommercial aged stands with have brushy ground based fuels and close crown contact.

[50] The effects of fuel models on potential fire size were modeled with the BehavePlus (V. 3.0.1) Fire modeling program. A landscape similar to Emile was modeled for a fire, burning under extreme weather conditions. In general, a change in a landscape area from a FM 8 to a FM 10 elevates the risk of fire increasing in size nearly 10 times (Project File).

and increased small-scale stand replacement patches. Today, the majority of the planning area is represented by FM 10 (48%). The biggest change has been to decrease the FM 8 group from the reference level to the current total of about 41%, because of commercial timber harvesting over the past 60 years (LRWA, 95).

Logging slash fuel models include slash loading from thinning and are represented by either a FM 11 or a FM 12. Emile stands that are proposed for moderate thinning (70-100 tpa) are represented by a FM 11 after harvest. Stands that are heavily thinned (50-70 tpa) are better represented by a FM 12 after harvest. Where treated, FM 11 or FM 12 stand areas would immediately convert back to a residual FM 8. Without slash treatment, FM 11 or FM 12 stands would retain higher fuel levels for about 10 years time, before converting back to either a FM 8 or a FM 10.

In Table 24 below, Emile stands representing four FM's, were modeled in BehavePlus[51] for a moderately dry burning scenario, typical of a mid-season fire on the Umpqua. These usually occur during the months of June until September in the Little River Watershed. Comparisons of both flame lengths and the expected fire area after an initial two-hour burning period are shown in Table 24. With adequate access, fire personnel responding are generally going to be onsite within this modeled timeframe. Generally, fire crews can directly attack surface fires with flame lengths less than 4-feet.

Table 24. BehavePlus Fire Model effects under various fuel models using typical Emile stand conditions and mid-season fire weather.

Fuel Model	Fuel Moisture	Flame Length (ft)	Fire Area in 2-hours (acres)
FM 8 (pre-harvest)	Moderately Dry	1.1	0.6
FM 10 (pre-harvest)	Moderately Dry	5.7	16.6
FM 11 (post-harvest)	Moderately Dry	3.5	5.7
FM 12 (post-harvest)	Moderately Dry	8.0	26.5

Fuels Treatments

Due to anticipated economic constraints, it is necessary to prioritize fuels treatments within the Emile Timber Sale. Areas receiving no treatment or partial treatment would have increased fire risk for a period of 5-25 years (Figure 16).

[51] BehavePlus 3.0.1, developed by Andrews and Bevins, models expected fire behavior with output variables dependent on user-identified fuel models, fuel/vegetation-overstory, fuel moisture, weather, terrain, and fire characteristics like time and expected torching.

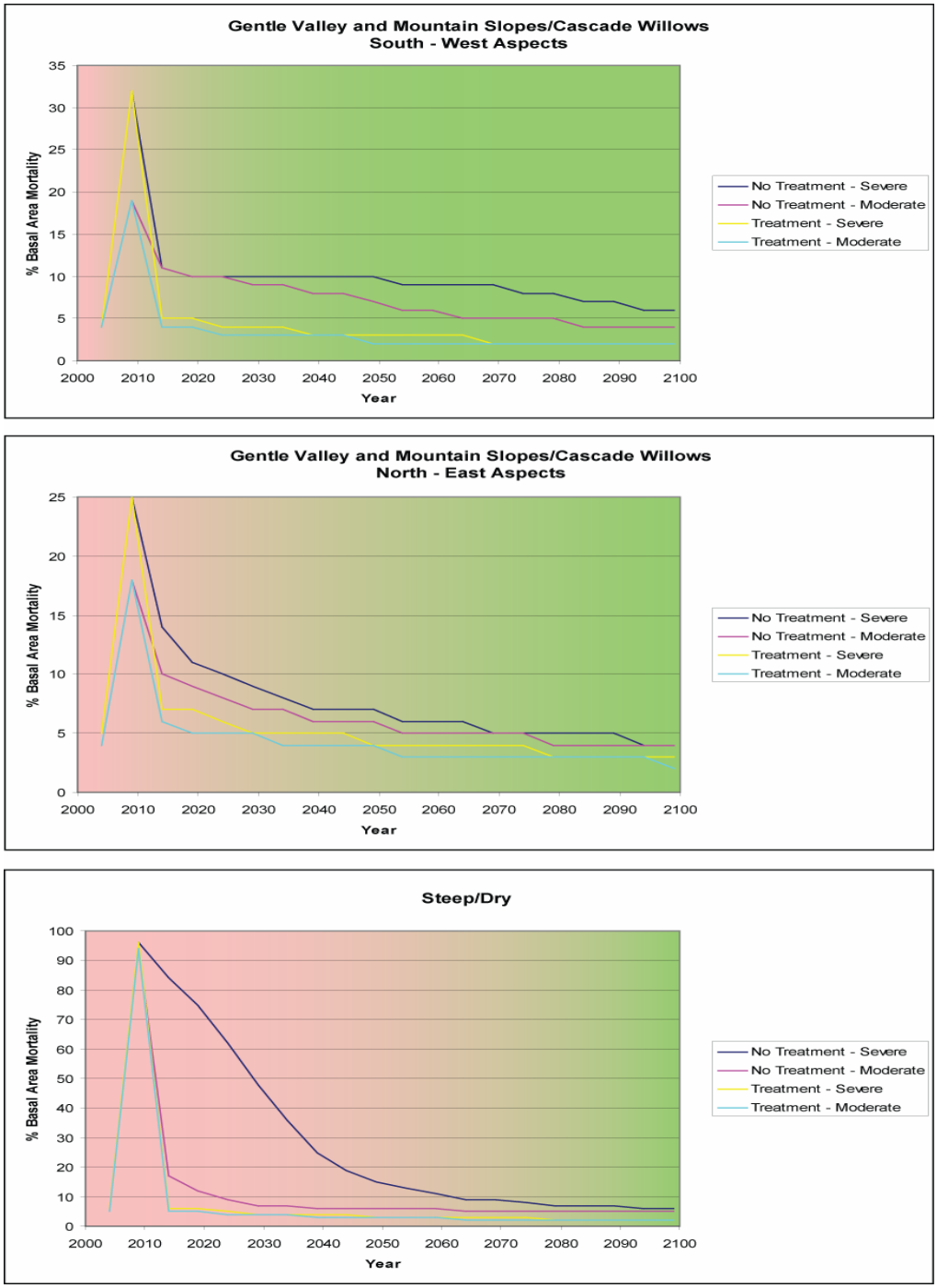


Figure 16. Fire risk as a function of % basal area mortality over time for each major land-type, with and without fuels treatment during moderate and severe fire weather conditions.

In addition to an increased ignition risk, the fire effects in these untreated or partially treated units would be more severe and could result in substantially higher overstory mortality. This risk can be mitigated by carefully selecting units based on their land type associations, surrounding fuels, and anticipated post-harvest condition. Areas of highest risk and greatest need for fuels treatment are those associated with the Steep Terrains land-type, while the lowest risk areas are those associated with the High Willows land-type. The type of fuels treatment is determined by access, economics, logistical

implementation and desirable disturbance for each land-type. For example, underburning is proposed in units within the Steep Terrain land type because it would promote stand development that better reflects natural and sustainable conditions. In addition to removing logging slash, underburning would also remove a large portion of the understory which would not be sustained in a higher frequency fire regime as is typically associated with Steep Terrains in this watershed (LRWA, 1995). Application of machine or hand piling is based on access and the ecological drive to develop a structured understory and midstory, which is largely preserved when treating isolated concentrations of fuels. Areas receiving no or partial (roadside) treatments are less prone to supporting high severity fires due to elevation, aspect, slope, access and existing barriers. Fuels treatments and land type associations are summarized in Figure 17.

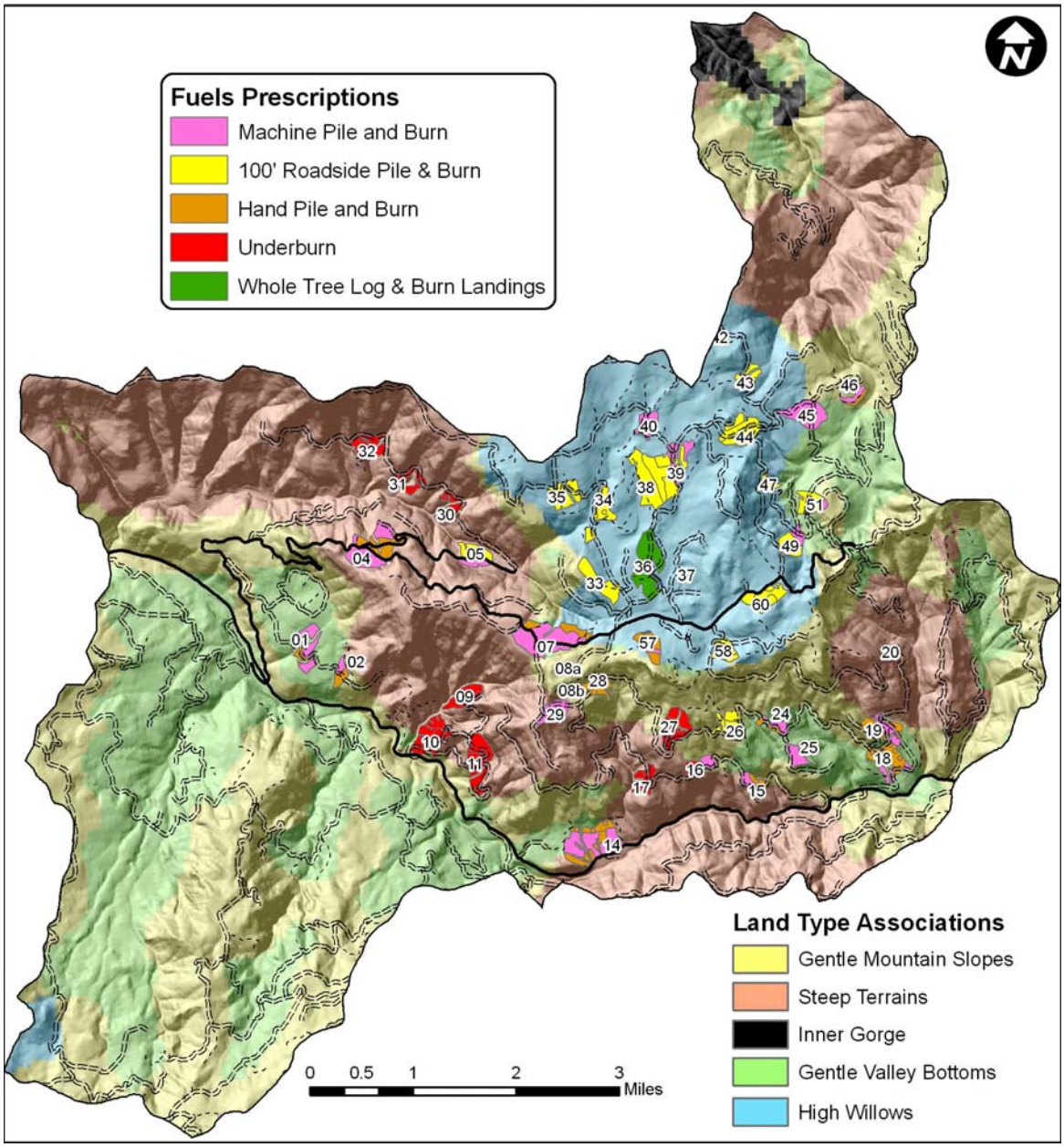


Figure 17. Proposed fuels treatments and land type associations for Alternatives 2, 3 & 4.

Stand replacement crown fire risk is another variable used to prioritize fuels treatments in this project. An analysis was conducted for the Emile project area using available fuels data, wildfire history and lands suitable to support the northern spotted owl. Areas particularly susceptible to stand replacement crown fires and negative effects to habitat for the northern spotted owl were identified. This analysis provided another validating factor in slash treatment prioritization. Steep Terrains and lands below 4,000 feet indicated the greatest risk for stand replacement fires (Figure 18).

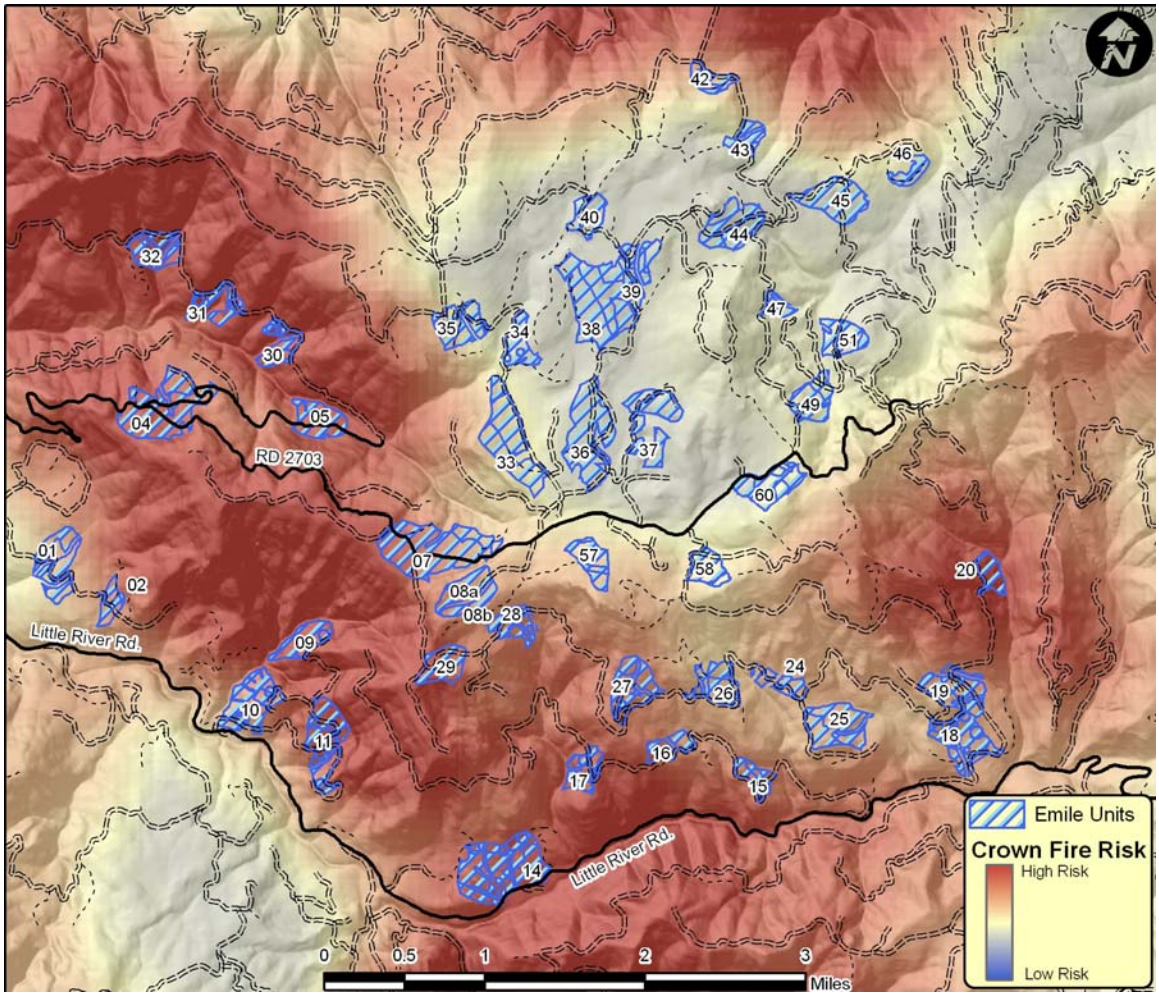


Figure 18: Crown fire risk analysis for the Emile project area.

Direct Effects

For fire and fuels, direct effects are those that would occur at the stand scale. Alternative 1 would not create or treat activity-generated fuels and would thus have no direct effects related to fuels and fuel loads.

All action alternatives would thin and remove trees from the stand, thus reducing canopy continuity and the potential for crown fire spread. All action alternatives would treat acreage as detailed in Table 25 below. There is very little difference among the action alternatives relative to fuels management. There are no resource differences between alternatives that would drive a proposed change in fuels treatments.

The direct effects of the various fuel treatments that include burning in the action alternatives would be to immediately lower 0-3" surface fuels, similar to a FM 11 or FM 12, to levels that would reduce future potential fire behavior (FM 8). The treated stands would continue to increase fire resiliency over time as the retained trees grow larger and increase in bark thickness. The majority of the Douglas-fir leave trees would average around 14" diameter, which is a diameter with a bark thickness (approximately ¾-1") that creates a successful barrier to expected ground fire burning effects.

The direct effect of not burning activity-generated fuels would be to increase the total surface tons of fuel in those stands. This fuel loading would remain at increased levels and present a higher fire risk for a period of several years after harvest (similar to FM 11 or FM 12).

Table 25. Summary of fuel treatment activities and effects by Alternative.

Treatment Type	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Effects of Alts. 2, 3, and 4.
Underburning unit = acres	0	337			Beneficial - reduced 0-3" surface fuels both for the short-term (up to 5 years) and the long-term (greater than 5 years) and increased stand resiliency to potential wildfire effects from a future fire. Adverse – CO^2 emissions potential into Class One or two airsheds for a short period of time. Higher cost per acre and fireline impacts surrounding treatment areas.
Handline Construction unit = miles	0	4.8			Beneficial – handlines restrict prescribed burning effects to within the stand area perimeter. Adverse – handlines expose mineral soil for approximately a 2-feet width around the harvested area. Revegetation is slow and may take up to 5-10 years.
Thinning & No Fuel Treatment unit = acres	0	664	583	664	Beneficial - Reduction of standing fuel and separation of crown layers. Short and long-term effect of reducing crown fire potential. Long-term benefit of increased fire resiliency against crown fire. Adverse - increase in the 0-3" surface fuels with a short-term increased risk (5-10 years) for loss due to potential wildfire. Lower fire intensities would be expected in the gentle, moist landscape areas where no fuel treatments are generally prescribed.

Treatment Type	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Effects of Alts. 2, 3, and 4.
Machine Pile & Burn unit = acres	0	579			Beneficial - reduced 0-3" surface fuels both for the short-term (up to 5 years) and the long-term (greater 5 years) and increased stand resiliency to potential wildfire effects from a future fire. Adverse – CO^2 emissions potential into Class One or Two airsheds for a short period of time. Moderate cost per acre.
Burning skyline and helicopter landings unit = sites	0	107			Beneficial – reduced 0-3" fuels on landings keeping road areas open and functional Adverse - Adverse – CO^2 emissions potential into Class One or two airsheds for a short period of time. Moderate cost per acre.
Hand Pile & Burn/Chipping unit = acres	0	328			Beneficial - reduced 0-3" surface fuels both for the short-term (up to 5 years) and the long-term (greater than 5 years) and increased stand resiliency to potential wildfire effects from a future fire. Chipping would store CO^2 and eliminate emissions. Chipping operations have a larger window for operations versus pile burning. Adverse – Burning has CO^2 emissions potential into Class One or two airsheds for a short period of time. Higher cost per acre and seasonal challenges to accomplish treatment targets. Chips can tie up nitrogen for the short-term.

The action alternatives all consume fuels with the combinations of treatments that are prescribed. Alternative 1 would continue to gradually increase the current fuel loading in the 0-3" fuel category that already exists across the Emile project area. All action alternatives would have a direct effect of reducing surface fuels (see Figure 17) that include portions of the litter, duff, 0-3" material, >3" material, and also the stand herb and shrub components.

Indirect Effects

Indirect effects are those that would occur at the landscape scale and/or later in time. For this analysis, the Little River watershed was used as a basis to compare landscape scale effects from fire disturbances. A timeframe of 20-100 years was used to show the long-term effects from future fire scenarios and is of sufficient length to include expected landscape level disturbances from wildfire. Thinning and treating the Emile stands would help lower the current moderate to high landscape risk susceptibility to fire effects. The

indirect effect and risk associated with residual and untreated fuel levels is different for the various fuel treatments applied. All fuel treatments prescribed would lower the risk of mortality from a future moderate wildfire to less than 20% for the retention trees left after harvest. Should a high severity wildfire occur within the first 10 years after harvest, only the stands with treated slash would effectively lower the risk of stand replacement to less than 40% of the retention trees. Stands that were both thinned and underburned would show a positive indirect effect increasing resilience to either a moderate or severe wildfire in the long term (greater than 5-25 years). This finding was noted in a 2005 study done after the Biscuit fire burned over a thinned stand.[52] Mortality was most severe in thinned treatments (80%–100%) without fuel treatments, moderate in untreated stands (53%–54%), and least severe in the thinned and underburned treatment (5%). Thinned treatments had higher fine-fuel loading and more extensive crown scorch, suggesting that greater consumption of fine fuels contributed to higher tree mortality. Fuel treatments intended to minimize tree mortality were found to be most effective if both ladder and surface fuels are treated. Both the Emile planning area and the Biscuit fire study area have moderate-severity fire regimes (Azuma et al 2004).

It should be noted that a mixed severity fire regime currently characterizes the Little River watershed. As stated in the Little River Watershed Analysis, currently the watershed is considered to be a moderate severity fire regime that is showing signs of transitioning to a high severity regime (LRWA, 1995). This is further supported through landscape fuels analyses and FRCC designations. The indirect effect and risk associated with increased untreated fuel levels is also different for the various landscape areas. The untreated activity fuels[53] are targeted for the High Willows and Gentle Valley Bottom landscape areas that are dominated by low-slope, moist conditions or mid-upper slope positions with minimal moisture limitations. One indirect effect from thinning the Emile stands, which lowers the fire regime condition class, would be to lower the risk of both passive and active crown fire. This would be done by separating the crowns between the retention trees and by increasing the distance between the shrub and understory trees and the base of the retained trees live crowns. In summary, Alternatives 2, 3, and 4 would somewhat increase landscape scale fire resiliency as compared to the no action alternative.

Cumulative Effects

The analysis area for fuels is the 131,853 acre Little River watershed, and is of sufficient size to characterize landscape-level fire behavior and events. Approximately 60% of the watershed has been harvested and activity fuels burned. However, much of the watershed is either private or managed by the Bureau of Land Management. Only 63% of the drainage is managed by the Forest Service (LRWA 1995). The effect of the past burning treatments was to reduce the total surface fuel loads on those sites. Since the 1950's, there have been thousands of acres of precommercial thinning (PCT) within the Little River watershed and in the Emile planning area (Table 7). Precommercial thinning reallocated growing space to fewer individual trees, and increased the horizontal distance between tree crowns. PCT also increased the vertical distance between the

[52] Crystal L. Raymond and David L. Peterson, Fuel treatments alter the effects of wildfire in a mixed-evergreen forest, Oregon, USA. 2005.

[53] After 5-25 years, the untreated Emile stand areas would become more resilient to wildfire as the fuel loading naturally decreases through decomposition. This gradual "meltdown" of the fuels would indirectly lower the fuel level while reducing the potential for increased fire behavior and future fire spread.

tree crowns and the existing ground fuels. Together this has the positive effect of reducing crown fire potential by reducing the ability to torch into the crowns and increasing the space between the crowns. These past practices have reduced fuel loadings over much of the drainage, lowering the risk of stand loss to potential wildfires and changing the current baseline surface fuel conditions in the managed stands. Proposed PCT and slash treatments included as connected actions under all action alternatives would have the same effects as past activities and as such represents a positive contribution to fire risk reduction in the planning area.

Past timber management, particularly regeneration harvest (Table 7) has increased fire risk and potential fire severity across the planning area. Although, there was approximately 12,367 acres of associated slash underburning in the planning area since the 1950's, there is very little relationship between modern burning practices and other slash treatments within the last 50-60 years. Untreated slash in the Emile Timber Sale would contribute to a cumulative effect of increasing fire risk and potential fire severity, thus locally reducing these stands' resilience to fire. Conversely, thinning and treating slash would contribute to a cumulative effect of decreased fire risk and increased stand resilience to fire.

No Wildland Fire Use Plan is currently in place for the planning area. Thus, fire suppression activities would continue and would be expected to reduce the extent of stand replacement fires in the planning area, but would also sustain stand and fuel conditions that would not occur under natural fire regimes. Other ongoing (Table 8) and reasonably foreseeable (Table 9) management actions in the planning area are limited in scale and would have neglible impacts on fuel conditions. When considered in the context of past, present, and future management actions in the planning area, all action alternatives would have limited negative effects in the form of untreated slash, but primarily represents a minor beneficial contribution to improved fuel conditions and increased fire resiliency in the planning area.

SOIL PRODUCTIVITY

There was a concern identified during scoping that the level of proposed ground-based logging would adversely affect soil conditions in the planning area. This concern may be based on past management practices, and/or assumptions that impacted acres will not receive soil-rehabilitation treatments or that those treatments do not truly rehabilitate the soil. Many authors have evaluated these concerns and this project used their findings and incorporated multiple project design features and mitigations measures designed to reduce impacts to soils (Heninger et al, 2002, Luce 1997, Luce et al 2001, Kolka, & Smidt M.F. 2004, Miller et al, 2004).The issue of impacts to soils did not drive development of an alternative. However, potential negative impacts to soils are tracked in this EA through disclosure of effects to soil productivity.

The maintenance of soil productivity during forest management activities is critical to maintaining healthy forest. Consequently, soil productivity is addressed in the Umpqua Land and Resource Management Plan (LRMP) with several standards and guidelines. The primary focus of this analysis centers on past and predicted soil disturbances and the maintenance of ground cover.

Relevant Standards and Guidelines

The standard and guidelines from the 1990 Umpqua Land Resource Management Plan (LRMP) related to soil productivity include:

Soil Productivity S&G 1, p IV-67: Requires that the combined total amount of unacceptable soil conditions (compaction, displacement of surface soil and severe burning) in proposed activity areas would not exceed 20 percent, including areas in roads and landings (D-41).

Soil Productivity S&G 2, p IV-68: Requires maintenance of ≥25% effective ground cover on areas with low erosion hazards and ≥45% in areas with moderate erosion hazards to prevent loss of topsoil through erosion (D-42).

Soil Productivity S&G 3, p IV-68: Requires maintenance of ≥65% ground cover for surface organic material (defined as litter, duff and wood) on mineral soils with cold climatic conditions, low nutrient levels, and/or low water holding capacities (D-42).

Soil productivity S&Gs 5, 10, 11, and 12 and other NWFP requirements are also addressed here or as mitigation measures or monitoring requirements in the soils section at the end of Chapter 2 (D-42 to D45).

Management History, Existing and Desired Conditions

The Umpqua Soil Resource Inventory or SRI (USDA 1976) and field review were used to provide soil interpretations for the planning area. The SRI provides landscape-scale soils information on broadly mapped areas (average size = 250 acres) that have distinctly unique geology, landform and soils that affect the growth and development of forest vegetation. This information is summarized for each mapping unit, and provides useful information for project planning (e.g., timber harvests) and assessment of effects. Information collected and utilized during the planning phase of the Emile proposal is documented in Table 26. This table provides pertinent information relative to: harvest activities, fuels reduction, reforestation and effective ground cover requirements following management activities that would occur under action alternatives. For example, units with the textural classification of clay loam tend to have higher levels of surface erosion potential than loams. The same is true for accelerated and natural sediment potential ratings in the forth column.

Table 26. Description of dominant soils mapped within proposed harvest units. Includes associated potentials for surface erosion, sediment and site class for timber regeneration. All information can be found in the Umpqua NF SRI.

Emile Unit	Dominant soil mapped	Texture	Surface Erosion Potential	Sediment Potential Accelerated/Natural[54]
1	244	Loam	Low to Mod	Mod/Low
2	244	Loam	Low to Mod	Mod/Low
4	245	Loam	Low to Mod	Mod/Low
5	135	Loam	Low to Mod	Mod/Low

[54] The sediment potential rating is based on the physical characteristics of the dominant soils mapped for each harvest unit.

Emile Unit	Dominant soil mapped	Texture	Surface Erosion Potential	Sediment Potential Accelerated/Natural[54]
7	47	Loam	Low to Mod	Mod/Low
8a	222	Loam	Low to Mod	Mod/Low
8b	222	Loam	Low to Mod	Mod/Low
9	411	Clay loam	Mod to High	High/Mod
10	411	Clay loam	Mod to High	High/Mod
11	411	Clay loam	Mod to High	High/Mod
14	225	Loam	Low to Mod	Mod/Low
15	14	Loam	Mod	Mod/Low
16	42	Sandy loam	Mod	Mod/Low
17	215	Sandy loam	Mod to High	High/Mod
18	25	Loam	Mod	Mod/Low
19	223	Loam	Low	Mod/Low
20	311	Loam	Mod to High	High/Mod
24	311	Loam	Mod to High	High/Mod
25	335	Loam	Low to High	Mod/Low
26	33	Clay loam	Low	Mod/Low
27	411	Clay loam	Mod to High	High/Mod
28	335	Clay loam	Low to High	Mod/Low
29	335	Sandy loam	Low to High	Mod/Low
30	411	Clay loam	Mod to High	High/Mod
31	411	Clay loam	Mod to High	High/Mod
32	422	Sandy loam	Low to Mod	Mod
33	524	Sandy loam	Low	Mod/Low
34	524	Sandy loam	Low	Mod/Low
35	524	Sandy loam	Low	Mod/Low
36	24	Sandy loam	Low	Mod/Low
37	222	Sandy loam	Low to Mod	Mod/Low
38	24	Sandy loam	Low	Mod/Low
39	24	Sandy loam	Low	Mod/Low
40	524	Sandy loam	Low	Mod/Low
42	24	Loam	Low	Mod/Low
43	223	Loam	Low	Mod/Low
44	222	Loam	Low to Mod	Mod/Low

Emile Unit	Dominant soil mapped	Texture	Surface Erosion Potential	Sediment Potential Accelerated/Natural[54]
45	223	Loam	Low to Mod	Mod/Low
46	222	Loam	Low to Mod	Mod/Low
47	222	Loam	Low to Mod	Mod/Low
49	222	Loam	Low to Mod	Mod/Low
50	322	Loam	Mod	Mod/Low
51	322	Loam	Mod	Mod/Low
57	411	Clay loam	Mod to High	High/Mod
58	187	Loam	Low	Mod/Low
60	187	Loam	Low	Mod/Low

As detailed below, past timber harvest practices have modified natural soil conditions and left a legacy of existing detrimental soil impacts in some units within the Emile planning area.

Soil Compaction and Displacement

The most common effect on soils associated with ground-based timber harvest operations is increased soil compaction with an additional effect being topsoil displacement (Adrian et al. 2005, Bulmer, C. 2000, and Heninger et al. 2002). During the first management entry into some of Emile's proposed activity units (1953 to 1966), ground based methods were used; the resulting impacts are visible in a series of aerial photographs (dated 1957 and 1966). The presence of traffic patterns (i.e. temporary roads and skid trails) in the photographs were used to estimate the extent of soil compaction and displacement created by the original harvest. Most of these impacts were then field verified during the planning stage of this project. Once field verified, an estimate of detrimental soil impacts (unacceptable soil conditions) was made for each Emile unit. Legacy impacts in some units currently leave these units in excess of S&G #1 for unacceptable soil disturbance (Table 27).

Table 27. Emile units with greater than 20% detrimental soil impacts from past harvest activities.

Percent of Detrimental Soil Impacts	Emile Unit
≥20%	4, 7, 8a, 8b, 14, 15, 24, 29, 34, 36, 37, 39, 40, 44, 45, 46, 47, 49, and 58.

Even though some units are well below the S&G's for detrimental conditions there are impacts within the boundaries of these units which have reduced tree growth or prohibited trees and other vegetation from growing within the prism of old harvest skid trails and landings. This type of vegetative suppression has been reported by many authors (Amaranthus et al. 1996, Fleming et al. 2006, Powers et al. 2005, Siegel-Issem et al. 2005, Williamson. 2000). This observation of reduced tree growth is not an absolute; some merchantable trees can be found within old trails and landings. However,

the relative number and importance of these trees is limited when considered in the context of the total acreage lost to skid trails and other detrimental soil conditions.

Field observations conducted for this analysis indicate the effect of compaction in some harvest units has lasted since the initial harvest with little recovery in the subsurface structure of the soils. Although mechanical weathering (i.e. from rain, wind, frost etc.) has changed the surface of these compacted soils, areas beneath the surface in the rooting zone remain largely unchanged and as such, limit moisture infiltration and tree growth.

Effective Ground Cover & Surface Organic Material

Above ground organic matter is considered an important component for managing the soils vitality because it supplies and affects ground nutrient cycling and availability (Adrian et al. 2005, Brady, 1990, Bulmer 2000, Jurgensen et al. 1997, Powers et al. 2005, Spears et al. 2003). The management of surface soil organic layers affects soil productivity. Decaying limbs, needles, bark and wood decompose into soil humus and other organic matter. Soil damage can occur when the surface organic layer is substantially reduced by erosion (Waldrop et al. 2003), burning (Busse et al. 2005) or mechanical means (Amaranthus et al. 1996 and Froelich et al. 1985).

Past management actions such as timber harvest and prescribed fire that removed vegetation, leaf litter, and duff potentially increased surface soil loss and limited long-term soil productivity. Thus, effective ground cover (EGC) and surface organic matter are important analysis factors for the soil resource. EGC is defined as all herbaceous or dead woody materials, synthetic materials and rock fragments >0.75" diameter that cover the surface of the ground and prevent soil erosion (LRMP IV-68). Surface organic material is defined as litter, duff, and woody material that are needed to maintain soil productivity (LRMP IV-68).

Within all of the proposed Emile units, effective ground cover litter, duff and wood provide nearly complete coverage. There are some locations where old harvest trails support surface runoff and have left exposed soil, but this condition tends to be the exception rather than the rule. Based on the site-specific ratings for erosion potential and resiliency to soil disturbance for individual Emile units, maintenance of varying levels of minimum ground cover are necessary to address both the risk of soil erosion (LRMP IV-68 S&G's 2 and 3) and the need to maintain soil organic matter for long-term site productivity. Units with colder climatic conditions and/or lower water holding capacities require higher levels of EGC.

Results of harvest-unit specific Water Erosion Prediction Program (WEPP) modeling[55] (see "Surface Erosion section of this chapter) (Elliot et al. 1999), indicate that all units are anticipated to produce a low level of erosion. However, known physical characteristics of mapped dominant soil types indicate somewhat higher levels of erosion risk; these data indicate surface erosion potentials for harvest rate from low to high erosion classes, and accelerated sediment potential (i.e. risk of potential for sediment delivery from harvest and other management activities) is rated moderate to

[55] WEPP-based models generate runoff predictions from all rain events in the form of subsurface lateral flow. This results in a continuous water output that tends to over predict runoff during events when little or no runoff would be measurable and over predict sediment delivery (Covert et al. 2000). However WEPP-based models provide the best means for comparing relative risks of sediment delivery associated with changes in hill slope and road related disturbances.

high (Table 26). It is worth noting that the S&Gs for EGC derived from soil characteristics were based on regeneration harvests, rather than thinning. Nonetheless, in order to ensure that soil productivity standards are maintained, erosion risks are adequately mitigated and S&Gs for Minimum Ground Cover Requirements (p IV-68) are met, the following unit specific EGC levels are recommended (Table 27a). Based on past experience with similar thinnings and fuels treatments, the majority of harvest units would easily meet or exceed these prescribed levels post treatment.

Table 27a. Recommendations for Effective Ground Cover for Emile Harvest Units.

Effective Ground Cover (EGC)	Unit
45%	1, 2, 4, 5, 7, 8a, 8b, 14, 15, 16, 18, 19, 25, 26, 28, 29, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42, 43, 44, 45, 46, 47, 49, 50, 51, 58, 60
65%	9, 10, 17, 20, 24, 27, 30, 31, 57

The desired condition for soils is to maintain the minimum prescribed levels of effective ground cover in all activity areas, and to keep soil compaction and displacement to less than 20% in all activity areas.

Direct and Indirect Effects

The direct and indirect effects are discussed at the scale of the treatment units. Direct effects would occur immediately as a result of thinning, fuel treatment, and road work while indirect effects would occur in the future as a result of potential wildfires and forgone opportunities for soil rehabilitation.

Displacement, compaction, and severe heating of the soil (from fire) are all considered unacceptable soil disturbance under the LRMP as listed above. Soil disturbance would exceed soil S&G 1 when legacy disturbance (from past management) combines with any new disturbance to affect more than 20% of a given treatment area. Thinning and associated activities can result in soil disturbance during yarding, burning and road building.

Currently there are 313 acres of legacy detrimental soil impacts within the Emile harvest units. Under Alternative 1, there would be no direct effects to soils because no harvest, fuels treatments, or road work would occur. However, under this alternative, legacy soil displacement and compaction from past harvest would not receive subsoiling treatments and detrimental impacts would remain at current levels; units 4, 7, 8a, 8b, 14, 15, 24, 29, 34, 36, 37, 39, 40, 45, 46, 47, 49 and 58 would continue to exceed standards and guidelines for unacceptable soil disturbance into the future.

The action alternatives would result in soil disturbance from new temporary road construction, re-use of legacy roads, log and helicopter landings, ground-based logging skid trails, and fuels treatments. Under Alternatives 2 and 4, approximately 138 acres of soil disturbance is expected from these activities. Under Alternative 3, approximately 124 acres of soil disturbance would occur. Alternatives 2 and 4 would disturb slightly more soil than Alternatives 3, primarily because more new temporary roads would be built under these alternatives. However, following subsoiling that is required mitigation for this project, detrimental soil impacts would be reduced from the existing 313 acres to 261 acres under Alternatives 2 and 4 and to 247 acres under Alternative 3. Concentrated

areas of legacy soil compaction were given priority for the required soil mitigation and were used to identify additional areas that would be subsoiled as connected actions to the alternatives.

Following completion of subsoiling mitigations, Alternatives 2, 3, and 4 would meet soil standards and guidelines for unacceptable soil disturbance varying from 8.1% (Alt 2 &4) to 8.5% (Alt 3), thus complying with soils standards and guidelines requiring no more than 20% unacceptable conditions on a individual treatment area basis.

Indirect effects to soils are primarily associated with maintaining (Alternative 1) or lowering (Alternatives 2, 3, and 4) risks of wildfire impacts on soils. Over the long term (ten years or more following implementation), the potential for a wildfire to severely burn soil would be slightly reduced by the action alternatives as compared to Alternative 1 (See Fire and Fuels section). The reduced risk only assumes that the underburning, machine pile burning, and jackpot burning would effectively reduce burn severity on soil from a future wildfire and that the other fuel treatments such as thinning, crushing, and handpile burning would not. This is because while they would reduce the spread of wildfire, they would not adequately reduce the fuel loading to prevent wildfire effects to soil in a ground fire.

Carbon, which includes down woody material, litter, and soil organic matter, is a critical element to site productivity and soil development. Most available nutrients for plants are retained in the upper ten inches of forest soils. Fine roots and mychorrizal fungi activity occur in the surface two inches of soil. Fine root development plays an important role in soil carbon sequestration (Lal, 2005) and long-term soil fertility. Forest soils that are low in organic matter are also less productive.

Under Alternatives 2, 3, and 4, effective ground cover (EGC) has been prescribed to mitigate both the risk of soil erosion and the need to maintain soil organic matter for long-term site productivity as required under LRMP standards and guidelines. The prescribed levels of EGC are listed above in Table 27a. Carbon storage in forest soils can be achieved during forest management (Lal, 2005). If forest harvesting is done with sufficient care, and does not substantially disrupt natural processes such as surface erosion and nutrient cycling, there may be little or no effect on soil organic carbon stock. (Lal, 2005).

Under Alternative 1, a future wildfire would likely be larger and possibly more severe than under the action alternatives. Instead of storing carbon and maintaining soil organic matter, a wildfire would release carbon into the atmosphere (Bonnicksen, T.M. 2008) first from the effect of the fire itself then the following decomposition of remaining organic matter. Alternative 1 forgoes restoration opportunities and leaves the planning area at a somewhat higher risk of high severity wildlife, thus, jeopardizing future soil conditions.

Cumulative Effects

The Emile planning area soils are relatively resilient to disturbance. Although past management actions (Table 7), such as timber harvest and road building have resulted in detrimental soil conditions in portions of the planning area, all action alternatives are within standards of acceptable disturbance, and would retain adequate levels of effective ground cover and therefore would not add to past soil impacts to result in any adverse cumulative effects to soil. In fact, actions and connected actions (i.e. obliteration of temporary roads on existing abandoned roads, skid roads/trails, and firelines; and subsoiling) that would occur under Alternatives 2, 3, and 4 would help to decrease soil

compaction and displacement and benefit overall soil productivity in the Emile harvest units. Ongoing and future activities (Table 8 and 9) are limited in scale and would also be required to meet soil standards and guidelines and as such would be expected to maintain or improve soil conditions in the planning area.

When considering the incremental impacts of the project, when added to past, present, and reasonable foreseeable future actions in the project area, it is determined that there are no meaningful adverse cumulative impacts associated with any of the alternatives; and implementation of Alternatives 2, 3, and 4, with project design features and required mitigation would begin to restore effects to soils from past management activities.

FOREST WILDLIFE

During scoping, Oregon Wild was concerned about the potential impacts of thinning on the northern spotted owl and its prey, as well as a suite of other wildlife species. This issue was addressed through project design and mitigation and through disclosure of potential effects to wildlife for all alternatives as described in this section. AFRC was concerned that Alternative 2 would not create sufficient foraging opportunities for big game in the MA-11 land allocation (big game winter range). This significant issue was addressed by development of Alternative 4. Potential effects to big game habitat for all alternatives are disclosed under Management Indicator Species.

This section includes the effects analysis for Threatened and Sensitive Wildlife Species, Management Indicator Species, Landbirds, and Rare and Uncommon Wildlife.

THREATENED AND SENSITIVE WILDLIFE SPECIES

This section covers species recognized under the federal Endangered Species Act, and species recognized as sensitive by the Forest Service. Federally listed species require consultation with the U.S. Fish and Wildlife Service before project implementation while no such requirement exists for sensitive species.

Sensitive species are species for which there is a documented concern for viability within one or more administrative unit within the species' historic range (FSM 2670.22, WO Amendment 2600-95-7). These species may require special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for Federal listing.

The Forest Service Manual (FSM 2672.4) requires a biological evaluation to determine potential effects of proposed ground-disturbing activities on sensitive species. This evaluation analyzes the proposed action and the significance of potential adverse effects on the population or its habitat within the area and on the species as a whole, and makes recommendations for removing, avoiding, or compensating for adverse effects. It must include: (1) sensitive species that may be present; (2) identification of occupied and unoccupied habitat; (3) an analysis of the effects of the proposed action on the species or its habitat; (4) a discussion of cumulative effects; (5) a determination of no effect, beneficial effect, or may affect; and, (6) recommendations for avoiding or mitigating any adverse effects if needed.

A pre-field review was performed to determine which sensitive species are most likely to be impacted by the proposed alternatives. Table 28 provides a list of Region 6 sensitive

wildlife species for the Umpqua National Forest, North Umpqua Ranger District[56] and Table 29 summarizes the presence or absence and potential impacts on these species and/or their habitat within or adjacent to the proposed timber harvest units and ground disturbance areas. This review is based on the latest documented survey and occurrence data, field reconnaissance, scientific literature review and GIS analysis. Impact or effect determinations are made for each species, based on this review. If a substantial, measurable impact or effect is anticipated, further analysis and discussion of the direct, indirect and cumulative effects is included following Table 29. All actions and connected actions associated with the alternatives were considered in this analysis. If an action is not discussed, its potential impacts were considered non-existent or so negible that they were not noteworthy.

Table 28. Proposed, Threatened, Endangered, and Sensitive Wildlife on the Umpqua National Forest, North Umpqua RD from Regional Foresters Revised List, January 2008.

Common Name	Scientific Name	Habitat Description and Information
Northern spotted owl	*Strix occidentalis caurina*	Old growth conifer forests or younger forests with old growth remnant structures such as large trees, snags and down wood. There are 9 historic owl cores within the Emile planning area.
Johnson's hairstreak	*Callophrys johnsoni*	Late successional conifer forests; larvae feeds on dwarf mistletoe (*Arceuthobium*) growing on pine and other conifers; documented on the Umpqua NF on the Diamond Lake RD.
Coronis fritillary	*Speyeria coronis coronis*	Wide-ranging in many habitats; larvae feed on violet; suspected on the Umpqua.
Mardon skipper	*Polites mardon*	Isolated populations in grassy lowlands or subalpine meadows; rocky serpentine meadows; larvae feed on grasses; suspected on the Umpqua.
Siskiyou short-horned grasshopper	*Chloealtis aspasma*	Grasslands; Siskiyou mountains; suspected on the Umpqua.
Evening fieldslug	*Deroceras hesperium*	Low to mid-elevations; associated with a variety of low vegetation, litter, and debris; rocks may be used; suspected on the Umpqua.
Salamander slug	*Gliabates oregonius*	Leaf litter; mature and old forests; some specimens found in Lane county; suspected on the Umpqua.
Crater lake tightcoil	*Pristiloma arcticum crateris*	Perennially wet areas in mature conifer forests within 33 feet of open water. Generally in areas that remain under snow for long periods in the winter. Documented on the DL Ranger District.
Foothill yellow-legged frog	*Rana boylii*	Ranges from northwest Oregon to Baja California. Found near streams and rivers. Low gradient reaches with sun-exposed bedrock and gravel/cobble substrates. Documented on NURD and Tiller RDs.

