United States Department of Agriculture
Forest Service
Umpqua National Forest

Tiller Ranger District
Umpqua National Forest
27812 Tiller Trail Hwy
Tiller, Oregon 97484
(541) 825-3100 FAX 825-3110

File Code: 1950
Date: June 6, 2008

Dear Interested Citizen:

Enclosed is a copy of the Curtis Timber Sale Project Environmental Assessment (EA). The Tiller Ranger District is giving notice of the opportunity to comment on Alternative 4 of the EA. Alternative 4 proposes to commercially thin about 1,500 acres of second growth forests generating about 12.7 million board feet of timber. Associated fuels treatments, temporary road construction (0.6 miles), road reconstruction, road maintenance, and other connected actions would also occur. The planning area includes all or portions of T29S, R1W and 1E; T30S, R1W and 1E, Willamette Meridian, Douglas County, Oregon. Additional copies of the Environmental Assessment are available by calling the Forest Supervisor's Office 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 District Ranger Roshanna Stone, Tiller Ranger District, 27812 Tiller Trail Highway, Tiller, OR 97484, (541)-825-3100, fax (541)-825-3110. The District 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-tiller@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 Stephanie Wessell, (541)-957-3221, email swessell@fs.fed.us at the Forest Supervisor's Office, 2900 NW Stewart Parkway, Roseburg, Oregon 97470; the Supervisor's 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 Stephanie Wessell, Project Coordinator, at the numbers listed above. Thank you for your continued interest in the Curtis Timber Sale Project.

Sincerely,

/s/Roshanna Stone

Roshanna Stone
District Ranger

Enclosure

United States Department of Agriculture

Forest Service

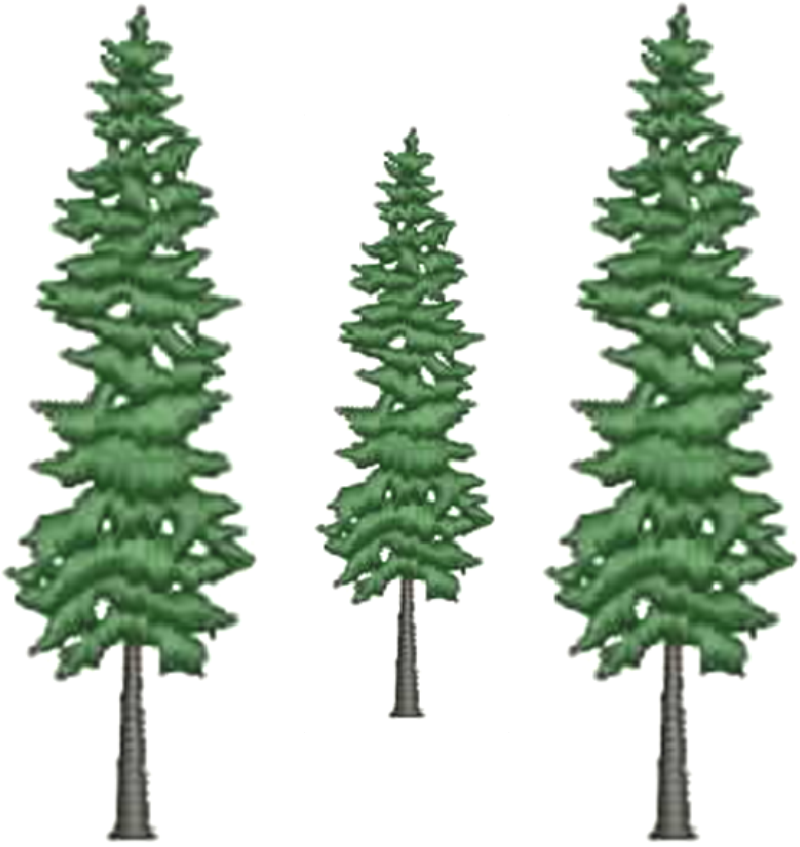
Pacific Northwest Region

Curtis Timber Sale Project

Umpqua National Forest

Tiller Ranger District

June 2008



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CURTIS TIMBER SALE PROJECT

ENVIRONMENTAL ASSESSMENT

Douglas County, Oregon

June 2008

Lead Agency:	USDA Forest Service, Umpqua National Forest
Responsible Official:	Roshanna Stone, District Ranger Tiller Ranger District 27812 Tiller Trail Highway Tiller, OR 97484 Phone: (541) 825-3100
For More Information Contact:	Stephanie Wessell Umpqua National Forest 2900 NW Stewart Parkway Roseburg, OR 97470 Phone: (541) 957-3221 email: swessell@fs.fed.us