[56] Only species that occur on the North Umpqua RD and potentially within the project area will be discussed in the EA. The action alternatives would have "no impact" on the following species and they will not be discussed further: Oregon shoulderband; Chace sideband; Oregon spotted frog; yellow rail; horned grebe; red-necked grebe; purple martin; Lewis' woodpecker; white-headed woodpecker; Pacific pallid bat; and wolverine. See the wildlife Biological Evaluation in the project file for more information on the above species.

Common Name	Scientific Name	Habitat Description and Information
Northern Pacific pond turtle	*Actinemys marmorata marmorata*	Inhabits marshes, ponds, lakes or slow-moving portions of rivers and streams. Large amounts of emergent logs, vegetation or rock are needed for basking and cover. Documented on all districts on the Umpqua NF.
Bufflehead	*Bucephala albeola*	Nest in tree or snag cavities near high Cascade lakes and ponds. Uncommon spring migrant and common fall migrant. Nesting has been documented on Diamond Lake RD, Winters on Tiller RD.
Black swift	*Cypseloides niger*	Aerial; forages over forests and open areas. Nests behind waterfalls in wet cliffs. Forages over several square kilometers, and larger. Documented occurrence on NU and DL Ranger Districts.
American peregrine falcon	*Falco peregrinus anatum*	Vertical rock cliffs with ledges or potholes. Often nests near prominent riparian habitat such as rivers or wetlands. Documented eyries on NURD, Diamond Lake, and Tiller RDs.
Bald eagle	*Haliaeetus leucocephalus*	Nest on cliff face ledges or large trees in close proximity to large bodies of water. Documented nesting on Diamond Lake, winters on Tiller and NURD.
Harlequin duck	*Histrionicus histrionicus*	Swift, rocky, large streams or rivers. Nest under rock overhangs, vegetation or streamside debris. Late spring migrant or summer visitor. Documented on North Umpqua, Diamond Lake, and Tiller Ranger Districts.
Pacific fringed myotis	*Myotis thysanodes vespertinus*	Uses caves, mines, buildings, bridges, trees and snags. Aerial feeder, but can glean from foliage and ground. Critical habitat is maternal roosts. Documented on NURD and Tiller RD.
Townsend's big-eared bat	*Corynorhinus townsendii*	Uses caves for breeding and hibernaculum. Documented nursery colony on the North Umpqua RD.
Pacific fisher	*Martes pennanti*	Late-successional forests. Associated with riparian areas. Large dead wood important, dens usually within cavities of large trees and snags. Documented occurrence on the DL Ranger District.

Table 29. Sensitive Species pre-field review and summary

Sensitive Species	Is species or habitat in or adjacent?	Is impact or effect expected?	Loss of viability or trend?
Northern spotted owl	Yes, species and habitat occur in the project area.	Potential – see discussion	No, consistent with the NWFP and management guidelines from USFWS.
Johnson's hairstreak	Yes, conifers with mistletoe are present in project area.	Potential – see discussion	No
Coronis fritillary	Yes, a variety of habitats are present within the project area.	Potential – see discussion	No
Mardon skipper	Remote possibility. Species range and all known sites occur in four geographically disjunct areas that are distant from the project area. Species dispersal capabilities less than 0.5 miles. Closest observation is a known population 62 miles south in Jackson Co. (2007).	No, it is not reasonable to expect impacts to individuals of this species. Thinning with directional felling away from meadows/openings represents indirect beneficial habitat impact through reduction in conifer encroachment.	No, consistent with conservation assessment
Siskiyou short-horned grasshopper	Yes, grassland/herbaceous habitats occur within the project area.	Potential – see discussion	No

Sensitive Species	Is species or habitat in or adjacent?	Is impact or effect expected?	Loss of viability or trend?
Evening fieldslug	Yes, wetlands occur in the project area.	Low potential – see discussion	No, consistent with conservation assessment and NWFP
Salamander slug	Low probability, habitat is present; no specimens have been detected in mollusk surveys across the Umpqua. Closest observation is 85 miles north in Lane County.	Low potential – see discussion	No, consistent with NWFP
Crater Lake tightcoil	Yes, habitat occurs within the project area.	Low potential – see discussion	No, consistent with conservation assessment and NWFP
Foothill yellow-legged frog	Yes, species and habitat occur within the project area.	Low potential – see discussion	No, consistent with conservation assessment and NWFP
Northern Pacific pond turtle	Yes, habitat occurs within the project area.	Low potential – see discussion	No
Bufflehead	Low probability, occasional use of pond/sump habitat in planning area is possible.	Low potential – see discussion	No
Black swift	Yes, species and habitat occur within the project area.	Potential – see discussion	No
American peregrine falcon	Yes, species and habitat occur within the project area.	Potential - see discussion	No
Bald eagle	Yes, habitat occurs in the project area.	Potential - see discussion	No, consistent with management guidelines from USFWS
Harlequin duck	Remote possibility. Species not documented currently or historically. Low potential habitat.	No, it is not reasonable to expect impacts to individuals of this species. None of the proposed activities would meaningful degrade potential habitat.	No
Pacific fringed myotis	Yes, habitat occurs in the project area.	Potential – see discussion	No, consistent with NWFP.
Townsend's big-eared bat	Yes, habitat occurs in the project area.	Potential – see discussion	No
Pacific fisher	Very low probability of species occurrence, closest observation 24 miles south of planning area; part of reintroduced population. Potential habitat occurs in late and old forests adjacent to proposed units.	Indirect – thinning would accelerate development of habitat. Not reasonable to expect disturbance impacts to individuals.	No, action alternatives do not impact current habitat, may benefit species through indirect effects.

Northern Spotted Owl *(Strix occidentalis caurina)* (Tracked as a Disclosure Issue)

The Northern spotted owl (NSO) is listed as a threatened species under the authority of the Endangered Species Act. Effects analysis for this species is based on an action area. The action area is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." (50 CFR 402). For the northern spotted owl, the action area includes all federal, state, and privately owned lands within 1.2 miles of proposed harvest units and all known or potential owl

home ranges that could be directly, indirectly or cumulatively impacted through the proposed actions.

Nesting, roosting, and foraging habitat (NRF) for the spotted owl is strongly associated with late-successional forests containing large conifers with broken tops or cavities for nesting, multiple canopy layers for thermal regulation and protection from predation and adequate amounts of large dead wood on the forest floor to support populations of prey (Thomas et al. 1990). Recent studies have documented nesting and use of stem exclusion and younger mature second-growth forests (Irwin et al. 2000). Amounts of coarse woody debris and large-diameter trees in these forests influenced their use.

Dispersal habitat for spotted owls satisfies needs for foraging, roosting and protection from predators and is characterized by forests that have a minimum average tree diameter of 11 inches and greater than 40% canopy cover. Maintenance of dispersal habitat on a minimum of 50% of federal lands within a given area (e.g., quarter-township) is a conventional threshold for adequate owl dispersal conditions.

Critical habitat units[57] (CHUs) are geographical areas occupied by a listed species where physical or biological features (primary constituent elements) are found that are essential to the conservation of the species and that may require special management considerations or protection.

The Emile Timber Sale action area (Figure 19) covers about 34,492 acres, of which 12,204 acres (35%) are currently NRF for the NSO. There are no proposed harvest units in NRF habitat. There are 11 potential NSO home ranges within the action area. There are nine historic owl territories and associated “owl cores” within the Emile planning area. Approximately 27,241 acres (79%) of the action area is considered to be dispersal habitat. All proposed harvest units are dispersal habitat.

The action area overlaps 18,851 acres of CHU OR-29 and all or portions of 26 thinning units are within this CHU. The land ownership in the CHU is mostly USFS (92%), BLM lands make up about 1% and the remaining 7% is comprised of privately owned industrial timber lands. CHU OR-29 contains about 72,028 acres of dispersal habitat (77% of the CHU), all of which occurs on Federal lands. Juvenile owls fledged in this area have been documented to disperse as far as 3 to 35 (avg. 14 miles) linear air miles within the first year. Older owls have been documented to disperse in and out of this CHU from 1 to 8 linear air miles (avg. 3 miles) (Forsman et al. 2002).

[57] The final rule at 57 FR 1838 determined the primary constituent elements of spotted owl critical habitat to be “…forested lands that are used or potentially used by the northern spotted owl for nesting, roosting, foraging, or dispersing.”

Figure 19. The Emile Timber Sale Northern Spotted Owl Action Area.

Direct and Indirect Effects:

Habitat

Alternative 1 would have no direct effects on the NSO because no above-ambient noise or habitat disturbing activities would occur as a result of this alternative. Commercial thinning proposed under all action alternatives is the primary management activity that would have potential effects on the NSO, so information most relevant to this species concerning thinning is summarized for enhanced understanding. Alternative 4 includes the largest acreage of canopy gaps and thins the most acres, so it is characterized below (Alternative 2 thins the same as Alternative 4, but proposes only one-acre gaps, and Alternative 3 thins 81 less acres and proposes only one-acre gaps). To minimize the potential for adverse effects on the owl, all units directly adjacent to owl cores would maintain $\geq$ 50% canopy closure and would not have canopy gaps created in them (all action alternatives).

Alternative 4 would commercially thin 44 conifer plantations ranging in age from 44 to 60 years old. These units cover about 2,496 acres. About 12% of these acres would be thinned to a stand density of 50-70 trees per acre, 60% would be thinned to 70-90 trees per acre, and about 2% would be converted into small gaps ranging from 1 to 2 acres in size, with one additional gap of 3-acres in Unit 18. Gaps would contain a clump of 5

trees per acre that would be subsequently killed with fire to create small snag patches. The remaining 26% would remain un-thinned as buffers or no treatment areas to achieve variable tree densities. Snag and down wood levels would be maintained at 50% tolerance levels within OR-CHU-29 and between 30-50% tolerance levels outside of the CHU. Existing snags and large down logs would be retained to the extent practical.

For Alternatives 2, 3, and 4, the direct effect of thinning would be an increase in the stand's average tree diameter (the average stand tree diameter would be greater than 11 inches dbh) and a decrease in the stand's average canopy closure. Thinning down to 50-70 trees per acre would reduce canopy closure to no lower than 40-50 percent (see Table 18 for estimated residual stand conditions by unit). Thinning to 70-90 trees per acre is expected to lower canopy closure to about 50-60 percent. These reductions in canopy closure would affect NSO dispersal habitat, however these units would still function as dispersal habitat for the owls, because the unit's overall post-thinning tree diameters and canopy closure would still meet the definition of dispersal habitat. Following thinning, there would be an expected gain in canopy closure of 2% per year (Chan 2006). Given the silvicultural prescription for the alternatives, the following acres of dispersal habitat would be modified by thinning, but maintained in a dispersal condition: Alternative 2 = 1,806 acres; Alternative 3 = 1,725 acres; and Alternative 4 = 1,788 acres. Small gaps larger than 1-acre would amount to a total of about 29 acres of dispersal habitat loss under Alternatives 2 and 3, and 47 acres of dispersal habitat loss under Alternative 4. However, these gaps would be scattered across several stands with various thinning treatments, including no-thin buffers, and overall stand average canopy cover would remain above 40%. Even if all of the thinning were to remove dispersal habitat by lowering the canopy closure to less than 40%, the amount of dispersal habitat would still cover more than 70% of the action area. This amount of dispersal habitat spread across an action area is well above the threshold commonly known as the "50-11-40 rule ", adopted as the strategy for enhancing successful NSO dispersal through a forested landscape. Commercial thinning would modify the structure of dispersal habitat and displace/disrupt prey during actual implementation, but the stands would still function as dispersal habitat for the owl as defined by Thomas et al. (1990). Thus, the direct impact to dispersal habitat of NSOs is considered to be minor and "may effect, but is not likely to adversely affect" the NSO.

Commercial thinning may indirectly affect NSOs through changes to prey species habitat. In this area, northern flying squirrels are an important food source for the owl, and therefore the abundance and richness of hypogenous fungi (an important food source for flying squirrels) is an important factor to consider. A recent study by Gomez et al. (2005) found that commercial thinning similar to that proposed in this project did not have measurable short-term effects (<3 yr) on density and survival of flying squirrels in the Oregon Coast Range. They also found greater biomass of *Rhizopogon* and *Gautieria* in moderately or heavily thinned stands (2 genera of fungi that are highly selected for by flying squirrels) and some evidence that thinning intensity may have positively affected the body mass of flying squirrels (Gomez et al. 2005). Thinning reduces competition among remaining trees and accelerates diameter growth of retained trees. Forest growth simulator and coarse wood dynamics models (FVS & FFE) used to forecast the effects of the silvicultural prescriptions showed that moderate to heavy thinning would accelerate successional development, while maintaining down wood at levels within normal ranges for these forest types (Mellen et al. 2006). Since the density of hypogenous fungi is positively associated with proximity to large trees and down wood, thinning should have an indirect beneficial effect of increasing food sources for owl prey species over time.

Gomez at al. (2005) noted that thinning of young Douglas-fir stands in western Oregon to tree densities of 67-134 TPA may have a neutral or positive influence on northern flying squirrels over longer periods of time because of structural changes created by thinning. Thinning and gap creation would increase light penetration to the forest floor and stimulate growth of herbaceous and shrubby vegetation. Northern flying squirrels (and wood rats – another important prey species) are likely to respond positively to these changes (Gomez et al. 2005). Over time, proposed silvicultural treatments particularly in the moist-gentle landtypes are expected to accelerate development of NRF habitat and improve long-term habitat connectivity in the action area, consequently, indirectly benefiting the NSO over the long-term.

Critical Habitat Unit

Action alternatives would affect a maximum of about 1,198 acres of CHU OR-29 or about 2% of the total amount of dispersal habitat within this CHU (on Federal land). The effect would be a modification of existing dispersal habitat caused by thinning the stands as described above. The effects of this action on dispersal habitat conditions in this CHU are negligible. Even if the proposed thinning removed dispersal habitat in all thinned units, the amount of dispersal habitat within the CHU would be 74%, well above the 50% threshold needed for maintenance of owl dispersal.

Disturbance

All action alternatives may also have direct effects on NSOs through noise generating disturbances within close proximity to both known NSO activity centers and spatially suitable habitat that may support nesting owls as determined by a spatial analysis of NRF conducted in accordance with procedures outlined by the USFWS (USDI/USDA 2007). Timber harvesting and associated activities (e.g. temporary road construction, chainsaw and helicopter operation, etc.) produce above ambient noise levels that have the potential to disturb nesting NSO's, and disrupt normal reproductive activities. Disturbance could cause nest abandonment, flushing of adults off of eggs thereby exposing them to harm, depressed feeding rates and avoidance of otherwise suitable habitat. To reduce these effects and avoid adverse effects on the owl, tree falling and yarding activities would be restricted to occur outside of the critical egg laying and incubation period (March 1 to July 15) within close proximity[58] of known or predicted owl sites under Alternatives 2, 3, and 4:

- Helicopter logging is prohibited March 1 to July 15 of any given year. This restriction applies to Units 14, 16, 27, 28, and 57 and use of the six proposed landings by helicopters.
- Temporary road construction or reconstruction and tree felling, bucking, and yarding activities are prohibited March 1 to July 15 of any given year in the following units: Units 1, 2, 7, 20, and 32.

Although some disturbance to the species could still occur beyond this time period, (because the raising and fledging of young continues until September), the likelihood of a disturbance resulting in any meaningful consequence to spotted owls is minimal.

Additionally, under all action alternatives prescribed fire from underburning would generate smoke during the critical egg laying season, because it is not practical to place

[58] A 260-meter buffer around a known (historic) or computer-generated owl site as described in USDI/USDA (2007) for conventional timber harvesting and a ½ mile distance for helicopters and helispots.

a March 1 to July 15 seasonal restriction on underburning, as it is rarely dry enough to accomplish burn objectives in the winter before March 1 and the risk of tree mortality and soil damage in the residual stand is too high in the summer and fall, after July 15. Smoke associated with the proposed underburning represents a potential disturbance effect to the NSO. However, the underburning of commercial plantations normally produces light to moderate levels of smoke, because the burns are designed to be low intensity, ground fires. On average, approximately 40 acres of underburning can be accomplished each day. The burning prescriptions do not allow burning during temperature inversions and require prevailing winds to be from the west to avoid air quality impacts to local towns. During burning, the on-site winds are typically upslope winds. Based on past experience, burning usually begins in the last week of April or first week of May and ends before mid-July. Smoke levels are not expected to be heavy and should dissipate quickly. To help reduce smoke impacts, handpiles would be burned during the fall.

Road maintenance operations, as well as other connected actions (e.g., precommercial thinning, instream wood placement) would abide by the terms and conditions in the Forest programmatic biological opinion (FWS-1-15-03-F-0454). That biological opinion addressed impacts from above-ambient noise levels and terms and conditions therein state that the Forest, "When possible, schedule these activities to occur after July 15 and before March 1". Thus, as mitigated, all action alternatives "may affect, but are not likely to adversely affect" the NSO through disturbance impacts.

Cumulative Effects: Past clearcut timber harvesting of late-successional and old growth forests is the management action that has had the largest cumulative impact on spotted owls through the removal of NRF habitat (Table 7). Current NRF levels have been reduced to about 35% of the action area. However, about 92% of the 34,492 acre action area is federally-owned and current (Table 8) and foreseeable impacts (Table 9) to NRF on federal lands are limited (i.e. 33 acres of potential NRF thinning). Ongoing and future actions on private lands within the action area would not impact NRF because private lands are primarily dispersal habitat or younger tree plantations. Thus, the current and expected future trend for NRF habitat within the action area and planning area is considered to be stable to increasing.

Based on an estimate of future clearcut harvesting on private land of 200 acres per year that would remove dispersal habitat within the action area, both the action area and CHU would remain above the 50% dispersal habitat threshold. Thus, due to the limited extent and magnitude of potential adverse effects and the expected beneficial effects, when considered in the context of past, present, and foreseeable actions, it is determined that there are no consequential negative cumulative effects associated with Alternatives 2, 3 and 4. Alternative 1 would cause no direct or indirect effects to this species; thus, there would be no associated cumulative effects, only forgone opportunities.

Effects Determination: Following consideration of the direct, indirect and cumulative impacts it is determined that the action alternatives, as mitigated, "may affect, but are not likely to adversely affect the spotted owl" its habitat and critical habitat (NLAA). The no action alternative would have no impact (NI) on this species except in the context of forgone opportunities.

Johnson's hairstreak[59] *(Callophrys johnsoni)*

Existing Condition: Hairstreaks are small butterflies. Preferred habitat is late successional and old-growth coniferous forests that contain mistletoes of the genus *Arceuthobium* (dwarf mistletoes). The species lays its eggs on the mistletoe and the larvae feed on all exposed parts of the host plant. Range is local and scarce throughout Pacific Northwest. Primary threats to this species include: logging of late successional forests, spraying of insecticides and herbicides, and potential hybridization with another species of butterfly.

There are no known occurrences of this species within the planning area or on the North Umpqua RD. The closest documented observation of the Johnson's hairstreak butterfly is a larva collected in June 1972 along the Clearwater River on the Diamond Lake RD, approximately 15 miles east of the planning area boundary. None of the proposed harvest units are preferred habitat for this butterfly, but conifers with mistletoe are present in the units; thus, species presence within the harvest units is possible and species presence in adjacent late-successional forests is assumed.

Direct and Indirect Impacts: Alternative 1 would not impact this species because no trees would be removed. None of the action alternatives would remove late successional or old-growth forests, nor spray with insecticide or herbicide, thus potential negative project impacts to this butterfly and its habitat are believed inconsequential to the species. However, although harvest units are not preferred late successional butterfly habitat, because some trees infected with mistletoe would be felled in stands selected for thinning, Alternatives 2, 3, and 4 could directly impact low quality potential habitat for the species. This potential impact would be reduced through silvicultural prescriptions that ensure some trees with mistletoe would be retained as current and future wildlife habitat. There is also a potential for direct impacts to individual eggs or larvae, if they were occupying mistletoe brooms during tree felling. Due to the fact that the harvest units are not preferred habitat for the species, this potential impact is not considered likely to occur at a frequency of consequence to the species.

Alternatives 2, 3, and 4 would also be expected to have indirect beneficial impacts to the Johnson's hairstreak butterfly by accelerating movement of the mid-seral thinned stands toward preferred late successional habitat conditions (primarily stands in the gentle-moist land types). Additionally, thinning in all stands would result in a reduction of canopy cover and subsequent increase in grass, forbs and shrubs in the understory. This should benefit adult butterflies, providing additional food sources in the planning area. Increasing structural and vegetative diversity would be expected to enhance habitat quality for this species in the planning area in the short- and long-terms. There are no meaningful differences between the action alternatives with regards to potential impacts to this species and its habitat.

Cumulative Impacts: The cumulative impacts to the Johnson's hairstreak butterfly are analyzed at the planning area scale. Cutting of late and old forests (particularly using timber harvest practices that were designed to rid stands of mistletoe) is the past management action (Table 7) that probably had the greatest influence on the Johnson's

[59] A detailed summary of habitat associations, life history traits, range/distribution etc. are documented in a species fact sheet on the Forest Service-Bureau of Land Management Pacific Northwest Interagency Special Status /Sensitive Species Program website: http://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/20050906-fact-sheet-johnsons-hairstreak.doc.

hairstreak butterfly and its habitat in the project area. Current (Table 8) and reasonably foreseeable actions (Table 9) in the planning area would not include spraying of insecticide or herbicides. Reasonably foreseeable impacts on late-successional forests are limited in scale and magnitude, and would not be expected to meaningfully reduce the ability of the planning area to support the Johnson's hairstreak. Alternative 1 foregoes the opportunity to enhance future butterfly habitat through thinning, but otherwise has no noteworthy impacts and as such, no meaningful cumulative impact. Alternatives 2, 3, and 4 have limited potential negative impacts and would result in movement of thinned stands toward a condition more favorable to the Johnson's hairstreak. Thus, when considered in the context of past, present, and foreseeable actions, it is determined that there would be no consequential negative cumulative impacts to the species associated with any action alternative.

Coronis fritillary[60] (*Speyeria coronis coronis*)

Existing Condition: This butterfly is found in many habitats in the western U.S. including oak woodlands, brushy foothills, mixed conifer forests, meadows, and sagebrush flats (Oppler 1999). Habitat associations described by Pyle (2002) are lower elevation canyons and grasslands as well as mid-montane meadows and forest margins and openings. Eggs are laid singly on litter near violets. There are no known documented observations of this species in or adjacent to the project area or elsewhere on the Umpqua National Forest. However, the Coronis fritillary is suspected on the Forest and the project area contains potential suitable habitat for the butterfly. Natural meadows and other forest openings may be the best potential habitat for the species within the Emile planning area.

Direct and Indirect Impacts: Alternative 1 would have no impact on this species. For all action alternatives, direct impacts to individuals or habitat (violets) could occur during log yarding and associated fuels treatments in proposed harvest units. However, protection of wetlands, streams, rock outcrops and directional felling of trees away from dry meadows and other unique habitats would mitigate this potential impact in areas believed to be most suitable for the species. Additionally, all action alternatives would be expected to have indirect beneficial impacts for the species through removal of conifers adjacent to some meadows, and provision of a diversity of habitat conditions within harvest units and across the planning area (i.e. moving mid-seral stands toward conditions that would occur under natural disturbance regimes). There are no meaningful differences between the action alternatives with regards to potential impacts to this species and its habitat.

Cumulative Impacts: The cumulative impacts to the Coronis frittilary butterfly are analyzed at the planning area scale. Past management actions that reduced habitat diversity may have lowered the quality of existing habitat for this butterfly within the Emile planning area. However, the subwatersheds that constitute the planning area still encompass a broad variety of habitat conditions over large acreages and as such, the area is believed to contain adequate suitable habitat to support the species where it exists. Current and foreseeable actions are limited in scale and are expected to have neglible impacts on this butterfly or its habitat within the planning area. Thus, when considered in the context of past, present, and foreseeable actions, it is determined that

[60] Additional life history information and habitat associations are documented in a species fact sheet: http://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/sfs-iile-speyeria-coronis-coronis.doc

there would be no consequential negative cumulative impacts to the Coronis fritillary associated with any action alternative.

Siskiyou short-horned grasshopper[61] *(Chloealtis aspasma)*

Existing Condition: This small, brown grasshopper occurs in grassland/herbaceous habitats (i.e. high elevation meadows and clear-cuts, grassy hilltops). It is distributed in two general areas in the state, one in Southern Oregon (Jackson Co.) and the other in Benton Co. The species appears to be associated with blue elderberry plants (*Sambucus caerulea*).

Conservation Considerations: Forest logging and mild or low intensity fire appears to provide open habitat for the host plant, blue elderberry, thereby increasing local populations of the grasshopper.

There are no known documented observations of this species in or adjacent to the planning area. The closest sighting of the species is a historic (1922) observation in Woodruff Meadows approximately 18 miles west of Crater Lake, at the border of forest and meadow. This species observation is about 24.7 miles southeast of the project area boundary. However, the Siskiyou short-horned grasshopper is suspected on the Umpqua National Forest and the project area contains potential suitable habitat for the species. Natural meadows and other forest openings may be the best potential habitat for the species within the Emile planning area.

Direct and Indirect Impacts: All action alternatives would thin adjacent to some meadows/unique habitats and as such it is possible that harvest and associated activities could directly impact individual grasshoppers. However, this potential impact is considered very unlikely to occur at a frequency of consequence to the species because no harvest, log yarding or fuels treatments would occur within the meadows where grasshoppers would generally be and none of the proposed activities would be expected to impact blue elderberry shrubs where grasshopper eggs are laid (directional felling of trees away from meadows is a project design feature that would be implemented to ensure protection of this unique habitat). Alternatives 2, 3, and 4 would also be expected to have indirect beneficial impacts to the species habitat through reduction of conifer encroachment on meadows/openings and through creation of canopy gaps that would provide future habitat for the species for a period of time. Of the three action alternatives, Alternative 4 would have the greatest potential beneficial habitat impacts for the grasshopper because it would create the highest acreage of canopy gaps and would also seed the gaps with native grass seed. Alternative 1 would have no direct impacts to the species, but forgoes the opportunity for habitat enhancement through meadow maintenance and gap creation.

Cumulative Impacts: Cumulative impacts to this species are analyzed at the planning area scale. Regeneration harvest that created forest openings is the past management action (Table 7) that likely had the greatest influence on this species within the Emile planning area; these activities resulted in enhanced habitat conditions for the grasshopper. Conversely, past and ongoing fire suppression activities limit the natural creation and maintenance of suitable grass/herbaceous habitat for the species. Other current (Table 8) and foreseeable actions (Table 9) are limited in scale and are expected to have neglible impacts on the species. Because the proposed actions represent a

[61] Additional life history information and habitat associations are documented in a species fact sheet: http://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/20050906-fact-sheet-chloealtis-aspasma.doc

primarily beneficial impact to the species, when considered in the context of past, present, and foreseeable actions, it is determined that there would be no consequential negative cumulative impacts to the Siskiyou short-horned grasshopper associated with any action alternative.

Evening Fieldslug[62] *(Deroceras hesperium)*

Existing Condition: The Evening fieldslug is associated with perennially wet meadows in forested habitats; microsites include a variety of low vegetation, litter and debris; rocks may also be used as refugia. This species appears to have high moisture requirements and is almost always found in or near herbaceous vegetation at the interface between soil and water, or under litter and other cover in wet situations where the soil and vegetation remain constantly saturated. Because of the apparent need for stable environments that remain wet throughout the year, suitable habitat may be considered to be limited to moist surface vegetation and cover objects within 30 m. (98 ft.) of perennial wetlands, springs, seeps and riparian areas. Water levels in many streams in western Oregon may fluctuate too much and too quickly to provide streamside habitat with constant enough moisture conditions for this species (USDI, BLM 1999).

Primary threats to this species are habitat loss from draining and conversion of wet meadows for agricultural, urbanization, grazing, forest management and other uses; and from fire. Natural threats may include ingrowth of conifer or hardwood tree and shrub species in historically herbaceous habitats, changes in hydrology that reduce the availability of water in wetlands, and exposure to vertebrate and invertebrate predators (i.e., predatory snails and beetles), especially in locally restricted areas.

Two-visit protocol surveys for terrestrial mollusks were conducted in 1998 and 1999 on approximately 870 acres within and adjacent to Emile thinning units in preparation for the Mjollnir timber sale, which never occurred. The Evening fieldslug was not detected during these surveys and there are no known documented observations of this species in or adjacent to the Emile planning area. The closest sighting of this species is a 1995 observation closely adjacent to the North Umpqua River, approximately 2.0 miles north of the project area boundary. The Emile planning area and proposed harvest units contain wet meadows and a variety of riparian habitats and thus, contain potential habitat for the slug. However, this species has not been documented during any of the extensive project level surveys on the North Umpqua RD in the past decade.

Direct and Indirect Impacts: Wetland protection and stream buffers, retention of $\geq$ 50% canopy closure in outer portions[63] of Riparian Reserves (i.e. maintenance of microclimates), down wood and hardwood retention requirements, and protection of rocky areas are all project design features that would mitigate and afford protection for the highest quality potential suitable habitat for this species, during timber harvest and associated activities under all action alternatives. However, thinning and backing prescribed fire and instream wood placement (designed to enhance future riparian conditions) would occur within 30m (98 feet) of some perennial riparian areas, thus, limited short-term impacts to potential habitat could occur under Alternatives 2, 3, and 4. Additionally, it is possible that proposed activities in these areas could disturb or destroy

---

[62] Additional life history information, habitat associations, and conservation measures are documented in the Conservation Assessment for the species: http://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/20050900-moll-evening-fieldslug.doc

[63] Thinned areas outside the no-harvest stream buffers applied under this project, but within the Riparian Reserves as defined by the Northwest Forest Plan.

eggs or individual slugs, if they were occupying these areas during project implementation. Due to the required protection of the highest quality potential habitat for the slug, the perceived low likelihood of species occurrence in the planning area (based on Mjollnir and other extensive surveys on the District), and the limited scale of proposed activities in suitable habitat, it is considered unlikely that these potential impacts would actually occur.

Alternatives 2, 3, and 4 would be expected to result in indirect beneficial impacts to the Evening fieldslug through enhanced riparian conditions in the long-term. There are no meaningful differences between the action alternatives with regards to potential impacts to this species and its habitat. Alternative 1 would have no direct impacts to the species, but forgoes the opportunity for future habitat enhancement through riparian thinning.

Cumulative Impacts: As described above, actions that result in wetland loss and/or alteration in the hydrologic regime of wetland ecosystems represent the primary threat to this species. Past management actions in the planning area (Table 7) and the Little River watershed degraded some riparian habitats, but are not believed to have resulted in substantial changes in wetland habitats or hydrologic regimes. Ongoing and foreseeable activities that would degrade or remove suitable habitat or further limit the areas potential to support the species are considered to be limited due to protections provided via standards and guidelines for management of wetlands and Riparian Reserves on public lands. Additionally, occupied sites on BLM and Forest Service lands must be managed in compliance with the Conservation Assessment (Burke 1998, revised Duncan 2005) and as such, are expected to sustain existing populations and support species persistence. Thus, due to expected long-term beneficial habitat impacts, the limited scale and magnitude of potential adverse direct habitat impacts and the low likelihood of species impacts actually occurring, when considered in the context of past, present, and foreseeable actions, it is determined that there would be no consequential cumulative impacts to the Evening fieldslug associated with any action alternative. Alternative 1 foregoes the opportunity to enhance future slug habitat through riparian thinning, but otherwise has no noteworthy impacts and as such, no meaningful cumulative impact.

Salamander slug[64] *(Gliabates oregonius)*

Existing Condition: Two voucher specimens verified as this species were discovered in the Zig Zag RD of Mt Hood NF during strategic surveys in 2002. This site is on the western slope of the Oregon Cascades in the western hemlock plant association. Data for this site records the oldest tree age as 103 years, overstory average age as 84 years, trees per acre average 343, basal area average 310, mean diameter of overstory trees is 17 inches dbh. The salamander slug was not detected during the previously described surveys for terrestrial mollusks and there are no known documented observations of this species in or adjacent to the Emile planning area. The closest sighting of the species is a 2005 observation in Lane County approximately 85 miles north of the project area boundary. The species has never been documented on the Umpqua National Forest during thousands of acres of project level and Strategic Surveys. However, the salamander slug is suspected on the Umpqua National Forest and the project area contains potential suitable habitat for the species.

[64] Additional information about this species is documented in a species account: http://web.or.blm.gov/mollusks/images/Gliabates_oregonia.pdf

Direct and Indirect Impacts: None of the alternatives would remove mature or old forests assumed to be the best potential suitable habitat for the species within the planning area. However, proposed timber harvest, fuels treatments and associated activities would nonetheless modify forest stands that may be potential habitat for the salamander slug. Reduction in canopy closures and damage to the understory shrub layer from thinning and partial consumption of forest understories, leaf litter and duff via prescribed fire, all represent direct habitat impacts that would reduce the quality of slug habitat in treated areas in the short-term. In the long-term, movement of the treated stands toward densities, species compositions, and structural characteristics that would occur under natural disturbance regimes may result in improved habitat conditions for the slugs over time, particularly in stands in the gentle/moist landtypes. These potential habitat impacts, both adverse and beneficial are considered to be inconsequential to the species because proposed activities would not impact areas believed to be the best habitat for the species; proposed harvest units all retain substantial unthinned areas in riparian habitats, etc. that would serve as habitat refugia; and the scale of the impact is limited relative to the availability of potential habitat in the planning area.

Additionally, if salamander slugs were occupying potential habitat during project implementation, it is possible that individuals could be displaced, injured or killed. However, based on lack of historic or current species observations in the planning area or anywhere on the Umpqua National Forest, and the perceived low likelihood of species presence in proposed harvest units, it is considered unlikely that this potential impact would occur at a frequency of consequence to the species.

Cumulative Impacts: Although the salamander slug is suspected on the Umpqua National Forest, as stated above, there is a presumed low likelihood that this area is a "source" breeding habitat for the species.

Cutting of late and old forests is the past management action (Table 7) that likely had the greatest influence on this species and its habitat in the planning area. Current (Table 8) and reasonably foreseeable actions (Table 9) that would impact late-successional and other forest habitat within the area are limited in scale and magnitude, and would not be expected to meaningfully reduce the ability of the planning area to support the salamander slug. Alternatives 2, 3, and 4 would have limited habitat and species impacts, but when considered in the context of past, present, and forseeable actions, none of the action alternatives would be expected to result in a meaningful adverse cumulative impact to the species. Alternative 1 would have no noteworthy impacts to the species.

Crater Lake Tightcoil[65] *(Pristiloma arcticum crateris)*

Existing Condition: This species is found sparsely distributed throughout the Oregon Cascades, at moderate to high elevations, over 2,000 feet (Duncan 2004). Habitat is defined as perennially moist situations in mature conifer forests and meadows among rushes, mosses and other surface vegetation or under rocks and woody debris within 33 feet of open water in wetlands, springs, seeps and streams. It generally occurs in areas which remain under snow for long periods in the winter. Riparian sites which experience

[65] Additional life history information, habitat associations, and conservation measures are documented in the Conservation Assessment for the species: http://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/20050713-moll-crater-lake-tightcoil.doc

periodic flooding or large fluctuations in water level are not suitable habitat for this species.

Loss or degradation of wetland habitat leading to loss of populations at sites occupied by the Crater Lake Tightcoil is considered to be the major threat to the species. Activities that compact soils or snow, disturb ground vegetation and/or litter, remove woody debris, alter temperature and/or humidity of the microsite, or alter the water table could be harmful to the habitat of this species. These activities include water diversions and improvements, livestock grazing and timber harvesting activities (Duncan 2004). Conservation measures for this species include minimizing temperature and humidity fluctuations in perennial wet areas. This includes maintaining natural understory vegetation and organic litter and coarse woody debris on the ground.

As previously described, two-visit protocol surveys for terrestrial mollusks were conducted on approximately 870 acres within and adjacent to Emile thinning units. The Crater Lake tightcoil was not detected during these surveys and has not been documented in the planning area, in the watersheds, or on the North Umpqua Ranger District. The closest known species occurrence is on the Diamond Lake Ranger District approximately 19.7 air miles to the southeast.

Direct and Indirect Impacts: Under Alternatives 2, 3, and 4 thinning and temporary road building would open up the stands, allowing more light to penetrate, changing the microclimate of the understory. However, perennial streams would be buffered by 60 feet and unsurveyed perennial wetlands considered to be suitable habitat for the species would be buffered by 33 feet to reduce potential impacts to the species and changes to habitat conditions. These buffer widths meet or exceed the Conservation Assessment recommendation for 33-foot buffers on perennial waters and would minimize direct and indirect impacts to the species from microclimate changes.

As detailed below, a limited amount of ground disturbance would occur in proximity to riparian habitats, thus, there would be potential direct impacts to the species and habitat associated with these actions. Overall, no direct impacts to the species are expected to actually occur under any action alternatives because the Crater Lake tightcoil was not detected during surveys of riparian habitat in the planning area or numerous other surveys on the North Umpqua RD.

Under all action alternatives, skyline cable corridors would be needed in some units, and occasionally individual trees would have to be felled within no-harvest buffers to allow for passage of the cable (trees would be left on site). Mitigations detailed in Chapter 2 would limit the amount of this type of disturbance to the greatest extent practical. Similarly, instream wood addition would entail falling of some trees within no-harvest buffers. Due to the limited and scattered nature of tree felling, no meaningful changes in riparian stand structure or alteration of microclimate are expected; thus, there would be no substantive negative impacts to potential habitat. Prescribed fire would also back into potential habitat for the species resulting in short-term changes in microclimate. Due to the limited scale and duration of this potential impact, consequences to habitat quality are minor.

Additionally, Alternatives 2, 3, and 4 would be expected to result in indirect beneficial impacts to the snail through enhanced riparian conditions in the long-term. There are no meaningful differences between the action alternatives with regards to potential impacts to this species and its habitat. Alternative 1 would have no direct impacts to the species,

since no ground disturbing activities would occur, but this alternative forgoes the opportunity for future habitat enhancement through riparian thinning.

All action alternatives also entail road maintenance, road reconstruction, temporary road reconstruction and obliteration, as well as additional culvert replacements (connected actions) in proximity to streams. All of this activity occurs on previously compacted sites that are considered to be low quality potential habitat. None of these activities would meaningfully degrade the existing quality of potential habitat due to the high level of current soil compaction and disturbance.

Cumulative Impacts: Cumulative impacts are analyzed at the planning area scale. Past timber harvest, road building and prescribed fire which occurred in proximity to perennially wet areas (Table 7) may have degraded the quality of potential Crater Lake tightcoil habitat in the planning area and watershed. Ongoing and reasonably foreseeable future projects (Tables 8 and 9) such as road work in proximity to streams would be expected to have minor impacts on potential habitat for the species similar to those described above. Following consideration of the incremental impacts of Alternatives 2, 3, and 4 when added to past, present and reasonable foreseeable future actions, it is determined that there are no consequential negative cumulative impacts associated with these alternatives. This conclusion is based on the low probability of this species occurring within the planning area (based on numerous project level surveys resulting in no known sites), the small scale and duration of proposed and future potential habitat-modifying activities, and the expected long-term benefits of current and future projects on habitat conditions. Alternative 1 would have no anticipated direct or indirect impacts on the species and thus, makes no contribution to a cumulative impact.

Determination of Impact: Following consideration of the direct, indirect and cumulative impacts, it is determined that the action alternatives May Impact Individuals or Habitat, but Will Not Likely Contribute towards Federal Listing or Cause a loss of Viability to the Population or Species (MIIH). Although the project is within the known range of the species, and habitat is present, due to protective project design features and mitigations, none of the action alternatives would be expected to cause a consequential negative impact on the species habitat or the persistence of the species at the site. The no action alternative would have no impact (NI) on this species, except in the context of forgone opportunities.

Foothill Yellow-legged Frog[66] *(Rana boylii)*

Existing Condition: The Oregon populations of this species inhabit sections of low-gradient streams and rivers with exposed bedrock and gravel/cobble bars below about 2,700 feet elevation. Breeding is documented in larger streams, but not in smaller tributaries which may be used as foraging or dispersal habitat.

Management Considerations: Considerations for maintaining local populations include maintaining stream habitat conditions, especially suitable flow regimes. Reducing the impacts of water-releases from dams, grazing, mining, recreation, agro-chemicals, introduced predators and competitors, road and forest management are all important considerations. The timing of activities to avoid the breeding season is also a consideration for this species' management.

---

[66] Additional life history information, habitat associations, and conservation measures are documented in the Conservation Assessment for the species: http://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/ca-ha-rana-boylii-2007-08-21.doc

The foothill yellow-legged frog occurs in the project area. Little River is known breeding habitat for this species and Little Taft Creek is potential habitat. Surveys of portions of Little Taft Creek and Little River were completed in the summer of 2007. No yellow-legged frogs were located in Little Taft Creek, but the species was documented further upstream on Little River than its previous known range. Units 10 and 14 are the closest proposed harvest units to potential habitat for the species.

Direct and Indirect Impacts: Alternative 1 would have no direct impacts on yellow-legged frogs or their habitat, but forgoes the opportunity to accelerate development of desired riparian habitat conditions through thinning. Alternatives 2, 3, and 4 would thin in proximity to potential yellow-legged frog habitat. However, as described above for the Crater Lake tightcoil, required no-harvest buffers on perennial streams would substantially limit potential direct impacts to the species or its habitat from proposed thinning and associated fuels treatments. Addition of minor amounts of sediment to Little Taft Creek and Little River from harvest, road work, and connected actions associated with the action alternatives also represents a minor, short-term impact to frog habitat (see "Aquatics Section" in this chapter). Due to the limited scale and duration of proposed activities, none of the potential habitat impacts would be consequential to the species. Additionally, Alternatives 2, 3, and 4 would be expected to result in indirect beneficial impacts to the frog through enhanced riparian conditions in the long-term. There are no meaningful differences between the action alternatives with regards to potential impacts to this species and its habitat.

Heavy equipment operation associated with all action alternatives could also displace, injure, or kill individual frogs, if they were using the potential habitat during project implementation. Due to riparian buffers on potential habitat in units (i.e. Units 10 and 14) and the distance between habitat in Little River and Road 27 (haul route) relative to normal frog movements, it is believed there is a low likelihood that this potential direct impact would occur at a frequency of consequence to the species.

Cumulative Impacts: Cumulative impacts are analyzed at the planning area scale. Past road building, timber harvest, and other management activities (Table 7) that occurred in and in close proximity to Little River and low elevation streams in the planning area are the primary contributors to a cumulative impact for this species. However, as evidenced by ongoing occupancy and reproduction of the species in the planning area, past management activities have not substantially degraded existing habitat conditions for this species nor limited the areas potential for occupancy by the yellow-legged frog. Ongoing and reasonably foreseeable future projects (Tables 8 and 9) such as road work in proximity to streams would be expected to have minor impacts on potential habitat for the species similar to those described above. Due to the limited extent of potential habitat modification that would occur under Emile and the low likelihood of consequential direct impacts to the frogs, following consideration of the incremental impacts of Alternatives 2, 3, and 4, when added to past, present and reasonably foreseeable future actions, it is determined that there are no consequential negative cumulative impacts associated with these alternatives. Alternative 1 would have no meaningful cumulative impacts to the species.

Northern Pacific Pond Turtle[67] *(Actinemys marmorata marmorata)*

Existing Condition: This highly aquatic turtle occurs in streams, ponds, lakes, and wetlands. It spends much of its life in water, but requires terrestrial habitats for nesting. In drier regions where stream habitats dry up in the summer, they were documented to use upland habitats an average of 50 m from stream channels (Rathbun et al. 2002). Reese and Welsh (1997) documented overwintering on the average about 200 meters, but as far as 500 meters from river systems, and mainly on north and east facing slopes.

The greatest single threat to the pond turtle is habitat destruction, alteration and fragmentation (Ashton et al 1997, NatureServe 2007). Habitat impacts can be caused by conversion of wetlands to farmland, water diversions and dams, channelization, mining, logging, and urbanization. Associated with habitat fragmentation is the effect on genetic isolation. Lack of genetic variability may be a serious threat to the continued survival of populations in Oregon and Washington and are discussed in detail by Holland (1991). Other threats include: motor vehicle traffic, human recreation activities in occupied habitat, chemical spills, exotic predators, grazing, fire, and drought.