Electronic comments can be mailed to: comments-pacificnorthwest-umpqua-tiller@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 reconstruction and road maintenance and implementing connected actions within the Matrix and Riparian Reserve land allocations of the Middle South Umpqua, Upper South Umpqua, and Jackson Creek watersheds on the Umpqua National Forest, Tiller Ranger District. Alternative 4 has been identified as the preferred alternative.

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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 the 130,206-acre Buckeye/Zinc and Jackson Creek watersheds located on the Tiller Ranger District of the Umpqua National Forest.

Chapter 1 describes the purpose and need for action and the proposed action for the Curtis 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 Curtis planning area is located within the Middle South Umpqua (23,329 acres), Jackson Creek (14,447 acres), and Upper South Umpqua (11,826 acres) 5th field watersheds on the Tiller Ranger District, Umpqua National Forest (UNF), approximately 5-20 air miles north and east of Tiller, Oregon in Douglas County (Figure 1). The 25,630-acre planning area is encompassed by five 6th field subwatersheds, including Ash/Zinc Facial, Buckeye, Francis Facial, Lower Jackson Facial, and Upper Jackson Facial. The planning area includes all or portions of T29S, R1W and 1E; T30S, R1W and 1E, Willamette Meridian, in Douglas County Oregon.

RELATIONSHIP TO OTHER PLANNING DOCUMENTS AND ANALYSES

The 1990 Umpqua National Forest Land and Resource Management Plan (LRMP; USDA 1990) 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 (USDA/USDI 1994), provide broad management direction for the Middle South Umpqua and Jackson Creek watersheds. The planning and analysis areas are within Management Areas 10 (MA 10) and 11 (MA 11) as established in the 1990 LRMP[1]. The planning area is made up entirely of the Matrix land allocation, including Riparian Reserves, as described in the 1994 Record of Decision (ROD; USDA/USDI 1994). The 1994 Northwest Forest Plan established Matrix land allocations where the majority of timber harvest and silviculture treatments are to occur. Riparian reserves, along streams and other wet areas, were primarily established for the conservation of aquatic and riparian-dependant terrestrial species. Overlaying both these land allocations are the Jackson Creek and South Umpqua River key watersheds which are part of the Northwest Forest Plan's Aquatic Conservation Strategy. Key watersheds were established as important locations for the

[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; in the Jackson Creek and Middle South Umpqua watersheds, the Matrix and Riparian Reserve land allocation comprise the planning area, along with the designation of Key Watersheds.

maintenance and recovery of anadromous fish species. The Aquatic Conservation Strategy is a landscape-scale approach based on maintaining the natural disturbance regime (USDA/USDI 1994).

This analysis tiers to the Final Environmental Impact Statement (FEIS) of the 1990 Umpqua National Forest LRMP (USDA 1990), as amended and the 2005 Final Environmental Impact Statement for the Pacific Northwest Region Invasive Plant Program (USDA 2005). It also incorporates by reference the recommendations and analysis in the 1995 Jackson Creek Watershed Analysis (WA; USDA 1995) and the 1996 Buckeye/Zinc Creek Watershed Analysis (USDA 1996).

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 Tiller Ranger District, 27812 Tiller Trail Highway, Tiller, OR 97484.