There are no documented observations of pond turtles in the planning area. However, the species is known to occur in Little River and there was a 1996 observation of the species approximately 3 miles downstream of the planning area. Historically, pond turtles were observed as far up Little River as the mouth of Emile Creek. Little River, Emile and Willow sumps/ponds are considered to be the best potential habitat for the species within the planning area boundary. The species was not observed at either of the sumps during multiple spot surveys of these areas during the summer of 2007.

Direct and Indirect Impacts: There are no anticipated noteworthy habitat impacts associated with any of the alternatives. Under Alternatives 2, 3, and 4 heavy equipment operation in proximity to sumps/ponds and vehicular traffic along the haul route have the potential to result in death or injury to individual turtles, if turtles were present during project implementation (i.e. in the wrong place at the wrong time). Regulation of logging vehicle speed would reduce the potential for this impact to occur. Additionally, due to the assumed low level of use of the planning area by the turtle (based on spot surveys and lack of recent observations), it is unlikely that this potential direct disturbance impact would occur at a frequency of consequence to the species. There are no meaningful differences between action alternatives with regards to impacts on pond turtles. Alternative 1 would have no expected direct or indirect impacts to the species.

Cumulative Impacts: Cumulative impacts are analyzed at the planning area scale. Past management actions that probably had the greatest influence on the pond turtle and its habitat in the project area include construction of Little River road and associated recreational developments and ongoing human uses on both private and public lands adjacent to Little River. Ongoing and future management actions (Tables 8 and 9) would have minor habitat impacts and similar potential direct impacts to the species as Emile. As there is no known nesting by the species in the planning area and assumed low levels of use, when considered in the context of past, present, and foreseeable actions,

[67] Additional life history information and habitat associations are documented in a species fact sheet: http://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/sfs-vert-hr-Actinemys-marmorata-marmorata-2007-10-05.doc

it is determined that the action alternatives may contribute to a potential cumulative direct impact of neglible consequence to this species.

Bufflehead *(Bucephala albeola)*

Existing Condition: Buffleheads are small "diving ducks" that can be found on small ponds to large lakes, and larger streams and rivers. They typically nest at high-elevation forested lakes in the central Cascades, in natural tree cavities or abandoned holes of northern flickers. Buffleheads are considered to be a common spring and fall migrant in Oregon, but a local, and uncommon breeder in the central and southern Cascades. Marshall et al. (2003) describes the species as possibly the most ubiquitous diving duck in western Oregon during the late fall through early spring. However, the breeding population is considered sensitive by ODFW because of small size and limited nesting habitat. Threats to the species are hunting, human disturbance from high recreation use at Cascades lakes (during the breeding season) and a shortage of suitable natural nesting cavities due to forestry practices.

There are no documented observations of this species in the Emile planning area. The closest sighting of the species was approximately 2 miles north of the planning area boundary- ten buffleheads were observed on a private pond north of the North Umpqua River in winter 1993. The only documented nesting of the species on the Umpqua NF was recorded when buffleheads nested at the sewage ponds adjacent to Diamond Lake (Fix 1990). It is possible that larger ponds/sumps within the planning area (i.e. Emile and Willow Flats) may be used by migrating buffleheads, although the ponds likely freeze in the winter.

Direct, Indirect, and Cumulative Impacts: Alternative 1 would have no direct, indirect, or cumulative impacts to the species because no ground disturbance or increased human presence would occur under this alternative. Alternatives 2, 3, and 4 would have no noteworthy impacts on potential bufflehead habitat. Minor disturbance impacts (i.e. temporary displacement of ducks) could occur if ducks were using pond/sump habitat during timber harvest and associated activities. However, disruption of breeding/nesting is considered very unlikely since this area is not important breeding habitat for the species and proposed activities would not remove potential nest trees. Additionally, due to the assumed low level of use of this area by buffleheads (based on lack of historic or current observations), any potential disturbance impacts are considered unlikely to occur at a frequency of consequence to the species. None of the actions associated with this or foreseeable projects are expected to be of consequence to the breeding population of buffleheads, which is the primary focus of concern for this species. Thus, when considered in the context of past, present, and foreseeable actions, it is determined that there would be no anticipated adverse cumulative impacts to buffleheads under any action alternative. There are no differences between the alternatives with regard to potential impacts to the species.

Black swift[68] *(Cypseloides niger)*

Existing Condition: The black swift is a summer breeding visitor to western North America. It nests in small colonies at sites behind waterfalls, in caves or deep gorges, or

[68] Additional life history information, habitat associations and conservation measures are documented in a species fact sheet: http://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/sfs-vert-bi-Cypseloides-niger-2007-08-31.doc

sea cliffs and sea caves. Moisture and deep shade are associated with nest site location.

The general relative inaccessibility of nest sites suggests that problems at these sites are currently not a major problem, although increasing numbers of recreational rock-climbers, hikers and cave explorers using areas near waterfalls may disturb birds (Audubon Watchlist). A more likely broad-scale threat is from a decrease in aerial insect abundance due to habitat loss and use of pesticides on breeding and wintering grounds. Birds may also be ingesting pesticides directly and bio-accumulating them in tissues, which may cause decreases in reproductive output and increases in adult mortality, especially under extreme weather conditions (Audubon Watchlist).

Waterfall habitat exists in multiple locations across the planning area; only areas that have some potential to be impacted by the project and of relevance to the species are discussed. Black swifts were observed during surveys of Grotto Falls in 2003. A thinning unit adjacent to Grotto Falls was dropped from all alternatives. The closest unit to Grotto Falls is Unit 5 approximately 0.3 miles from the site. Cedar Creek Falls also contains potential habitat for the black swift. Portions of Unit 15 that were closely adjacent to these falls were dropped under all alternatives. There are additional waterfalls near Units 5, 7, and 20 that may be suitable habitat for the species; habitat evaluation and surveys (as needed) are planned for summer 2008.

Direct, Indirect, and Cumulative Impacts: Alternative 1 would have no direct, indirect, or cumulative impacts to the species because no ground disturbance or increased human presence would occur under this alternative. Alternatives 2, 3, and 4 would not modify nesting habitat (waterfalls) and would not spray insecticides, thus potential impacts to habitat for this species are considered inconsequential to the species. Proposed thinning and prescribed fire would occur in potential foraging habitat for the black swift, but would not be expected to reduce habitat effectiveness (i.e. reduce aerial insects).

All action alternatives have potential disturbance impacts to this species through increased human and vehicle presence and elevated noise levels in proximity to suitable habitat during the nesting season. Meaningful disturbance impacts to the known site for this species (Grotto Falls) are not considered likely to occur due to distance of the proposed harvest unit and road from the falls. If additional black swift nest sites are identified at any other potential habitat in proximity to proposed activities, appropriate seasonal restrictions would be implemented to reduce disturbance impacts at these sites.

There are no anticipated cumulative impacts to habitat associated with any action alternative due to the fact that none of the past (Table 7), current (Table 8) or forseeable (Table 9) actions are believed to have meaningfully degraded waterfall habitat in the planning area. Past actions with potential disturbance impacts to black swifts would not overlap in time with the Emile project. Current and forseeable road maintenance (Table 9) and noxious weed work represent ambient noise levels and are not expected to result in additional disturbance to black swifts. Thus, when considered in the context of past, present, and foreseeable actions, it is determined that there would be no anticipated adverse cumulative impacts to black swifts under any action alternative. There are no differences between the alternatives with regard to potential impacts to the species.

American Peregrine Falcon *(Falco peregrinus anatum)*

Existing Condition: This bird is a long distance migrant that ranges from Mexico to Alaska. It nests on tall (usually greater than 75 feet) cliffs with ledges or potholes and usually lays from 3-4 eggs in late March to early April. Chicks are usually fledged by late July. It preys on small to medium sized birds, such as Stellar's jays, woodpeckers, flickers, pigeons and shorebirds. This bird has high site fidelity and commonly uses the same nest ledge (eyrie) year after year. During the nesting season it becomes easily agitated by human-caused disturbances within close proximity to the eyrie (< 0.25 miles).

The near total disappearance of this raptor from much of the United States caused its listing in 1970 under the Endangered Species Conservation Act of 1969 (pre ESA). Subsequent recovery efforts have established over 2,000 breeding pairs across the United States and about as many unpaired "floaters" across their range (White et al. 2002). As a result, the peregrine falcon was removed from the Federal List of Endangered and Threatened Species (List) on August 25, 1999, but remains on the Regional Forester's sensitive species list. In addition, the falcon is still protected under the Migratory Bird Treaty Act of 1918 (USDA 1999).

There is one known falcon eyrie within the planning area boundary; Unit 20 is located in the secondary management zone of this site. The tertiary management zone of an additional falcon eyrie also extends into Emile planning area. Multiple units are included in the tertiary management zones of the two falcon eyries. Monitoring surveys to determine reproductive status at all known eyries are conducted annually on the District. The planning area also contains additional cliff habitat that is potential nesting habitat for the peregrine falcon; surveys of areas that could incur impacts from the project are planned for spring/summer 2008.

Direct and Indirect Impacts: Alternative 1 would have no direct impacts on peregrine falcons because no above-ambient noise or habitat disturbing activities would occur as a result of this alternative. Alternatives 2, 3, and 4 could result in disturbance impacts to peregrine falcons during the nesting season. The following seasonal restriction would be implemented to minimize potential disruption to nesting falcons in the planning area:

> Prohibit timber harvest activities including felling, bucking, and yarding during Jan 1 to July 31. This seasonal restriction applies to unit 20 and may be applied to other units and activities, if new falcon eyries are established during the lifetime of the project.

Alternatives 2, 3, and 4 would not modify habitat within the primary management zone of the known falcon eyrie, but would within the secondary and tertiary management zones of the eyries. These management zones should provide foraging habitat with an adequate prey base for the falcons. Foraging habitat within the zones should provide for a variety of vegetative conditions both spatially and temporally. Silvicultural prescriptions for all action alternatives are consistent with the intent and direction for habitat management within these zones: prescriptions would retain hardwoods, Pacific yew, and minor conifer species; restore sugar pine; retain a portion of each stand in an unthinned condition; create canopy gaps that would favor development of understory grasses and shrubs; protect existing coarse wood to the extent practical; and create snags.

All action alternatives would modify falcon foraging habitat through thinning, temporary road building, and post-harvest fuels treatment. However, treatments would not be expected to negatively impact the quality of the habitat for the species except during the

physical implementation of the project. During this time frame, prey species could be temporarily displaced or occur at lower levels. Due to the small scale of the project relative to the availability of suitable foraging habitat and the limited duration of the project, this impact is considered to be of minimal consequence to the species.

Following implementation and over the next decade or more, proposed thinning represents a potential beneficial indirect impact to the species through the provision of structural diversity within treated stands and maintenance of a variety of vegetative conditions across the planning area that would support a varied prey base for the falcons. Proposed underburning would also result in creation of burned snags that attract woodpeckers and other falcon prey. None of the other proposed activities would have noteworthy impacts to the falcon or its habitat. There are no meaningful differences between the action alternatives relative to this species.

Cumulative Impacts: Cumulative impacts to falcons are analyzed at the planning area and watershed scale; see Tables 7, 8, and 9 for a summary of relevant management activities that contribute to cumulative impacts. Alternative 1 would have no anticipated direct or indirect impacts to this species (except forgone opportunities), thus no cumulative impacts would occur.

Past management activities that resulted in a reduced occurrence of high-density snag patches (i.e. fire suppression) and production of high levels of ambient noise in proximity to cliff habitat (i.e. timber harvest and road building) are the primary activities that have impacted the quality of peregrine habitat within the planning area. However, due to the limited duration of noise production and the ability of the falcon to utilize a variety of prey species, these past activities have not meaningfully reduced the ability of the planning area to support this species. Similarly, due to required guidelines for the protection and management of this species, present and forseeable future activities, that could overlap in time or space with impacts from Emile are expected to be of minimal consequence to the species or its habitat. Thus, due to the limited extent, likelihood, duration, and magnitude of potential adverse impacts and the expected beneficial impacts, when considered in the context of past, present, and foreseeable action, it is determined that there are no consequential negative cumulative impacts associated with Alternatives 2, 3, and 4.

Northern Bald Eagle *(Haliaeetus leucocephalus)*

This large eagle primarily nests in forested areas near large bodies of water and along rivers (Marshall et al. 2003). Nests in Oregon occur mainly in prominent, live conifer trees.They are opportunistic feeders, but prey mainly on fish. If food is abundant year-round, they are known to become resident, otherwise they wander in seasonal migrations to find food (Marshall et al. 2003).

Bald eagles were placed on the Endangered Species list in 1978 due to a reduction of numbers caused by DDT and other pesticides in their food supply. In 2007, the US Fish and Wildlife Service de-Listed the species based on reduced threats and recovery of the breeding population in the lower 48 States. Protections provided under the Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treat Act (MBTA) remain in place and the Five-Year Monitoring Period following de-listing is currently in effect.

There are no documented current or historic bald eagle nests or communal winter roosts within the Emile planning area; and there are no documented observations of bald eagles in the area. The species is not known to nest on Little River, but has been observed roosting and foraging along the river near Glide. The closest observation of the

species is in the northern portion of the project area near the North Umpqua River, where no activities are proposed under Emile.

Direct, Indirect, and Cumulative Impacts: Alternative 1 would have no impacts on bald eagles because no above-ambient noise or habitat disturbing activities would occur as a result of this alternative. Alternatives 2, 3, and 4 would not impact any known bald eagle nest sites or communal winter roosts. Although considered unlikely due to lack of species observations in the planning area, it is possible that individual eagles could be temporarily disturbed and displaced, if they were using the area during project implementation. This potential impact would be inconsequential to the species. It is also possible that eagles may use second growth trees in some of the Emile units (primarily units near Little River) as foraging perches, and proposed commercial thinning would remove some of these trees. Due to the small scale of the tree removal relative to the abundance of potential perch trees remaining in the stands and elsewhere in the planning area, this potential direct impact is considered to be an insignificant impact to eagle habitat. Similarly, limited tree clearing for temporary road building, and some helicopter landings within and adjacent to units would remove potential foraging perches, but would have no meaningfully measurable or detectable impacts on eagle habitat. Thinning would also have indirect beneficial impacts on eagle habitat through the accelerated development of suitable large trees for nesting and roosting. Due to lack of current or historic nest sites in the planning area; protections (i.e. BGEPA and MBTA) that would be implemented if a new bald eagle nest were established during forseeable management actions (Table 9); the limited scale of impacts to potential foraging habitat and the low likelihood and consequences of any potential disturbance impacts associated with this project, it is determined that there are no consequential negative cumulative impacts associated with Alternatives 2, 3, and 4.

Pacific Fringed Myotis *(Myotis thysanodes vespertinus)*

Existing Condition: This bat is often described as a cave-dwelling bat (Verts and Carraway 1998, Cristy and West 1993). However, fringed myotis are known to roost in rock crevices, bridges, buildings, large trees and snags (Cross et al. 1996, Weller and Zabel 2001). Weller and Zabel (2001) documented that habitat use by this species is influenced by the availability of large (>12 inch d.b.h.), tall snags for roosting. Roosts tend to be near stream channels which are used for travel and foraging corridors, and also occurred in portions of stands that had lower canopy closures (probably easier roost access and sun exposure/micro-climate relationships). Fringed myotis often utilized snags in semi-open areas and forest edges (Cross et al. 1996) and seemed to prefer snags over green trees for roosting.

There are no known maternity colonies for this species on the Umpqua. There is one documented observation of the fringed myotis adjacent to the planning area- a lactating female found roosting under a bridge in 1995 approximately 1.0 miles west of the planning area boundary. Rock crevices, bridges and older forests adjacent to proposed harvest units are considered the best potential habitat for the species in the project area.

Direct, Indirect, and Cumulative Impacts: Alternatives 2, 3, and 4 could result in disturbance impacts to bats, if bats were roosting under bridges, in rock crevices or in large snags/trees adjacent to harvest units, haul routes, etc. during project implementation. Because proposed activities would not remove nesting/roosting structures and occurrence of the species in proximity to the potentially disturbing activities is believed to limited, consequences of this potential impact to the species are considered to be minor. Additionally, the limited felling of snags (for safety) associated

with harvest activities represents a minor habitat impact. This potential impact is considered inconsequential to the species because it is limited in scale and is not expected to modify the most suitable habitat for the species within the planning area (i.e. old-growth trees and snags, rocky areas). Thinning would also result in the accelerated development of large diameter trees but a slight delay in attainment of desired future large snag levels, and as such represents both an indirect beneficial impact and a minor negative impact on future habitat.

Impacts to cave and rock habitat for this species- past, present, and future, are believed to be non-existent or neglible. Cutting of late and old forests is the past management action (Table 7) that likely had the greatest influence on this species and its habitat in the planning area. Current (Table 8) and reasonably foreseeable actions (Table 9) that would impact late-successional and other forest habitat within the area are limited in scale and magnitude, and would not be expected to meaningfully reduce the ability of the planning area to support the fringed myotis bat. Alternatives 2, 3, and 4 would have limited habitat and species impacts, but when considered in the context of past, present, and forseeable actions, none of the action alternatives would be expected to result in a meaningful adverse cumulative impact to the species. Alternative 1 would have no noteworthy direct, indirect, or cumulative impacts on this species.

Townsend's Big-eared Bat *(Corynorhinus townsendii)*

Existing Condition: These bats use caves, abandoned mines, deep rock crevices, shaded rock overhangs, boulder talus, bridges and buildings for roosting, birthing and rearing of young. Hibernacula and maternal roost sites are the most sensitive to human disturbances.

There are no known nursery colonies or winter hibernacula for this bat in or closely adjacent to the Emile planning area. There are no documented observations of the species in the planning area. The closest documented sighting is a 1993 observation of a single bat roosting under Steamboat Creek bridge approximately 2.1 miles northeast of the northern planning area boundary. Potential habitat for the species within Emile occurs under bridges and in rocky habitats.

Direct, Indirect, and Cumulative Impacts: There are no anticipated habitat impacts associated with any of the alternatives. However, as detailed above for the fringed myotis, there is the potential for heavy equipment operation in proximity to bridges and rocky habitats to result in disturbance impacts to individuals, if bats were roosting in these areas during project implementation. This type of disturbance could temporarily displace individual bats, but would not be expected to result in death or injury.

Past management actions are believed to have had limited impacts on cave habitats that support this species. Nursery colonies and winter hibernacula are protected on both Forest Service and BLM lands and as such current and foreseeable management actions are also expected to have relatively minor impacts on the species and its habitat. The contribution of this project toward a cumulative impact to the species is neglible and would not be expected to reduce the project areas ability to support this species or be of any meaningful consequence to the species. Alternative 1 would have no noteworthy direct, indirect, or cumulative impacts on this species.

Summary of Impacts Determination Statements for R6 Sensitive Species

In order to reduce redundancy in this section of the document, the following paragraph summarizes the impacts determination statements for all of the following R6 Sensitive Wildlife Species including: Johnson's hairstreak, Coronis fritillary, Siskiyou short-horned grasshopper, Evening fieldslug, Salamander slug, Crater Lake tightcoil snail, Foothill yellow-legged frog, Northern Pacific pond turtle, Bufflehead, Black swift, Peregrine falcon, Bald eagle, Pacific fringed myotis, and Townsend's big-eared bat.

> **Determination of Impact:** Following consideration of the direct, indirect and cumulative impacts, it is determined that the action alternatives May Impact Individuals or Habitat, but Will Not Likely Contribute towards Federal Listing or Cause a loss of Viability to the Population or Species (MIIH). The no action alternative would have no impact (NI) on these species except in the context of foregone opportunities.

Table 30 summarizes the determinations of effects/impacts by alternative for all R6 sensitive wildlife species that could potentially be impacted by the Emile project.

Table 30. Determination of effects to Proposed, Threatened, Endangered, and Sensitive Wildlife Species.

Sensitive Wildlife Species	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Northern spotted owl	NE	NLAA	NLAA	NLAA
Johnson's hairstreak	NI	MIIH	MIIH	MIIH
Coronis fritillary	NI	MIIH	MIIH	MIIH
Mardon skipper	NI	NI	NI	NI
Siskiyou short-horned grasshopper	NI	MIIH	MIIH	MIIH
Evening fieldslug	NI	MIIH	MIIH	MIIH
Salamander slug	NI	MIIH	MIIH	MIIH
Crater Lake tightcoil snail	NI	MIIH	MIIH	MIIH
Foothill yellow-legged frog	NI	MIIH	MIIH	MIIH
Northern Pacific pond turtle	NI	MIIH	MIIH	MIIH
Bufflehead	NI	MIIH	MIIH	MIIH
Black swift	NI	MIIH	MIIH	MIIH
Peregrine Falcon	NI	MIIH	MIIH	MIIH
Bald eagle	NI	MIIH	MIIH	MIIH
Harlequin Duck	NI	NI	NI	NI
Pacific fringed myotis	NI	MIIH	MIIH	MIIH
Townsend's big-eared bat	NI	MIIH	MIIH	MIIH
Pacific fisher	NI	MIIH	MIIH	MIIH

***Threatened** and **endangered** species determination calls follow nomenclature established by the US Fish and Wildlife Service:*
***NE**= No Effect,*
***NLAA**= Not Likely to Adversely Affect,*
***LAA**= Likely to Adversely Affect.*

***Sensitive** species determinations follow nomenclature established in the Forest Service Handbook:*
***NI**= No Impact,*
***MIIH**= May Impact Individuals or Habitat but will not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species,*
***WIFV** = Will Impact Individuals or Habitat with a Consequence that the Action May Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species.*

MANAGEMENT INDICATOR SPECIES (COMPONENTS TRACKED AS A SIGNIFICANT ISSUE)

The Umpqua National Forest Land Management Plan (USDA 1990) designated seven species, and one group of species (cavity nesters) as Management Indicator Species (MIS) (Table 31).

Table 31. List of the Umpqua National Forests Management Indicator Species.

Umpqua N.F. Management Indicator Species		
Common Name	**Scientific Name**	**Species or Habitat Present?**
Northern Spotted Owl	*Strix occidentalis caurina*	Yes
Pileated Woodpecker	*Dryocopus pileatus*	Yes
Pine Marten	*Martes americana*	No
Bald Eagle	*Haliaeetus leucocephalus*	Yes
Peregrine Falcon	*Falco peregrinus*	Yes
Roosevelt Elk	*Cervus elaphus roosevelti*	Yes
Blacktail Deer	*Odocoileus hemionus*	Yes
Cavity Nesters		Yes

MIS were selected to track and evaluate the effects of Forest management activities on all wildlife species that occur on the Forest. The northern spotted owl, pine marten, and pileated woodpecker represent mature and old growth conifer habitats. Primary cavity excavators represent the dead and defective tree habitat. Big game winter range is represented by Roosevelt elk and black-tailed deer. Effects to the bald eagle, peregrine falcon, and spotted owl were discussed under the sensitive species section of this document and are not repeated here. The planning area is located in the lower elevations of the forest, and pine marten occur at higher elevations in true-fir, mountain hemlock and lodgepole pine forest types. Therefore, pine marten are not discussed further.

Relevant Standards and Guidelines

- Wildlife S&G#13. Pileated Woodpecker Habitats - Provide one habitat area for every 12,000 to 13,000 acres of suitable habitat. Habitats will be distributed in such a way that any given habitat unit will be connected to two or more other suitable habitats (LRMP IV-37).

  - This Standard and Guideline has been superseded by the Northwest Forest Plan Late Successional Reserve land allocation, which encompasses all previous Pileated Woodpecker Habitats.

- Wildlife S&G#14. Pine Marten Habitats - Provide one habitat area for every 4,000 to 5,000 acres of suitable habitat. Habitat will be distributed in such a way that any given habitat unit will be connected to two or more other suitable habitats (LRMP IV-37).
  - 12 of 13 described pine marten habitat areas are currently encompassed within Late Successional Reserves created by the Northwest Forest Plan. The additional habitat area is located on the Diamond Lake RD.
- Wildlife S&G#17. When planning timber sales in important big game areas, a habitat effectiveness model ("A Model to Evaluate Elk Habitat in Western Oregon" or similar model) will be used to compare the impact of various alternatives on big game habitat (LRMP IV-38).
  - See MIS discussion for elk and black-tailed deer.
- Wildlife S&G's relevant to cavity-nesters are listed in CWD section.
  - See MIS discussion for primary cavity-nesters.

Roosevelt Elk and Black-tailed Deer – Big Game Winter Range (Tracked as a Significant Issue)

During scoping, concern over big game foraging habitat was raised as an issue. AFRC was concerned that the proposed one-acre canopy gaps would not create large enough openings to increase foraging opportunities for big game and that typical thinning treatments would not provide adequate forage. This significant issue was addressed with the development of Alternative 4. The effects to big game habitat are disclosed in this section.

Certain areas of the forest were identified as big game winter range under the Umpqua LRMP (USDA1990). Designated as "Management Area 11", these areas were designed to provide for big game winter range habitat and timber production consistent with other resource objectives. They emphasize winter range management achieved through forage and cover production on land used or suitable for occupancy by deer and elk. Timber harvest is encouraged to provide stable production of forage and cover. A 60:40 ratio of forage to cover habitat was once considered optimum for winter range (Thomas et al. 1979, Smith 1985, Brown 1991), but more recent studies suggest smaller ratios may be suitable as long as the interspersion of forage and cover is good (Jones 1991, Larkin et al. 2004). Ultimately however, forage is the most limiting factor.

The Forest Plan has several standards and guidelines that apply to elk and deer (big game) winter range. The relevant ones that apply to this project include the use of a habitat effectiveness model ("A Model to Evaluate Elk Habitat in Western Oregon" or similar model) to compare the impact of various alternatives on big game habitat (LRMP IV-38) and direction for management of deer and elk winter range areas described in Forest Plan Prescription C4-I. Correlation analysis of habitat effectiveness indices with local elk telemetry data indicated the "spatial index" for habitat effectiveness (HE) has the highest correlation with elk locations. This index, which is derived from sizing and spacing (interspersion) of forage and cover (Wisdom et al. 1986) is used in this analysis to compare the habitat effectiveness of each alternative.

Existing Condition: The Emile planning area occurs within the 1,009,697 acre Dixon Wildlife Management Unit (WMU). This WMU contains about 626,622 acres of National Forest Land, 131,286 acres of BLM-managed forest, and private and state lands make up 251,286 acres, located in the western Cascades. The planning area makes up about 3.5% of this forest land. The forage/cover ratio in the Dixon WMU is 20:80. The elk population trend in this WMU is estimated to be declining and may indicate a decrease in forage habitat that is affecting winter range. The majority of the high quality forage in the WMU is found on private lands on the western and southern portions of the WMU, in the lower elevation valleys. Elk herds have relocated to some of these areas over the last 15 years. Forage areas on federal lands are decreasing due to reductions in regeneration harvests and as existing units transition from early to mid seral vegetative conditions. However, clearcutting continues to be used as a silvicultural method on private land.

The Emile planning area is 35,482 acres in size with 6,459 acres of designated winter range (18%). The forage/cover ratio within the planning area is currently 14:86. Optimum forage to cover ratio is considered to be 60:40. The difference between the optimum and existing ratios indicates that forage areas should be increased within the planning area to benefit big game. However, the HEs = 0.972 for the planning area. This number represents a highly viable condition for the habitat variable sizing and spacing of cover to forage areas, indicating that although forage is limited within the planning area, available forage is well-juxtaposed with cover to make the habitat useful to elk and deer. Portions of the planning area are used year round by big game.

Direct and Indirect Impacts: The direct and indirect effects to big game winter range were analyzed at the planning area scale. Table 32 summarizes the effects of each alternative on big game habitat as measured by the indicators for this significant issue.

Table 32. Emile Alternatives effects on big game forage in the planning area.

Indicator	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Acres of Early Successional Habitat Created	0	29	29	47
Acres Seeded with Big Game Forage Mix	0	49	47	96
Number of 2-3 Acre Gaps Created	0	0	0	19

Alternative 1 (no action) would maintain the declining trend in forage habitat on federal lands resulting in poorer future forage habitat and winter range conditions. This would have a negative impact on elk and deer. Alternatives 2, 3, and 4 would improve the quantity and quality of big game foraging habitat in proximity to cover within the project area through several actions: creation of canopy gaps within proposed harvest units (followed by forage seeding within gaps in Alternative 4); creation/expansion of additional openings followed by forage seeding on temporary roads, major skid trails, landings, appropriate helicopter landings, and selected areas of noxious weed treatments; thinning (particularly in 50-70 tpa areas); and conifer thinning adjacent to some natural meadows. Gap creation and to a much lesser degree “heavy” thinning would increase the amount of sunlight to reach the shrub/forb/grass component of the harvested units creating forage habitat. Seeding openings with a native big game forage

mix would improve forage quality. Thinning adjacent to meadows would serve to maintain existing natural foraging habitat (i.e. reduce conifer encroachment). The effect of these actions is an increase of elk and deer forage production that would occur over the next 10-20 years and then begin to decline as the stands begin to develop larger trees, tree crowns expand and begin to close in again. Alternative 4 would result in the greatest improvements in big game foraging habitat because it creates the largest acreage of canopy gaps (forage quantity) and accomplishes the most forage seeding (forage quality) of the action alternatives. Due to small scale of proposed activities relative to the large size of the planning area (i.e. thinning proposed on about 5% of Emile planning area), the forage:cover ratio for all action alternatives remains at 14:86 and HEs = 0.972. However, all action alternatives nonetheless represent an improvement in big game winter range and a beneficial impact on deer and elk over the existing condition.

Roads affect how elk and deer use winter range in that they tend to shy away from roads open to traffic (Rowland et al. 2004, Wisdom et al. 2005). The action alternatives would have no impact on open road density in the planning area as no new roads would be constructed and left in place. During project implementation, all action alternatives have potential disturbance impacts to deer and elk through increased human activity.

Cumulative Effects: The cumulative effects of this project are analyzed at the WMU-scale, for that portion that is National Forest Land. This is the spatial scale at which elk populations are monitored by Oregon Department of Fish and Wildlife. Clearcut harvesting is expected to be fairly limited on Federal lands in the foreseeable future. This suggests a continued decline in the amount of forage habitat within this WMU over the next 1-2 decades. Thinning on Federal Forest Lands (Matrix, AMA and LSR) that is similar to the proposed action would likely occur over the next 1-2 decades at a scale of about 1,000 to 3,000 acres per year. This would provide small incremental inputs of forage in the form of small gaps, and an improvement of understory forage vegetation, similar in scale to this project. Given the past, present and foreseeable actions, the direct and indirect effects of the action alternatives (when cumulatively added on to foreseeable future actions) would not be enough to stop the declining trend in forage habitat and forage/cover ratios within the WMU.

Pileated Woodpecker (*Dryocopus pileatus*) & Primary Cavity Excavators

Existing Condition: Primary cavity excavators are defined as bird species that actually construct foraging or nesting cavities in snags and large trees. Many species of wildlife use snags for food sources, nesting, roosting, perching, food storage and even hibernating. The Forest Plan has several standards and guidelines that apply to primary cavity excavators and snag habitat. Most of the relevant ones that apply to this project have already been listed under the Coarse Woody Debris section. An additional standard and guideline required the Forest to manage for a 60% potential population capacity (PPC), which provides an indicator of the number of cavity-nesting species likely to be present on the Forest in comparison to the Forest's total potential (USDA 1990).

Habitat for primary cavity excavators, such as woodpeckers and sapsuckers, consists of dead or defective trees (snags) of the proper size and in adequate numbers to support breeding birds. It was believed that these birds would survive on the Forest providing that at least 20 percent of the potential habitat is retained and well distributed across the Forest (USDA 1990). The Oregon Department of Fish and Wildlife criteria for Forest

planning suggested a 60 percent level for snag habitat. More recent information suggests higher levels are needed (Mellen et al. 2005).

The planning area is located on the west-slopes of the Cascade Mountains in Oregon. There is a Cascade Mountain breeding bird survey (BBS) route to the southeast of the planning area (Cinderella Route-69244). This route is part of a large-scale survey of North American breeding birds and has been used to monitor landbirds on an annual basis for many years (Sauer et al. 2005). The primary cavity excavators found in the planning area and surrounding forest are listed in Table 33 (Sauer et al. 2005).

Table 33. List of the cavity nesters documented on the nearest BBS route to the Emile planning area (69244) or otherwise known to occur, their population trends for Oregon from 1966-2006. Data courtesy of Sauer et al. 2006.

Species	Local status	Trend	Trend Estimate
Red-breasted sapsucker	Common	Stable	1.81
Hairy woodpecker	Common	Stable*	-1.03
Northern flicker	Common	Decreasing	-1.12
Pileated woodpecker	Common	Increasing	1.96

Red-breasted sapsucker, hairy, and pileated woodpeckers, and northern flicker are resident nesters on the Umpqua National Forest.

Direct and Indirect Effects: The direct and indirect effects to primary cavity nesters were analyzed at the planning area scale. The action that has the largest direct effect on these species would be thinning and snag creation in gaps. The indirect effects result from changes in future snag recruitment caused by both thinning and snag creation via inoculation or other methods. This indirect effect would occur over the next 100 years as the stands develop into older forests. Alternative 1 would maintain snag levels in smaller diameters, but higher densities. Larger diameter snags, which are more valuable habitat, would develop slowly, and would not reach desired levels for another 10-15 years. The action alternatives would decrease small diameter snags densities through timber harvesting impacts. However, timber harvesting and fuels treatments would also damage and create some new snags and snag creation proposed as a connected action would also mitigate snag reductions. Large snags would develop slightly slower than the no action alternative and not reach levels recommended by DecAID for another 15-20 years. These changes in snag levels would have minor negative effects on primary cavity excavators because they maintain lower, but adequate numbers of snags in the short and long term. Hagar et al. (2004) recorded increases in population density of red-breasted sapsuckers and hairy woodpeckers for heavy thinning on the Willamette National Forest. Hayes et al. (2003) noted a three-fold increase in hairy woodpeckers, within 5 years following similar commercial thinning treatments in the Coast Range of Oregon. The reasons for these increases may be related to the attraction of these species to trees damaged during thinning (Hagar et al. 2004). Both species can utilize smaller diameter trees. Bate (1995) found both species mostly using >18” dbh hard snags, and populations declined in densely stocked conifer stands with small (<10” dbh) trees. Pileated woodpeckers are mostly associated with late-successional forest and primarily use larger snags.

During fuels reduction treatments, the action alternatives would create small clumps of snags by killing retention trees within the 1 to 3 acre gaps with fire. Fire-killed trees mimic a natural process, and the dead trees have a higher tendency to remain standing, as opposed to trees that have been artificially girdled at their base. These snag clumps would provide habitat for primary cavity excavators such as the hairy woodpecker, red-breasted sapsucker and northern flicker. The creation of gaps would also benefit the flicker, because this bird primarily feeds on the ground in open areas and forest edges (Elchuk and Wiebe 2003).

The pileated woodpecker would be indirectly affected by the thinning and inoculations, because these actions would change the rate of large snag recruitment over time. However, under all alternatives large snag habitat would be attained at desired levels in the next two decades. There are no meaningful differences between the action alternatives with regard to impacts on cavity nesters.

Cumulative Effects

Cumulative impacts are analyzed at the planning area scale. Past timber harvesting on federal (Table 7) and private lands, as well as fire exclusion are the management actions that have had the greatest influence on habitat condition and availability for primary cavity excavators in the Emile planning area. However, the trend in clearcut harvesting on federal forest lands that caused concerns for decreasing populations of primary cavity excavators has been dramatically decreased by the NWFP. Currently, the primary type of timber harvesting occurring on federal lands in the planning area and watershed is commercial thinning with mitigations for snag recruitment. Ongoing and foreseeable future harvest in the Emile planning area (Tables 8 and 9) is limited in scale and includes mitigations to ensure adequate snag levels are retained; thus, future impacts to primary cavity nesters are expected to be minimal. Given the current management approach to timber harvesting in this area, populations of primary cavity excavators are expected to stabilize and increase in the foreseeable future. Thus, due to the limited scale and magnitude of potential adverse impacts, in the context of past, present, and foreseeable actions, it is determined that there are no expected meaningful cumulative impacts to primary cavity excavators associated with Alternatives 2, 3 and 4. Alternative 1 would cause no direct or indirect impacts to this species group; thus, there would be no associated cumulative impacts.

LANDBIRDS

Executive Order (EO) 13186, signed January 10, 2001, lists several responsibilities of federal agencies to protect migratory birds, among them to support the conservation intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions. Additional direction comes from the Memorandum of Understanding (MOU) between USDA Forest Service and USDI Fish and Wildlife Service, signed January 17, 2001. The purpose of this MOU was to strengthen migratory bird conservation through enhanced collaboration between the Forest Service and Fish and Wildlife Service, in coordination with state, tribal and local governments. The MOU identified specific activities for bird conservation, pursuant to EO -13186 including: strive to protect, restore, enhance, and manage habitat of migratory birds, and prevent the further loss or degradation of remaining habitats on National Forest System lands. This includes: Identifying management practices that impact populations of high priority migratory bird species, including nesting, migration, or over-wintering habitats on

National Forest System lands, and developing management objectives or recommendations that avoid or minimize these impacts. Although this interim MOU expired on January 15, 2003, the conservation measures that it contained are still applicable for use in environmental planning today. The interim MOU continues to provide guidance until a new MOU is finalized pursuant to the executive order.

Relevant Standards and Guidelines

The Forest Plan has no specific standards and guidelines for landbirds, other than for cavity nesters (discussed above), raptors (protected from human disturbance until nesting and fledging is complete), and TES species (e.g., northern spotted owl).

Existing and Desired Conditions: The Forest Service (USDA 2000) and the Partners in Flight Conservation Program (PIF 2000) have developed a conservation plan to maintain and restore forest habitats necessary to sustain long-term, healthy bird populations. This plan focuses on 28 bird species representing a range of habitats from stand initiation to old forest and provides recommendations for forest management at both the stand and landscape-scale. Nineteen of these species represent habitat types found on the Umpqua National Forest and within the Emile planning area (Table 34). There is a Cascade Mountain (BBS) route closely adjacent to the Emile planning area. The Cinderella Route (69244) begins approximately 2.5 miles east of the planning area and continues southeast for approximately 24 miles. Data from this route were used to help document which landbirds occur in the planning area.

Table 34. Landbirds identified by the Oregon/Washington Partners In Flight Conservation Plans for the Western Forests (Altman 1999 & 2000) representing habitats found within the Emile planning area.

Western Cascades Focal Species			
Common Name	Habitat Attribute	Abiotic and Landscape Factors[1,2]	Documented in or Adjacent to the Project Area
Old Growth			
Vaux's Swift	Large Snags	• Found at sea level to >5,000 ft • Availability of large hollow snags major limiting factor	Yes
Brown Creeper*	Large Trees	• Found at sea level to >5,000ft • Sensitive to habitat fragmentation • Peak densities occur in closed canopy stands >100 years old	Yes
Red Crossbill	Conifer Cones	• Found at sea level to >5,000ft, found higher locally • Seed availability critical to breeding	Yes
Pileated Woodpecker	Large Snags	• Found at low to moderate elevations • Require mature forest for nesting, will forage in younger stands	Yes
Varied Thrush	Mid-story Tree Layers	• Found at sea level to >5,000ft, found higher locally • Prefers a component of riparian vegetation and deciduous vegetation	Yes
Hermit Warbler	Closed Canopy	• Found at sea level to >5,000ft	Yes

Western Cascades Focal Species			
Common Name	Habitat Attribute	Abiotic and Landscape Factors[1,2]	Documented in or Adjacent to the Project Area
		• Forage high in canopy, avoids areas with shrubs	
Pacific-slope Flycatcher	Deciduous Canopy/subcanopy Trees	• Found at sea level - 4,192 ft • Prefer riparian drainages and north slopes	Yes
Hammond's Flycatcher	Open Mid-story	• Elevation 1,050-4,500 ft • Will respond positively to thinning from below to open the mid-story	Yes
Wilson's Warbler	Deciduous Understory	• Elevation from sea level to 5,000 ft • Prefers habitat heterogeneity and edge habitats	Yes
Winter Wren	Forest Floor Complexity	• Elevation from sea level to 5,000 ft • Sensitive to habitat fragmentation • Ground nester	Yes
Pole Forest: Stem Exclusion			
Black-throated Gray Warbler	Deciduous Canopy Trees	• Elevation from 900-4,200 ft • More abundant in unthinned plantations	Yes
Hutton's Vireo	Deciduous Subcanopy/ understory	• Elevation from 900-3,000 ft • More abundant in unthinned forest	Yes
Early-Seral Forest: Stand Initiation			
Olive-sided Flycatcher^	Residual Canopy Trees	• Elevation from sea level to 5,000 ft • Can utilize late seral and early seral stands if large green trees remain	Yes
Western Bluebird	Snags	• Elevation from sea level to 5,000 ft • Will utilize clear-cuts if snags are retained	Yes
Orange-crowned Warbler	Deciduous Vegetation	• Elevation from sea level to above 5,000 ft • Prefer young stands with at least 30% cover deciduous shrubs	Yes
Rufous Hummingbird	Nectar-producing Plants	• Will utilize both old-growth and clearcuts if sufficient flowering plants are present	Yes
Lincoln's sparrow	Montane Wet Meadows	• Breeds above 3,000 ft in elevation • Breeding season depends on snowpack	Yes
American pipit	Alpine	• Prefer open habitats with sparse cover	No
Black swift^	Waterfalls	See Sensitive Species	Yes

^Also Audubon Society Watchlist Species for 2007

Although proposed activities under Emile action alternatives would occur in proximity to habitat types for many landbirds, activities would be concentrated in mid-seral closed canopy stands. The conservation strategy for the coniferous forests of western Oregon and Washington (PIF 1999) describes the conditions found within the proposed harvest stands as "pole forest - stem exclusion", as described below (PIF 1999):

> These forest conditions are structurally simple and characterized by an even-aged, single-layered, closed-canopy with little or no understory development. Where understory vegetation exists, it is generally low growing and dominated by one or two shade-tolerant species. Stands may range from sapling trees with high foliage ratios that have attained canopy closure, to large pole trees that are densely stocked and have low foliage ratios and a high degree of canopy lift. These forest conditions are relatively depauperate in landbird species composition and richness.

The conservation strategy identified two focal bird species for this forest type, black-throated gray warbler and Hutton's vireo. The black-throated gray warbler is associated with overstory deciduous trees and Hutton's vireo is associated with the understory shrubs. Long-term (1966-2006) monitoring data from Oregon and the Cascades indicate a declining to stable population trend for the warbler (not statistically significant) and an increasing population trend for the vireo (statistically significant).

Direct and Indirect Effects: The direct (short-term) and indirect (long-term) effects to landbirds were analyzed at the planning area scale. Alternative 1 would have no direct impacts to landbirds because no thinning, fuels treatments, or other habitat modifying activities would occur. Thinning and fuels treatments associated with Alternatives 2, 3, and 4 would change landbird habitat within proposed harvest units, resulting in positive impacts for some bird species and negative impacts for others. For the two focal species associated with stem exclusion forest types, proposed activities would reduce habitat quality in the short-term within the treated stands. Hayes et al. (2003) and Hagar et al. (2004) found that thinning young Douglas-fir in western Oregon caused localized declines in black-throated gray warblers and Hutton's vireo over 5 years, but did not cause extirpations. Given that approximately 26% of the acreage within proposed harvest units would remain untreated and given the abundance of stem exclusion stands within the planning area that are not proposed harvest units, potential impacts to habitat for the black-throated gray warblers and Hutton's vireos are considered to be minor and inconsequential to the species. Temporary road construction under Alternatives 2, 3 and 4 would not have a measurable effect on these birds because the change in forest crown closure would be essentially no different than the crown closure changes caused by thinning (given the narrow width of these roads).

There are also potential beneficial indirect impacts for a variety of landbirds associated with the action alternatives. Thinning and gap creation would open up the forest canopy and result in an increase in the deciduous tree and shrub component, as well as increasing ground vegetation in openings. Insects that comprise a large component of landbird prey base would respond favorably to these conditions. Recent studies are leading research scientists to conclude that commercial thinning in dense, young Douglas-fir plantations can increase diversity of breeding songbirds (Hayes et al. 2003, Hagar et al. 2004). A variety of thinning intensities and patterns, ranging from no thinning to very widely spaced residual trees, is recommended to maximize bird diversity at the landscape scale and structural diversity both within and among stands (Hagar et al. 2004). Reducing crown density and creating small openings in dense stands may maintain suitable habitat for the dusky flycatcher (Marshall et al. 2003).

For all action alternatives, timber harvest, temporary road construction/reconstruction, and fuels treatments that would occur in the spring represent a potential disturbance impact to nesting landbirds. These direct impacts would be reduced through a variety of project design features. As a result of seasonal restrictions for the northern spotted owl, for several units/areas, timber harvest operations would not occur until after July 15 and

would end before spring (outside of the primary land bird breeding season). Similarly, burning of slash piles would occur in the fall and winter rather than during the spring breeding season, limiting potential direct impacts to landbirds. Underburning would occur in late spring and may cause disruption of nesting on approximately 311 acres. However, as detailed in the northern spotted owl section, this impact is of short-duration (1-2 days) at any one location and would not likely occur all in one year. Thus, although impacts are anticipated, due to the limited magnitude, and spatial and temporal distribution of the impacts and the abundance of "unimpacted" habitats in the planning area, potential impacts are not considered consequential to the species. There are no meaningful differences between the action alternatives relative to their potential impacts on landbirds.

Cumulative Effects

Given the broad geographic range of these landbird species, it is difficult to determine an appropriate and meaningful scale for assessing potential cumulative impacts of the project. However, at the planning area scale, past timber harvesting in the Little River drainage (Table 7) has resulted in high existing levels of habitat in the stem exclusion stage. Past, ongoing and foreseeable future activities (Tables 7-9) in the area that would impact landbird habitat in this structural category are very limited. There are thousands of acres of 15-20 year-old stands in the Emile planning area that will be reaching the stem-exclusion successional stage over the next few decades, thus potential habitat for landbirds associated with stem-exclusion conditions is not expected to be limited in the near future. Thus, when considered in the context of past, present, and foreseeable actions, it is determined that there are no consequential cumulative impacts associated with the action alternatives. Alternative 1 would cause no direct or indirect impacts to landbirds and thus, no cumulative impacts.

RARE AND UNCOMMON WILDLIFE SPECIES

The red tree vole (*Arborimus longicaudus*) and great gray owl (*Strix nebulosa*) are considered to be regionally Rare and Uncommon wildlife species whose known ranges include the Umpqua National Forest and overlap the Emile planning area. These species are not included on the Regional Forester's Sensitive Species list for the Umpqua National Forest (updated January 2008) or discussed elsewhere in this document. They are discussed briefly below for purposes of full disclosure.

The red tree vole is included on the Regional Forester's sensitive species list only in the portion of its range on the Northwest Oregon coast north of Highway 20. In addition to occurring outside of this area of concern, the harvest units do meet the stand criteria for suitable habitat (i.e. mature/old-growth forests, with QMD $\geq$ 18" dbh) that would potentially contribute to a reasonable assurance of species persistence within the planning area, and as such proposed activities would not be expected to cause a consequential negative impact on the species habitat or the persistence of the species at the site (Survey Protocol for the Red Tree Vole, V 2., 2002).

The great gray owl is included on the Regional Forester's sensitive species list only in Washington State. In addition to occurring outside of this area of concern, the harvest units are not of an age/size class to meet stand criteria for suitable nesting habitat (i.e. 38-42" dbh trees) that would potentially contribute to a reasonable assurance of species persistence within the planning area, and as such proposed activities would not be expected to cause a consequential negative impact on the species habitat or the

persistence of the species at the site (Survey Protocol for the Great Gray Owl, V. 3.0, 2004).

UNIQUE HABITATS

Unique habitats are small patches of non-forested openings that vary in size from 1 to 75 acres and include meadows, hardwood stands, wetlands, ponds, caves, cliffs, and rock outcrops (USDA, Forest Service 1990). They are important due to their scarcity in the forest environment and high wildlife and plant values (USDA, Forest Service 1990). Approximately 85% of the plant species diversity of the Western Cascades is found in non-forested habitats (Hickman 1976) which make up about 3% of the Umpqua National Forest. Unique habitats in the 131,853 acre Little River Watershed, account for roughly 2% (approx. 2,000 acres) of the area (USDA, Umpqua NF 1997 & 1999). The majority of unique habitats in the watershed are meadows and mosaic areas of large trees, rock outcrops and small ponds. (USDA USDI, Umpqua NF 1995).

Existing and Desired Conditions

Fire exclusion in the twentieth century may be permitting the gradual succession of meadow to forest with profound consequences to biodiversity (Halpern 1999). Studies in the central Cascade Range of Oregon suggest that these invasions are related to changes in regional climate and cessation of sheep grazing during the middle part of the 20th century (Miller and Halpern 1998). It is likely that natural fire, particularly in dry meadows on south- and west-facing slopes, played an important role in creating and maintaining openings (Halpern 1999).

There are approximately 1,130 acres of mapped unique habitats within the Emile planning area including wet and dry meadows, rock, broken canopy, and hardwoods. There are approximately 215 acres of unique habitats mapped immediately adjacent to or within the project units (Table 35). These openings range from about 1 to 92 acres in size. The proposed harvest units and their corresponding unique habitats are listed in Table 35. Areas of concern from a potential adverse impacts to wetlands perspective were identified and assigned appropriate buffers during project planning. Units 9, 16, 29, 39, 40, and 47, all have unique habitats adjacent to unit boundaries in which the buffer intersects the proposed units, not the unique habitats. In other instances, such as with unit 37, the unique habitat was buffered by 150’ or to the edge of the road and will not be entered. Therefore, the edge of the unique habitat is protected by the road and the unique habitats will not be entered.

Table 35. Proposed Harvest Units with Unique Habitats.

Unique Habitat	Unit Location	Acres	Buffer Size (feet)
Dry Meadow	9	1.41	0
	16	2.61	0
	24	6.65	150'
	26	1.30	0
	29	2.39	0
	33	3.14	0
	37	1.14	150’
	45	2.43	0
	46	6.58	0
	47	2.00	0

Unique Habitat	Unit Location	Acres	Buffer Size (feet)
Wet Meadow	1	2.05	Part 150' and remaining 1.25 acres encompassed by no-thin area.
	33/34	47.06	150' and/or to road. (3.7 acre projection into unit 33: stream buffer or 50')
	36	(included in unit 57 meadow acres)	150'
	37	(included in unit 57 meadow acres)	150' and/or to road
	39	4.42	to road
	40	6.83	150' (0.3 acres encompassed by no thin).
	57	92.02	150'
Broken Canopy	40	4.99	150'
	40	15.51	150' (0.6 acres encompassed by no-thin)
Rock	57	16.92	150'
Total		**215.43**	

The desired condition is to keep the number and amount of unique habitats at their current levels or on an increasing trend for the future, and to keep unique habitats free of new invasive species as a means to maintaining their biodiversity. The specific desired condition for the wetlands and wet meadows is the maintenance of water tables so that the wet areas continue to function, in keeping with objective 7 of the Aquatic Conservation Strategy.

Direct and Indirect Effects

Direct effects in the context of unique habitats are those that would occur within the habitats or their immediate surroundings during and shortly following implementation. Indirect effects are those that could occur later in time or beyond the immediate area of today's existing unique habitats.

Alternative 1 would result in no short-term direct effects to unique habitats because no activities would occur in or near them. Over the long-term, the no action alternative may increase the risk of stand-replacement fire which could result in an increase of open meadows. Depending on many variables, a wildfire could improve or adversely affect meadow vegetation. Tree encroachment in meadows could be slowed or halted by a wildfire. Without fire, the natural succession in wetlands is trending toward forest encroachment and eventually canopy closure. The adverse effects associated with a stand-replacing wildfire could include a loss of diversity in the seed bank and introduction of invasive weeds. Alternative 1 could result in an adverse effect to unique habitats if fire exclusion continues to allow trees and invasive plants in some cases, to invade the existing meadows.

Because of buffers and the requirement to directionally fall trees away from unique habitats there would be no meaningful adverse direct effects to unique habitats associated with Alternatives 2, 3, 4, and the connected actions. Thinning would also be expected to maintain/enhance some meadows through a reduction in encroaching

conifers, representing a potential beneficial effect to some unique habitats. Over the long-term, thinning and proposed burning under Alternatives 2, 3, and 4 may improve resilience to stand replacement fire; a likely indirect beneficial effect to some unique habitats. The existing water table elevations in the wetlands located in units 33, 37, 39, and 57 would not be adversely affected by the thinning since the wetlands would be buffered and since the partial harvest of trees is not expected to change ground water levels to any measurable degree. Similarly, areas considered to be wet meadows or broken canopy are adequately buffered or otherwise encompassed by no-thin portions of units such that no adverse impacts are anticipated. Therefore, the action alternatives would be consistent with objective 7 of the Aquatic Conservation Strategy, which calls for the maintenance of water table elevation in meadows and wetlands. There are no meaningful differences between the action alternatives with regard to potential impacts to unique habitats.

Forest Plan Amendment

In terms of the proposed Forest Plan Amendment, the responsible official will make a Determination of Significance of Change to the Forest Plan in the Decision Notice/ Finding of No Significant Impact. In order to make that determination, FSH 1909.12, Section 5.32, outlines the factors to be used to determine whether a proposed change to the LRMP is significant or not significant, based on National Forest Management Act requirements. A discussion of each of these four factors follows.

1. Timing. Determine whether the change is necessary during or after the plan period. In most cases, the later the change, the less likely it is to be significant for the forest plan. The proposed amendment is necessary now in order to harvest the Emile stands and meet the desired stand conditions, and would occur at the end of the current plan period. Therefore, timing is not considered to be a significant factor related to the amendment.

2. Location and Size. Define the relationship of the affected area to the overall planning area. In most cases, the smaller the area affected by the change, the less likely it is to be significant for the forest plan. There are approximately 1,130 acres of mapped unique habitats in the Emile planning area. The proposed amendment would affect approximately 25 acres of unique habitat across the 35,482 acre planning area. This represents 0.07 % of the planning area and 2.2 % of the mapped unique habitats within the planning area. Even if all 215 acres of unique habitat described in Table 35 were impacted by the project, only 0.6% of the planning area and 19% of the unique habitats would be impacted. Thus, impacts to unique habitats are limited in scale and consequence. Therefore, the location and size of the area involved in the proposed amendment are not considered to be significant.

3. Goals, Objectives, and Outputs. Determine whether the change would alter long-term levels of goods and services projected by the forest plan. The proposed amendment would not change existing goals, or outputs as defined by the Forest Plan. The proposal would not result in changes in the level of goods and services currently being produced, which are consistent with levels projected by the LRMP. Therefore, the goals, objectives, and outputs are not considered to be a significant factor related to the proposed amendment.

4. Determine whether the change in a management prescription is only for a specific situation or whether it would apply to future decisions throughout the planning area. The

proposed amendment would not permanently change management of unique habitats. This amendment applies to this project only; upon completion of this project, Prescription C5-1 would again apply. Therefore, changes in management prescription are not considered to be a significant factor related to the proposed amendment.

Cumulative Effects

The scope of analysis for cumulative effects to unique habitats is Units 1, 9, 16, 24, 26, 27, 29, 33, 34, 36, 37, 39, 40, 45, 46, 47, and 57 because these are the only locations where the effects of the action alternatives could possibly overlap with and add to past effects (Table 7), potentially resulting in cumulative effects. There are no other on-going or planned future activities in these units (Tables 8 and 9) that would contribute to a cumulative effect.

Past logging in the units likely prevented or slowed meadow encroachment by removing all the trees in the stand. Although extreme, this may have helped meadows retain their size. Damage associated with logging and road building may have occurred to vegetation, wildlife habitat, and soils in some or all of the unique habitats in the subwatersheds.

The past effects of harvesting are offset by fire exclusion that is permitting the gradual succession of dry meadow to forest (Halpern 1999). Past activities within these units have also contributed to the occurrence of invasive plants in unique habitats, along roads, and especially on old landings.

With the implementation of on-going noxious weed control, thinning, noxious weed mitigation measures, and connected actions, the effects of Alternatives 2, 3, and 4 combined with the lasting effects of past activities, is likely going to be beneficial in terms of cumulative effects. These benefits are primarily associated with removal of some encroaching conifers and stopping the continual habitat degradation by removing noxious weeds from the units and sale area.

Aquatic Conservation Strategy

As disclosed above in this Unique Habitat section, no adverse impacts to the wetlands or wet meadows are expected from any of the proposed activities in any of the action alternatives including road work, thinning, burning, or yarding activities. As such, the water tables associated with project's wet areas would not be affected so wet areas would remain unaltered and wet, consistent with ACS objective 7.

INVASIVE PLANTS/NOXIOUS WEEDS

Invasive plant species are alien plants whose introduction does, or is likely to cause, economic or environmental harm, or harm to human health (USDA, Forest Service 2005). Noxious weeds are plant species designated as such by the Secretary of Agriculture or by the responsible State official, and generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and being new to or not common to the United States. Noxious weeds infest over 420,000 acres of National Forests and Grasslands in the Pacific Northwest Region (USDA, Forest Service 2005).

Existing and Desired Conditions

The health of native plant communities throughout the Pacific Northwest is at risk by noxious weeds and other invasive plants. Introduced plant species thrive in new

ecosystems for various reasons including a lack of predators, change in disturbance regime, and adaptations for growing on nutrient-poor soils. As a result, weeds are capable of out-competing native plants, ultimately altering the structure and lowering the diversity of native plant communities. The frequency of fire can also be altered in ways that are detrimental to natural ecosystems (Harrod and Reichard 2001). Further, different soil organisms predominate under different kinds of vegetation. Replacement of native plant communities with weed species can be expected to change soil microbial populations and nutrient cycling processes.

Weeds are introduced by a variety of agents, most notably highway and off-road vehicles, construction equipment, and wind. They can also be moved by water, animals, and humans. Most weeds take advantage of disturbed areas such as roadsides, trails, logged units, burns, rock quarries, mined sites and areas around human structures. Established populations serve as sources for further dispersal, especially along road, power line, and trail corridors. Roads are considered the first point of entry for weed species into a landscape, and roads serve as corridors along which plants move farther into the landscape.

The increase of noxious weed introductions on the Umpqua National Forest is directly related to expanding weed populations on nearby federal, state, and private lands. Populations of extremely aggressive species such as yellow star-thistle, rush skeletonweed, false brome, and meadow knapweed, have become roadside weeds on frequently traveled highways in Oregon and along arterial roads in the Umpqua and adjacent national forests. These infestations are managed, when possible, primarily through biological control methods, although small isolated infestations may be subject to intensive controls such as hand pulling and/or herbicides. The greatest risk of human-caused noxious weed introduction into the proposed units is from seed-contaminated vehicles and equipment traveling through the planning area.

The Umpqua National Forest has classified its noxious weeds into four categories: high priority species (Forest Rating A), lower priority species (Forest Rating B), detection species (Forest Rating D), and other weeds of interest (Forest Rating O). The noxious weeds known to occur on the North Umpqua Ranger District are presented, by category, in Table 36.

Table 36. Noxious Weed List for the North Umpqua Ranger District[69] and Emile Planning Area[70].

Common Name	Scientific Name	Total Acres	Forest Distribution	Emile Planning Area
High-Priority Species				

[69] Noxious weeds found on other Ranger Districts, but not on North Umpqua include: False Brome, Italian Thistle, Spotted Knapweed, Diffuse Knapweed, Yellow Starthistle, Japanese Knotweed, and Giant Knotweed. Not included in the table are aggressive, invasive, non-native plants that have yet to be detected on the Umpqua National Forest, but have a high potential to occur on the Forest (Rating – D). These D-rated species include Biddy-biddy, Woolly Distaff Thistle, Russian Knapweed, Houndstongue, Yellow Nutsedge, Orange Hawkweed, Dalmatian Toadflax, Purple Loosestrife, Milk Thistle, Spanish Broom, Puncture Vine, and Spiny Cocklebur.

[70] Noxious weeds found on the North Umpqua RD, but not found within the Emile planning area include: Rush Skeleton Weed, Portuguese Broom, French Broom, English Ivy, Sulfur Cinquefoil, Gorse, and Common Teasel.

Common Name	Scientific Name	Total Acres	Forest Distribution	Emile Planning Area
(Forest Rating A)				
Scotch Broom	*Cystisus scoparius*	>750	All Ranger Districts	Yes
Yellow Toadflax	*Linaria vulgaris*	7	All Ranger Districts	Yes
Lower-Priority Species (Forest Rating B)				
Meadow Knapweed	*Centaurea debeauxii* spp. *thuillieri*	>1,000	All, particularly North Umpqua Ranger District	Yes
Bull Thistle	*Cirsium vulgare*	>1,000	All Ranger Districts	Yes
Canada Thistle	*Cirsium arvense*	>1,000	All Ranger Districts	Yes
St. Johnswort	*Hypericum perforatum*	>5,000	All Ranger Districts	Yes
Himalayan Blackberry	*Rubus discolor*	>500	All, particularly Tiller Ranger District	Yes
Tansy Ragwort	*Senecio jacobaea*	>1,000	All Ranger Districts	Yes
Other Weeds of Interest (Forest Rating O)				
Oxeye Daisy	*Chrysanthemum leucanthemum*	>1,000	All Ranger Districts	Yes
Chicory	*Cichorium intybus*	<100	Suspected on all	Yes
Wild Carrot	*Daucus carrota*	<500	Suspected on all	Yes

A small amount of the Little River and Middle North Umpqua watersheds have not been impacted by invasive plants (USDA, Umpqua NF 1999). The Little River and Middle North Umpqua Watershed Analyses (USDA, Umpqua NF 1995 & 1999) identified occurrences of meadow knapweed, Canada thistle, bull thistle, Scotch broom, tansy ragwort, and gorse in the watersheds.

Noxious weed surveys for Emile were conducted in 2007. All the noxious weeds currently found in the planning area are presented in Table 36. The Scotch broom and some occurrences of Himalayan blackberry, in and adjacent to the planning area, would be targeted for removal and subsequent control, if needed, as outlined in the Botany Mitigation Measures in Chapter 2 (see the botany project file for a map of these weed occurrences).

The Little River and Middle North Umpqua Watershed Analyses (USDA, Umpqua NF 1995 & 1999) recommends the need for continued weed education for the public and agency personnel. It further recommends minimizing soil disturbing activities as a way to avoid spreading weeds, and the use of biological controls. Forest-wide weed management recommendations, such as those recommended in the watershed analysis, were included in the Umpqua National Forest's LRMP, by amendment, in 2003 (USDA, Umpqua NF 2003).

The desired condition for the watershed and planning area is to continue preventing new noxious weeds from becoming established, and preventing the spread of existing priority A noxious weed occurrences (sometimes isolated patches of other noxious weeds are included in this group) by using an integrated (manual, biological, and chemical tools) pest management approach. High quality and healthy native plant communities remain diverse and resilient. Damaged ecosystems are restored where possible.

Relevant Standards and Guidelines

Forest Service Region 6 issued a Record of Decision (ROD) in October 2005, for the Pacific Northwest Region Invasive Plant Program Final Environmental Impact Statement. The 2005 ROD added a set of standards to Forest Plans (USDA, Forest Service 2005). Several of the standards that are pertinent to this project are incorporated into the Botany Mitigation Measures in Chapter 2.

The Umpqua National Forest LRMP was also amended in 2003 (USDA, Umpqua NF 2003) with the following relevant standards and guidelines:

- Integrated weed management prevention and treatment strategies will be used to treat noxious weeds within the constraints of laws, policies and regulations and to meet Forest Management objectives. Methods may include manual (mowing, clipping, grubbing), biological, heated steam, competitive seeding, competitive planting, solarization, prescribed fire, grazing, chemical, or other applicable methods designed to control and/or eradicate the noxious weed. Biological controls tested and sanctioned by the US Department of Agriculture would be allowed to occur. Manual control methods within disturbed sites, such as along roads, trailheads, landings and within administrative sites would be allowed at any time.
- Require all ground disturbing machinery to be washed prior to entering and leaving the Forest, using the appropriate timber sale contract provisions and construction contract requirements.
- Require the use of certified-weed-free seed for all re-vegetation projects.
- Re-vegetate disturbed sites as soon as practical using native species unless there is no immediate resource concern and the site is anticipated to re-vegetate naturally to native species to desired cover standards.

Direct, Indirect, and Cumulative Effects

Alternative 1 would not result in any direct or indirect effects because ground disturbing activities with the potential to encourage new noxious weed invasions, would not occur. However, since Alternative 1 may result in a slightly greater long-term risk of stand replacement wildfire, it could potentially contribute to the proliferation of new and existing noxious weeds if a future wildfire were to burn through the planning area or subwatershed. Over the long-term, following fuels treatments, the action alternatives may result in stands that have an increased resiliency to stand-replacing fires by reducing fire behavior (by lowering fire intensity and severity - see fuels section). Continued noxious weed inventory, monitoring, and management would be subject to funding levels and district priorities.

Alternatives 2, 3, and 4 may contribute to the introduction or proliferation of noxious weeds in the watershed. The application of Standards and Guidelines, mitigation measures, future weed treatment, competitive planting, monitoring, etc., would minimize, but may not completely prevent the introduction and/or spread of invasive plants.

Mitigation includes post-sale and follow-up treatments on as much as 190 acres. On-going forest-wide noxious weed surveys would continue to document new infestations of noxious weeds within Little River and Middle North Umpqua Watershed and other watersheds on the forest. All three action alternatives would also include treating (depending on funding), before harvest activities begin, preexisting occurrences of Scotch broom and selected occurrences of Himalayan blackberry, and any high-priority noxious weeds discovered growing in planning area roadways, quarries, pullouts, and landings to help attain the desired condition. The action alternatives would also implement competitive planting where the noxious weed treatments on pre-existing populations creates new bare ground having little chance of natural restoration occurring.

Treating fuels by burning is proposed for all the action alternatives. Underburning would occur on approximately 311 acres for Alternatives 2, 3, and 4. Keeley et al. (2004) found that prescribed fire can reduce the occurrence of invasive weeds the first year following a burn. This reduction of invasive weeds is expected to occur over some of the acreage prescribed for underburning by the following growing season. However, invasive and noxious weeds could eventually come back in places with low competition and low canopy closure. To prevent the possible reinvasion of weeds these areas would be monitored and managed closely for noxious weeds as part of the mitigation measures listed in Chapter 2.

New roads create prime invasive weed habitat. Alternatives 2 and 4 would result in 1.0 miles of new road temporary construction and 7.3 miles of reconstruction; while Alternative 3 would result in 0.6 miles of new road temporary construction and 7.1 miles of reconstruction. As such, Alternatives 2 and 4 create more risk than Alternative 3 for introduction of noxious or other invasive weeds into areas where road activities occur. Because of the increased risk associated with road activities, it will be especially important for these roads to be re-vegetated where appropriate, mulched, and monitored. Noxious weed treatments would be implemented as necessary. In other words, the connected actions and mitigation measures related to re-vegetation, erosion control, and noxious weed monitoring/eradication are crucial to preventing adverse weedy conditions on and adjacent to roads for all action alternatives.

Cumulative impacts for this project are analyzed at the planning area scale. The invasive and noxious weeds found in the Emile planning area are a consequence of past regeneration harvests since the 1940's, road building, recreation, and burning/fuels treatments (Table 7). Although invasive and noxious weeds are currently present along roads and in openings throughout the area, compliance with current management direction for noxious weeds in the Emile project and in current and future projects (Tables 8 and 9) is expected to result in decreased rates of spread of invasive plants in the planning area and watershed. Additionally, connected actions associated with the Emile project, as well as on-going and anticipated noxious weed treatment programs are expected to result in improved conditions relative to the extent and consequences of noxious weeds populations. With the implementation of successful connected actions, mitigation measures, and monitoring to deal with noxious weeds, the potential incremental impacts of all alternatives in the Emile project as mitigated are considered to be minor. Following consideration of the incremental impacts of the project, when added to past, present, and reasonably foreseeable future actions in the planning area, it is determined that there are no meaningful cumulative impacts associated with any of the alternatives.

THREATENED, ENDANGERED, AND SENSITIVE BOTANY SPECIES

Biological Evaluation

This Biological Evaluation evaluates potential impacts to Threatened, Endangered, or Sensitive (TES) vascular plants, lichens, and bryophytes from the Emile Timber Sale. It is Forest Service policy to "ensure that Forest Service actions do not contribute to loss of viability of any native or desired plant or contribute…trends towards Federal listing of any species" (FSM 2672.41).

There are currently 39 vascular plant species, 20 fungi, 12 lichens, and 24 bryophytes listed as Sensitive on the Umpqua National Forest (Table 37)[71]. There are two species known or suspected to occur on the Forest that are listed under the Endangered Species Act. *Lupinus sulphureus ssp. kincaidii* is listed as threatened and has been documented on the Tiller Ranger District located on the Umpqua National Forest. Although there are isolated occurrences documented throughout the Umpqua basin, this species occurs in low elevation upland prairies and is primarily known from the Willamette Valley grasslands. *Plagiobothrys hirtus* is listed as endangered and is confined to low-elevation wetlands in the vicinity of Sutherlin in northern Douglas County. It has not been documented on the Forest to date.

Pre-field Review

The sensitive fungi, lichens, and bryophytes with potential habitat in the planning area (Table 37) would most likely be found in the gentle valley bottom and gentle mountain slopes landscape areas. Dry conditions generally associated with Steep Terrain are normally not conducive to sensitive non-vascular plants (an exception is Encalypta brevipes which has a preference for rock outcrops) and fungi. The sensitive vascular plants with potential habitat in the area (Table 37) are generally associated with meadows, streams, or rock outcrops in any of the three landscape areas. The closed-canopy plantations proposed for commercial thinning under each of the action alternatives are generally not suitable habitat for species found on the sensitive species list; however, the scattered natural openings, riparian zones, and plantation boundaries adjacent to mature forest are potential habitat for a number of sensitive species. Consequently, habitat becomes a major focus for survey efforts.

---

[71] Only species that occur on the North Umpqua RD and have habitat within the Emile project area are listed in Table 37 and will be discussed in this EA. The action alternatives would have "no effect or no impact" on the following species and they will not be discussed further: LUPINUS SULPHUREUS SSP. KINCAIDII; PLAGIOBOTRYS HIRTUS; BRYUM CALOBRYOIDES; CALYPOGEIA SPHAGNICOLA; JAMESONIELLA AUTUMNALIS VAR. HETEROSTIPA; MARSUPELLA EMARGINATA VAR. AQUATICA; POLYTRICHUM SPHAEROTHECIUM; PSEUDOLESKEELLA SERPENTINENSIS; CODRIOPHORUS DEPRESSUM; SPLACHNUM AMPULLACEUM; TOMENTYPNUM NITENS; TREMATODON BOASII; CHAENOTHECA SUBROSCIDA; DERMATOCARPON MEIOPHYLLIZUM; LEPTOGIUM BURNETIAE; LOBARIA LINITA; PSEUDOCYPHELLARIA RAINIERENSIS; CHROOGOMPHUS LOCULATUS; CUDONIA MONTICOLA; DERMOCYBE HUMBOLDTENSIS; GASTROBOLETUS IMBELLUS; GASTROBOLETUS VIVIDUS; GOMPHUS BONARII; GOMPHUS KAUFFMANII; PSEUDORHIZINA CALIFORNICA; MARTELLIA FRAGRANS; STAGNICOLA PERPLEXA; ARABIS SUFFRUTESCENS VAR. HORIZONTALIS; ARNICA VISCOSA; BOTRYCHIUM PUMICOLA; CALAMAGROSTIS BREWERI; CALOCHORTUS UMPQUAENSIS; CAREX ABRUPTA; CAREX CRAWFORDII; CAREX DIANDRA; CAREX LASIOCARPA VAR. AMERICANA; CAREX NARDINA; CAREX SERRATODENS; CAREX VERNACULA; CIMICIFUGA ELATA; COLLOMIA MAZAMA; ELATINE BRACHYSPERMA; EUCEPHALUS VIALIS; PERIDERIDIA ERYTHRORHIZA; ROTALA RAMOSIOR; SCHEUCHZERIA PALUSTRIS VAR.; SCIRPUS SUBTERMINALIS; UTRICULARIA MINOR; UTRICULARIA OCHROLEUCA; VIOLA PRIMULIFOLIA SSP. OCCIDENTALIS; WOLFFIA BOREALIS; and WOLFFIA COLUMBIANA. See the Botanical Biological Evaluation in the project file for more information on the above species.

Pre-field review indicated potential habitat for a number of TES species and Rare or Uncommon species within the project area. This review consisted of consultation and analysis of Umpqua National Forest database records, aerial photographs, survey protocols for lichens, bryophytes, and vascular species, previous botanical survey records, USGS topographical maps, and working knowledge of the area. Each species on the Umpqua National Forest Sensitive Species list is considered.

Pre-field review also indicated that the zone of influence for populations of Lupinus sulphureus ssp. kincaidii and Plagiobothrys hirtus is far removed from any direct, indirect, or cumulative effects associated with any of the alternatives and connected actions. Therefore, the implementation of any of the alternatives would have "No Effect" on these federally listed species.

Table 37. A Project Effects Assessment for Documented or Suspected Botany Species.

Scientific Name	Sensitive List	Prefield Review	Field Survey	Risk Assessment & Effects Summary	
		Habitat Present?	Species Located?	Alt. 1	Alts. 2, 3, 4
Bryophytes					
BARBILOPHOZIA LYCOPODIOIDES	S	Y	N	NI	NI
CHILOSCYPHUS GEMMIPARUS	S	Y	N	NI	NI
ENCALYPTA BREVICOLLA VAR. CRUMIANA	S	Y	N	NI	NI
ENCALYPTA BREVIPES	S	Y	N	NI	NI
ENTOSTHODON FASCICULARIS	S	Y	N	NI	NI
HELODIUM BLANDOWII	D	Y	N	NI	NI
MEESIA ULIGINOSA	S	Y	N	NI	NI
PORELLA BOLANDERI	S	Y	N	NI	NI
RHIZOMNIUM NUDUM	D	Y	N	NI	NI
SCHISTOSTEGA PENNATA	D	Y	N	NI	NI
TAYLORIA SERRATA	S	Y	N	NI	NI
TETRAPHIS GENICULATA	S	Y	N	NI	NI
TETRAPLODON MNIOIDES	D	Y	N	NI	NI
TRITOMARIA EXSECTIFORMIS	D	Y	N	NI	NI
Lichens					
LEPTOGIUM CYANESCENS	D	Y	N	NI	NI
NEPHROMA OCCULTUM	D	Y	N	NI	NI
PANNARIA RUBIGINOSA	S	Y	N	NI	NI
PELTIGERA PACIFICA	D	Y	Y	NI	NI
PSEUDOCYPHELLARIA MALLOTA	D	Y	N	NI	NI
RAMALINA POLLINARIA	S	Y	N	NI	NI
USNEA LONGISSIMA	D	Y	N	NI	NI
Fungi					
BOLETUS PULCHERRIMUS	D	Y	Unknown (Unk)	NI	MIIH
CORTINARIUS BARLOWENSIS	D	Y	Unk	NI	MIIH

Scientific Name	Sensitive List	Prefield Review	Field Survey	Risk Assessment & Effects Summary	
		Habitat Present?	Species Located?	Alt. 1	Alts. 2, 3, 4
DESTUNTZIA RUBRA	S	Y	Unk	NI	MIIH
LEUCOGASTER CITRINUS	D	Y	Unk	NI	MIIH
RAMARIA AMYLOIDEA	D	Y	Unk	NI	MIIH
RAMARIA AURANTIISICCESCENS	D	Y	Unk	NI	MIIH
RAMARIA LARGENTII	D	Y	Unk	NI	MIIH
RAMARIA SPINULOSA VAR. DIMINUTIVA	S	Y	Unk	NI	MIIH
RHIZOPOGON EXIGUUS	S	Y	Unk	NI	MIIH
RHIZOPOGON INQUINATUS	S	Y	Unk	NI	MIIH
Vascular Plants					
ADIANTUM JORDANII	S	Y	N	NI	NI
ASPLENIUM SEPTENTRIONALE	D	Y	N	NI	NI
BOTRYCHIUM MINGANENSE	S	Y	N	NI	NI
CYPRIPEDIUM FASCICULATUM	D	Y	N	NI	NI
GENTIANA NEWBERRYI	S	Y	N	NI	NI
ILIAMNA LATIBRACTEATA	D	Y	N	NI	NI
KALMIOPSIS FRAGRANS	D	Y	N	NI	NI
LEWISIA COLUMBIANA VAR. COLUMBIANA	D	Y	N	NI	NI
LEWISIA LEANA	S	Y	N	NI	NI
OPHIOGLOSSUM PUSILLUM	D	Y	N	NI	NI
PELLAEA ANDROMEDIFOLIA	S	Y	N	NI	NI
POA RHIZOMATA	S	Y	N	NI	NI
POLYSTICHUM CALIFORNICUM	D	Y	Y	NI	NI
ROMANZOFFIA THOMPSONII	D	Y	Y	NI	NI

S	Suspected to occur on the Umpqua National Forest
D	Documented occurrence on the Umpqua National Forest (as of 2007)
NI	No Impact
MIIH	May impact individuals or habitat but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species.
WOFV	Will impact individuals or habitat with a consequence that the action may contribute to a trend towards Federal listing or cause a loss of viability to the population or species.
BI	Beneficial impact.

Results of the Field Reconnaissance

Intuitive controlled[72] and complete surveys, for botany species listed in Table 37, were conducted throughout 2007, by qualified botanical personnel. Non-suitable habitats in the units were field verified from appropriate vantage points or during travel between

[72] The proposed project area is traversed so that all major habitats and topographic features have been investigated. Potential habitats receive a complete survey.

suitable potential habitats. The surveyors followed appropriate taxonomy[73] and applicable protocols listed in the references section.

Effects to Sensitive Species

Peltigera pacifica

There are two sites of *Peltigera pacifica* located within the proposed planning area (see Lichens in Table 37). All of the populations are located within unit boundaries. Although this species has a wide geographic range, it is rare in distribution and occurs within the Northwest Forest Plan area. In addition to these four sites, there are an additional 25 sites scattered throughout the Umpqua National Forest. *P. pacifica* is found on soil, moss, rocks, logs, and trees bases in moist, low elevation forests (McCune and Geiser 1997). Buffers associated with the Riparian Reserves and possibly Late-Successional forest types in which this species is found should assist in protection of the species and its habitat (USDA Forest Service, USDI Bureau of Land Management 2004). All sites are within or adjacent to riparian reserves and would be protected by a 100 ft. radius, no-entry buffer.

Direct, Indirect, and Cumulative Effects

Alternative 1 would take longer to develop late-successional forest characteristics, in comparison to the action alternatives. By not thinning and treating for fuels, the densely stocked units may be more susceptible to stand replacement fires, which would delay the process of developing late-successional habitat for *P. pacifica*. Delaying successional development is considered an adverse trend to the survival and propagation of *P. pacifica*. The action alternatives would have no direct or indirect effects due to the implementation of 100-foot no-entry buffers around the known sites of this lichen. The action alternatives would not cause any adverse cumulative effects to Pacific felt lichen since there are no direct or indirect effects. There are no differences between the action alternatives with regard to potential impacts to this species. Therefore, it is determined that the alternatives would have "No Impact" on *Peltigera pacifica.*

Polystichum californica

There is one site of *Polystichum californica* located within a proposed harvest unit. This species is an evergreen fern that can be found in almost any ecological niche although it is typically found in moist areas and shaded habitats. It is known mostly from the Coast Range of northern California with isolated occurrences as far north as western Washington. Known sites on the Forest are located on the North Umpqua and Diamond Lake Ranger Districts and are between 1,280 – 3,550' in elevation (Helliwell 1998). Alteration of the microclimatic habitat brought about by timber harvest, fire, or windthrow can threaten populations of *P. californica*,

Direct, Indirect, and Cumulative Effects

Alternative 1 would take longer to develop late-successional forest characteristics, in comparison to the action alternatives. By not thinning and treating for fuels, the densely stocked units may be more susceptible to stand replacement fires, which would delay the process of developing late-successional habitat for *P. californica*. Delaying

[73] Plant taxonomy is consistent with Abrams 1960, Arora 1986, Derr et al. 2003, Hickman 1993, Hitchcock and Cronquist 1973, Hitchcock et al. 1969, Lawton 1971, Lesher et al. 2003, McCune and Geiser 1997, Schofield 1992, USDA/USDI 1999, and Wagner and Christy 1996.

successional development is considered an adverse trend to the survival and propagation of *P. californica*. The action alternatives would have no direct or indirect effects due to the implementation of 100-foot no-entry buffers around the known sites of this lichen. In addition to the 100-foot no-entry buffer, the location of this species resides on a corner section of the unit that has been removed from the unit as a result of buffering and will not be subjected to any logging activities. The action alternatives would not cause any adverse cumulative effects to *P. californica* since there are no direct or indirect effects. There are no differences between the action alternatives with regard to potential impacts to this species. Therefore, it is determined that the alternatives would have "No Impact" on *P. californica.*

Romanzoffia thompsonii

There are three known sites of *R. thompsonii* located within the proposed timber sale planning area. Of these populations, none of them are located within any of the proposed sale units. It grows in vernally moist seeps on rock outcrops in fully-open to partially-shaded sites at elevations from 1,000 to 4,500 feet (Helliwell 1998). Currently, this plant is known from the western Cascades and foothills in Douglas, Jackson, Linn, Lane, and Marion counties.

Potential threats are numerous and range from non-native species to activities that alter hydrology such as road building, water diversions, logging, groundwater pumping, and development of rock quarries (Helliwell 1998). So far populations appear to be stable, but the species was only described in 1996, and it is not possible to assess what the historic population trend has been.

Direct, Indirect, and Cumulative Effects

Alternatives 1, 2, 3, and 4 would have no direct or indirect effect to *R. thompsonii* because the known sites occur outside of any of the proposed units and would not be affected by any proposed or connected actions. The proposed project road construction would not affect *R. thompsonii* habitat nor the hydrology associated with the planning area occurrence.

Under the no action alternative, if wildfire were to occur within *R. thompsonii* unique habitat when it is in fruit, the seeds would not likely be affected because of moist soil conditions of the seeps where it grows. Fire could provide benefits such as invasive plant reduction or removal and reduction of accumulated duff layers that may prevent seeds from germinating. Neither the no-action nor the action alternatives would cause adverse cumulative effects to *R. thompsonii* since there are no direct or indirect effects. Therefore, it is determined that the alternatives would have "No Impact" on R. thompsonii.

Fungi

Although data published on the habitat requirements for rare fungi is only broadly described (Auorora 1986, Castellano et al. 1999, Castellano et al. 2003, Exeter et al. 2006), modeling performed by York and Heliwell (2007) indicates that there is suitable habitat for *Ramaria amyloidea, R. aurantiisiccescens,and R. largentii.* There is only one known site of the sensitive fungi species, *Ramaria largentii,* found within the Emile Timber Sale Project Area. The proposed timber harvest targets second-growth stands

that appear to represent poor habitat for most sensitive species of fungi, which are generally thought to favor older stands.

Modeling performed by York and Heliwell (2007) indicates that there is no suitable habitat for *Turbinellus kauffmanii* in the Emile planning area.

The locations of *Pseudorhizina californica (Gyromitra c.)* on the Forest occur along wetland and riparian ecotones, so its habitat is protected by no-harvest buffers within the riparian reserves.

Boletus pulcherrimus could possibly occur within the planning area. There is a single known site on the Forest of *B. pulcherrimus* along the North Umpqua Trail, one site of C. *barlowensis* on the Cottage Grove Ranger District, and a site *of L. citrinus* south of Cavitt Falls on Roseburg BLM. Although these species are thought to be associated with old-growth stands, the described habitat for each of these species is rather general, but is consistent with stands within the planning area. There is also a reasonable chance that that *Ramaria amyloidea, R. aurantiisiccescens, R. largentii, Turbinellus kauffmanii, Rhizopogon spp.,* and *D. rubra* could occur within the planning area.

Direct, Indirect, and Cumulative Effects to Fungi

The "no action" alternative would not result in any direct or indirect impacts to sensitive fungi and their mycelial networks due to the absence of ground disturbing activities. Under the action alternatives, there is the potential for direct adverse impacts to the aforementioned species, were they to be present in the proposed units. Activities associated with removal of host trees would disrupt the networks of fungal mycelia within the top few inches of the soil (Kranabetter and Wylie, 1998; Amaranthus and Perry, 1994). However, all the prescriptions retain between 50 and 90 trees per acre (tpa). Retention of these trees would leave refugia for the suspected fungi which could contribute, if needed, to re-colonization (Luoma et al. 2006). As these thinned stands develop late successional characteristics species within the refugias are expected to re-colonize the thinned stands. There is also the potential for indirect impacts to sensitive fungi due to the alteration of habitat quality from the opening of the canopy, soil disturbance, and short-term disruption of down wood recruitment. Based on the preceding discussion, all action alternatives may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the populations or species.

Past ground disturbing activities, such as timber harvest and road building (Table 7), removed and degraded habitat for fungi in the planning area. However, approximately 38% of the planning area exists as late-successional habitat and an additional 25% is in the same age class/condition as the Emile units (i.e. stem exclusion stage), thus, potential suitable habitat remains relatively abundant in the planning area. Potential impacts associated with this project are minor as are potential impacts associated with ongoing and future projects (Tables 8 and 9). Thus, no meaningful cumulative impacts are expected under any action alternatives.

Rare or Uncommon Species

Pre-field review indicated potential habitat for a *Cypripedium montanum* and no potential habitat for *Platismatia lacunosa* (Table 38) Rare or Uncommon Species. This review consisted of consultation and analysis of Umpqua National Forest database records, aerial photographs, survey protocols for lichens, bryophytes, and vascular species,

previous botanical survey records, USGS topographical maps, and working knowledge of the area. Each species on the Umpqua National Forest Sensitive Species list and Rare or Uncommon Species list was considered.

Direct, Indirect, and Cumulative Effects

Because there were no Rare or Uncommon Species located within the project area there are no direct, indirect or cumulative effects associated with any of the alternatives and connected actions; therefore the implementation of any of the alternatives would have "No Impact" on these species.

Table 38. Rare or Uncommon Species

Effects to other Rare or Uncommon Species				
Scientific Name	**Known Umpqua Occurrence**	**Potential Habitat**	**Results of Survey**	**Risk Assessment**
PLATISMATIA LACUNOSA	D	N	N	NI
CYPRIPEDIUM MONTATUM	D	Y	N	NI
S Suspected to occur on the Umpqua National Forest				
D Documented occurrence on the Umpqua National Forest (as of 2007)				
NI No Impact				
MIIH May impact individuals or habitat but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species.				
WOFV Will impact individuals or habitat with a consequence that the action may contribute to a trend towards Federal listing or cause a loss of viability to the population or species.				
BI Beneficial impact.				

Vascular and Non-Vascular Species (Non-TES)

There is an abundance of vascular and non-vascular plants located within the planning area. Many of these species, including invasives, can be found adjacent to roads. During times of increased road activity, these species can be subjected to an increase in the amount of dust being translocated onto the surface area of the plants. The proposed action includes using magnesium chloride (MgCl) on the roads for dust abatement. Concern for the potential effects of magnesium chloride on roadside vegetation was an issue identified during scoping. This issue did not drive development of an alternative; however, requested disclosure is included in this section.

Direct, Indirect, and Cumulative Effects

Alternative 1 would not result in any direct or indirect effects because there would be no increase in vehicular traffic associated with a no-action alternative. Alternatives 2, 3, and 4 would contribute to an increase in vehicular traffic and as such could result in increased depositions of dust on resident plants. Increased dust deposits can have substantial effects on plant life including reduced photosynthesis, increased incidence of plant pests and diseases, and reduced effectiveness of pesticide sprays (McCrea 1984). The use of MgCl under the action alternatives would minimize the amount of dust being deposited on roadside plants.

Past research has demonstrated that there are some negative impacts associated with the application of MgCl as a dust abatement strategy. Negative impacts to tree growth (Foley et al.,1996, Hanes et all., 1976, and Hanes et al., 1970) and alterations in plant nutrition resulting from altered soil osmotic pressure (Sanders and Addo, 1993) were observed. There have also been observations of browning occurring in some roadside vegetation where MgCl has been applied to the roads.

For Alternatives 2, 3, and 4, potential effects to vascular plants resulting from the application of MgCl could be weakened responses to infection and increased mortality of vegetation. An increase in mortality of roadside vegetation would leave room for an increase in the introduction of invasive species. Repeated application of MgCl on the system roads could result in an accumulation of this dust suppressant and an increase in the amount of invasives that grow alongside the roads. However, potential effects to vegetation would be reduced through required mitigation that prohibits spraying of dust abatement within 1 foot of the outside edge of road ditchlines and within 25 feet of streams; and by limiting application of MgCl to typically once a season. Due to both required mitigation and the limited scale of this activity, the consequences of any direct, indirect, or cumulative effects would be minimal to the majority of the plants; and any plant responses brought about by MgCl would be short lived.