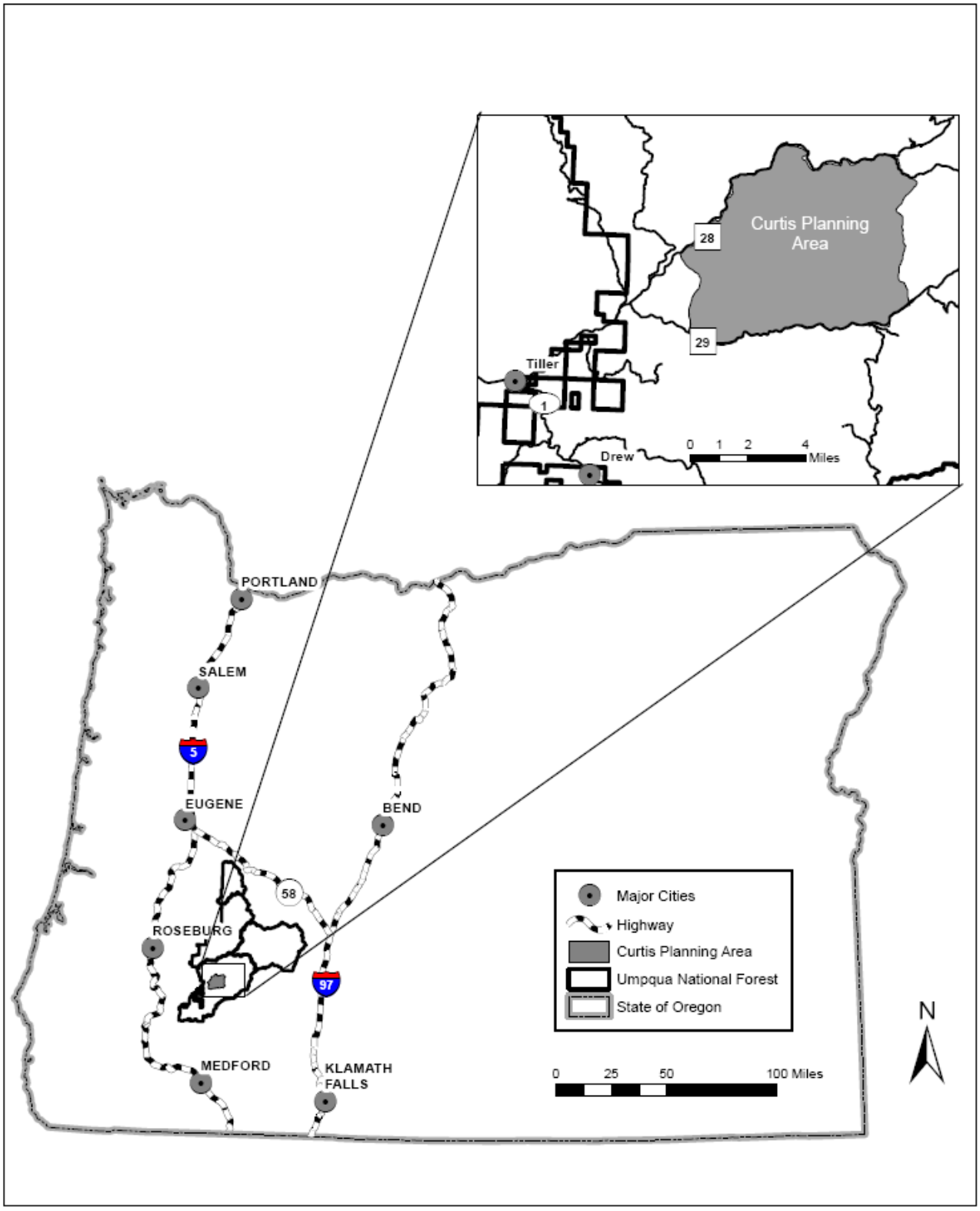

Figure 1. Location of the Curtis Timber Sale Project, Tiller RD, Umpqua NF.

Jackson Creek and Buckeye/Zinc Watershed Analyses

Both the 1995 Jackson Creek and 1996 Buckeye/Zinc Watershed Analyses (WAs) are relevant for this project. Both WAs recommend restorative thinning to avoid mortality in second growth stands and to restore species composition and structure more typical of native forest prior to fire suppression in the uplands and riparian reserves (USDA 1995; USDA 1996).

The watersheds have five broad landscape areas based on relationships between forest vegetation, climate, and physiography: gentle/moist; high elevation; inner gorge; gentle mountain slopes; and steep/dry (Figure 2). These landscape delineations each represent broad areas of land that tend to have similar disturbance processes. Inclusions of landforms that differ from these delineations can be found at this broad scale of mapping. The units in the Curtis planning area primarily fall into two of the landscape areas – the gentle moist landscape area and the inner gorge landscape area.