Although there are no known current studies examining the effect of dust suppressants on non-vascular plants, there could be direct effects associated with the rehydration of exsiccated[74] plants under the action alternatives. Due to the sensitivity of some lichens and mosses to heavy metals, there could also be indirect effects associated with uptake and storage of magnesium within the organism itself which would have deleterious effects to the organism as a whole. However, as described above, due to project design features and mitigations, as well as the limited scale of the proposed chemical dust abatement, potential negative impacts to non-vascular plants are considered to be of minimal consequence.

MgCl was not typically used for dust abatement on timber sale haul routes until approximately the mid 1990's on the Umpqua National Forest. Past timber harvest in the planning area since this time period is limited in scale (Table 7) and thus, application of MgCl in the planning area has also likely been limited. The only known use of chemical dust abatement treatment in recent times in the Emile planning area was in 2002 when MgCl was applied to sections of Little River Road (FS Road 27) during fire suppression activities. There are no other known current or forseeable projects that would apply MgCl (Tables 8 and 9). Thus, due to the limited impacts of this project as mitigated, when combined with past, present, and foreseeable future projects, there are no anticipated meaningful cumulative impacts to vascular or non-vascular plants associated with any of the action alternatives.

Aquatic Environment

The proposed action and its relationship to the aquatic environment were assessed during the scoping process. Concerns were raised over impacts of new temporary road construction. This road issue was addressed in the development of Alternative 3, and the effects related to this issue are disclosed in this section and under the Terrestrial and Social Environments.

[74] Exsiccated refers to a dried condition. Exsiccation is common for non-vascular plants during times of drought.

Multiple concerns were also raised during scoping over impacts to water quality and Riparian Reserves (see Chapter 1). Many of these issues were addressed by the application of mitigation measures and standards and guidelines that lessen activity impacts. The effects related to these concerns are also disclosed in this aquatic section.

The compatibility with the objectives of the ACS is discussed in this section of Chapter 3 and under the headings of Forest Vegetation and Unique Habitats in the Terrestrial Environment section of this Chapter. The results of watershed analysis are presented, a description of the existing condition of the important physical and biological components of the ACS are discussed, and conclusions are presented regarding how the alternatives move conditions toward desired conditions in terms of all nine ACS objectives which include:

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.

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

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. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

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.

9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

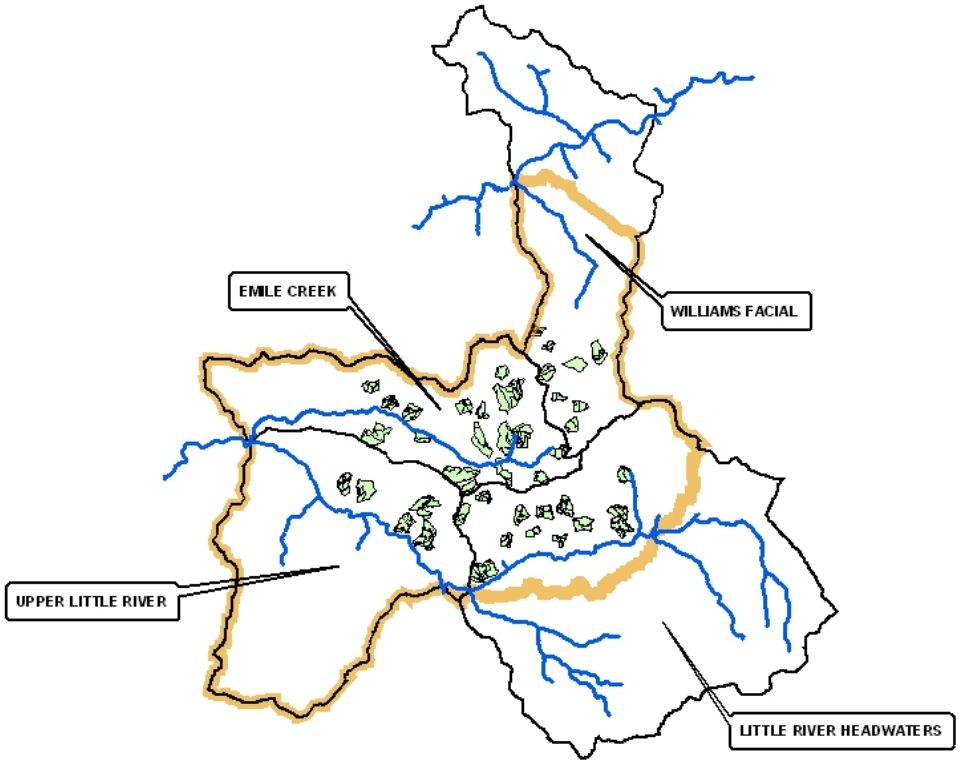


Figure 20. The four subwatersheds that subdivide the Emile Planning Area with the Proposed Action units.

The Emile planning area encompasses the Upper Little River and Emile sub-watersheds and portions of the Little River Headwaters and Williams Facial. The Williams Facial sub-watershed is part of the Middle North Umpqua watershed while the other three subwatersheds are part of the Little River Watershed (Figure 20, Table 39).

Table 39. Summary of 6th Level Subwatersheds that are included in the Emile Planning Area.

Subwatershed Name 6th Level	Watershed Name 5th level	Total Acres	Acres in Planning Area	Subwatershed Stream Density (miles/mile^2)	Subwatershed Fish Bearing Stream Miles (Class I & II)
Upper Little River	Little River	13,355	13,355	4.0	9.2
Emile	Little River	8,718	8,718	3.7	8.0
Little River Headwaters	Little River	22,371	7,434	4.7 (5.2)*	24.3 (6.5)*
Williams Facial	Middle North Umpqua	12,417	5,975	4.0 (4.2)*	13.3 (3.6)*
Totals:	---	56,861	35,482	---	54.8 (27.3)

* Numbers in parentheses are within the planning area.

BENEFICIAL USES OF WATER

To meet the Clean Water Act and standards and guidelines in the Umpqua National Forest Plan (watershed standard and guideline 1), the beneficial uses of waters must be identified and management activities planned so they would not interfere with or be injurious to the beneficial uses of adjacent and downstream waters. The relevant beneficial uses of the North Umpqua River and its tributaries, including Little River as determined by Oregon Department of Environmental Quality are: 1) public and private domestic water supply; 2) industrial water supply; 3) irrigation; 4) livestock watering; 5) resident fish and aquatic life; 6) wildlife and hunting; 7) fishing; 8) water contact recreation; and 9) aesthetic quality (ODEQ, 2003).

Relevant Standards and Guidelines

The relevant standard and guidelines from the Umpqua LRMP related to water quality include:

Water quality/riparian area S&G 1: All effective shading vegetation would be maintained on perennial streams unless a site-specific assessment shows that shade removal will not result in water temperature increase or degrade aquatic habitat.

Water quality/riparian area S&G 5: Streams would be designated for protection on timber sale maps (e.g.; Timber Sale Contract provision B6.5).

Water quality/riparian area S&G 12: The application of best management practices (BMPs) for the protection of water quality and beneficial uses (e.g.; fish habitat or potable water) would be monitored where ground disturbing activities occur.

Watershed cumulative effects and water quality, S&G 1: The beneficial uses of water must be identified and management activities planned so they would not interfere with or be injurious to the beneficial uses of adjacent and downstream waters.

Watershed cumulative effects and water quality S&G 2: Beneficial uses of water and aquatic habitats would not be degraded by turbidity, sediment, or scoured stream channels caused by timber harvest, road construction, and related activities.

Watershed Analysis Recommendations

The 1995 Little River and 2001 Middle North Umpqua watershed analyses (WAs) recommend restorative thinning in riparian reserves. In addition, the Northwest Forest Plan Temperature TMDL Implementation Strategies (USDA/USDI, 2005) balances thinning and the retention of stream shade. Buffer width deviation on perennial streams less than the strategy recommendations would require a separate temperature analysis in order to determine the acceptability of size and extent (spatial and temporal) of the effect and lead to a long-term ecological benefit.

WATER QUALITY

Existing and Desired Conditions

A combination of naturally occurring hydrologic conditions and past management practices have resulted in elevated summer stream temperatures in the majority of streams in the planning area. Early studies with small steams in western Oregon found that solar radiation was the primary source of energy causing summertime water

temperature increase when streamside vegetation was removed. Removal of stream shade during timber harvesting was a common practice from initial entry into the watersheds in the 1940's through the early 1980's on Forest Service land. Flooding and debris torrents also contributed to the loss of stream shade and wider channels. Substantial riparian vegetation removal along perennial streams has contributed to increased stream temperatures. In the early 1980's riparian buffers were utilized; however these buffers were not always adequate for maintaining stream shade. Only after the Northwest Forest Plan in 1994 was shade and other riparian dependent functions consistently addressed through riparian reserves along all streams. Low base flows typical of the Western Cascades contribute to conditions which result in relatively high, naturally occurring summer stream temperatures.

The Oregon Department of Environmental Quality (DEQ) water quality standards are applied to protect the most sensitive beneficial uses in a waterbody. Oregon's stream temperature standard is designed to protect cold water fish (salmonids) rearing and spawning as the most sensitive beneficial use. Numeric criteria in the temperature standard were developed to protect different aspects of the life histories of salmon and trout: spawning, rearing and migration. This biologically-based criterion requires the seven-day moving average of the daily maximum temperature shall not exceed 60.8^{o}F (16^{o}C) for the protection of salmonid and resident fisheries in core cold-water habitat.

PH has also been affected by the loss of riparian shade. Recent modeling (Oregon Department of Environmental Quality, 2001) for stream temperature and pH Total Maximum Daily Load (TMDL) in the Little River Watershed indicated that the past loss of riparian shade is the cause of elevated pH levels. PH modeling determined that Little River achieving the load allocations established for temperature would reduce periphyton growth and lead to the attainment of the water quality standards for pH. Emile Creek was not modeled but due to the similarities of climate, substrate, algal species and ecoregion it can be assumed that bringing temperatures to system potential shade would result in slowing the algal growth rate to the point where pH would remain within the water quality standard of 6.5 to 8.5 (DEQ, 2001).

DEQ has identified water quality limited streams throughout the State of Oregon as required by the Clean Water Act, Section 303(d). Little River, Emile and the North Umpqua all exceed temperature standards (Table 40). The temperature exceedances occur during the summer months, for salmonid fish spawning and/or rearing. Little River and Emile Creek are also listed for pH criteria.

Table 40. Temperature and pH Listings in the Planning Area.

Waterbody Name	River Mile	Parameter	Season
Emile Creek	Mouth to Headwaters	Spawning and Rearing Temperature	Summer
Emile Creek	0-1.0	pH	Summer
Little River	Mouth to Hemlock Creek	Rearing Temperature	Summer

Waterbody Name	River Mile	Parameter	Season
Little River	Mouth to White Creek	pH	Summer
North Umpqua River*	Mouth to Steamboat Creek	Rearing Temperature	Summer
Little River	Mouth to Hemlock to Headwaters	Sediment	--

*Just downstream of planning area boundary.

The Northwest Forest Plan (NWFP) provides for long-term maintenance of water quality in conjunction with allowing vegetative treatment necessary or desirable to restore ecological health in riparian areas that have been previously harvested or affected by fire exclusion or other disturbance. The Forest Service and Bureau of Land Management (BLM) sought concurrence with DEQ that the standards, guidelines and practices identified in the NWFP are sufficient for protecting and restoring stream temperatures. Working cooperatively these agencies developed a streamlined approach that meets DEQ's expectations for stream temperature compliance under the Clean Water Act. This methodology recognizes that thinning prescriptions that are protective of vegetation that produces shade during the period of greatest solar radiation, and that limits the loss of vegetation that produces shade during the rest of the day, will ensure benefits for effective shade over the long-term. It also recognizes that thinning outside the primary shade zone[75] can benefit effective shade over the long-term within overstocked stands by accelerating tree growth.

The desired condition is the maintenance of water quality in keeping with ACS objective 4, while moving stem exclusion forest stands toward the desired range of natural variability.

Direct and Indirect Effects

Direct effects in the context of water quality are those that would occur in planning area streams within a unit. Direct effects are triggered immediately as a result of the Emile alternatives. Indirect effects are those that could either occur later in time or downstream of a unit at the drainage or larger scale.

Alternative 1 would result in no direct or indirect effects to water quality, since no riparian trees would be cut along any perennial streams that could affect stream shade and influence stream temperature and pH. No ground disturbing activities would occur that would accelerate sediment delivery and reduce water clarity (measured by turbidity).

Thinning trees under Alternatives 2, 3, and 4 would not have a direct or indirect effect on stream temperature or pH since no riparian trees would be harvested along any perennial stream. The silvicultural prescription requires the retention of a minimum 60-foot no-harvest buffer on all perennial streams thereby retaining the effective shade in

[75] The primary shade zone consists of the trees that intercept solar radiation during the hottest portion of the day and year. The primary shade zone can vary from 12 to 60 feet depending on slope and tree height.

the primary stream shade zone along all perennial streams. Thus, no measurable increase in stream temperature or pH due to riparian shade removal is anticipated under these alternatives in any streams within or downstream of the planning area due to riparian thinning. The treatment would benefit stand development by reducing stand density and accelerating the development of large trees.

The presence of instream aquatic plants can have a profound effect on the variability of pH throughout a day and from day to day. In the Little River, the emphasis is on attached algae (periphyton) which cling to rocks and other substrate. Nitrogen, phosphorus, light availability, and stream temperature are all parameters necessary for supporting periphyton growth.

While clear-cut harvesting can release nitrogen that can leach to adjacent surface waters during runoff periods (Brown, 1972 and 1973; Sollins et al. 1980; Sollins and McCorison, 1981; Harr and Fredriksen, 1988; MacDonald et al. 1991; Beschta et al, 1995), thinning treatments typically do not result in nitrogen delivery to streams. Nitrogen leaching to surface water is directly proportional to the size (clear-cut versus thinning and small gaps) of created openings (Prescott, 2002; Lindo and Visser, 2003). Harvesting the same proportion of trees as single trees reduces the likelihood of nitrogen losses to the soil and potentially to the local streams. Release of nitrogen associated with the gaps, which are in all action alternatives, would probably elevate mobile nitrogen at the site scale in the surface soil, but not deliver additional nitrogen to streams. This is because of the limited amount of released nitrogen, which would be utilized on-site in the soil by microbial activity or taken up and used by the residual trees (MacDonald et al. 1991). Therefore, nutrient levels in the streams near harvest units and further downstream would remain the same as before treatment under all the action alternatives.

The Little River TMDL stated that there is little reason to believe that nutrients can be reduced to concentrations needed to limit algal growth in the Little River (DEQ, 2001). It was determined by pH modeling that achieving the load allocations established for temperature would reduce periphyton growth and lead to the attainment of the water quality standards for pH in Little River. The rate of periphyton growth is limited by the availability of light, nutrients, and water temperature. In a situation where the available light for periphyton growth is at an optimum level and nutrients are plentiful, then the growth of periphyton would be dependent on the temperature effect (Thomann and Mueller, 1987).

The underburning of activity fuels within riparian reserves would likely not impact the overall effective shade. All the action alternatives include underburning on less than 20% of the total thinned acreage. The mitigation measures of underburning during moist conditions and not igniting fire inside shade buffers largely reduces the risk of killing overstory trees and impacting the stream shade.

Although the underburning would potentially release nitrogen to the soil, the mobile nitrogen would remain local and utilized on-site by microbial activity and/or vegetation. Since prescribed fire would not consume large amounts of organic matter (carbon), the surface carbon would help to “hold” fire-released nitrogen at the site (Brady, 1990).

The action alternatives would cause short-term direct and/or indirect turbidity and sediment bearing nutrient release effects from in-stream work (crossing repair, temporary road reconstruction and removal). Road reconstruction under Alternatives 2, 3, and 4 would address on-going turbidity sources and associated nutrient input. For all the alternatives, no new road stream crossings would be constructed. However, the

removal or repair of three existing crossings would occur under all the action alternatives as well as the construction of rolling dips to lessen diversion potential at 10-15 additional stream crossings reducing the risk of sediment delivery and fluvial erosion. Alternative 3 has 0.54 miles of road reconstruction within the Riparian Reserve and Alternatives 2 and 4 have 0.66 miles therefore effects are anticipated to be less under Alternative 3.

The use of Best Management Practices and project design features (see Chapter 2) for the reconstruction or removal of each crossing, including timing of in-stream work and erosion control measures, would minimize effects at the immediate work site and downstream through the first winter season. All the action alternatives would cause in-stream work induced turbid water with potential sediment bearing nutrient release. This direct effect would be short-term and only occur during in-stream work and mitigated from carrying downstream through the BMPs and design features. Direct and indirect effects (turbid water and nutrient release) in response to rain and runoff would be short-term (one season) during the wet season and difficult to discern from background runoff turbidity. These effects would not be expected as mitigation measures (erosion control) become effective with time (by the second season).

Although Alternative 1 would not have the in-stream work effects, the long-term direct and indirect erosion and nutrient release effects at these crossings from chronic road drainage problems would not be fixed. Over the long-term (by the second season), the action alternatives would correct chronic road drainage problems providing a benefiting water quality trend while Alternative 1 would not.

Wet season haul on gravel roads requires administrative attentiveness in order to protect water quality. The Best Management Practices (see Chapter 2) identify the Umpqua Road Rules, which call for suspending work when either road or environmental damage such as stream turbidity is predicted. The implementation of the Road Rules would prevent direct and indirect impacts to water quality.

The connected action common to Alternatives 2, 3, and 4 that would potentially have an influence on water quality includes tree falling in small streams. Tree falling would occur directly downstream of temporary road reconstruction sites that would be decommissioned after harvest. These logs would promote sediment storage and channel stability, but would cause a direct short-term (during placement) turbidity effect and possibly an indirect short-term (first wet season) turbidity effect until mitigation measures (erosion control) become effective (see Riparian Forest section in this Chapter). The indirect short-term turbidity effect during the wet season would be difficult to discern from background turbidity, which is a similar impact to the road crossing work that was previously discussed. While there are short-term impacts, they are outweighed by the long-term benefits of sediment storage and stabilization of the stream channels.

Cumulative Effects

Past harvesting of perennial stream shade occurred up until about the early 1980's on the Forest Service land within the watershed. Loss of stream shade has contributed to past elevated stream temperatures and pH in planning area streams until the recovery of stream shade. These past harvest activities have been identified in the past activities cumulative effects table (Table 7). However, areas harvested prior to the early 1980's would today be nearly recovered.

Alternative 1 would result in no direct or indirect effects to water temperature, pH, or turbidity to incrementally add to possible downstream heating, algae responses, or

stream turbidity due to past, present or reasonable foreseeable future disturbance. Therefore, Alternative 1 would not have a cumulative temperature, pH or turbidity effect.

Alternatives 2, 3, and 4 would protect the effective shade along perennial streams. Therefore, no accumulative temperature effect would occur.

The action alternatives and connected actions would cause short-term direct and/or indirect turbidity and sediment bearing nutrient release effects from in-stream work. Since the spatial extent of the effect would be for the immediate stream, only similar activities on the same stream would influence a cumulative effect. However, no other activities would incrementally add to past, present, or reasonably foreseeable similar effects in these streams. Beneficial uses of water and aquatic habitats would not be degraded by pH, turbidity, or scoured stream channels caused by timber harvest, road construction, and related activities as identified in the watershed cumulative effects and water quality standard and guideline 2. Therefore, no cumulative pH or turbidity effect would result from these action alternatives.

Aquatic Conservation Strategy

As disclosed above in this water quality section, no prolonged or adverse impacts to water quality or the associated beneficial uses of water are expected from any of the proposed activities in any of the action alternatives including those actions occurring in the riparian reserve land allocation. As such, the long-term trend of improving water quality in the watershed will not be set back; water quality in planning area streams would continue to support healthy riparian, aquatic and wetland ecosystems consistent with ACS objective 4. Since the action alternatives apply all relevant standards and guidelines, and since they were developed to restore riparian ecosystem health at the stream reach and landscape scale, they are also in keeping with the overarching intent of the Aquatic Conservation Strategy (USDA/USDI, 1994).

STREAM FLOWS

The streamflow regime of the Emile Planning Area is influenced by Western Cascades geology. The Western Cascades streamflow regime responds rapidly during winter runoff events. The streamflow regime has large annual flow fluctuations between summer low flow and winter high flow.

Relevant Standards and Guidelines

The relevant standard and guidelines from the Umpqua LRMP related to streamflow include:

Watershed cumulative effects and water quality, S&G 2: Beneficial uses of water and aquatic habitats would not be degraded by turbidity, sediment, or scoured stream channels caused by timber harvest, road construction, and related activities.

Watershed cumulative effects and water quality, S&G 4: Beneficial uses of water and aquatic habitat (water quality) would not be degraded by increased peak flows caused by canopy removal from timber harvest, road construction, and related activities.

Existing and Desired Conditions

The planning area is mostly within the transient snow zone, between 2,000 to 5,000 feet in elevation, where winter peak flows are an important fluvial process. In this zone, warm rain can follow a colder snow storm causing rapid snowmelt. In the Upper

Willamette sub-basin, 88% of floods with a return period of greater than 6 years were associated with rain-on-snow events (Harr 1979, Christner 1981). Sizeable canopy openings can result in greater snow accumulation and more rapid snowmelt compared to locations lacking large canopy openings.

The forest canopy has a major influence on snow accumulation, distribution, and melting rates. The Umpqua Forest Plan requires an analysis of forest canopy conditions (standard and guideline 4, listed above). An area is considered fully recovered when the canopy closure is 70% and the average tree diameter is eight inches (USDA, Umpqua NF, 1990). The hydrologic recovery level represents an area compilation of forest canopy re-development following disturbance. It also represents the potential influence on the streamflow and stream channel effects from floods. A hydrologic recovery of 75% or greater would maintain current peak flows and avoid adverse change to physical channel condition and associated factors such as water quality and fish habitat. Statistically discernible increases in peak flows have occurred when greater than 25% of smaller drainages have been clear-cut harvested and included roads; that is, the hydrologic recovery was less than 75% (Jones and Grant, 1996; Thomas and Megahan, 1998). Conditions below the 75% hydrologic recovery value (i.e.; lower levels of hydrologic recovery) need further evaluation for potential peak flow cumulative effects from rapid snowmelt during rain-on-snow storms (following S&G 4).

The hydrologic recovery levels for the Emile planning area are currently above the 75% level of concern. The current hydrologic levels are displayed in Table 41.

Table 41. Current Hydrologic Recovery for the Planning Area[76].

Subwatershed*	Area (acres)	Hydrologic Recovery
Emile Creek	6,429	93%
Upper Little River	3,731	93%
Little River Headwaters (within Planning Area)	7,429	90%
Williams Facial (Cougar Creek Drainage)	5,981	93%

*Assumes no canopy on the private land within the Forest Service boundary.

Some studies have proposed that forest roads on steep slopes may intercept subsurface flow and hasten its arrival as surface flow to stream channels (Montgomery, 1994; Wemple et al, 1996). A recent study found that in seven of eight small catchments studied (25-625 acres) the subsurface flow interception effect by roads produced moderate (13-36%) increases of large (>1 return period) peak discharge events and increases persisted for decades (Jones, 2000). The planning area is composed of many smaller catchments of this size range that contribute to larger drainages.

[76] Upper Little River includes only the southern portion of the subwatershed of Little River where harvest is planned. This is a facial drainage so any harvest related peak discharges would be attenuated once entering the mainstem of Little River due to scale. Emile Creek includes only areas within the FS boundary also due to scale.

Interception of ground water at road-cuts and the extension of the channel network through the road ditches with too few relief culverts can potentially alter the timing of water delivery to the stream network. Road ditches draining into a stream and culverts with gullies below that connect directly to a stream channel can extend the stream network (Wemple et al, 1996). There are many stream crossing culverts that are connected to ditches greater than 300 feet within the planning area.

The desired condition is the protection of flow regimes in keeping with ACS objective 6, while moving stem exclusion forest stands toward the desired range of natural variability.

Indirect Effects and Cumulative Effects

The overall hydrologic recovery analysis of snow accumulation and melt utilized research that was done on the Umpqua and Gifford Pinchot National Forests. This research indicated that a shelterwood canopy can allow about 60% greater snowpack runoff than mature forest (Storck et al. 1999) at the site scale. Therefore, it is anticipated that there would be an approximate 40% canopy recovery condition for proposed thinning units with 50-70 trees per acre and no recovery for canopy gaps. Only 322 acres are thinned to 50-70 trees per acre under Alternatives 2 and 4 and 305 acres under Alternative 3. For the lighter thinning prescription of 70-90 trees per acre no meaningful reduction in recovery condition is anticipated.

Under Alternatives 2, 3 and 4, the proposed silvicultural treatments would increase the potential for snow accumulation in created gaps and in the thinned areas where overall canopy closure from 40-70 trees per acre would be less than 70% but greater than 50%. The remaining leave trees in the thinned areas would buffer any snowpack from rapid snowmelt during rain-on-snow events. The leave trees would break up the flow of warm wind across the snow pack and substantially mitigate the rapid melt process. Because of the thinning treatment and the recovery of past harvesting, the resulting reduced hydrologic recovery level in the planning area would remain above the level of concern at the drainage, subwatershed and watershed scales. Even under the assumption that all the proposed silvicultural treatments would retain no residual canopy, the hydrologic recovery level would still be above 75% at the subwatershed scale as described in Table 41.

Therefore, the hydrologic recovery would maintain current peak flows and avoid adverse change to physical channel conditions and associated factors such as water quality and fish habitat (consistent with S&Gs 2 and 4, listed above). No cumulative peak flow effect is expected under the action alternatives when considering past, present, or reasonably foreseeable future activities (Tables 7-9).

Aquatic Conservation Strategy

As disclosed above in this stream flow section, no impacts to flow regimes or the associated beneficial uses of water are expected from any of the proposed activities in any of the action alternatives including those actions occurring in riparian reserves such as restorative thinning, underburning, and planting. As such, the timing, magnitude, and duration of peak, high, and low flows are protected under all action alternatives, consistent with ACS objective 6. Since the action alternatives apply all relevant standards and guidelines, and since they were developed to restore riparian ecosystem health at the stream reach and landscape scale, they are also in keeping with the overarching intent of the Aquatic Conservation Strategy (USDA/USDI, 1994).

RIPARIAN RESERVES

The riparian reserve land allocation was established in the Northwest Forest Plan as part of the Aquatic Conservation Strategy (USDA/USDI, 1994). This riparian reserve analysis is based on the guidance in the Northwest Forest Plan which, in general, is defined for this analysis as one site potential tree height on non-fish bearing streams (either perennial or intermittent) and two site potential tree heights on fish bearing streams. A site potential tree height is the average maximum height of the tallest dominant tree at 200 years or older for a given area. The height of site potential trees in the planning area has been established at 180 feet.

The Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems. This strategy is in part based on natural disturbance processes. Proposed riparian actions are assessed in relation to the watershed's existing condition and any short or long-term effects to such conditions.

Existing and Desired Conditions

In the Emile planning area 37% of the riparian reserves within the Forest Service boundary have been previously clearcut. The previously clearcut riparian reserves are primarily Douglas-fir plantations presently in the stem exclusion stage. These stem exclusion stands are very dense and lack diversity due to the selection of Douglas-fir over other species during planting and precommercial thinning. If left untreated many stands are on a track to develop as closed, homogeneous stands that do not represent desired conditions for the riparian reserve land allocation.

Roads in riparian areas have the potential to limit shade and deposition of large wood and debris to streams and riparian areas over long time periods since permanent roads are long-term features. In the Emile planning area there are about 46.8 miles of permanent system road in the watershed's riparian areas within FS boundaries.

The planning area also has many miles of abandoned roads within or leading to historic thinning units. These dead-end roads were built in the 1950's and 1960's to haul logs out of the original clearcuts. These roads are referred to as "unclassified roads" by the Forest Service because they were built and left after logging and never evaluated as part of the long-term road system. Under today's practices, many of the abandoned roads in the Emile units would have qualified as temporary roads that would have been obliterated following logging use. A few of the abandoned roads located on slopes, and that lack surface rock, had long-term erosion problems that continue today.

The desired condition for the second-growth riparian reserves is a decrease in riparian area occupied by permanent roads, increased species and structural diversity, and lower risk of stand replacement fire in keeping with ACS objectives 2, 3, 8, and 9.

Relevant Standards and Guidelines

The standards and guidelines for riparian areas (as per the 1990 Umpqua National Forest LRMP) and riparian reserves (as per the1994 Northwest Forest Plans) specifically related to the Emile alternatives include:

Umpqua LRMP C-2-VIII, IX, X. Prohibit timber harvest and site preparation…except to meet riparian objectives. Yarding corridors are permitted at designated locations with full log suspension over the streambank and protected vegetation. Corridors must minimize disturbance to riparian vegetation and meet riparian objectives. Incorporate activities that minimize both prescribed fire and wildfire damage to riparian vegetation.

Northwest Forest Plan TM-1 (c). Prohibit timber harvest except where silvicultural practices are applied to control stocking, to acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.

Northwest Forest Plan FM-1. Design fuel treatments to meet Aquatic Conservation Strategy objectives, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression could be damaging to long-term ecosystem function.

Northwest Forest Plan FM-4. Design prescribed burning and prescriptions to contribute to attainment of Aquatic Conservation Strategy objectives.

Watershed Analysis Recommendations

1995 Little River and 2001 Middle North Umpqua Watershed Analyses:

- Both WA's recommend thinning in riparian areas of managed stands to meet watershed restoration objectives such as large trees for stream shading and down wood (Mid Nump WA pg. 135; Little River WA-pg. Recommendations-8, 16).
- Both WA's recommend a focus on thinning in overstocked managed, mid-successional (stem exclusion) stands with thinning prescriptions based on the concept of landscape areas and natural disturbance regimes[77] (Mid NUMP WA-pg. 123; Little River WA-pg. Recommendations-6,8).

2001 Middle North Umpqua Watershed Analysis:

- Reintroduce fire into late seral Riparian Reserves, especially in the streep/dry land (Mid Nump WA pg. 135).

Proposed Riparian Reserve Treatments

The action alternatives would apply restorative thinning to riparian reserves using various logging methods and activity fuel reduction techniques (Table 42).

Table 42. Thinning, fuel treatment, and logging activity proposed in riparian reserves.

Actions	Alt. 1	Alternative 2	Alternative 3	Alternative 4
Thinning in Riparian Reserves				
Total Riparian Reserve in commercial harvest units	N/A	570 acres	570 acres	570 acres

[77] Landscape areas are referred to as "land units" in the Little River WA and as landscape areas in the Middle North Umpqua WA.

Actions	Alt. 1	Alternative 2	Alternative 3	Alternative 4
Commercial Thinning in Riparian Reserves	0	425 acres (75%)	414 acres (73%)	425 acres (75%)
Precommercial thinning of nearby plantations	0	526 ac	526 acres	526 acres
Riparian gap creation	0	1.5 acres in 4 gaps	1.5 acres in 4 gaps	1.5 acres in 4 gaps
Fuel Treatments in Riparian Reserves				
Underburn	0	82 acres	82 acres	82 acres
Machine pile	0	139 acres	138 acres	139 acres
Hand pile burning	0	150 acres	150 acres	150 acres
Whole Tree Yard	0	5 acres	5 acres	5 acres
Total RR fuel treatments	0	377 acres	376 acres	377 acres
Logging Systems in Riparian Reserves				
Skyline	0	243 acres	238 acres	243 acres
Helicopter	0	16 acres	16 acres	16 acres
Mechanized	0	166 acres	160 acres	166 acres

The riparian reserve thinning prescriptions would be the same as in the adjacent uplands, which involves low thinning (where the smaller trees are harvested) combined with gap creation as detailed in the Forest Vegetation section of this Chapter. All action alternatives would create four gaps totaling 1.5 acres in the Riparian Reserve. Gaps would be placed outside the primary shade zone of perennial streams. The riparian reserve thinning would retain no-harvest buffers along intermittent stream channels with steep and/or potentially unstable banks to ensure that harvest activity would not disturb stream banks or beds. The exception is a few intermittent channels with gentle slopes where the risk of bank and streambed erosion has been determined to be very low. Thinning would occur along these channels with no buffers, but no trees would be yarded across the channels under any of the action alternatives.

Road work in the riparian reserve would be necessary in order to access the plantations for thinning and log haul (Table 43). No new temporary roads would be created in riparian reserves with only existing abandoned roads, skid trails or firelines utilized and obliterated after use.

Table 43. Road actions within Riparian Reserves to provide access for thinning.

	Alt. 1	Alternative 2	Alternative 3	Alternative 4
New permanent roads	0	0	0	0
New temporary roads (obliterated following use)	0	0	0	0
Reconstruct abandoned road, added to system	0	0	0	0
Reconstruct abandoned road, skid trails, or firelines; obliterate after use	0	0.66 miles	0.54 miles	0.66 miles
Change from existing condition	**0**	**0.66 miles less in Riparian Reserve**	**0.54 miles in Riparian Reserve**	**0.66 miles less in Riparian Reserve**

Finally one existing quarry in riparian reserves would be used as a helicopter landing under the all the action alternatives. This proposed helicopter landing is on the other side of a road and over 200 feet away from the stream.

Direct Effects

The direct effects to riparian forest conditions are defined as those occurring within the confines of the riparian reserve over the course of one to two decades.

The thinning and fuel treatments under the action alternatives would lower the existing canopy closure down to approximately 50-60% (depending on the thinning intensity) allowing more light penetration, resulting in warmer and dryer riparian forest conditions compared to Alternative 1. The thinning under the three action alternatives would also lower the rate of litter input to streams and the riparian forest floor which represents important nutrient cycling and food bases of aquatic and terrestrial organisms. This thinning effect may lower local populations of dependant aquatic organisms. Such effects would gradually subside as canopy closure returns over time (Figure 11). Chan et. al (2006) reported that percent skylight through the canopy following a variety of thinning treatments rapidly decreased by an average of 2% per year in the Oregon coast range as the crowns of leave trees and understory vegetation respond to the thinning with rapid growth.

Under the action alternatives, neither the gaps nor the general thinning surrounding such gaps are expected to exert unusual or extraordinary impacts to riparian forest conditions, since these activities approximate moderate severity fire that lowers tree density and creates pockets of dead trees and openings under the natural disturbance processes (Zenner, 2005). In contrast under Alternative 1, the absence of disturbance would maintain the stem exclusion stage and delay the development of late successional stand structures for many decades (Andrews et al., 2005).

The prescribed underburning can be expected to negatively affect existing down wood by consuming some of the advanced decay class logs now present on the riparian forest floor. It is also expected to increase the recruitment of new snags and down wood,

which would help to off-set these losses. Underburning is expected to create exposed soil and these areas are more prone to surface erosion and noxious weed introductions. These effects are typically short-term, since ground vegetation quickly recovers in the first two years following burning, so the magnitude of such effects would be limited. These impacts are described further in the soil and noxious weeds sections of this Chapter. The action alternatives are very similar in their amount of such burning so no real differences in effects can be expected among them.

The fuel treatments that apply fire to concentrated slash piles (machine pile and handpile burning) would also result in direct effects to riparian reserves in terms of site productivity and bare soil exposure. Such concentrated pile burning typically removes the soil duff, mineral soil can be exposed, and small, low mobility organisms can be killed. The extent of these impacts in riparian reserves is very limited since machine piles can be expected to affect about 5% of the acres displayed in Table 42, and hand piles about 3% of the treatment area displayed in Table 42.

Disturbance of riparian ground cover, vegetation, and small organisms associated with the fuel treatments are somewhat minimized because the concentrated slash piles would be burned during wet weather in fall when site impacts are minimized to the extent possible. A mitigation measure incorporated into the action alternatives requires that underburning burning occur during moist conditions where large down wood and duff are less likely to be completely consumed. This measure is expected to lessen impacts and meet standard and guideline FM-1.

The above direct effects from thinning and burning would occur on a small scale in terms of the riparian reserve network in the planning area. Moreover, no cut buffers on all perennial streams and most of the intermittent streams would help moderate these effects providing a cooler, dense forest paralleling all the buffered channels.

The logging in riparian areas, which was raised as a concern during scoping, would also result in effects to riparian conditions under the action alternatives. The ground-based logging would exert the most direct impact to riparian reserves due to soil and vegetation disturbance compared to skyline and helicopter logging[78]. Soil disturbance results in a loss of site productivity, and vegetation clearing results in habitat modification. Overall, Alternative 3 would result in slightly less logging impacts in riparian reserves than Alternative 2 and 4 because it would implement slightly fewer acres of ground-based logging. The actual amount of disturbance expected with the ground-based logging would be about 1/10 of the total ground-based logging acres displayed in Table 42, because skid trails typically affect about 10% of the area logged with ground-based systems.

Mitigation measures to minimize impacts from ground based logging include limiting the density of skid trails, restricting equipment entry to no closer than 50 feet from stream channels, and subsoiling of skid trails after use. These measures, detailed at the end of Chapter 2, are included in all action alternatives and function to lower the extent and intensity of the impacts disclosed above.

[78] Post-treatment monitoring of timber sales has revealed that the amount of disturbed soil varies by logging system with helicopter logging typically disturbing less than 1% of the surface of a given harvest unit, skyline logging disturbing up to about 4%, and ground-based logging disturbing about 10% of the surface of a harvest unit (USDA Forest Service, 1997).

Under Alternative 1, no soil disturbance or vegetation removal from logging or activity fuel burning would occur, thus no organisms would be killed, no bare soil would be exposed, and no productivity losses would occur in riparian reserves.

The instream wood erosion mitigation would have very limited small-scale, direct effects to riparian forest conditions due to the scattered nature of the riparian tree falling of 75 trees. The mitigation measure is designed to lessen impacts to stream channels due to temporary road reconstruction sites. Trees would be felled or lined from dense riparian stands with minimal change to immediate site conditions.

In summary, several types of direct adverse effects to riparian forest conditions can be expected to occur under all three action alternatives. The magnitude of these effects at the site-scale in relation to the planning area and the broader watershed scale are inconsequential. This is because both the extent and the duration of these impacts (as described above) are predicted to be low.

Indirect Effects

The indirect effects to riparian reserve forests are those that would occur within the riparian reserves of the Emile harvest units over the long-term (continue for more than two decades), or that would occur beyond the immediate Emile treatment areas.

The obliteration of existing abandoned roads within riparian reserves under the action alternatives (Table 43) would achieve the desired condition of fewer overall acres of existing road occupying the riparian reserve land allocation. Alternatives 2 and 4 would result in the largest net decrease of existing roads in the riparian reserves, and are therefore slightly better at achieving the desired condition of decreased area occupied by permanent roads compared to Alternative 3. Alternative 1 would result in no beneficial long-term effects from existing road obliteration in the riparian reserve land allocation.

Thinning under the action alternatives would lower snag and down wood recruitment rates compared to Alternative 1, by removing trees that would die from suppression mortality. The majority of the snag recruitment loss would be from smaller-sized trees (Figures 9-11) because suppression mortality typically kills smaller, suppressed trees rather than the larger dominate trees.

The large wood recruitment loss to perennial stream channels would be largely mitigated by the 60 foot no-cut buffers, since most of the wood that naturally recruits to streams comes from within the first 65 feet of the stream (Murphy and Koski, 1989; McDade et. al 1990). The three gaps proposed in the riparian areas would result in the most long-term impact to riparian snag and down wood recruitment because of the limited number of leave trees remaining in the gaps. However, these three small localized sites of lost recruitment only cover about 1.5 acres and are on the outer portions of the riparian buffers beyond the recruitment zone. The effects of this snag and down wood recruitment loss include the loss of habitat for aquatic and terrestrial species that depend on these habitat structures. Though habitats and habitat quality would be diminished, the small scattered extent of the thinning and gap creation is not expected to result in riparian species population declines. In the context of the riparian reserve network at the watershed level, this amount is inconsequential.

The action alternatives would result in long-term beneficial effects to riparian forest structure and composition with the development of more desired riparian structural conditions sooner than Alternative 1. As such, under the action alternatives, S&G TM-1 (c) would be met because the silvicultural practices applied to control stocking in the

riparian reserve contribute to meeting the desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.

The created canopy gaps would approximate a moderate severity fire, the process that historically created gaps and triggered the initiation of understory layers (Zenner, 2005). Establishment of shade-tolerant conifers is an essential step in development of the multilayered characteristics of old-growth (Franklin et al. 2002). The prescribed tree planting in the gaps would accelerate this process. Over time, the commercial thinning would also result in riparian stands attaining more characteristics of late seral forests compared to Alternative 1, thus meeting desired conditions for riparian reserves. These beneficial effects would gradually improve habitat connectivity for riparian dependant species that rely on late-successional forest conditions. The magnitude of these beneficial effects from the action alternatives are slight since only a small portion of the riparian reserve land allocation in the planning area would experience the benefits and the rate at which these effects would accrue over time is gradual.

The precommercial thinning in the riparian reserve allocation (Table 42) would also result in beneficial effects by moving stands toward the desired condition, because such thinning would accelerate the growth of riparian trees. Precommercial thinning of plantations has also been shown to be a useful management tool to encourage old-growth understory plants (Lindh and Muir 2004); neither of these beneficial effects would occur under Alternative 1.

STREAM CHANNELS

Streams in the planning area are primarily affected by roads that cross them or that exist near them, by the age of the adjacent forest that provides bank stability and large wood input, and by the effects of disturbance such as floods and fire. The impact to streams from the various forms of road work is disclosed in this section.

Existing Condition and Desired Condition

Many of the streams in the Emile planning area have experienced impacts from stream cleanout (removal of wood from the channel) and riparian forest clearcutting during the early decades of timber harvesting.

Aquatic connectivity in the planning area is affected by stream crossings that limit upstream passage of aquatic organisms and that constrict the flow of water during winter storms. There are numerous undersized stream crossing culverts in the vicinity of the Emile planning area that are restricting the passage of stream flow during large storm events. Undersized culverts can result in a crossing failure that can deliver substantial amounts of sediment to streams as well as creating conditions for chronic fluvial erosion. The desired future condition of the planning area would include a decreased risk of road-related stream diversion and stream crossing failure consistent with ACS objective 5 that addresses the sediment regime.

Riparian Reserve Road Standards and Guidelines from the Northwest Forest Plan

RF-2a. For each existing or planned road, meet Aquatic Conservation Strategy objectives by minimizing road and landing locations in riparian reserves.

RF-2e. For each existing or planned road, meet Aquatic Conservation Strategy objectives by minimizing disruption of natural hydrologic flow paths, including diversion of stream flow and interception of surface and subsurface flow.

RF-3. Determine the influence of each road on the Aquatic Conservation Strategy objectives through watershed analysis.

RF-3a. Meet ACS objectives by reconstructing roads and associated drainage features that pose a substantial risk.

RF-3c. Meet ACS objectives by closing and stabilizing, or obliterating and stabilizing roads based on the ongoing and potential effects considering short-term and long-term transportation needs.

Proposed Road Treatments in Stream Channels

All action alternatives would implement routine timber sale road reconstruction to achieve safe and effective haul conditions. None of the new temporary roads under the three action alternatives would cross any streams.

In addition to the above reconstruction done with the timber sale contract, the action alternatives would implement several connected actions at stream crossings (Table 45). This work is beyond routine timber sale reconstruction, and it is intended to lower risk of stream sedimentation at high priority, undersized stream crossings in response to standard and guidelines RF-3 and RF-2e.

Table 45. Instream Road Work at Stream Crossings.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Road work with the timber sale contract				
Replacement of undersized high erosion potential stream crossings	0	1	1	1
Reconstruction of abandoned stream crossings & obliteration (old fords)	0	4	3	4
Connected or similar actions				
Replacement of undersized stream crossings	0	2	2	2
Rolling-dips installed on erosion prone roads	0	10-15	10-15	10-15
Addition of Large Wood for Stream Channel Stabilization*	0	75 trees	75 trees	75 trees

* Located in small streams below abandoned stream crossings that are being reconstructed and obliterated.

Several mitigation measures are included as part of this instream road work in perennial channels (as detailed in the Road Reconstruction mitigation measures of Chapter 2) to lower or minimize the risk of water contamination and turbidity when equipment and workers are working in and near these streams.

Four of the abandoned roads that would be reconstructed and used under the action alternatives, presently cross small streams where they pose erosion problems (Table 45). These stream crossings continue to exert minor, localized problems because the crossings divert water or have the potential to divert water. These streams were originally filled in with dirt and/or logs to provide the road crossing. These problem crossings, located in units 14, 27, 37 and 39 are being reconstructed for use this entry and obliterated. In addition, up to 75 logs are being felled directly downstream of the stream crossing to improve channel stability and store and meter out sediment.

Direct Effects

The direct effects to stream channels are defined as those short-term effects at the immediate location of instream project areas over a period of up to 5 years. This is based on observations of the recovery time for inchannel and bank disturbances associated with road reconstruction, obliteration, and instream restoration projects.

The direct effects to stream channels from instream road work would be increased sediment input associated with implementing the work, with bare soil exposure throughout the area of the stream crossing work. Channel banks and beds would also be highly modified during these activities with equipment working on banks and within channels to excavate existing fill material surrounding the existing culverts and backfill around the new culverts. Fish would not be present at the stream crossings proposed for replacement or obliteration, since all crossings are located in non-fish bearing streams.

The reopening of existing closed roads and the blading activities on both open and re-opened closed roads can result in short-term increased sediment delivery and a direct effect to the beneficial uses of water compared to doing no blading and no reopening. This is due to the removal of vegetation and the loosening of soil surfaces making more material subject to erosion and water transport. However, by following Forest Plan Standards and Guidelines for only minimal ditch blading and by maintaining a functioning road drainage system without increasing flow from roads directly into streams, the road maintenance activities associated with the action alternatives would not substantially affect the timing, volume, rate and character of the sediment input, storage or transport.

The amount of sedimentation potentially delivered with each instream construction site is low with an expected 2 year duration (Table 46). This level of sedimentation from dispersed instream construction sites under the various action alternatives is minimal with respect to the overall sediment regime of the planning area. Moreover, the erosion control measures and restrictions on the timing of work (listed in Chapter 2 mitigations, under road reconstruction) would effectively lower both the extent and duration of the work-site sedimentation.

The work at stream fords and sections of road leading to the fords (Table 45) plus the subsequent haul across these small channels would result in new disruption of these previously impacted, but healed sites. These fords would occur on small perennial or intermittent streams, where rock would be added to allow trucks to cross the small channels without bogging down. The placement of rock and the shaping of the fords with heavy equipment to prepare them for truck traffic would result in sedimentation at the time the work is done in the perennial channels, or once winter rains begin in the intermittent channels.

Instream wood falling has a low potential of exerting direct effects to the aquatic ecosystem. The purpose of the instream wood falling is to provide structure to the channel below the reconstructed fords. Localized areas of erosion may occur, but would be offset by the additional sediment storage provided by the instream wood.

Under Alternative 1, no direct effects to stream channels or aquatic organisms would occur since no instream work would occur.

Indirect Effects

The indirect effects to stream channels are defined as the long-term effects of the instream work that would last longer than 5 years, plus any downstream effects in perennial streams or fish bearing streams in the planning area.

The action alternatives would result in long-term beneficial effects to stream channel connectivity as a result of work done to improved stream crossings compared to Alternative 1, where no such work would occur.

All action alternatives would result in improved stream connectivity at three stream crossings sites where proposed work increases culvert capacity. Improved connectivity equates to improved movement of organisms up and downstream and/or improved flow of water, sediment, and wood (to varying degrees) compared to these same sites under Alternative 1 where no work would occur.

The instream wood additions under the action alternatives would result in long-term beneficial effects to aquatic habitats and organisms. The placement of wood is expected to improve instream conditions by slowing water velocities and helping to trap and store bed materials as mitigation for the upstream disturbance created by the reconstruction and subsequent removal of the abandoned road, skid trails and firelines that are being utilized in this timber sale.

Taken in total (Table 46), the adverse effects associated with the action alternatives are generally out-weighed by the longer-term beneficial effects. In other words, the accelerated attainment of desired riparian forest conditions through thinning and the improvement of stream connectivity through restorative road work outweighs the short-term adverse effects (small scale habitat losses, microclimate changes, and sediment delivery) because the beneficial effects operate over a longer period of time resulting in more overall net benefits.

Table 46. Summary of riparian reserve actions and effects.

Riparian	Riparian/	Primary Effect (Beneficial	Duration	Amounts by Alternative

				1	2	3	4
Commercial thinning	Lower tree density & less crown closure	Beneficial—improved species and structural diversity/late successional characteristics, lower risk of severe fire effects Adverse—dryer microclimate, less litter to streams/forest floor	30 years 10-20 years	0	425 ac (w/ 1.5 ac in gaps)	414 ac (w/ 1.5 ac in gaps)	425 ac (w/ 1.5 ac in gaps)
	Change in snag and down wood recruitment process	Adverse—loss of suppression mortality in smaller-sized trees Beneficial—accelerated growth of leave trees for future recruitment	30 years up to 60 years				
Precommercial thinning	Lower tree density & less crown closure	Beneficial—moves stands to more fire resilient conditions	15 years	0	526 ac	526 ac	526 ac
Timber sale road actions	Obliteration of existing roads, skid roads, trail and firelines	Beneficial—improved connectivity	perpetuity	0	0.66 mi rd reduction	0.54 mi rd reduction	0.66 mi rd reduction
Instream Restora-tion	Large wood additions	Beneficial—sediment storage	15+ years	0	75 trees	75 trees	75 trees

Riparian Actions	Riparian/ Stream Change	Primary Effect (Beneficial and/or Adverse)	Duration	Amounts by Alternative			
				1	2	3	4
	Replacement of undersized stream crossings	Beneficial— improved connectivity plus lower risk of stream diversion &/or washout Adverse— sedimentation at the site and downstream.	25 years 1-2 years	0 0	3 sites	3 sites	3 sites
	Rolling dips at high erosion risk sites	Adverse— extremely small scale sedimentation at the site and downstream.. Beneficial – reduction of mass wasting risk	1-2 years 20+ years	0	10-15 sites	10-15 sites	10-15 sites
Fuels Treatment	Activity fuel created, not treated	Adverse— increased hazard and stand replacement fire	5-10 years	0	192 ac	181 ac	192 ac
	Underburning	Beneficial-- reintroduction of excluded process	20 years	0	82 ac	82 ac	82 ac
	Equipment piling of slash	Adverse--soil disturbance, loss of site productivity, risk of weed infestations	5-20 years	0	28 ac	28 ac	20 ac

Cumulative Effects to Streams Channels and Riparian Forest Condition

The potential of the Emile action alternatives to result in either adverse or beneficial cumulative effects to riparian forest and stream conditions is addressed at the scale of the planning area. Since the direct and indirect effects to riparian forests and stream channels result in low magnitude effects it is reasonable to assume that these effects would only overlap with the effects of other past, present, and foreseeable future activities at the scale of the planning area.

The adverse effects of the action alternatives on riparian forest conditions such as lower snag and down wood recruitment levels would overlap with all the past clearcutting of the riparian reserve in the planning area because these acres are not yet producing a full compliment of snag and down wood habitats. The added impacts from the Emile action alternatives on these habitat features would combine with these on-going past impacts and result in an incremental additive impact to snags and down wood habitat structures. However snag and down wood levels would remain within natural ranges and snag creation would mitigate this impact in some areas.

Substantial impacts to streams and riparian forests have resulted from past road building and timber harvest in the Emile planning area. The existing 46.8 miles of road in the planning area's riparian reserves continues to exert profound local effects to streams at stream crossings with broader stream system impacts to connectivity given the hundreds of stream crossings that exist.

In contrast to the short-term cumulative effects detailed above, the longer-term beneficial effects of the action alternatives on stream channels including the stream crossing replacements, obliteration of abandoned roads and installation of the rolling dips would all incrementally add to the present and pending restorative work and have beneficial cumulative effects to both riparian forest conditions and stream channels. While this area has not been a focus area for the district's restoration program there has been several miles of road decommissioning including the two-mile Alpine loop road with several stream crossing removals completed a few years ago.

In general, since the beneficial cumulative effects of the Emile action alternatives are more long lasting and generally more profound in terms of habitat changes (improved stream connectivity, lowered risk of stand replacement fire, and accelerated late successional characteristics), they tend to outweigh the cumulative adverse effects.

Aquatic Conservation Strategy

The riparian reserves included in this project have regenerated under unnaturally dense conditions that do not reflect the historic disturbance regime. The actions within riparian reserves under Alternatives 2, 3, and 4 are in compliance with Northwest Forest Plan riparian reserve standard and guideline TM-1c which calls for the application of silvicultural practices to meet desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.

As disclosed above under the Riparian Reserve discussion, the action alternatives would restore species composition and structural diversity of plant communities, and they would also supply sufficient coarse woody debris in riparian areas. As such they are consistent with ACS objective 8. In addition, the restorative riparian thinning would also be consistent with ACS objective 9, because the thinning would provide long-term habitat for riparian dependant plant and animal species. By restoring more open stands like those that historically developed following disturbance, the stem exclusion stands would be less prone to stand-replacement fire at the site level, and more likely to develop habitat characteristics needed by riparian dependant species. Finally, at the broader scale, the riparian forest restoration under the action alternatives advances the role of riparian reserves in providing connectivity within and between watersheds, consistent with ACS objective 2. By maximizing the amount of riparian treatment in unnaturally dense stands, the stands would advance more rapidly to maturity, and move the riparian network back toward the natural range of variability of more late-successional habitat.

As disclosed above under the Stream Channel discussion, the instream restorative work (stream crossing removals, stream crossing modifications, and instream wood additions) is consistent with ACS objective 3 of restoring the physical integrity of stream shorelines, banks and bottom configurations, and ACS objective 2 of restoring unobstructed routes for aquatic species movement. The other instream road work (reconstruction of abandoned stream crossings & subsequent obliteration) follows riparian reserve standards and guidelines for roads. Though short term, small scale adverse effects are expected under the action alternatives, the broader long-term objective of moving riparian and upland stands toward the natural range of variability addresses the overarching intent of the Aquatic Conservation Strategy. Alternative 1 would not pro-actively implement any of the objectives of the Aquatic Conservation Strategy.

Erosion and Sedimentation

Erosion and sedimentation are geomorphic processes that shape the physical appearance of the landscape and strongly influence aquatic ecosystems. The range of natural variability for sediment delivery to streams and wetlands within the planning area is considered to be very large, because erosional processes are influenced by infrequent natural disturbance events such as floods and wildfire. Sedimentation rates to streams are typically inconsequential on a year to year basis but can spike several orders of magnitude during large storm events. Land management has the potential to accelerate erosion rates and the volume of sediment entering streams and wetlands.

Within the planning area, sediment enters the aquatic environment through mass wasting, fluvial erosion, and surface erosion.

MASS WASTING

Mass wasting is the dominant mechanism of sediment production within temperate rain forests of the Pacific Northwest (Naimen, et al., 1990) which includes the Emile Planning area. The potential mass wasting processes within the planning area include rapid-shallow landslides such as debris avalanches and in-channel debris flows, and slow-moving deeper-seated forms of mass-movement that include rotational slumps, earth flows, and soil creep. Topography has a strong influence on the type of landsliding. Concerns for mass wasting are addressed in all action alternatives by applying standards and guidelines.

Existing and Desired Conditions

A majority of the acres proposed for thinning occur in earth flow terrain or upland plateau geology. Earth flow terrain is gently-sloping and weakly-dissected where soils are fine-textured, fairly deep, and poorly drained (Swanson and Swanston, 1976). Earth flow terrain within the planning area is largely dormant (inactive) in the present day climatic regime. Movement of earth flows appears to be more strongly influenced by long-term increases in precipitation rather than high intensity rainfall events (Swanston, 1991). The upland plateau terrain located in the upper portion of the Emile subwatershed is characterized by elevated, gently sloping, smooth land surfaces. Thousand foot-thick rocks resistant to erosion have preserved these gentle surfaces. Upland plateau stream gradients and stream densities are low (USDA, 1995).

Rapid-shallow landslides typically occur on steep, well-dissected hillslopes where soils are coarse-textured and relatively thin. Rapid-shallow landslides occur during high intensity rainfall events or periods of prolonged rainfall. The steep topography necessary to trigger rapid-shallow landslides is present in the planning area on the steeper slopes

outside the areas mapped as earthflow terrain or upland plateau. Only about 15% of the proposed thinning is located in this steeper terrain.

Roads that bisect steep terrain can pose a risk of road failure that can trigger debris flows that scour channels and deposit sediment into downstream locations. An inventory of all the potential haul routes identified seven miles of road reconstruction and fourteen sites that are in need of reconstruction. This reconstruction work would lower the risk of stream sedimentation at unstable sites to help further ACS objectives and meet S&G RF-3c.

Road stream crossings in any mountainous terrain can also trigger mass wasting when culverts are undersized and become plugged. Under some circumstances, water can divert down the road where it might exit the road in a steep area causing a rapid-shallow landslide. In the mid-90s a culvert inventory was completed in Little River. Many of the culverts in Little River in the planning area are undersized and/or have diversion potential. This inventory identified the potential risk for sediment delivery to streams should a site failure occur by overtopping (culvert washout) or diversion. Three existing steam crossings were identified for replacement within the planning area that pose a high risk for sediment delivery (Table 47).

Table 47. High priority undersized stream crossings proposed for replacement under the action alternatives.

Road Number	Proposed Work	Estimated Potential Sediment Delivery if Site Fails Completely (m^3)
2700-095	Replace damaged, undersized 42” culvert with high erosion potential.	431
2700-095	Replace undersized 30” culvert with high erosion and diversion potential.	355
2703-150	Replace extremely undersized 30” culvert with high erosion potential.	1,041

In addition, ten to fifteen rolling dips are proposed under the action alternatives. These dips would help to prevent diversion of the stream which decreases the risk of erosion including debris flows. A stream crossing has diversion potential if, when stream crossing capacity is exceeded (i.e. the culvert plugs), the stream would back up behind the fill and flow down the road rather than flow directly over the road fill and back into the natural channel. Diversion potential exists on roads that have a continuous climbing grade across the stream crossing or where the road slopes away from the stream crossing in at least one direction. A crossing without diversion potential may breach the crossing fill if it overtops, but the stream will not leave the natural channel. In almost all cases, diversion will create a greater erosional consequence of capacity exceedance than streamflows that breach the fill but remain in the channel. Sidecast fill failures are a common consequence of diversion. In steep terrain with extensive sidecast materials associated with the roads, diverted flows often initiate landslides. These landslides can initiate debris torrents (a form of mass wasting) and have consequences far down the basin.

Flows can also be diverted to adjacent drainages as they are diverted down roads or ditchlines. This causes an increase in the peak flows of the receiving channel and consequent erosion. Under some conditions enlargement of the channels receiving diverted flows occurs, with very large increases in erosion and sedimentation and loss of riparian habitats. Downslope road drainage structures capacity can easily exceed capacity when diverted streamflow enters them.

The desired condition is to meet ACS objectives through improved road drainage and stream crossings resulting in less risk of mass wasting, in keeping with ACS objective 5 of restoring the sediment regime.

Relevant Standards and Guidelines

LRMP Soil S&G 5. Prepare a risk and hazard analysis when the potential exists for triggering slope mass-movements as a result of proposed land management activities. Alternative prescriptions or mitigation measures are required when management activities might substantially increase the potential risk or hazard of accelerating landslide activity and when that landslide activity may result in damage to aquatic resources.

RF-2e. For each existing or planned road, meet Aquatic Conservation Strategy objectives by minimizing disruption of natural hydrologic flow paths, including diversion of stream flow and interception of surface and subsurface flow (USDA/USDI, 1994).

RF-3a. Meet ACS objectives by reconstructing roads and associated drainage features that pose a substantial risk (USDA/USDI, 1994).

RF-4. Existing stream crossings determined to pose a substantial risk to riparian conditions will be improved to accommodate at least a 100-year flood. Crossings will be maintained to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure (USDA/USDI, 1994).

Direct and Indirect Effects

The thinning under the various action alternatives is not expected to trigger any rapid-shallow landsliding because the continued presence of tree roots in the thinnings substantially lowers the risk of rapid-shallow landslides, since live tree roots stabilize steep slopes. Moreover, risk modeling , aerial photo interpretation, soil inventory review, and intensive field review satisfied LRMP soil standard and guideline 5 eliminating sites of potential mass movement from proposed Emile harvest units. The mass wasting potential in the Emile units ranged from low in the earthflow and high plateau terrain to moderate in the steeper terrain. Sites that were deemed unstable were eliminated from the harvest units. For example, potentially unstable ground was identified and removed from harvest unit 20.

In areas of earth flow terrain, changes in water routing from roads or logging can lead to localized slumping, or channel down cutting due to the deep nature of the fine-textured soils that can lose cohesion when water is abundant. A few of the streams were exhibiting some signs of downcutting. These streams received wider no-cut buffers. No cut buffers have been applied to all such sensitive areas, lowering any risks associated with the action alternatives.

With respect to the road work under the action alternatives, none of the new temporary road construction would likely trigger landslides even in the event of a major storm. Under all action alternatives, none of the new temporary road construction is within 150 feet of any stream channels. All would be obliterated or stabilized before winter weather

begins. This would involve subsoiling where it is needed and feasible, so that water can infiltrate rather than runoff as described in the mitigation measures section of Chapter 2. As such, the new temporary roads would not create any new water concentrations or diversions, so no new instability problems are expected.

Under the action alternatives, the reconstruction of three high risk stream crossings (Table 47) and the installation of the rolling dips would result in potential beneficial effects to the aquatic environment. Such modifications to the existing road network would decrease the risk of mass wasting thereby meeting the desired condition of reducing fine sediment delivery to streams. Though the extent of these beneficial effects is limited due to the small amount of road actually treated, the magnitude of the beneficial effects is substantial. This is because the three culverts to be treated have a high chance of failure with substantial sediment delivery potential to planning area streams close to fish bearing locations. The harvest-related mass wasting risk would be moderated by the reduction in risk from roadwork proposed under all action alternatives. Alternative 1 would have the indirect effect of perpetuating the mass wasting risk associated with the existing road system.

None of the action alternatives are expected to result in any meaningful adverse short-term direct effects or longer-term indirect effects to the aquatic environment as a result of rapid-shallow landslides due to field evaluations and subsequent removal of lands that appear to be unstable.

Cumulative effects

Since there are no predicted adverse direct or indirect effects of sustained or increased mass wasting under the action alternatives it could not combine with other past, present, or future conditions to result in a cumulative effect to aquatic environments due to mass wasting.

In contrast, the potential effects of mass wasting that might initiate from the stream crossings should they fail under Alternative 1 has the potential to incrementally add to various forms of sedimentation accumulating in Little River. This potential cumulative effect might occur if a major storm were to cause the stream crossings to fail. A major storm (greater than the 25-year event that occurred in 1996), could potentially cause road failures in the watershed. Widespread road failures could potentially combine to deliver substantial quantities of sediment to Little River.

SURFACE EROSION

Surface erosion occurs when mineral soil is exposed to the erosive forces of water, wind and gravity. Surface erosion can result as an indirect effect as a result of forest management and fuel treatments when the protective surface layer of duff and other materials such as wood and rock is removed or displaced, exposing mineral soil to erosive forces. Activities such as dragging trees across the ground during yarding, burning activity-created fuels, road building, reconstruction, or decommissioning, and timber haul on existing dirt or gravel roads all can result in sedimentation of the aquatic environment.

Existing and Desired Conditions

The proposed thinning units located on gentle to moderate slopes were originally clearcut primarily using dozers that displaced, compacted and exposed soil. Skid trail disturbance during these harvest activities covered 1 to 24% of the tractor harvested

area. Tractor yarding that occurred on slopes greater than approximately 35 to 55% required cutting skid trails into the slope. While surface erosion was likely high after these historic activities, most of the historic logging surface erosion has subsided with the return of ground cover.

Log truck tires detach pieces of crushed aggregate and finer materials from the matrix of the roadbed that would remain bound without the traffic. Steeper roads with little roadbed maintenance result in more dynamic "washboarding" and slipping with more detachment of bed materials. The transport of detached materials from the roadbed is accomplished by water running over the surface of the road and in the ditches. Without water on the road surface, there would not be much transport that could send sediment to streams. The transport of materials by water is much greater on rutted roads and loaded log trucks hauling in wet weather can create ruts. The presence of ruts increases the amount of material that would potentially deposit in a stream because concentrated water in the ruts detaches and transports road surface materials into ditches or directly into streams if the ruts direct the flow into streams. During rainstorms the ditches may also be flowing water, which aids in the transport of loosened road materials to streams.

Regular road maintenance is critical to keeping the levels of road-related surface erosion in check particularly with increased use. Road maintenance has declined sharply in the last two decades because fewer timber sales have occurred to help pay for road maintenance. Annual road maintenance is limited to main-use roads, which are part of the primary road system identified in the Forest's Access and Travel Management Plan (USDA, Umpqua NF 2003).

In general, the season of haul under all action alternatives would be within the normal operating period with contract language stating that haul would be curtailed to avoid resource damage including road-related sediment production from timber haul. Haul could be curtailed during wet conditions anytime during the operating period if such damage is possible.

All haul roads that would be used under all the action alternatives were assessed for their ability to withstand the haul associated with the Emile project. All paved and aggregate surface haul roads are adequate to support timber haul during the season of June 1 through October 31st with the proposed road maintenance, as long as haul is shut down during times of intermittent wet weather that can potentially occur anytime during this period. "Unseasonable weather" could result in either a longer or a shorter acceptable season for haul, based on site specific road and weather conditions. Work may be shut down anytime during the operating season if substantial rainfall occurs and creates conditions where sediment, turbid runoff or soil compaction could occur. Waivers to operate outside this period may be granted and would be heavily dependent on prevailing weather patterns at the time, the type of work, the road conditions and if activity would not impact water quality.

Roads subjected to heavy truck traffic under the action alternatives, would be treated with dust abatement (magnesium chloride) to reduce surface wear, to mitigate traffic visibility problems, and to prevent road dust from entering streams. Without dust abatement excessive rutting and wash boarding would develop, leading to greater potential for surface erosion, especially on steeper road grades. Dust abatement binds the aggregate surface together, greatly reducing the amount of detachment of surface particles, as well as making for a longer lasting road surface without washboards or rutting. Road blading would occur as part of the dust abatement application process.

The desired condition is lower amounts of long-term chronic surface erosion associated with both system roads and legacy skid trails.

Relevant Standards and Guidelines

The relevant standards and guidelines related to surface erosion are found in the Umpqua NF Land and Resource Management Plan (USDA, Umpqua NF, 1990).

Soil S&G 2 requires the establishment of a minimum amount of effective ground cover in order to meet acceptable levels of surface soil loss resulting from gravity, water, or wind action. The ground cover must exist within the first year following the end of a ground disturbing activity. Based on a moderate level of erosion risk, effective ground cover levels would be 65% in all gentle to steep sideslopes and 85% in steep headwall areas. The prescription for 65% effective ground cover would be obtained under low intensity – short duration spring-like underburning, while 85% EGC represents a very low intensity – short duration underburn under spring-like conditions. If adequate ground cover is not present, straw mulch and/or grass seed would be applied as needed.

Soil S&G 11 requires monitoring during and immediately following the implementation of individual unit burning to assess the adequacy of EGC during underburning with adjustments, as needed, in order to meet the requirements.

Soil S&G 13 requires the use of erosion control measures such as seeding with native plants, weed-free straw, or other forms of mulch, where existing ground cover is lost in an area in excess of 0.5 acres.

Soil S&G 16 requires the identification of erosion control in existing developed areas where pre-existing surface erosion is on-going.

Direct Effects

Direct effects are defined as the short-term effects of sedimentation that might occur within planning area streams as an immediate result of the proposed road work, timber haul, logging and treatment of activity fuels with fire.

The potential for hill slope erosion and runoff from roads to deliver sediment to streams was evaluated using the Umpqua Soil Resource Inventory or SRI (USDA 1976) and Disturbed WEPP; a soil erosion model. The SRI provided textural data for the model and this information was validated through field evaluations. Disturbed WEPP utilizes historic data from local weather stations, soil texture and rock cover information from the SRI along with slope and slope length data obtained through GIS mapping.

Sediment is the small portion of the surface erosion that reaches the stream channel. Many of the thinning units did not register a measurable amount of sediment under Alternative 1. Those units that displayed a response in background sedimentation were all less than one ton/ac/year, with most requiring a least a six year rainfall event to produce sediment with the model. Modeled sediment delivery is presented as a relative comparison but the models tend to over-predict[79], thus delivery rates in this analysis represent a worse case scenario.

[79] WEPP-based models generate runoff predictions from all rain events in the form of subsurface lateral flow. This results in a continuous water output that tends to over predict runoff during events when little or no runoff would be measurable and over predict sediment delivery (Covert et al. 2000). However WEPP-based models provide the best means for comparing relative risks of sediment delivery associated with changes in hill slope and road related disturbances.

Table 48. Dominant soil and texture by harvest unit and estimated sediment delivery.

Unit	Texture (SRI)	Sediment modeled with WEPP (ton/ac) 15-yr Precipitation Event		
		Alternative 1	Alternatives 2, 3, 4	Wildfire Moderate Intensity
1	Loam	0.00	0.02	1.24
2	Loam	0.00	0.01	0.18
4	Loam	0.00	0.00	0.07
5	Loam	0.00	0.05	0.48
7	Loam	0.00	0.02	0.21
8	Loam	0.00	0.02	0.21
8b	Loam	0.00	0.04	0.27
9	Clay loam	0.00	0.67	4.69
10	Clay loam	0.73	2.84	13.14
11	Clay loam	0.99	1.30	14.26
14	Loam	0.85	1.15	11.34
15	Loam	0.01	0.22	3.25
16	Sandy loam	0.00	0.14	0.76
17	Sandy loam	0.00	0.01	0.79
18	Loam	0.00	0.01	0.56
19	Loam	0.00	0.24	1.11
20	Loam	0.00	0.01	1.16
24	Loam	0.00	0.08	0.85
25	Loam	0.00	0.23	1.16
26	Clay loam	0.00	0.09	0.85
27	Clay loam	0.63	1.31	11.47
28	Clay loam	0.77	0.99	11.17
29	Sandy loam	0.00	0.01	1.13
30	Clay loam	0.00	0.00	0.37
31	Clay loam	0.10	0.46	10.00
32	Clay loam	0.74	1.6	11.02
33	Sandy loam	0.00	0.00	0.04
34	Sandy loam	0.00	0.00	0.16
35	Sandy loam	0.00	0.00	0.13
36	Sandy loam	0.00	0.00	0.03
37	Sandy loam	0.00	0.02*	0.34
38	Sandy loam	0.00	0.04	0.44
39	Sandy loam	0.00	0.04	0.38
40	Sandy loam	0.00	0.03	0.27
42	Loam	0.00	0.01	0.43
43	Loam	0.00	0.21	1.10
44	Loam	0.00	0.13	0.83
45	Loam	0.00	0.04	0.43
46	Loam	0.00	0.00	0.58
47	Loam	0.00	0.12	0.95
49	Loam	0.00	0.13	1.20
51	Loam	0.00	0.15	1.16
57	Clay loam	0.90	0.97	11.47
58	Loam	0.00	0.00	0.41
60	Loam	0.00	0.05	0.63

Unit	Texture (SRI)	Sediment modeled with WEPP (ton/ac) 15-yr Precipitation Event		
		Alternative 1	Alternatives 2, 3, 4	Wildfire Moderate Intensity
Average (tons/acre)		0.13	0.14	2.73

* No increase under Alternative 3 as unit is not harvested.

Most units show low increases over background sediment delivery under all the action alternatives. All action alternatives have a potential benefit of reducing the potential for sediment delivery risk associated with a wildfire at the site scale. The thinning and fuels treatments would reduce the risk of wildfire and thus, reduce the risk of a much larger sediment delivery occurring.

Additionally there may be some localized erosion take place immediately after subsoiling activities. This erosion would be predominantly within the first year and then the soil profile would subside and consolidation of fractured soil would reduce this effect. Mitigation of this effect would be the use of effective ground cover on the surface of subsoiling treatments. A detectable direct or indirect effect from erosion or sediment caused by the harvest or mitigation activities within the Emile planning area is not expected.

Pile burning and proposed underburning have the potential to leave areas of exposed soil surface. However, as previously described multiple project design features and mitigations activities (i.e. effective ground cover requirements) would be applied under both alternatives to limit the duration and magnitude of all proposed activities on surface erosion.

Grading and graveling dirt roads under the action alternatives would help to decrease erosion by more effectively dispersing surface water before it becomes concentrated runoff over road surfaces. The potential benefit from increased road maintenance in the planning area would be similar between alternatives, reducing the potential for sediment delivery over the next ten years from roads.

Under the action alternatives, the controlled haul provision under the timber sale contract, restriction of wet season haul to paved and aggregate surface roads, use of dust abatement, and required blading to remove ruts as they develop during the haul would limit the amount of surface materials transported to streams from the roadbed. On sections of road without dust abatement, i.e. where restricted immediately adjacent to perennial stream crossings, blading may be required more often than where dust abatement is used. Blading would be kept as current as possible when wet weather is anticipated.

If a light rain occurs on a non-rutted road surface for a short period of time, any detached particles are likely to be transported a short distance and deposited back onto the roadbed surface. Very minimal sediment delivery from haul-related dust is expected under any action alternative because dust abatement would mitigate almost all effects. Alternative 1 would result in no direct effects to the aquatic environment or the beneficial uses of water because no haul would occur under this alternative.

Most of the temporary road disturbance would occur on roads previously used during past entries and abandoned. Because of location and no new stream crossings, sediment delivery from new and temporary roads would not produce large differences between action alternatives. When considering haul as a factor, Alternative 3 would have slightly less risk for delivering sediment to streams than Alternatives 2 and 4 because haul would occur on one less road mile.

Installation of stream crossing improvements and rolling dips would have a net benefit of reducing the potential sediment delivery in all alternatives once new soil disturbance has revegetated.

Given nominal increase in surface erosion modeled and the avoidance of wet weather haul and other proven mitigation measures, the amounts of sediment reaching the stream channel would likely be negligible, therefore the increased risk to beneficial uses further downstream is unlikely.

Cumulative Effects

Given the short duration and limited extent of the surface erosion associated with the harvest activities under the action alternatives, the overall magnitude of direct and indirect adverse effects to the aquatic environment and aquatic organisms from surface erosion is considered to be low. The sediment sources associated with the action alternatives (the creation of bare ground form logging, burning, and road-related work) would only last for 1-2 years following implementation and mitigation measures for erosion control, timing of the project work and timber haul, and temporary road obliteration all serve to help reduce the risk of surface erosion and the magnitude of potential sedimentation impacts on the aquatic environment. Given the very limited or benign effects of the action alternatives associated with surface erosion, it is unlikely that any of the Emile alternatives would result in an incremental additive impact to the aquatic environment due to harvest related surface erosion.

Cumulatively, when considering past, present and foreseeable activities, there would be no adverse or unacceptable net effect from sediment delivery to streams as a result of soil disturbance from yarding logs, roads work and haul, and fuel treatments. Other commercial thinning sales that have been implemented on the district in the past ten years have not resulted in a measurable change to streams. Alternative 1 would result in no cumulative impacts to the aquatic environment from surface erosion because no ground-disturbing activities would occur.

FLUVIAL EROSION

Fluvial erosion is the erosion of stream banks and stream beds from the forces of water. Stream channels change both spatially and temporally under the fundamental influences of climate, geology, and topography. These factors help determine the streamflow and sediment regimes, as well as riparian vegetation which provides in-stream wood. Disturbances can affect stream channel form and the equilibrium between sediment input and output.

Relevant Standards and Guidelines

The relevant standard and guidelines from the LRMP related to fluvial erosion is watershed cumulative effects and water quality S&G 2: Beneficial uses of water and aquatic habitats would not be degraded by scoured stream channels caused by timber harvest, road construction, and related activities.

Existing and Desired Conditions

The most sensitive channels in the planning area are associated with dormant earthflow terrain. These channels include intermittent and perennial streams. In addition, some channels are not connected downstream by surface flow and are referred to as interrupted streams. The interrupted channels are typically very small, and the water that flows in them during the rainy season drains back into the soil and becomes subsurface water. The beneficial use of these interrupted streams is more locally focused on wildlife and plants.

Earthflow channels often lack the complex geology structure in the form of various sized substrates (cobbles and small to large boulders) and are dependent on external input, specifically large wood recruitment, for channel complexity and stability. The erosional processes associated with these channels involve a high proportion of fine sediments that have little armoring of the bed and banks. As a result they often have little resistance to down-cutting and bank erosion during winter storm flow.

The intermittent and small perennial non-fish bearing stream channels in the earthflow terrain have been the most impacted channels due to historical timber management, and road building. The past clearcutting of riparian vegetation especially along the near vertical banks of these stream channels has contributed to root strength loss, which otherwise helps to bind the fine-textured soil in-place and provides physical resistance to fluvial erosion, therefore controlling sediment delivery. Past logging disturbances from yarding old-growth near and across these sensitive channels without suspension or mitigation measures has also influenced potential delivery of sediment to these stream channels. The removal of large channel wood has changed channel stability and affected sediment storage, delivery, and routing. Wildfire in unmanaged areas of earthflow terrain has also influenced sediment delivery and routing, but not to the potential extent as managed areas. Large wood left behind in stream channels from past logging has provided channel storage and localized stability. The desired condition is improved stream channel conditions.

Direct and Indirect Effects

Direct effects from fluvial erosion are described at the scale of stream segments within or adjacent to harvest units and during the activity. Indirect effects are downstream of the unit at the drainage scale and greater, and after the activity over 2-3 decades.

Alternative 1 would not change existing fluvial erosion processes that are currently occurring. Future recruitment of large channel wood that would stabilize and provide storage of channel sediment would continue to be delayed because of the densely stocked riparian with younger Douglas-fir, which is delaying the development of large trees along channels.

Alternatives 2, 3, and 4 would thin riparian reserves (see Riparian Forest Conditions in this Chapter). The riparian reserve thinning would retain no-harvest buffers along intermittent stream channels. The exception is where intermittent channels are gentle and bank and bed erosion has been determined to not be a risk. Thinning would occur along these channels with no buffers, but no trees would be yarded across the channels under any of the action alternatives.

The action alternatives also include work that would correct road erosion (culvert upgrades, fill failure repair, rolling dips installation for erosion control and removal of abandoned roads blocking small stream courses). These actions would reduce potential fluvial erosion by disconnecting existing sediment and water pathways. Under all the

alternatives, the proposed road treatments would reduce potential sediment sources and pathways that contribute to fluvial erosion.

None of the action alternatives would increase peak flows or accelerate sedimentation that would affect fluvial erosion. The riparian reserve thinning would improve overall health and vigor of the riparian leave trees and the potential future channel recruitment of large wood, while reducing the long-term risk of wildfire impacts on the riparian reserves. Therefore, no direct or indirect effects associated with fluvial erosion in planning area streams would occur.

Cumulative Effects

Alternative 1 would not incrementally add to past, present, or reasonably foreseeable future activities to cause a cumulative fluvial erosion effect since no action would occur.

Since Alternatives 2, 3, and 4 would not cause any indirect fluvial erosion (as described above), they would not have any effects that would incrementally add to past, present, or reasonably foreseeable future activities to cause a cumulative fluvial erosion effect at any of the analysis scales.

Aquatic Conservation Strategy

The long-term benefits of the restorative road activities under the action alternatives outweigh the short-term impacts of road work needed to implement the thinning. As such, the action alternatives are consistent with ACS objective 5 which calls for the restoration of sediment regimes. Alternative 1 would not proactively address the Aquatic Conservation Strategy.

Chemical Contamination- Tracked as a Disclosure Issue

All action alternatives present some risk of water contamination due to the use of fuel products and dust abatement chemicals that have the potential to enter streams if spilled or misapplied. Dust abatement would be accomplished through the application of magnesium chloride to the gravel haul roads. Excessive rates of application could potentially increase either the surface runoff or the migration of the material through the soil to stream channels. The primary risk of water contamination would occur with a spill near a waterway.

Magnesium chloride is highly soluble and moves through the soil with water. The movement is largely dependent on the rate of application, the frequency and intensity of rainfall, the drainage characteristics of the area of application and the chemical and physical nature of the soil. During periods of long duration or high intensity rainfall, in areas of high surface runoff, or in areas of high soil permeability, magnesium can move considerable distances either as surface runoff or as soil leachate (materials dissolved in water that is within the soil). Surface runoff typically drains into streams, lakes, or ponds whereas leachates feed ground water. Under these conditions it is the constituent ions of magnesium and chloride (Mg^{2+}, and Cl^-) that migrate through the environment.

Magnesium ions are readily held by soil particles while chlorides tend to remain in solution and potentially infiltrate ground water or runoff into surface waters. Magnesium is a very common element in soil and water and because they readily bond with soil particles they typically do not migrate far from their point of application, which is the case of dust abatement chemical application (USDA, 1997). Because chlorides do not bond well with soil particles and tend to migrate, their effects are more widespread. Although chloride is present in all natural waters it usually occurs in concentrations of less than 50 ppm (parts per million). Trout begin to suffer serious effects from chlorides when

concentrations reach 400 ppm. Concentrations in excess of 10,000 ppm place all fresh water biota in immediate jeopardy. At typical application rates these concentrations would not be expected to occur (USDA, 1999).

Environmental Effects of Chemical Contamination

Direct Effects

Alternative 1 would have no direct effects relative to chemical contamination because no chemicals would be applied as a result of this alternative.

Under Alternatives 2, 3 and 4, a dust abatement spill or petroleum spill could potentially result in direct effects to aquatic resources and the beneficial uses of water. Dust abatement would be applied to FS Roads 27 (Little River Road) and 2703 for a total of 15.3 miles, a quarter of the haul route. Portions of the haul routes within the planning area are narrow and winding and increased truck traffic elevates the potential for an accident. Several haul roads parallel stream bottoms. If an accident were to occur near a stream, fuel or dust abatement chemicals could enter live waterways. This could result in immediate physical harm from a truck entering a waterway, water pollution that could kill or otherwise harm aquatic organisms, and the additional disturbance associated with cleanup.

The risk of water contamination due to the application of dust abatement is minimized under all action alternatives by several mitigation measures that would be required under the timber sale contract. Dust abatement with chemical compounds under all action alternatives include maintaining an average 25 foot no treatment buffer at perennial stream crossings and maintaining a 1-foot no treatment area adjacent to the outside edge of the ditch line. Moreover, the application of dust abatement materials would normally occur only once per year in a window of time when no rain is forecast for at least three days. The buffering of applications away from perennial stream crossings has been found to effectively mitigate pollution of adjacent waters (USDA 1999). The rate of application of dust abatement compounds in the planning area would be “typical” and therefore is not expected to contribute to adverse riparian or aquatic effects.

Magnesim chloride is typically used on a limited basis and at low application rates, as compared to study areas where the most noticeable effects have been seen. Based on the literature review and typical application rates for dust abatement purposes that would be used in the Emile planning area, effects from these compounds to plants and animals in the riparian and aquatic environments would be negligible under all action alternatives.

Timber sale purchasers would be required to have spill prevention and recovery equipment on site, they would be required to develop spill prevention plans if substantial amounts of fuel or other pollutants are stored in sale areas, and traffic control measures would be required in the timber sale contract. All these requirements associated with all action alternatives, detailed in Chapter 2 and in the Best Management Practices Checklist (Project Record), function to diminish the chances that potential direct effects to aquatic resources and the beneficial uses of water from project-related pollutants would actually occur. Thus, risk of chemical contamination is considered to be low for all action alternatives.

Indirect Effects

Under Alternatives 2, 3 and 4 pollution of off-site or downstream waters is possible if trucks transporting fuel or dust abatement compounds were to spill into a river or stream enroute to the project area. The likelihood of this occurring is proportional to the amount of fuel and dust abatement used in the various action alternatives. Alternative 1 would not utilize these compounds and would result in no risk of indirect effects to downstream beneficial uses due to water contamination. Alternatives 2, 3 and 4 would present more risk of indirect effects to downstream beneficial uses because of the amount of potentially polluting products transported to the project area. The action alternatives present similar risks of an accidental spill contaminating off-site or downstream waters and the beneficial uses of those waters. The likelihood of an accidental spill is believed to be low under all alternatives; however no mitigation measures would be applied to the transport of potential pollutants outside the timber sale areas.

Cumulative Effects

Most past and on-going land management operations throughout the Umpqua River basin such as silvicultural activities, timber sales, and all forms of road work use a variety of potentially polluting products (such as dust abatement, petroleum, concrete, adhesives, cleansers, herbicides, etc) that pose a risk of entering waterways if spilled or mishandled. The level of timber harvest and associated road work on Federal land located primarily in the upper elevations of the Umpqua River basin has diminished over the last two decades relative to the previous three decades. Therefore, the level of additive effects that can contaminate water from such actions has also diminished.

Potential contamination of waters within the River basin associated with private industrial forestry operations, intensive agricultural operations (using pesticides, fertilizers, other petroleum products, and herbicides), and city and town development and use by people (sewage, plus all the above mentioned potential pollutants and others not mentioned) has not diminished. Water contaminations from these sources can be expected to increase as demand for food and natural resources increases with the human populations. Therefore, the lower areas of the Umpqua River basin are where the cumulative effects of all the additive forms and sources of water contamination would be most likely realized.

The chances of any of the Emile action alternatives resulting in any cumulative effects to water contamination hinges on whether a substantial spill of petroleum or dust abatement products occurs. Should a spill occur and clean-up measures fail, a cumulative effect could be realized. This is particularly true the further downstream an accidental spill occurs.

None of the Emile alternatives are expected to appreciably affect water quality over the long-term (decades, or longer), and none are expected to degrade the chemical contamination/nutrients indicator considered by NOAA Fisheries unless an accidental spill were to occur. The chances of such a spill are offset as much as possible by a series of Best Management Practices required in the timber sale contract of the action alternatives. Any impacts to water quality associated with contamination of water due to timber sale operations would be short-term and likely localized. As such, the broad-scale goals of the ACS would not be impacted.

FISHERIES

Existing Conditions

The Little River and Middle North Umpqua Watershed Analyses provide a detailed description of fish habitat in the planning area and are incorporated by reference into this document. The following paragraphs summarize key information regarding habitat conditions relevant to the Emile project.

Mainstem Little River

A combination of naturally occurring hydrologic conditions and past management practices have resulted in elevated summer stream temperatures in the majority of streams in the planning area. The riparian habitat along Little River varies greatly but generally has been degraded by past timber harvesting and roads. The riparian forest can be characterized as consisting of young hardwoods (alder and bigleaf maple) dominating the inner riparian zone and young conifers (Douglas-fir, western hemlock, and western redcedar) dominating the outer riparian zone. In some sections large and mature size-class conifers are scattered throughout the riparian zone on the south bank; conversely, the north bank riparian zone has been degraded by the presence of Forest road 2700. Shade provided by the riparian vegetation was also variable. In some reaches canopy closure and shade were high, while other sections were open to solar exposure and subsequent heating.

Past timber harvesting, stream cleanout operations, and road construction has reduced current amounts of instream LWM and reduced future recruitment of instream LWM. These management practices of removing or reducing recruitment levels of wood has degraded and simplified the aquatic habitats by shifting the composition of channel substrates from abundant gravel and cobble to boulder, bedrock, and silt, by increasing the rate of channelization, and by reducing the amount of off-channel habitat (i.e. side channels, pocket pools, backwater pools etc.). The Little River WA reports 32% of the riparian habitat found in the middle section of the watershed is in a late seral condition and 59% of the riparian forest found in the upper watershed is considered to be mature or old growth forest.

The most common aquatic habitats of Little River were large mid channel scour pools, large bedrock trench pools, long low gradient riffles, moderate gradient rapids, and shallow non-turbulent riffles. Sections of channel dominated by bedrock are common and perhaps more so than if more instream LWM was available to retain gravels and cobbles. Substrate composition in Little River has changed over time due to management activities in the watershed and there is currently a lack of suitable spawning substrate in Little River.

Emile Creek

The aquatic habitats of Emile Creek are diverse but have been degraded by past timber harvesting and associated road building activities, particularly in the lower reaches. Also it may be that the dominant channel substrate in the lower reaches has shifted from one of coarse gravel and small cobble to one currently of boulders and bedrock. This shift has taken place due to a lack of instream LWM combined with an increase in peak runoff and channelization from adjacent roads. Emile Creek appears to be largely a resident trout stream. Coho salmon and steelhead trout are present in the lower 1.2 miles of Emile Creek where further access is blocked by a 12 foot waterfall. Several waterfalls encountered during the survey of Emile Creek would be the upstream limit of fish

distribution if not for what is assumed to have been a fish stocking program having occurred in the headwater region.

In general, the riparian habitat along Emile Creek has been most affected by roads and timber harvesting in the lower reaches, while the upper reaches are in better condition with few road intrusions and less timber harvesting. Although roads only entered the riparian zone in the upper reaches at stream crossings there are several places where timber harvest units have encroached into the riparian zone. Nevertheless, the upper reaches generally contain a mature riparian forest providing good canopy closure (shade) and good potential for recruitment of LWM. In fact the upper reaches contain a moderate to high amount of instream LWM as a result of riparian forest with a mature component.

The lower reaches have been degraded by past timber harvesting, stream cleanout operations, and road construction. Past management practices of removing or starving the stream of wood has degraded and simplified the aquatic habitats by shifting the composition of channel substrates from abundant gravel and cobble to boulder, bedrock, and silt, by increasing the rate of channelization, and by reducing the amount of off-channel habitat (i.e. side channels, pocket pools, backwater pools etc.). The most common riparian species comprising the dominant overstory and understory structure of the riparian habitat includes; Douglas-fir, western hemlock, western redcedar, red alder, bigleaf maple, vine maple, and willow.

Large mid channel scour pools are common in the lower 1.2 miles, however, fast water habitats such as rapids, riffles, and cascades dominate the middle and upper sections of Emile Creek. An exception to this would be the large plunge pools located at the base of the several waterfalls Emile Creek.

Emile Creek lacks instream woody material in all size classes in the lower reaches, and lacks large size LWM in all reaches. Moderate to abundant amounts of small and medium class LWM are found in the upper reaches of Emile. It would appear this condition is a result of a mature riparian habitat in better condition than the younger riparian forest located lower in the drainage. A total of 396 pieces of LWM (combined size classes) were counted for an average 53.6 pieces/mile. This amount is considered within the range of variability for LWM in a stream of this size.

Middle North Umpqua River

The North Umpqua River[80] is characterized by forced pool-riffle morphology, or a series of pools and bars created by flow obstructions such as bedrock outcrops, boulders, or large wood. Large wood is not a common feature because the river has a high capacity for floating it downstream. Debris jams at bends, constrictions, or channel margins may locally influence channel morphology and habitat, causing additional scour or sediment deposition and, on rare occasions, contributing to the formation of a side channel and/or island habitat. Large boulders and abundant bedrock outcrops create pools and provide channel complexity. Accumulations of cobble and gravel tend to be found in the tail out areas of large deep pools, islands, large boulder complexes or along the margins of the channel.

Forest management activities and the 1964 flood have substantially altered the river channel and aquatic habitats. Disturbances including road construction and timber

[80] The North Umpqua River is designated as a Wild and Scenic River. No activities are proposed within the North Umpqua River corridor under any Emile alternative.

harvest contributed to erosion in the river's tributaries. Approximately 40 percent of this sediment is estimated to have been delivered to stream channels, creating high rates of sediment delivery to the mainstem North Umpqua River (Stillwater 1999). Highway 138 has increased the local fine sediment supply due to erosion of the cut slopes and ditch lines and failures of fill slopes. Some of the highway was constructed on the floodplain, reducing channel-floodplain interactions, stream shading, and large wood recruitment to the channel. Channel confinement has been increased by Highway 138 in certain areas where modest channel widening or meandering and sediment deposition may have previously been possible.

Changes to channels have likely degraded habitat conditions for anadromous salmonids and other aquatic organisms, reducing pool area, gravel availability, and habitat complexity, while increasing the proportion of glide habitats and bedrock substrates.

Due to the inherent resiliency of the mainstem channel, the gross appearance (and resultant habitat elements) is likely similar today to what it was historically. However, much of the fine-textured and uncommon attributes, such as large wood, side channels, backwater areas, and relatively wide vegetated floodplains, are likely altered and/or reduced in both number and extent. These changes from the reference conditions are primarily due to human-caused alteration and uses, such as road construction, wood removal, and recreational development and maintenance. It is these rare and unusual attributes that provide high-quality habitat elements for a large suite of aquatic organisms, including potentially limiting life-history stages for resident and anadromous fish. The dominant coarse features provide for an abundance of adult resting and older-age juvenile rearing habitat. The non-abundant habitats, such as spawning, incubation, and some rearing habitats (early, post emergence and over-wintering), have been further diminished by dams, floodplain development, wood removal, channelization, fill, and armoring with riprap.

Cougar Creek

Cougar Creek is a 4th order stream that is fish bearing. Anadromy extends up Cougar Creek about 1.5 miles to an impassable falls. Steelhead trout are the only anadromous fish known to use Cougar Creek. Cougar Creek has an additional 1.75 miles of resident fish habitat.

The lower 1.6 miles of Cougar Creek is characterized by a moderately steep V-shaped valley with a valley floor of less than 100 feet. The upper reaches of the stream exhibit a narrowed valley form and increased gradient and entrenchment. Stream gradients range from 4 to 6 percent in the lower reaches to over 15 percent in the upper reaches. Streambed substrate in the lower reaches is dominated by cobble and gravel with pockets of small and large boulders. The upper reaches are dominated by bed rock with patchy inclusions of gravel in all reaches. Large woody material within Cougar Creek ranged between 2 and 36 pieces per mile. This is below the desired condition of 50 to 110 pieces per mile. Riffles dominate the habitat type along the entire length of the stream. Pools are generally widely spaced and shallow. Nearly 50 percent (2,787 acres) of the watershed is located in the Cougar Bluffs Inventoried Roadless Area.

AQUATIC BIOLOGICAL EVALUATION AND ESSENTIAL FISH HABITAT

There are five species of fish listed as sensitive by the Forest Service on the Umpqua National Forest (Figure 21):

1) Oregon Coast (OC) coho salmon (threatened) - Oregon Coast coho use the North Umpqua River during all life cycles. Coho utilize the entire North Umpqua

River up to Soda Springs Dam as well as many of the tributaries. Coho spawn in the main stem and in several main tributaries to the North Umpqua. Cougar Creek is the only North Umpqua tributary that drains part of the Emile planning area. There is no known coho use in Cougar Creek as the steep channel gradient precludes coho from entering the stream.

Within Little River coho distribution extends from the mouth up river to Poore Creek Falls (RM ~19). Snorkel surveys in 2007 identified coho fry up to the falls but not beyond them. The best coho habitat in Little River has historically been in Cavitt Creek nearly 7 miles downstream from the planning area.

2) Pacific Coast (PC) chum salmon (sensitive) - Chum salmon have not been known to occur in the North Umpqua River above Little River or in Little River. Chum salmon are located approximately 180 miles downstream of the Emile planning area.

3) Oregon Coast (OC) spring chinook salmon - Spring chinook adults return in late spring and spend the summer in the deep pools of the mainstem of the North Umpqua River and to a lesser degree in the deep pools of Little River. They spawn in the low to moderate gradient reaches utilizing larger spawning substrate than the other salmonids. Chinook salmon use the North Umpqua River from its mouth all the way to the impassable Soda Springs hydro-electric dam (~75 miles). Chinook are not known to enter Cougar Creek which drains part of the planning area into the North Umpqua River. Chinook use in Little River extends from the mouth upstream about 19 miles to Poore Creek Falls.

4) Oregon Coast (OC) steelhead trout (candidate) - Steelhead is probably the most abundant salmonid in the North Umpqua River basin including Little River, requiring high quality, complex stream channels similar to the cutthroat.

Steelhead trout distribution extends from the mouth of the North Umpqua to Soda Springs Dam and up into many of its tributaries including Cougar Creek. Within Little River steelhead habitat extends the entire length of the planning area and extends 1.2 miles up Emile Creek and 0.25 miles into Taft Creek.

5) Umpqua Oregon Chub (sensitive) - This chub is endemic to the Umpqua basin (mainstem Umpqua, South Umpqua, and to a lesser extent North Umpqua river systems). Habitat selection by the chub is moderate to slow flowing water (runs and channel margins). Surveys conducted in 1998 indicated distribution about 20 miles downstream from the project action area.

There are also two sensitive aquatic invertebrates, the Western ridged mussel and the rotund lanx that could occur within the Emile planning area. Western ridged mussels occur in streams of all sizes and are rarely found in lakes or reservoirs. They are found mainly in low to mid-elevation watersheds, and do not often inhabit high elevation headwater streams where western pearlshells can be found. They can withstand moderate amounts of sedimentation, but are usually absent from habitats with unstable or very soft substrates.

The rotund lanx is a small freshwater limpet and the current distribution appears to be scattered and local in portions of the Umpqua River below the confluence with Little River, all of Little River, portions of the South Umpqua and major tributaries above Roseburg, and Cow Creek. The rotund lanx is found in unpolluted rivers and large streams at low to moderate elevations, in highly oxygenated, swift-flowing, cold water on stable cobble, boulder or bedrock substrates where aquatic macrophytes and epiphytic

algae are generally rare to absent. A 2006 aquatic mollusk survey found this species in the mainstem North Umpqua. Most likely this species would be found in Emile Creek, Pinnacle Creek, and Cougar Creek within the project area.

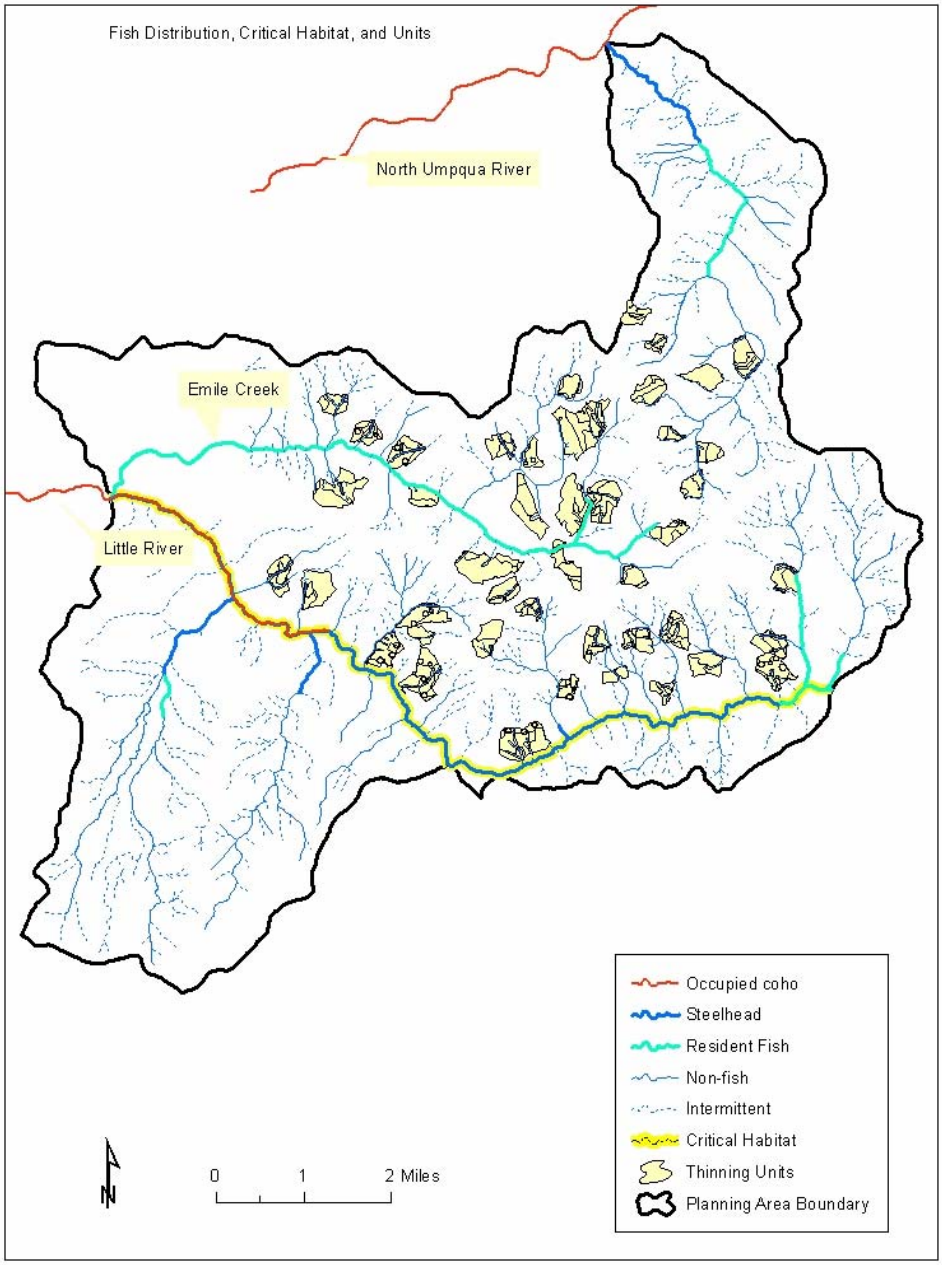


Figure 21. Location of the Emile project in relation to fish species distribution.

Direct and Indirect Effects

Alternative 1 proposes no activities that would modify or otherwise affect fish or sensitive aquatic invertebrates or habitat; thus, there are no direct impacts associated with this alternative.

No meaningful direct impacts to the species described above living in the North Umpqua or Little River drainages or other fish bearing tributaries are expected from the harvest, log haul, or fuels treatments under any action alternative. This conclusion is based on the following rationale. No-harvest buffers on a majority of the stream channels (measured from the edge of the stream channels) would exist, eliminating any direct logging effects to fish and sensitive aquatic invertebrates. Non-fish bearing perennial streams would be protected by a minimum 60 foot buffer while intermittent channels would have 25 to 50 foot minimum buffers. The exception being a few intermittent channels with gentle slopes where the risk of bank and streambed erosion has been determined to be very low. Fish bearing streams would be protected by a minimum 60 foot buffer. Although no harvest activities would occur in the no-cut buffers, some skyline harvest units may require cable corridors in them. Cable corridors are typically very narrow and allow for the skyline cable to move unimpeded from an anchor tree to the landing area. In order to gain log suspension the cable anchor at times would need to be located across a stream channel and a short distance up the facing slope. Creating the corridor could require the cutting of none to several trees per corridor. Corridors across stream channels are expected to be few and would not be a meaningful impact on stream shade or sediment delivery. Any trees cut for cable corridors would be felled and left in place.

Fuels treatment activities would take place in all harvest units and would also occur in portions of riparian areas that are harvested. A total of approximately 425 acres of thinning and fuels treatment would occur in the outer portions of Riparian Reserves under the action alternatives. There are no meaningful differences in fuels prescriptions with regard to effects to fisheries between the action alternatives. Fuels treatments under all action alternatives would have no direct effect on water or habitat quality. None of the action alternatives would create or burn piles within 20 feet of the no-harvest buffers. Grapple piles would not be created within 50 feet of the no-harvest buffer. The limited amount of riparian area treated, the no-treatment stream buffers, and the hand and grapple piling mitigations would minimize the potential for any meaningful direct effects to aquatic habitat.

The proposed log haul for the action alternatives is described in Chapter 2. Log haul would occur under “dry conditions”. These conditions include the normal operating season described as June 1 to October 31, but could also occur outside these calendar dates if suitably dry conditions exist[81]. Describing the haul season in terms of suitably dry conditions rather than calendar dates provides management flexibility, but has little to no risk of resulting in increased sediment production and transport to local stream channels. Road maintenance prior to log haul would improve road drainage and assure stream extensions, due to ditch lines, are minimized by cleaning culverts and adding cross drains where necessary. In addition, blading and reshaping roads, where necessary, would decrease water channeling and ponding on the road surface. Haul outside the June 1 to October 31 dates would not occur when precipitation events are imminent or excessive road deformity would occur during haul due to road moisture

[81] Haul outside of the normal season of operation (May 15 – October 15) would only occur under specific road conditions. These would include: no water channeling on or sheeting across the road surface, no excessive deformity of the road surface caused by the weight of the vehicle, at least 3 days of elapsed time since last measurable rain fall, no haul during active precipitation, and haul would not occur if there are other resource concerns that would preclude haul. If conditions deteriorate or if excessive fines migrate to the road surface due to log haul traffic, activity would be halted.

conditions; and haul would be suspended if surface run off carrying sediment were reaching stream channels.

Haul during suitably dry conditions has little potential to create or deliver road-derived sediment to live stream channels. Portions of the haul route are located parallel to OC coho and steelhead habitat as well as Essential Fish Habitat (EFH). Approximately 5 miles of the haul route adjacent to OC coho habitat are gravel roadway. The remainder of the haul route along this habitat is paved. The haul route consists of about 7 miles of paved roadway, 42 miles of gravel surface roads, and 8 miles of native surface road within the action area. Along the paved haul route there are 5 non-fish perennial, and 2 perennial fish bearing stream crossings. There is one paved stream crossing on OC coho habitat at Emile Creek. There are 48 non-fish perennial channel crossings, and 7 fish bearing channel crossings on the gravel portion of the haul route. There are no stream crossings on the gravel portion of the haul route that cross anadromous stream channels.

Intermittent crossings would not play a meaningful role in potential sediment delivery until rains charged the surrounding watershed enough to produce continuous flow in their channels. This typically does not occur until November. If extended haul is occurring when intermittent channels are flowing water no additional impacts are expected. This is due to road maintenance and improvements that would occur prior to haul, BMP's that would be in place, and the monitoring of road conditions during haul to assure that resource damage is not occurring. If at any time activity related sediment in roadside ditch lines reaches any stream channel haul would be suspended until conditions improve and haul can resume without impact to streams.

Underburning would occur under all action alternatives on 82 acres of Riparian Reserve outside of the primary shade zone. Ignition for underburning would occur outside of riparian reserves. Underburning would occur during moist conditions, resulting in essentially no effect to overstory riparian forest conditions that would translate to an impact to fish bearing streams from increased stream temperature. The potential for sediment and nutrient delivery would be little to none based on topography, stream side buffers, and burn location. Since no meaningful increase in winter peak flows are expected from any of the alternatives, no impacts to fish bearing habitat during their overwintering life cycle would be expected to occur.

No direct effect from timber harvest, log haul, or fuels treatment on listed sensitive fish or sensitive aquatic invertebrates species would occur. Maintaining a no-harvest buffer along all streams would adequately filter and disperse overland flow before it reaches the streams. This no-harvest buffer distance would be sufficient in prescription to prevent any meaningful amount of additional sediment from disturbed ground from reaching the stream channel. Burning of slash piles would be limited to the interior of the units, and landings with low erosion potential. There would be no hand piles within 20 feet of the no-harvest buffers and no grapple piles within 50 feet of the no-harvest buffers. The vast majority of sediment resulting from slash burning would likely filter into the forest floor before reaching stream channels.

There would be 57.5 miles of road maintenance made under Alternatives 2 and 4 and 56.5 miles under Alternative 3. This would include ditch line and culvert cleaning, road surface blading and shaping, and adding crushed rock where needed. Road improvements would also include three culvert replacements which would occur within the stream channel. In addition, ten to fifteen rolling dips are proposed under the action alternatives. These dips would help to prevent diversion of the stream which decreases

the risk of erosion including debris flows. Project design criteria and Best Management Practices would be implemented during road maintenance activities (See Chapter 2). About 1.8 miles of closed road would be opened for logging activities, after use these roads would be closed. This would include the same type of work as road improvements. Instream work associated with road improvement would occur during low flow conditions.

Proposed road improvement would reduce road-derived sediment generated during increased road use over the life of the project. Road-derived sediment would be directed onto the forest floor through cross drains where it would be filtered before reaching stream channels. There would be about one mile of new temporary road constructed and 7.3 miles of temporary road reconstruction under Alternatives 2 and 4. Under Alternative 3 there would be only 0.6 miles of new temporary road and 7.1 miles of temporary road reconstructed. No new temporary roads are located within 150 ft of streams. There are approximately 0.66 miles of reconstructed temporary road in riparian reserves under Alternatives 2 and 4 and 0.54 miles under Alternative 3. No-harvest riparian buffers and large wood placement below stream crossings at reconstruction locations would be sufficient to prevent adverse amounts of sediment delivery from all temporary road construction to fish bearing streams. All temporary roads would be decommissioned after use. All action alternatives would reconstruct six one acre helispots on old landings or quarry sites where few trees would need to be cut and little ground would need to be cleared. Due to distances between helispots and stream channels, no meaningful amount of sediment delivery from this source is expected.

Culvert replacements would be the largest potential source of sediment to the stream channels. During excavation of the old culverts, stream banks would be highly susceptible to erosion from precipitation events, as well as from the flow of the stream itself. Erosion from the stream would be minimized by routing the stream flow around the work site and implementing erosion prevention measures such as silt fencing (See Chapter 2 BMPS). The risk of sediment to downstream habitat caused by precipitation during instream work would be minimized by performing this work during the summer months when rain is less likely and stream flows are at their minimum.

Instream work would occur during low summer flow conditions, typically July 1 to September 15. At this time steelhead and salmon alevins have exited the gravels and are free swimming fry not subject to suffocation from siltation of spawning gravel and are able to move away from areas of localized turbidity. Streams in the planning area are efficient at moving fine sediment through the system. Due to timing of construction, project design criteria (PDC's), and BMP's the reconstruction is expected to transport a negligible amount of sediment to down stream fish habitat and would not have a negative effect on EFH. The duration of the slight increase of sediment to the system would be short lived, localized, and would likely be undetectable against background levels. This project would have negligible amounts of fine sediment from road activities that would enter stream channels at stream crossings. The impacts are expected to be insignificant to salmonid habitat. This is due to dry condition haul and mitigated wet season haul requirements and as indicated above, sediment input would be minimized through PDC's and BMP's (e.g. turbidity reduction measures and suspension of haul operations prior to periods of precipitation).

The ditch lines adjacent to crossings are typically well vegetated. Road maintenance activities would minimize disturbance to grasses and forbs that are growing in the ditch line that act as sediment traps. Where haul routes parallel stream channels, a sufficient filter strip between the ditch and the stream exists to slow and capture any sediment

laden runoff in the event of a rain storm during haul. The contract administrator also has the authority to suspend operations if weather conditions arise that would cause a transport of sediment from the road surface to the stream.

Considering the information above regarding vegetated ditch lines, the presence of an adequate filter strip between the road and the stream, dry condition haul and mitigated wet season haul, following instream work time lines, and road improvements prior to haul, the likelihood and potential quantity of material reaching the stream are discountable and insignificant.

The no action alternative would leave stands of timber in stem exclusion condition at elevated risk to wildfire. Temporary roads constructed during the last timber entry into this area 40 to 60 years ago and not rehabbed would remain on the landscape as chronic sources of sediment. Three high risk culverts and 10-15 crossings with high erosion and mass wasting risk would remain untreated which could result in substantial sediment delivery to habitat. Thus Alternative 1, through lack of action, would have a negative indirect impact on the sediment regime and downstream fish habitat through continued erosion of roads.

None of the Emile action alternatives would affect fish and sensitive aquatic invertebrates by meaningfully affecting downstream water quality or aquatic habitat in Little River or the North Umpqua River through the release of additional nutrients, sediment, or by increasing water temperature (See Water Quality section above). The reconstruction and subsequent obliteration of temporary roads with stream crossings may have a short term negative, but discountable effect on EFH in Little River in the vicinity of the planning area, but would prove beneficial to habitat over the long term by eliminating chronic sediment sources.

Alternatives 2, 3, and 4 may have beneficial effects to riparian forest conditions by lowering the risk and potential severity of fire at the site scale. In addition riparian thinning would speed the growth of the residual trees accelerating attainment of desired riparian characteristics. Underplanting in the thinned stands would increase tree species diversity in what are now relatively homogeneous Douglas-fir plantations. This is a potential beneficial indirect effect to the water quality and fish habitat in the Emile planning area.

None of the connected actions described in Chapter 2 proposed under the action alternatives would result in any indirect effects over the long-term or in downstream areas as described previously. All of these connected actions are minor activities of limited scope and duration. As such, these connected actions would have little chance of resulting in a negative effect to water quality or instream habitats, but may have long term beneficial effects.

Aquatic Conservation Strategy

No meaningful negative impacts to habitat elements or the associated beneficial uses of water are expected from any of the proposed activities in any of the action alternatives including those actions proposed to take place within the Riparian Reserve land allocations. Moreover, the action alternatives were designed to accomplish broad landscape objectives addressing natural disturbance processes, and to contribute to restoring the watersheds over the long term which is in keeping with the intent of the Aquatic Conservation Strategy. The No Action Alternative would not proactively implement this conservation strategy.

Cumulative Effects

The Emile action alternatives do not have the potential to result in any meaningful cumulative effects to water quality, streamflows, or the sediment regime that would affect sensitive fish or sensitive aquatic invertebrates. This is simply due to the lack of any substantial risk of direct or indirect effects associated with these alternatives. Alternatives 2, 3, and 4 have nothing meaningful or measurable (either adverse or beneficial) that would incrementally add to any other past, present, or reasonably foreseeable actions in the affected 5th, 6th, or 7th field watersheds.

The risk of mass wasting under Alternative 1 has the chance of resulting in cumulative effects to fish and sensitive aquatic invertebrates if the untreated crossings were to fail. If road failures were to reach Little River as debris flows, this impact could incrementally add to other forms of future sediment delivery to result in a cumulative effect. Thus, future sediment sources such as wildfires, the failure of other unstable road segments or undersized culverts, and fluvial erosion during extreme flood events could combine with the risk of sedimentation under Alternative 1 to result in a cumulative effect on fish and sensitive aquatic species. The magnitude of the potential cumulative effect from Alternative 1 is not known. It is not possible to predict if a debris flow would actually occur since it depends on the weather and the condition of the road at the time of the event.

Determination of Effects

Essential Fish Habitat – *No Adverse Affect*

As discussed above throughout this aquatic section, it is unlikely that downstream effects would occur that would adversely affect any Essential Fish Habitat as defined under the Magnuson-Steven Fishery Conservation and Management Act (MSA) for salmon commercial fisheries.

Sensitive Fish and Aquatic Invertebrate Species (Table 49)

Oregon Coast Coho Salmon: *Not Likely to Adversely Affect (NLAA).*

Oregon Coast spring chinook, OC Steelhead, Umpqua Oregon Chub, Western ridged mussel, and Rotund Lanx*: May affect individuals or habitat but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population (MIIH).*

This sale was designed to minimize negative effects to OC coho salmon and salmon habitat, while still meeting the resource objectives associated with the project. The implementation of this project would likely result in effects of insignificant magnitude to the temperature, sediment/turbidity, substrate, peak/base flows, pool frequency, large pools, off-channel habitat, width/depth ratio, streambanks, floodplain connectivity, and drainage network indicators. Discountable effects may result to the chemical contamination and refugia indicators while neutral effects are expected to the physical barriers and large woody material indicators.

The negative but insignificant habitat effects would likely result in no adverse effects to OC coho salmon. The proposed action would have no direct effects to listed fish. No actions are proposed within the channels, or that would directly affect the channels, of any stream reaches which may be inhabited by listed fish. The above discussions of impacts from sedimentation disclosed negligible and discountable negative effects from such sediment to down stream habitat; as such, no impacts are expected to occur.

Pacific Coast Chum: *No Impact (NI).*

The closest suitable habitat being over 180 river miles downstream from a project which has been determined to have, at most, discountable or insignificant effects at the site scale for species with similar life histories.

Table 49: Determination of effects to Threatened, Endangered, and Sensitive Aquatic Species.

Species	Alts. 2, 3, 4
OC coho salmon (threatened) and OC coho critical habitat	NLAA
OC spring chinook	MIIH
Oregon Coast steelhead (candidate)	MIIH
Umpqua Oregon chub (sensitive)	MIIH
Western ridged mussel	MIIH
Rotund Lanx	MIIH
Pacific Coast chum salmon (sensitive)	NI

Specifically Required and Other Disclosures

RECREATION

Recreation within the planning area can best be described as dispersed with minimal developed recreation opportunities. Primary activities within the planning area boundary include hunting, hiking, and camping at low to non-developed camping areas. The camping areas are used by campers in the summer and hunters in the fall. Recreation sites include the Emile, Fairy and Cougar Shelters, used as overnight camping areas. Emile shelter is the only camping area in close proximity to a unit proposed for vegetation management activities.

Trailheads to Big Tree and Grotto Falls are also within the planning area boundary. These trailheads and trails are not within harvest units, but are located on proposed timber haul routes. Campgrounds located near and outside the planning area boundary include Lake in the Woods, Hemlock Lake, White Creek and Coolwater. Cougar Bluff Roadless Area is within the planning area, but is located well north of all proposed vegetation management activities.

Relevant Standards and Guidelines

No specific Standards and Guidelines apply to the planning area. All general Standards and Guidelines for this area (primarily regarding dispersed recreation sites) would continue to be met with this project.

Direct and Indirect Effects

There would be no direct, indirect or cumulative effects to recreation sites under Alternative 1 as no actions would occur that would impact recreationists or recreational opportunities. Ongoing activities such as road and trail maintenance (Table 9) would continue to improve visitor experiences to the recreation sites in the area.

Under all action alternatives, there would be no direct, indirect, or cumulative impacts to the Cougar Bluff Inventoried Roadless Area because no management actions would occur in or closely adjacent to this area.

The closest developed campground is Coolwater Creek, which occurs along the haul route. Proposed management activities (such as thinning) would not occur in proximity to this area. Because of this, potential impacts from thinning are considered to be minimal or non-existent. Because it occurs along the haul route, traffic related noise and congestion is expected to occur and may have short term negative effects to people in the area. As for dispersed sites, the shelters at Willow Flats and Emile generally do not receive heavy use and would be miminally impacted by any activity in the area. However, the area is utilized by hunters during deer and elk season (fall). Logging and burning operations and implementation of connected actions that extend into the fall have the possibility of disrupting hunters by causing noise, limiting access while active yarding is occurring, and by reducing visibility during burning. However, these disruptions would be short term and would generally occur during the work week and not on weekends when use is heaviest.

There are potential direct negative impacts to trailhead conditions at Big Tree and Grotto Falls since these trailheads are located along a proposed haul route. To mitigate this impact haul traffic would be discouraged from using any parking areas used for access to the trails or any of the other recreation sites in the planning area. If any visual degradation at the trailheads occurs, site revegetation and rehabilitation would be required.

Overall, the primary effects to recreationists and recreational opportunities (such as driving for pleasure) in the planning area under all action alternatives would include short-term noise disturbance during logging operations; short-term traffic congestion during yarding and logging operations; possible short-term access limitations (temporary road closures) during logging and yarding to protect the safety of forest visitors; and short-term air quality impacts (visibility) during fuel treatment operations. All effects to recreationists would be limited in extent and duration given that logging operations would take place during the normal operating season and would not likely extend year-round, except where winter haul may take place.

None of the connected actions would have any lasting effects on the recreation resources. Short term impacts include equipment blocking or taking up space on roads, fire or forestry personnel moving or driving throughout the forest, increases in traffic from crew movement during precommercial thinning operations, and a possible increase in dispersed recreation site use by forest workers. All of these impacts would be short term and seasonal, and are not expected to have a major effect on recreation in the area.

Indirectly, recreationists would likely find the area more visually appealing in the future, as shrubs and other more colorful species grow into the more open forest. Proposed management activities within the timber units include creating 1-3 acre gaps that would in turn enhance big game forage areas and as a result could potentially improve hunting in the planning area. Upgrades to the existing road system into the area would also improve the quality of visitor access.

Cumulative Effects

The scale at which cumulative effects are analyzed is the planning area. In terms of cumulative effects, when combined with the past (Table 7), ongoing (Table 8) and

reasonably foreseeable activities (Table 9), the limited extent and duration of direct and indirect effects to recreationists under the action alternatives are not expected to contribute to any meaningful cumulative effect to people recreating in the area.

VISUALS

The Visual Management System is a management tool to recognize the scenic qualities of a specific area. It establishes criteria for identification and classification of the scenic quality as well as visitor's concern for scenic quality. Each visual quality objective (VQO[82]) represents the degree of alteration from the natural appearing environment. The Umpqua LRMP applies the Visual Management System Inventory as a minimum standard that project proposals should achieve when implemented. The visual resources can also be described by the USDA's National Forest Scenery Management System (SMS) (Agriculture Handbook Number 701). The Umpqua National Forest LRMP has not been amended to officially adopt this system. However, SMS terms are described in parenthesis where applicable, in order to provide information as to how the alternatives address visual resource protection.

Management of the visual resources requires proposed activities to comply with the assigned objective. For Emile, objectives include retention (high scenic integrity), partial retention (moderate scenic integrity), modification (low scenic integrity) or maximum modification (very low scenic integrity). No areas of retention would be affected by the project. In the areas with the VQO of partial retention, management activities are to remain visually subordinate to the characteristic landscape. In areas with a VQO of modification, management activities may visually dominate the landscape; however, roads and visible remnants from logging such as slash and stumps, etc. should remain visually subordinate to the landscape. The maximum modification VQO allows management activities of vegetative and landform alterations to dominate the landscape. The majority of the planning area is either modification or maximum modification and is not viewed from either a primary observations area or any primary access route; most of the harvest units fall within the maximum modification VQO. Table 50 describes the visual quality objectives found in the planning area.

Table 50. Acres of VQO within the planning area and within the thinned areas of each alternative.

Visual Quality Objective	Planning Area Acres	Alternative 1 – includes all no thin areas	Alternative 2 – includes only areas to be thinned	Alternative 3 – includes only areas to be thinned	Alternative 4 – includes only areas to be thinned
Retention	113	0	0	0	0
Partial Retention	127	0	0	0	0
Modification	5,732	585	449	439	449

[82] The VQO inventory is divided into three components: the distance zone, the sensitivity level (constituent information), and the variety class (scenic attractiveness). The distance zones are described as FG-foreground, MG-middleground, and BG-background. The sensitivity level (1-highest, 2-average sensitivity, and 3-lowest) rates the concern for scenic quality. The visual inventory also describes the primary and sometimes the secondary place where a specific area can be viewed. This is usually from a prominent point of view or primary use area, or a particular road. Variety class relates to how distinct or common the visual resource is.

Visual Quality Objective	Planning Area Acres	Alternative 1 – includes all no thin areas	Alternative 2 – includes only areas to be thinned	Alternative 3 – includes only areas to be thinned	Alternative 4 – includes only areas to be thinned
Maximum Modification	20,855	1,911	1,386	1,315	1,386
Totals	35,482	2,496	1,835	1,754	1,835

Little River Road is classified as a sensitivity level 2 road under the Umpqua LRMP, which means that it has an average sensitivity for concern over scenic quality; all other roads and routes in the planning area have sensitivity level of 3.

Relevant Standards and Guidelines

Visual Standards and Guidelines are listed on pages IV-19 to IV-26. No visually sensitive areas listed in the LRMP would be affected by the thinning. Specifically for this project, the Umpqua LRMP lists the following standards and guidelines:

- The maximum percentage of created openings at any one time is based on the VQO objective and distance zone. For partial retention, this ranges between 10-25% maximum created opening. For modification, a maximum of 15-30% of the landscape may be in created openings, while in maximum modification areas, up to 33% of the landscape may be in created openings.
- A harvest unit is considered to be a created opening when the average stand height is less than 20 feet tall in foreground and middle ground distance zones, and less than 4.5 feet tall in background distance zones.
- Activity slash within viewsheds shall be treated commensurate with the VQO.

Direct and Indirect Effects

The scale at which effects are analyzed is the planning area. Alternative 1 would have no direct, indirect, or cumulative effects to the visual quality of the area because no ground disturbing activities would occur.

Alternatives 2-4 utilize thinning prescriptions and burning. Thinning prescriptions and fuels treatments are not proposed in retention or partial retention areas; thus, there would be no effects to visuals in these areas. The one to three acre openings along with the associated residual slash would not degrade the visual quality in the modification or maximum modification VQOs. All thresholds for created openings (Forest Plan Standards and Guidelines) would be met. Burning would have the potential to directly and indirectly impact visuals, especially if the burn were 'hot' and consumed more slash or trees than planned. However, the effects from the slash burns would fade after a few years, as vegetation grows and the burned area no longer becomes visible.

Topography and residuals trees are expected to form a partial or complete visual barrier between created openings and Little River and other major roads. Because of this, they are not expected to be readily visible to the average forest visitor. Therefore, all Standards and Guidelines would be met. No other direct or indirect effects from any other actions or connected actions would occur with these alternatives.

None of the connected actions would have any lasting effects on the visual resources. Short term impacts include equipment visible in and along roads, small piles visible

along roads, charred vegetation visible after burning, and other minor changes to the visible environment; these are all considered normal forest activities that a visitor would reasonably expect to see in a National Forest.

Cumulative Effects

The scale at which cumulative effects are analyzed is the planning area. All past regeneration harvest was considered (11,538 acres in the planning area). Of those acres, about 644 acres were regeneration harvested after 1990; those harvest units would potentially still have a visual impact in the area as the trees may be less than 20 feet tall. All areas harvested after 1990 with proposed activities for this project would be well within the VQO objectives and thresholds for created openings.

The no action alternative has no cumulative effect on visuals, because it does not alter the landscape. As described above Alternatives 2-4 would have minimal direct and indirect effects to visuals, given that the prescriptions call for thinning in second growth managed stands with small openings created within the thinning units, and there is limited effect on visuals from burning or connected actions. Since the existing condition is far below the thresholds for visual impact, and the action alternatives add minimally to the existing openings, it is not possible to have a meaningful cumulative impact to visuals. When considering past projects, present activities and the lack of reasonably foreseeable activities in the planning area that would have the potential to affect visual quality, no cumulative effects are anticipated to occur with these alternatives.

AIR QUALITY

Standards for ambient air quality[83] are set by the Environmental Protection Agency (EPA) and are designed to protect human health and welfare. Air quality can be impacted by the presence of particulate matter and other pollutants produced by both prescribed burning and wildfire[84]. Three primary pollutants produced by fire are particulate matter, carbon monoxide (CO) and carbon dioxide (CO_2). The closest population center or designated area[85] is Roseburg which is about 9 miles to the west. The closest Class I Airsheds (where there is an emphasis on the reduction of regional haze) are Boulder Creek Wilderness (about 9 miles to the northeast), Diamond Peak Wilderness (about 18 miles to the east), and Crater Lake National Park (about 26 miles to the southeast).

Burning techniques that minimize consumption during the smoldering phase of burning directly reduce emissions production. When compared to a summer wildfire, early season (spring, early summer) or late fall burning lessens emissions output by reducing 0-3 inch fuel consumption and leaving the majority of the moist duff, litter layer and larger woody material intact. The duff layer and large coarse woody debris generate the most emissions during the smoldering phase of combustion. Fall burns exceed spring

---

[83] Ambient air quality is defined under the Clean Air Act of 1963 as the air quality outside of industrial site boundaries.

[84] Although prescribed burning affects air quality in ways similar to wildfire, it offers some advantages over wildfire. Prescribed burning plans are developed and implemented to minimize impacts on the airshed by the consideration of atmospheric conditions, season of burn (e.g., burning is restricted between July 1 to September 15 under the Oregon Visibility Protection Plan), fuel and duff moisture, diurnal wind shifts, ignition techniques and rapid mop-up.

[85] Designated areas as delineated in the Smoke Management Plan Administrative Rule and defined by the rule as principle population centers.

burns in duff consumption and emission levels. Prior to burning, emissions are predicted given certain weather, burn prescription and site parameters, in order to meet State standards (Sandberg et al. 2002).

Particulate Matter

The major pollutant of concern from smoke is fine particulate matter (Sandberg et al. 2002), which can travel great distances, reduce visibility, and absorb and transmit harmful gases. EPA standards have been established for two classes of airborne particulate matter – PM 10 and PM 2.5. PM 10 is particulate matter less than 10 microns in diameter while PM 2.5 is a subset that is less than 2.5 microns in diameter. Studies indicate that 90 percent of all smoke particles emitted during wildland burning (both prescribed and wildfire) are PM 10; of these, the majority are PM 2.5 (Hardy et. al. 1991). PM 2.5 causes the majority of air quality impacts. Human health studies on the effects of particulate matter indicate that fine particles are largely responsible for health effects (O'Neill et al. 1997).

Particulate matter emissions were estimated for the Emile Timber Sale Project using the First Order Fire Effects Model (FOFEM version 5.1.1). Only the treatments that use fire would produce emissions, while none of the other treatments (such as chipping or cut-to-length/crushing) would directly impact air quality. Three main emissions (PM 2.5, CO, CO2) are compared, analyzed and summarized in Table 51. All action alternatives have the same prescribed fire treatment acres and thus effects associated with smoke do not vary among the action alternatives. The amounts of PM 2.5 displayed include all burning that would occur. Because not all units would be burned the same day and not all piles would be burned at the same time, the amount of emissions produced is not likely to affect population centers. This is because the emissions would last only a short time (the day of the burning) and would disperse rapidly, minimizing any direct effects to humans.

Table 51. Total PM 2.5 Emile Emissions in Tons by Alternative.

Fuels Treatment	Thinning and Burning Acres	PM 2.5 Tons per Acre[86]	Total PM2.5 Emissions with Activity Fuels burned[87]
Alternative 1	1244[88]	1.16	1,449
Alternative 2/3/4	1244	0.94	1,174

The effects of the emissions would cause temporary and short-term visibility impacts in the immediate project areas during ignition and burning of activity-created fuels, and the duration and extent of the effects would be affected by wind speed and direction. Weather systems can cause inversions that would affect dispersal of smoke down wind. The localized effects of burning in the project area would be short-term degradation of

[86] PM 2.5 emissions from a moist burning scenario used for Alternatives 2-4 and emissions from a dry burning scenario used for Alternative 1

[87] Emile activity fuels burned include those with the following fuel treatments: underburning, jackpot burning, machine pile and burning, burning of both skyline and helicopter landings and the handpiling and burning associated with all Emile stands.

[88] Alternative 1 acres used are the same acreage as Alternative 2. Although these acres would not be cut they are calculated to estimate PM 2.5 emissions from a future wildfire

air quality from prescribed burning, primarily during the actual burning stage and during inversions. Smoke from prescribed burning may be visible to people driving through the area. In most cases, the impacts to recreationist would likely be limited to the day of the burn, since limited camping occurs in the planning area. Burning piles in the fall would have minimal impacts to hunters or dispersed recreation users; this is due primarily to the favorable dispersal of smoke in the fall. Hunters in the area may be affected for a short period of time (the day of the burn), but would not experience adverse long-term impacts. Very minor amounts of particulates would be generated by roadwork and road use during harvest activities. Dust abatement would be used on roads during dry periods to minimize this particulate source. Since smoke dissipates rapidly, there are no past or future projects, that when combined with any of the action alternatives associated with the Emile Project, would contribute to any cumulative effect on air quality.

Carbon Monoxide and Carbon Dioxide

Carbon monoxide (CO) is a product of combustion that rapidly dilutes at short distances from a fire, therefore posing little to no risk to the broader community (Sandberg and Dost 1990). However, it can be present at high enough levels near a fire to pose hazards[89] to firefighters. It is a chemical asphyxiate that interferes with oxygen transport in blood.

The production of carbon dioxide (CO2) from the burning of forest residues contributes to the accumulation of greenhouse gases within the earth's atmosphere (Sandberg et al, 2002). Fires in the western United States are minor contributors of these gases, when compared to savannah and forest fires in the tropical regions of the earth (Sandberg et al. 2002). For the purposes of full disclosure, the following analysis of CO and CO2 emissions is provided.

Under Alternative 1, no direct emissions of CO or CO2 would occur, as no fuels treatment would immediately take place. The information in Table 52 shows that a wildfire that burns under moderate-high severity conditions would generally create 23% additional CO emissions and 19% additional CO2 emissions compared to a fire burned under prescribed conditions which minimize negative stand and air effects.

[89] Pilots (in closed environments) exposed to carbon monoxide have developed headaches, fatigue, decreased concentration and impaired judgment. Long-term exposure to low levels of carbon monoxide produce accelerated arteriosclerosis, increasing the risk of cardiovascular diseases such as heart attack and stroke (Sandberg and Dost 1990).

Table 52: CO and CO2 Emissions in Tons by Alternative.

Alternative	Thinning and Burning Acres	Total CO Emissions (tons)	Total CO_2 Emissions (tons)
Alternative 1	1,244[90]	18,914	100,240
Alternatives 2/3/4	1,244	15,328	84,524
Alternative 4	953	11,693	64,480

Considering the remoteness of the project area to any definable population centers, and the ability of firefighters to seek fresh air during project implementation, and during a wildfire event, no long term exposure to these gases would be expected; therefore, no direct or indirect effects to humans are anticipate from the Emile fuel treatments.

Cumulative Effects

There are no past projects that when combined with any of the alternatives associated with the Emile project would contribute to cumulative effects for PM 2.5, carbon monoxide or carbon dioxide emissions, since smoke disperses and does not linger long enough to interact with projects that occurred in prior years. Burning conducted by other user groups or the public (firewood burning for heat or other slash burnings) may also occur at the same time that burning for the Emile project occurs. The Forest Service is required to file a burn plan with Oregon Department of Environmental Quality (ODEQ) and would comply with the strict standards for air quality. ODEQ would not allow burning when atmospheric conditions exist that may result in an inversion. ODEQ strictly regulates burning; as such, there is very little likelihood that the effects from the Emile Project would combine with other projects or other burning. Therefore, there would be no anticipated cumulative effects to air quality.

HERITAGE RESOURCES

The affected environment for heritage resources falls within the areas of proposed ground disturbing activities (timber harvest, fuels treatment, road construction, reconstruction, and decommissioning, subsoiling, landing construction, etc.).

Forest Plan goals and objectives and Cultural Resource (Heritage) Standards and Guidelines are listed in Chapter IV, pages 28-30 of the Umpqua National Forest LRMP. All applicable Standards and Guidelines have been met through the inventory and evaluation of any historic or prehistoric heritage resources. All historic properties have been avoided.

A heritage resource inventory was conducted as part of the compliance process of section 106 of the National Historic Preservation Act of 1966. The Emile Timber Sale Project reconnaissance report has been completed and submitted to the State Historic Preservation Office (SHPO) as required. The Emile cultural resources inventory and monitoring meets the criteria for Case-by Case Review required by the Programmatic

[90] Alternative 1 acres used are the same acreage as Alternative 2. Although these acres would not be cut they are calculated to estimate both CO and CO2 emissions from a future wildfire

Agreement[91] among the United States Department of Agriculture Forest Service, Pacific Northwest Region (Region 6), the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer Regarding Cultural Resources Management in the State of Oregon (PA).

The potential exists for unidentified heritage resources in the Emile project area, especially in areas where heavy shrub cover makes surveying difficult. Mitigation measures described in Chapter 2 would protect undiscovered heritage resources, lowering the potential for effects to these resources. Overall, proposed ground disturbing activities would have little potential to affect heritage resources. Standard contract provisions would provide for protection of heritage resources discovered during project implementation.

The Umpqua National Forest sent a cover letter with the quarterly copies of the Schedule of Proposed Action (SOPA) to each of the Tribes. Each quarter, the cover letter highlights new projects and projects that may be of interest to the Tribes; the Emile Timber Sale Project was identified as a new project when the project was first initiated. The Confederated Tribes of the Grand Ronde, Confederated Tribes of the Siletz, and the Cow Creek Band of Umpqua Tribe of Indians were contacted by Debra Barner, Heritage Program Manager for the Forest. Other contacts in the form of phone calls, letters, opportunities to participate in public tours and public meetings, and meetings at Tribal offices were also utilized to interact with the Tribes. No interest in this project was expressed by any of the tribes.

Under the treaties with the Tribes, no trust resources or reserved treaty rights are given for the lands managed by the Umpqua National Forest. Therefore, no effects to trust resources or reserved treaty rights would occur with any of the alternatives.

Based on the results of the heritage surveys, review and mitigation of known resources, mitigation of undiscovered sites, and consultation with tribes, there would be no direct, indirect, or cumulative effects on the known heritage resources as the result of implementing any of the proposed Emile Timber Sale Project alternatives, because all known sites occur outside of the area affected by the project. The action alternatives may reduce the potential of damage to historic properties due to the reduced risk of high intensity fire occurrence in the future. The no action alternative would have no direct or cumulative effect on any heritage resources. Indirectly, a wildfire may have the potential to burn or damage existing heritage resources, especially if the fire was of high intensity under Alternative 1.

UNIQUE HABITATS

Unique habitats are discussed under the terrestrial section of this Chapter. No further information will be added here.

WETLANDS AND FLOODPLAINS

Floodplains are associated with perennial streams and vary from only a few feet to much larger areas depending on the size of the stream and the topography of the streambanks and surrounding area. The action alternatives propose thinning and fuel treatments in most riparian areas (Table 42). The action alternatives would also include general road

[91] The Stipulation III (B)1 Programmatic Agreement is between the Advisory Council on Historic Preservation (ACHP), Oregon State Historic Preservation Office, and the United States Forest Service, Region 6.

maintenance activities, reconstruction of stream crossings and removing some existing crossings on existing abandoned roads (Table 43). Most of these actions would be improvements over the existing condition by reducing erosional risks. No new occupancy of project floodplains would occur; the culvert replacements and related road work would occur within the original locations.

No effects to floodplains associated with timber harvest under any action alternative would occur since perennial streams would receive no-cut buffers. Slash burning may back into riparian areas in order to reduce fuel loads. No adverse direct, indirect, or cumulative effects to floodplains are expected to occur.

The environmental effects of road reconstruction within the floodplain are consistent with the Standards and Guidelines for the Umpqua National Forest LRMP and have been evaluated and declared in the LRMP Final EIS (March 1990). Since the activities in this project follow those Standards and Guidelines, this activity will not be declared separately for this sale.

Potential impacts to wetlands are described under unique habitats in the terrestrial section of Chapter 3. Action alternatives are consistent with objective 7 of the Aquatic Conservation Strategy, which calls for the maintenance of water table elevations in meadows and wetlands. Given the design features and mitigation incorporated into the action alternatives, no adverse direct, indirect, or cumulative effects to wetlands are anticipated under any of the Emile alternatives.

PRIME FARMLANDS, RANGELANDS, FORESTLANDS, AND PARKLANDS

No prime farmlands, rangelands, forestlands or parklands exist within the area; therefore; no direct, indirect or cumulative effects would occur.

POTENTIAL OR UNUSUAL EXPENDITURES OF ENERGY

The action alternatives would require expenditures of fuel for workers to access the Emile project for use of power equipment and to utilize the logging systems. In addition, jet fuel use for helicopter operations would also occur under the action alternatives however, these alternatives would not result in any unusual expenditure of fuel. The no action alternative would require no expenditure of fuel. No other direct, indirect, or cumulative effects are expected to occur with any of the action alternatives.

CONFLICTS WITH PLANS, POLICIES, OR OTHER JURISDICTIONS

Implementation of any of the alternatives would not conflict with the plans or policies of other jurisdictions, including the Tribes. This project would not conflict with any other policies, regulations, or laws, including the Clean Water Act, Endangered Species Act, and the National Historic Preservation Act. Effects to air quality and compliance with the Clean Air Act are described in this chapter. The Cougar Bluffs Inventoried Roadless Area is in the planning area, but no activities would occur in or near it; and as such, there are no direct, indirect, or cumulative effects to this area. No activities would take place in the North Umpqua River Wild and Scenic River Corridor.

CONSUMERS, CIVIL RIGHTS, MINORITY GROUPS, AND WOMEN

Contracting procedures would ensure that projects made available to contractors through this project would be advertised and awarded in a manner that gives proper consideration to minority and women-owned business groups. Because of this

consideration, there would be no direct, indirect, or cumulative effects to consumers, civil rights, or minority groups with implementation of any of the alternatives.

ENVIRONMENTAL JUSTICE

On February 11, 1994, President Clinton signed Executive Order 12898. This order directs Federal agencies to address environmental justice by identifying and disclosing the effects of the proposed activities on minority and low-income populations. The effects of the alternatives on the economic conditions of the State and county are disclosed in the Economics section of this chapter.

According to 2006 statistical data for Douglas County, about 7% of the population is made up of minorities. Unemployment and poverty in the county is higher than the State average. The project occurs well away from any large population center that would be directly affected by the project. The community of Peel lies along the haul route and has a small store that may see an increase in business during logging operations. The communities of Idleyld Park and Glide, which are to the west of the planning area, may also see an increase in business and an increase in traffic. Continued implementation of the Lobo, Tugboat, and Wapiti projects would also contribute to an increase of log truck traffic. The reasonably foreseeable timber sales resulting from the D-Bug project on the Diamond Lake Ranger District may also contribute to log truck traffic; overall, this increase in traffic may be measurable, but would not be comparable to the logging that occurred in the area in the late 1980's. No other adverse direct, indirect, or cumulative effects to these communities are expected to occur.

The stands that would be thinned have some recreational value, as described in the recreation section. Where there is dispersed recreation, the effects to those recreating in the area would be greatest. Minority groups or low-income groups that use these areas may be impacted during logging operations by the increase in log truck traffic. These groups may choose to recreate elsewhere. Adverse impacts to these groups would end when logging and other connected actions are completed. Overall, none of the action alternatives imposes any other additional hardships on minority or low-income communities; therefore, there would be no direct, indirect, or cumulative effects to environmental justice with any action alternative. Alternative 1 would have no direct, indirect, or cumulative effects to any low-income or minority populations that utilize the area for recreation.

This page intentionally left blank.

CHAPTER 4

CONSULTATION WITH OTHERS

PUBLIC INVOLVEMENT

Formal scoping (a process used to surface issues) began when the project was first listed in the July 2007 Umpqua National Forest Quarterly Schedule of Proposed Actions (SOPA). A scoping notice describing the project components and querying interest in a field trip was sent to 136 members of the public on October 30, 2007 with the intent of introducing the proposed action and soliciting issues. Two members of the public expressed interest in attending a late November field trip, but weather conditions and scheduling conflicts prevented a trip from occurring in a timely manner and both individuals agreed that a spring field trip to the project area would be acceptable. Douglas County joined as a Cooperating Agency on the project on November 21, 2007.

The formal scoping period for the project ended on November 30, 2007, however, all input received was considered regardless of timelines. In total, eight letters/emails were received during scoping. The Forest Service communicated with interested parties as issues were finalized and alternatives developed. The Emile project record contains a detailed scoping summary that describes Forest Service outreach efforts, the scoping comments received for the project, and how the Forest Service addressed scoping comments. Concerns for the project were focused on roads, riparian areas, economics, big game forage, and retention of wildlife habitat and old-growth features.

Draft EA Chapters 1 and 2 (issues and alternatives) and the project scoping summary were posted on the Umpqua National Forest website and an email concerning this information was sent to all parties who provided scoping comments on March 25, 2008. A project update and field trip invitation was sent to 136 members of the public on May 19. A public field trip was held on May 29th and eight members of the public attended.

AGENCY AND OTHER GOVERNMENT CONSULTATION

The regulatory agencies charged with overseeing the Endangered Species Act (US Fish and Wildlife Service and NOAA Fisheries) were consulted as appropriate during the planning process. US Fish and Wildlife Service participated in a field trip on August 07, 2007 and provided recommendations for incorporation into the proposed action. Informal discussions with NOAA Fisheries began in early 2008 when the Forest Service became aware that the Coho salmon would be relisted under the ESA. Consultation with both regulatory agencies will be finalized prior to the issuance of the Decision Notice. Tribal consultation also occurred; no interest in this project was expressed by the Tribes.

INTERDISCIPLINARY TEAM

The following people are members of the Interdisciplinary Team (IDT) that participated in the preparation or review of all or part of this environmental assessment:

Rick Abbott	Silviculturist
Jim Archuleta	Soil Scientist
Joy Archuleta	Hydrologist/Aquatic Writer/Editor

Bryan Benz	Botanist
Mike Brown	Fire/Fuels Specialist
Sherri Chambers	IDT Leader, Writer/Editor, Wildlife Biologist
Stu Carlson	Logging Systems Specialist
Derek Ibarquen	Recreation Specialist
Chris Kelly	Heritage Resources
Mike Kinney	Roads
Ron McMullin	Fisheries Biologist
Steve Nelson	Economics

In addition, the following people assisted in developing the proposal or in the editing and review of this document:

Debbie Anderson	Forest NEPA Coordinator
Debra Barner	Forest Archaeologist
Carol Boyd	Geographic Information Systems Specialist
Carol Cushing	District Ranger
Ray Davis	Forest Wildlife Biologist
Ed Hall	Geographic Information Systems Specialist

REFERENCES CITED

Abrams, Leroy. 1923-1960. Illustrated Flora of the Pacific States, Vol. 1-4. Stanford University Press, Stanford, California.

Adrian, A., T.A. Thomas, R.E. Miller, H.W. Anderson, and B.L. Flaming. 2005. Ground-Based Forest Harvesting Effects on Soil Physical Properties and Douglas-Fir Growth. Soil Sci Soc. Am. J. 69:1822-1832.

Agee, J.K. 1993. Fire ecology of Pacific Northwest forests. Island Press, Washington D.C.

Amaranthus M. P., D. Page-Dumroese, A. Harvey, E. Cazares and L.F. Bednar. 1996. Soil compaction and organic matter affect conifer seedlings, nonmycorrhizal and ectomycorrhizal root tip abundance and diversity. USDA Forest Service Pacific Northwest Research Station, Research paper NR 494.

Andrews, L. S., J. P. Perkins, J. T. Thrailkill, N. J. Poage and J. C. Tappeiner II. 2005. Silvicultural approaches to develop northern spotted owl nesting sties, central coast ranges, Oregon. West. J. Appl. For, 20(1): 13-27.

Arora, David. 1986. Mushrooms Demystified. Ten Speed Press, Berkeley, California.

Ashton, D.T., A.J. Lind, and K.E. Schlick. 1997. Western Pond Turtle (Clemmys marmorata) Natural History. USDA Forest Service, Pacific Southwest Research Station.

Audubon WatchList - Black Swift.htm
http://audubon2.org/watchlist/viewSpecies.jsp?id=38

Azuma, David L.; Donnegan, Joseph; Gedney, Donald. 2004. Southwest Oregon Biscuit Fire. Res. Pap. PNW-RP-560. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 32p.

Bate, Lisa J. 1995. Monitoring woodpecker abundance and habitat in the central Oregon Cascades. Moscow, ID: University of Idaho. 116 p. M.S. thesis.

Brady, Nyle C. 1990. The nature and properties of soils. 11th Edition; pp 499-501.

Biswell, Brian, M. Blow, R. Breckel, L. Finley and J. Lint. 2002. Survey protocol for the red tree vole. Version 2.1, Revision, October 2002.
http://www.blm.gov/or/plans/surveyandmanage/SP/RedTreeVole/200210/RTV%20protocol%20revision-V.2.1-final.pdf

Beschta, Robert L., James R. Boyle, Carol C. Chambers, Wayne P. Gibson, Stanley V. Gregory, Jeffery Grizzel, Joan C. Hagar, Joan C. Hagar, Judy L. Li, William C. McComb, Tye W. Parzybok, Maryanne L. Reiter, George H. Taylor, and James E. Warila. 1995. Cumulative effects of forest practices in Oregon: literature and synthesis. Prepared for Oregon Department of Forestry, Salem, OR.

Bonnicksen, T.M. 2008. Greenhouse gas emissions from four California wildfires: opportunities to prevent and reverse environmental and climate impacts. FCEM Report 2. The Forest Foundation, Auburn, California. 19 p.

Brady, Nyle C. 1990. The nature and properties of soils. 11th Edition; pp 499-501.

Brown, George W. 1972. The Alsea watershed study. School of Forestry, Oregon State University; Corvallis, OR. Reprinted from Vol. XXXII, Pacific Logging Congress 1972 Loggers Handbook.

Brown, George W., Arnold R. Gahler, and Richard B. Marston. 1973. Nutrient losses after clear-cut logging and slash burning in the Oregon coast range. Water Resources Research, October 1973; American Geophysical Union.

Brown, R. C. 1991. Effects of timber management practices on elk. Arizona Game and Fish Department Resources Branch Technical Report No. 10.

Bulmer, C. 2000. Reclamation of forest soils with excavator tillage and organic amendments. Forest Ecology and Management 133:157-163.

Burke, C.J. 1979. Historic Fires in the central western Cascade, Oregon. M.S. thesis, Oregon State University, Corvallis, Oregon.

Busse, M.D., Hubbert, K.R. Fiddler G.O., Shestak C.J. and Powers R.F. 2005. Leathal soil temperatures during burning of masticated forest residues. Int. J. Wildland Fire. 14, 267-276

Castellano, M.A., J.E. Smith, T. O'Dell, E. Cázares, and S. Nugent. 1999. Handbook to strategy 1 fungal taxa from the Northwest Forest Plan. Gen. Tech. Rep. PNW-GTR-476. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 195 p.

Castellana, M.A., E. Cázares, B. Fondrick, and T. Dreisbach. 2003. Handbook to Additional Fungal Species of Special Concern in the Northwest Forest Plan. USDA, Forest Service, Gen. Tech. Report PNW-GTR-572, Corvallis, OR.

Chan, S.S., D.J. Larson, K.G. Mass-Hebner, W.H. Emmingham, S.R. Johnson, and D.A. Mikowski. 2006. Overstory and understory development in thinned and underplanted Oregon Coast range Douglas-fir stands. Can. J. For. Res. 36:2696-2711.

Christner, Jere, 1981. Changes in peak streamflows from managed areas of the Willamette National Forest. USDA Forest Service, Pacific Northwest Region, Willamette National Forest. Forest Report. 28p.

Council on Environmental Quality. 2005. Memo from CEQ on cumulative effects guidance. June 2005.

Covert, Ashley S., William J. Eliot, Timothy E. Link. 2005. Evaluation of runoff prediction from WEPP-based erosion models for harvested and burned forest watersheds. American Soc. of Ag. Eng. ISSN 0001-2351 Vol. 48(3): 1091-1100.

Cristy, R.E. and S.D. West. 1993. Biology of bats in Douglas-fir forests. USDA Forest Service Gen. Tech. Rep. PNW-GTR-308. 27pp.

Cross, S.P., H. Lauchstedt and C. Harmes. 1996. Characterizing forest roost sites of some bats of special concern occurring in Roseburg and Medford BLM Districts. Final Report – Department of Biology. Southern Oregon State College, Ashland, OR. 47pp.

Derr, Chiska, Richard Helliwell, Andrea Ruchty, Lisa Hoover, Linda Geiser, David Lebo, and John Davis. 2003. Survey Protocols for Survey & Manage Category A & C Lichens.

USDA Forest Service, USDI Bureau of Land Management, and USDI Fish & Wildlife Service, Portland, Oregon.

Derr, Chiska, Robin D. Lesher, Linda H. Geiser, and Marty M. Stein. 2003. 2003 amendment to the survey protocol for survey & manage category A & C lichens in the Northwest forest plan area. USDA Forest Service, USDI Bureau of Land Management, and USDI Fish & Wildlife Service, Portland, Oregon.

Dietrich, William E., and David R. Montgomery, 1998, SHALSTAB, A digital terrain model for mapping shallow landslide potential: Technical Report, National Council of the Paper Industry for Air and Stream Improvement, Corvallis, Oregon, 29 p.

Donnelly, D.M. and R.R. Johnson. 1997. Westside Cascades variant of the Forest Vegetation Simulator. WO-Forest Management Service Center, USDA-Forest Service, Fort Collins, CO. 68 pp.

Duncan, N. 2004. Conservation Assessments for Crater Lake Tightcoil (Pristiloma arcticum crateris), Oregon Shoulderband (Helminthoglypta hertleini), and Chace Sideband (Monadenia chaceana). USDA-For. Serv. and USDI-BLM. Roseburg, OR.

Elliot, William J., David E. Hall, Dayna L. Scheele. 1999. WEPP: road (draft 12/1999) WEPP interface for predicting forest road runoff, erosion, and sediment delivery. USDA_For. Sev. Rocky Mtn. Research Sta. and San Diamas Tech. and Dev. Center. http://forest.moscowfsl.wsu.edu/fswepp.

FEMAT. 1994. Forest ecosystem management: an ecological, economic, and social assessment. Portland, OR: U.S. Department of Agriculture; U.S. Department of the Interior [and others]. [Irregular pagination].

Foley, G., Cropley, S., and Giummara, G., 1996. Road Dust Control Techniques – Evaluation of Chemical Dust Suppressant's Performance, ARRB Transport Research Ltd., Special Report 54, Victoria, Australia.

Forest Service Handbook, 1909.15, Chapter 18.

Forest Service Handbook, 2409.19, Chapter 60. Stewardship Contracting.

Forsman, E.D., J. A. Reid, S.A. Graham, J.S. Mowdy and A.L. Price. 2002. Demographic characteristics of northern spotted owls (Strix occidentalis) on the Tyee study area, Roseburg, Oregon: 1985-2002. Annual research report. 12p.

Franklin J.F. , T.A. Spies, R. Van Pelt, A.B. Carey, D.A. Thornburg, D.R. Berg, D.B. Lindenmayer, M.E. Harmon, W.S. Keeton, D.C. Shaw, K. Bible, J. Chen. 2002. Disturbance and structural development of natural forest ecosystems with silvicultural implications, using Douglas-fir forests as an example. Forest Ecology and Management 155:) 399-423.

Froehlich. H.A. and D.H. McNabb. 1984. Minimizing Soil Compaction in Pacific Northwest Forests. In: Earl L. Stone (ed.) Forest Soils and Treatment Impacts. Proc. of Sixth North American Forest Soils Conference. Univ. of Tenn. Conferences, 2016 Lake Ave. Knoxville. June 1983. pp. 159-192.

Garman S. L., J. H. Cissel, and J. H. Mayo. 2003. Accelerating development of late-successional conditions in young managed Douglas-fir stands: a simulation study. USDA Forest Service, General Technical Report PNW-GTR-557.

Gebert, Krista M., and Charles E. Keegan III, Sue Willits, Al Chase, April 2002. Utilization of Oregon's Timber Harvest and Associated Direct Economic Effects, 1998. Pacific Northwest Research Station General Technical Report PNW-GTR-532.

Giachini, A.J. 2005. Systematics, phylogeny, and ecology of Gomphus sensu lato. Dissertation, Oregon State University, Corvallis, Oregon.

Holland, D. C. 1991. A synopsis of the ecology and status of the western pond turtle (Clemmys marmorata) in 1991. Prepared for the USFWS, National Ecology Research Center, San Simeon Field Station.

Gomez, D.M., R.G. Anthony, and J.P. Hayes. 2005. Influence of thinning of Douglas-fir forests on population parameters and diet of northern flying squirrels. Journal of Wild. Management 69(4):1670–1682.

Hagar, J., Howlin, S. & Ganio, L. 2004. Short-term response of songbirds to experimental thinning of young Douglas-fir forests in the Oregon Cascades. For. Ecol. Manage. 199: 333-347.

Halpern, C.B. 1999. Effects of prescribed burning at Bunchgrass Meadow: An establishment report and baseline data submitted to the McKenzie Ranger District Willamette NF, Oregon.

Hanes, R.E., Zelanzny, L.W., and Blaser, R.E., 1970. Effects of Deicing Salts on Water Quality and Biota. National Cooperative Highway Research Program, Report No. 91.

Hanes, R.E., Zelanzny, L.W., Verghese, K.G., Bosshart, R.P., Carson Jr., E.W., Wolf, D.D., 1976. Effects of Deicing Salts on Plant Biota and Soil. National Cooperative Highway Research Program, Report No. 170.

Harr, R.D., R.L. Fredriksen,1988. Water quality after logging small watersheds within the Bull Run Watershed, Oregon. Water Resources Bulletin 24:1103-1111.

Hardy, Colin C.; Ottmar, Roger D.; Peterson, Janice L; Core, John E.; Seamon, Paula; [Editors] 2001. Smoke management guide for prescribed and wildland fire: 2001 edition PMS 420-2. NFES 1279. Boise, ID: National Wildfire Coordination Group. 226 p

Harr, R.D., 1979. Effects of timber harvest on streamflow in the rain-dominated portion of the Pacific Northwest, in Proceedings of a Workshop on Scheduling timber Harvest for Hydrologic Concerns, USDA, Forest Service, Portland, OR. 45p.

Hatten, Jeff, Darlene Zabowski, George Scherer, Elizabeth Dolan. 2005. A comparison of soil properties after contemporary wildfire and fire suppression. For. Eco. & Mgt. 220 (2005) 227-241.

Hayes, J.P., J.M. Weikel, and M.M.P. Huso. 2003. Response of birds to thinning young Douglas-fir forests. Ecological Applications: Vol. 13, No. 5, pp. 1222–1232.

Helliwell, R. 1998. Rare Vascular Plants of the Umpqua National Forest. USDA, Forest Service, Pacific Northwest Region, Portland, Oregon.

Helliwell, R. and Dana York 2006. A Predictive Habitat Model and Field Validation for the Rare Lichen Pseudocyphellaria rainierensis. Supervisor's Office, Roseburg, Oregon.

Heninger, R., Scott, W., Dobkowski, A., Miller, R., Anderson, H., and Duke, S.. 2002. Soil disturbance and 10-year growth response of coast Douglas-fir on nontilled and tilled skid trails in the Oregon Cascades. Can. J. For. Res. 32: 233–246.

Hickman, James C., Ed. 1993. The Jepson Manual, Higher Plants of California. University of California Press, Berkeley, California.

Hitchcock, C. L., and A. Cronquist. 1973. Flora of the Pacific Northwest. University of Washington Press, Seattle, Washington.

Hitchcock, C. L., A. Cronquist, M. Ownbey, and J. W. Thompson. 1955-1969. Vascular Plants of the Pacific Northwest, Parts 1-5. University of Washington Press, Seattle, Washington.

Hockaday, William C., Amanda M. Grannas, Sunghwan Kim, Patrick G. Hatcher. 2006. Direct molecular evidence for the degradation and mobility of black carbon in soils from ultrahigh-resolution mass spectral analysis of dissolved organic matter from a fire-impacted forest soil. Organic Geochemistry 37 (2006) 501-510.

Irwin, L.L., D.F. Rock, and G.P. Miller 2000. Stand structures used by northern spotted owls in managed forests. J. Raptor Res. 34(3):175-186.

Jones, J. A. 2000. Hydrologic processes and peak flow discharge response to forest removal, regrowth and roads in ten small experimental basins, Western Cascades, Oregon. Water Resources Research.

Jones, J.A., and G.E. Grant. 1996. Peak flow responses to clear-cutting and roads in small and large basins, western Cascades, Oregon. Water Resource Research. 32(4): pgs 959-974.

Kolka, R.K and Smidt M.F. 2004. Effects of forest road amelioration techniques on soil bulk density, surface runoff, sediment transport, soil moisture and seedling growth. Forest Ecology and Management 202. p 313–323

Korb, J.E., N.C. Johnson, and W. W. Covington. 2004. Slash Pile Burning Effects on Soil Biotic and Chemical Properties and Plant Establishment: Recommendations for Amelioration. Restoration Ecology Vol. 12 No. 1, pp. 52-62.

Kozloff, E.N. 2005. Plants of Western Oregon, Washington & British Columbia. Timber Press, Portland, OR

Lal, R. 2005. Forest soils and carbon sequestration. For. Eco. & Mgt. 220 (2005) 242-258.

Larkin J.L., J.J. Cox, M.W. Wichrowski, M.R. Dzialak, and D.S. Maehr D.S. 2004. Influences on Release-Site Fidelity of Translocated Elk. Restoration Ecology, 12: 1, pp. 97-105

Lawton, Elva. 1971. Moss Flora OF The Pacific Northwest. Hattori Botanical Laboratory, Obi, Nichinan-shi, Miyazaki-ken, Japan.

Leonard, W.P., H.A. Brown, L.L.C. Jones, K.R. McAllister and R.M. Storm. 1993. Amphibians of Washington and Oregon. Seattle Audubon Society, Seattle, WA. 168pp.

Lesher, Robin D., Chiska C. Derr, and Linda H. Geiser. 2003. Natural History and Management Considerations for Northwest Forest Plan Survey and Manage Lichens. USDA Forest Service, Pacific Northwest Region, Portland, Oregon.

Liang, B., Lehmann, J., Soloman, D., Kinyangi, J., Grossman, J., O'Neill, B., Skjenstad, J.O., Luizao, F.J., Pertersen, J. and E.G. Neves. 2006 Black Carbon Increases Cation Exchange Capacity in Soils. Soil Sci. Soc. Am. J. 70:1719–1730

Lindo, Zoë and Suzanne Visser. 2003. Microbial biomass, nitrogen and phosphorus mineralization, and mesofauna in boreal conifer and deciduous forest floors following partial and clear-cut harvesting. Can. J. For. Res. Vol. 33, pp 1610-1620.

Lindh, B.C. and P.S. Muir. 2004. Understory vegetation in young Douglas-fir forests: does thinning help restore old-growth composition? Forest Ecology and Management 192 (2004) 285-296.

Luce, C.H. 1997. Effectiveness of Road Ripping and Restoring Infiltration capacity of Frorest Roads. Restoration ecology Vol. 5 No 3,pp 265-270.

Luce, C.H., Rieman B.E., Dunham J.B., Clayton J.L., King J.G., and Black T.A.. 2001. Incorporating Aquatic Ecology into Decisions on Prioritization of Road Decommissioning. Water Resources IMPACT Vol 3. pp8-14

Luoma, Daniel L. and Joyce Eberhart. 2005. Results from green-tree retention experiments: ectomycorrhizal fungi. From, balancing ecosystem values proceedings, biodiversity. Dept. For. Sci., OSU, Corvallis, OR
Luoma, D.L., C.A. Stockdale, R. Molina, and J.L. Eberhart. 2006. The spatial influence of Pseudotsuga menziesii retention trees on ectomycorrhiza diversity. Can. J. For. Res. 36: 2561-2573.

Marshall D. B., M. G. Hunter, and A. L. Contreras (eds.). 2003. Birds of Oregon: A general reference. Oregon State University Press, Corvallis, OR.

McCune, Bruce and Geiser, Linda. 1997. Macrolichens of the Pacific Northwest. Oregon State University Press and USDA Forest Service Publishing. Corvallis, Oregon.

McDade, M. H., F. J. Swanson, W. A. Mckee, J. F. Franklin, and J. Van Sickle. 1990. Source distances for coarse woody debris entering small streams in western Oregon and Washington. Canadian Journal of Forest Research 20: 326-330.

McDonald, L. H., A. W. Smart, and R.C. Wissmar. 1991. Monitoring Guidelines to evaluate effects of Forestry activities on streams in the Pacific Northwest and Alaska. EPA/910/9-91-001. Region 10 USEPA, Seattle WA. 166p.

Mellen, K., B.G. Marcot, J.L. Ohmann, K. Waddell, S.A. Livingston, E.A. Willhite, B.B. Hostetler, C. Ogden, and T. Dreisbach. 2006. DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. Version 1.10. USDA Forest Service, Pacific Northwest Region and Pacific Northwest Research Station; USDI Fish and Wildlife Service, Oregon State Office; Portland, Oregon. http://wwwnotes.fs.fed.us:81/pnw/DecAID/DecAID.nsf

Miller, R.E., Colbert, S.R. and L.A. Morris. 2004. Effects of Heavy Equipment on Physical Properties of Soils and on Long-term Productivity: A Review of Literature and Current Research. National Council for Air and Stream Improvement Technical Bul #887.

Montgomery, D.R. 1994. Road surface drainage, channel initiation, and slope instability. Water Resources Research, 30(6): 1925-1932.

Muir, P.S., R.L. Mattingly, J.C. Tappeiner II, J.D. Bailey, W.E. Elliott, J.C. Hagar, J.C. Miller, E.B. Peterson, and E.E. Starkey. 2002. Managing for biodiversity in young Douglas-fir forests of western Oregon. U.S. Geological Survey, Biological Resources Division, Biological Science Report USGS/BRD/BSR–2002-0006. 76 pp.

Murphy, M. L., and K. V. Koski. 1989. Input and depletion of woody debris in Alaska streams and implications for streamside management. North American Journal of Fisheries Management 9: 427-436.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

Naiman, R.J., T.J. Beechie, L.E. Benda, D.R. Berg, P.A. Bisson, L.H. MacDonald, M.D. O'Connor, P.L. Olson, and E.A. Steel. 1990. Fundamental Elements of Ecologically Healthy Watersheds in the Pacific Northwest Coastal Ecoregion.

Nussbaum, R. A., E. D. Brodie, Jr. and R. M. Storm. 1983. Amphibians and reptiles of the Pacific Northwest. Univ. Press of Idaho. 332pp.

ODEQ. 2002. Final 2002 303(d) Database.

Oregon Department of Environmental Quality, Division 50. June 15, 2001. Oregon State archives administrative rules: 340-050-0025, 340-050-0026, 340-050-0031, 350-050-0035, 340-050-0065, 340-050-0070, and 340-050-0080. In: The Oregon administrative rules of domestic wastewater treatment facility biosolids, biosolids derived products, and domestic septage. Salem, OR. URL: http://www.deq.state.or.us/wq/biosolids/regs.htm

Oregon Department of Environmental Quality (ODEQ). 2003. Consolidated assessment and listing methodology for Oregon's 2002 303(d) list of water quality limited waterbodies and integrated 305(b) report.

Oregon Department of Environmental Quality (ODEQ). 2003. Designated beneficial uses – Umpqua Basin. Oregon Administrated Rules 340-41-0320, Table 320A. http://www.deq.state.or.us/wq/rules/div041/dbutables/table320a.pdf

Oregon Department of Environmental Quality (ODEQ). 2006. Umpqua basin total maximum daily load (tmdl) and water quality management plan (wqmp). Medford, Oregon.

Ohmann, J. L., and K. L. Waddell. 2002. Regional patterns of dead wood in forested habitats of Oregon and Washington. pp 535-560. In: Laudenslayer, William F., Jr.; Valentine, Brad; Weatherspoon, C. Philip; Lisle, Thomas E., technical coordinators. Proceedings of the symposium on the ecology and management of dead wood in western forests. 1999 November 2-4; Reno, NV. Gen. Tech. Rep. PSW-GTR-181. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.

Oliver C. D. and B. C. Larsen. 1996. Forest Stand Dynamics. Wiley and Sons, Inc. New York.

OLMIS. Oregon Labor Market Information System. Oregon Employment Department. www.olmis.org Summary Covered Employment and Payroll Report, Douglas County, 2002.

OMB A-94. Office of Management and Budget Circular No. A-94. October 29, 1992, revised 1999. Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs.

O'Neill, Robert V.; Hunsaker, Carolyn T.; Jones, K. Bruce; Ritters, Kurt H.; Wickham, James D.; Schwartz, Paul M.; Goodman, Iris A.; Jackson, Barbara L.; Baillargeon, William S. 1997. Monitoring environmental quality at the landscape scale BioScience 47(8): 513-519.

O'Farrell, M.J. and E.H. Studier. 1980. Myotis thysanodes. Mammalian Species 137:1-5.

Opler P.A. 1999. A field guide to western butterflies. Peterson Field Guide. Hughton Miffin Co. New York, New York. 540 p.

Ormsbee, Pat. 2003. Personal Communication,10-17-2003. Bats

PIF. 1999. Conservation strategy for landbirds in coniferous forests of western Oregon and Washington. Version 1.0. 111 p.

Poage , N.J. and J. C. Tappeiner, 2002. Long-term patterns of diameter and basal area growth of old-growth Douglas-fir trees in western Oregon. Can. J. For. Res. 32: 1232-1243.

Pyle. R.M. 2002. The Butterflies of Cascadia. A field guide to all the species of Washington, Oregon, and surrounding territories. Seattle Audubon Society. 420.pp.

Powers, R.F., D. Andrew Scott, F.G. Sanchez, R.A. Voldseth, D. Page-Dumroese, J.D. Elioff, and D.M. Stone. 2005. The North American long-term soil productivity experiment: Findings from the first decade of research. Forest Ecology and Management 220; 31–50.

Ragon, Robert. 2003. Pers. Comm. Douglas Timber Operators Executive Director.

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. Am. Water Res. Assn.

Rathbun, G. B., N. Siepel, and D. Holland. 1992. Nesting behavior and movements of western pond turtles, clemmys marmorata. Southwestern Naturalist 37:319-324.
Raymond, Crystal L. and David L. Peterson, Fuel treatments alter the effects of wildfire in a mixed-evergreen forest, Oregon, USA. 2005. Can. J. For. Res. 35: 2981-2995 (2005).

Reese, D. A., and H. H. Welsh. 1997. Use of terrestrial habitat by western pond turtles, Clemmys marmorata: implications for management. pp 352-357 in J. Van Abbema, editor. Proceedings: Conservation, Restoration, and Management of Tortoises and Turtles--an International Conference. State University of New York, Purchase, New York.
Reinhardt, E.. Crookston, N.L. (Technical Editors). 2003. The Fire and Fuels Extension to the Forest Vegetation Simulator. Gen. Tech. Rep. RMRS-GTR-116. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 209 p.

Rowland, M. M., M. J. Wisdom, B. K. Johnson, and M. A. Penninger. 2004. Effects of roads on elk: Implications for management in forested ecosystems. Transactions of the North American Wildlife and Natural Resource Conference 69: in press.

Sandberg, D.V. and F.N. Dost. 1990. Effects of prescribed fire on air quality and human health. In: Walstad, J.W.; Radosevich, S.R.; Sandberg, D.V., eds. Natural and

prescribed fire in Pacific Northwest forests. Corvallis: Oregon State University Press: 191–218.

Sandberg, David V.; Ottmar, Roger D.; Peterson, Janice L.; Core, John. 2002. Wildland fire on ecosystems: effects of fire on air. Gen. Tech. Rep. RMRS-GTR-42-vol. 5. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 79 p.

Sanders, T.G., and J.Q. Addo, 1993. Effectiveness and Environmental Impact of Road Dust Suppressants, Mountain-Plains Consortium, MPC-94-28.

Sauer, J. R., J. E. Hines, and J. Fallon. 2006. The North American breeding bird survey, results and analysis 1966 - 2004. Version 2005.2. USGS Patuxent Wildlife Research Center, Laurel, MD http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Schofield, Wilf. 1992. Some Common Mosses of British Columbia. Royal British Columbia Museum. Victoria, British Columbia, Canada.

Schofield, W. 2002. Field guide to liverwort genera of Pacific North America. University of Washington Press, Seattle, WA.

Shestak, C.J., and M.D. Busse. 2005. Compaction Alters Physical but Not Biological Indices of Soil Health. Soil Sci Soc. Am. J. 69:236-246.

Siegel-Issem, C. M., J. A. Burger, R. F. Powers, F. Ponder, and S. C. Patterson. 2005. Seedling Root Growth as a Function of Soil Density and Water Content. Soil Sci. Soc. Am. J. 69:215–226 (2005).

Simcock, R.C., R.L. Parfitt, M.F. Skinner, J. Dando, and J.D. Graham. 2006. The effects of soil compaction on the establishment and growth of Pinus radiate. Can. J. For. Res.36:1077-1086.

Siskiyou National Forest, 1997. Unpublished report Soil Disturbances from Helicopter Yarding in the Upper Pistol Timber Sale. Southwestern Oregon

Sollins, P., C.C. Grier, F.M. McCorison, K. Cromack, Jr., R. Fogel, and R.L. Fredriksen, 1980. The internal element cycles of an old-growth Douglas-fir ecosystem in Western Oregon. Ecological Monographs 50:261-285.

Spelter, Henry, and Tim McKeever, March 2001. Profile 2001: Softwood Sawmills in the United States and Canada. Res. Pap. FPL-RP-594. Madison, WI: USDA, Forest Service, Forest Products Laboratory. 73p.

Spies, T. A., J. F. Franklin and M. Klopsch. 1990. Canopy gaps in Douglas-fir forests of the Cascade Mountains. Can. J. For. Research. 20:649-658.

Stillwater Sciences. 1999. North Umpqua Cooperative Watershed Analysis, North Umpqua Hydroelectric Project, FERC Project No. 1927.

Stevenson, Dwayne. and Brenda Turner, October, 2003. Employment Projections By Occupation 2002-2012, Region 5. Oregon Employment Department, Salem, OR.

Storck, P., T. Kern, and S. Bolton. 1999. Measurement of differences in Snow accumulation, melt, and micrometeorology due to forest harvesting. Northwest Science 73:87-101

Swanson and Swanston, 1976, Timber harvesting, mass erosion, and steep land forest geomorphology in the Pacific Northwest: in, Donald R. Coates, ed., Geomorphology.

Swanston, Douglas N., 1991. Natural Processes: In Donald R. Coates, ed., Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats, American Fisheries Society Special Publication 19, p. 139-179.

Switalski, T.A., JA Bissonette, 2004. T.H. DeLuca, C.H. Luce, and MA Madej. Benefits and impacts of road removal. Frontiers in Ecology and the Environment 2004; 2(1): 21–28

Tappeiner et al, 1997. Density, ages and growth rates in old-growth and young-growth forests in coastal Oregon. Can. J. For. Res. 27:638-648).

Thomas, J.W., H. Black, Jr., R.J. Scherzinger, and R.J. Pedersen. 1979. Deer and Elk. Chapter 8 In: J.W. Thomas (tech. ed.). Wildlife habitats in managed forests: the Blue Mountains of Oregon and Washington. U.S. Dept. of Agriculture Forest Service. Agriculture Handbook No. 553

Thomas, J.W., E.D. Forsman, J.B. Lint, E.C. Meslow, B.R. Noon, and J. Verner. 1990. A conservation strategy for the northern spotted owl. A report by the Interagency Scientific Committee to address the conservation of the northern spotted owl. USDA, Forest Service, and U. S. Department of the Interior, Fish and Wildlife Service, Bureau of Land Management, and National Park Service. Portland, OR.

Thomas, R.B., and W.F. Megahan, 1998. Peak flow responses to clear-cutting and roads in small and large basins, western Cascades, Oregon: A second opinion. Water Resources Research 34(12): 3393-3403. (April 1, b).

USDA Forest Service. 1976. Soil Resource Inventory.

USDA, Forest Service. 1988. General Water Quality Best Management Practices Handbook for the Pacific Northwest Region.

USDA, Forest Service. 1990. Umpqua National Forest Land and Resource Management Plan. Pacific Northwest Region. Umpqua National Forest, Roseburg, OR.

USDA, Forest Service. 1995. Little River Watershed Analysis. Umpqua National Forest.

USDA, Forest Service. 1997. Monitoring records (1993-1997) for unacceptable soil conditions, effective ground cover, and large woody material following skyline and tractor harvest, and broadcast burning in clearcut, thinned and unmanaged stands. Umpqua

USDA, Forest Service. 1999, Roads Analysis - Informing Decisions about Managing the National Forest Transportation System: U.S. Dept. Agriculture, Forest Service, Washington Office, FS-643, 222 p.

USDA, Forest Service and USDI, Bureau of Land Management. 1999. Survey protocols for protection buffer bryophytes, version 2.0.

USDA, Forest Service. 2000. Landbird strategic plan. Washington, DC. 21pp.

USDA, Forest Service. 2001. Middle North Umpqua Watershed Analysis. Umpqua National Forest. Roseburg, OR.

USDA, Forest Service. 2003. Umpqua National Forest Roads Analysis Report: Forest Scale.

USDA, Forest Service. 2005. Pacific Northwest Region invasive plant program, preventing and managing invasive plants, FEIS, ROD. Portland, OR.

USDA/USDI. 1994. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl, Portland, Oregon.

USDA, Forest Service. 2008. R6 Regional Forester's sensitive plant list. Pacific Northwest Region, January, Portland, Oregon.

USDA/USDI. 1994. Record of Decision for 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, Appendix J2 – Results of additional species analysis. Portland, Oregon. 475pp.

USDA/USDI. 2004. Survey Protocol for the Great Gray Owl within the Range of the Northwest Forest Plan. 66 pages.

USDA/USDI. 1999. Survey protocols for protection buffer bryophytes, version 2.0. Portland, OR.

USDA/USDI. 2001. Record of Decision and Standards and Guidelines for amendments to the survey and manage, protection buffer, and other mitigation measures standards and guidelines. Portland, Oregon.

USDA/USDI. 2005. Northwest Forest Plan Temperature TMDL Implementation Strategy. Evaluation of the Northwest Forest Plan Aquatic Conservation Strategy and Associated tools to achieve and maintain stream temperature water quality standards.

USDI, Bureau of Land Management. 2006. GeoBob GIS Database includes Forest Service & BLM ISMS October Data. Portland, OR.

Verts, B.J. and L.N. Carraway. 1998. Land mammals of Oregon. Univ. of California Press, Berkley, CA. 800pp.

Wagner, David D. and Christy, John. 1996. Guide for the Identification of Rare, Threatened or Sensitive Bryophytes in the Range of the Northern Spotted Owl, Western Washington, Western Oregon, and Northwestern California. USDI and USDA publication. Eugene, Oregon.

Waldrop, M. P, J.G. McColl, and R. F. Powers 2003. Effects of Forest Postharvest Management Practices on Enzyme Activities in Decomposing Litter. Soil Sci. Soc. Am. J. 67:1250–1256.

Weller, T.J. and C.J. Zabel. 2001. Characteristics of fringed myotis day roosts in Northern California. J. Wildl. Manage. 65(3):489-497.

Williamson J.R., and W.A. Neilsen. 2000. The influence of forest site on rate and extent of soil compaction and profile disturbance of skid trails during ground-based harvesting. Can. J. For. Res. 30: 1196–1205.

Wisdom, M.J., L.R. Bright, C.G Carey [and others]. 1986. A model to evaluate elk habitat in western Oregon. R6-F&WL-216-1986. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 36 p.

Wisdom, M.J., B.K. Johnson, M. Vavra, J.M. Boyd, J.M. Boyd, P.K. Coe, J.G. Kie, A.A. Ager and N.J. Cimon. 2005. In, Wisdom, M.J. (technical editor). 2005. The Starkey

Project, A synthesis of long-term studies of elk and mule deer. Alliance Communication Group, Lawrence, KA. 252 p.

York, D.A., and R. Helliwell. 2007. A habitat suitability model for six rare Pacific Northwest fungi using ecological niche factor analysis. USDA Forest Service, Umpqua National Forest Supervisor's Office, Roseburg, OR.

Zenner, Eric K., 2005. Development of tree size distributions in Douglas-fir forests under differing disturbance regimes. Ecological Applications, 15(2): 701-714.