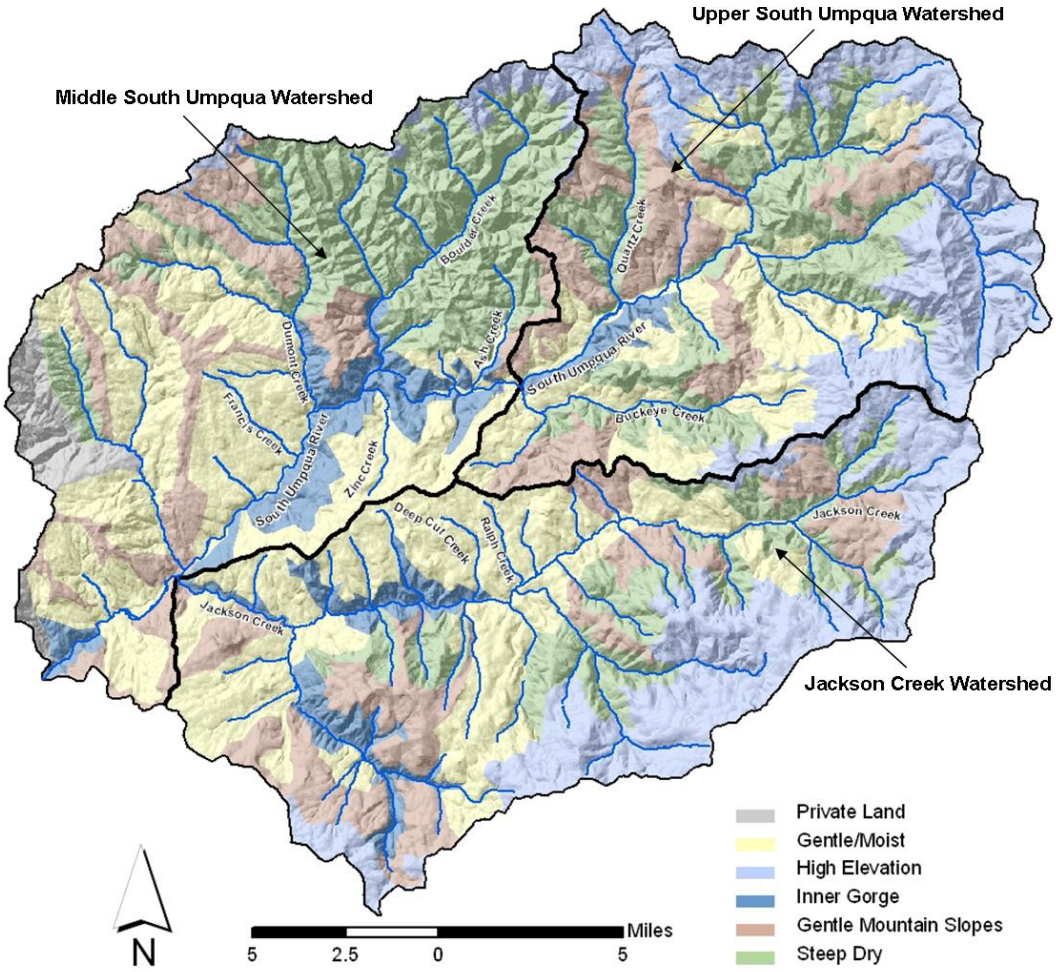

Figure 2. Landscape Areas in the Federal ownership of Jackson Creek, Middle South Umpqua, and Upper South Umpqua Watersheds.

The gentle moist landscape area is the most likely area to be a refuge from frequent fire. The ancient landslide deposits that filled valley bottom areas retain high moisture levels through the growing season. Historically, surface fire dominated with limited amounts of crown fire. The inner gorge 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 WA recommendations are relevant for the Curtis project:

- Restore species composition and structure more typical of native forests in off-site pine plantations and in Douglas-fir/ponderosa pine plantations (USDA 1995).
- Improve the health of sugar pine (USDA 1995).
- Concentrate activities in areas that have been heavily impacted by harvesting in order to restore the landscape level vegetation (USDA 1996).
- Focus vegetation treatments on the stem exclusion stands to promote diversity and expedite the development of late-successional habitat (USDA 1996).

Additional WA recommendations relevant to the Curtis 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 Curtis project focuses primarily on the watershed analysis recommendations for stands of second growth timber in the stem exclusion stage of development.

Roads Analyses

The Umpqua National Forest roads analysis report (USDA 2003) evaluated access issues for key road systems across the forest and recommended further evaluations at the watershed and project scale. Opportunities to modify the road system within the planning area were identified in the Curtis project. Road work needed to accomplish harvest and haul are included in the proposed action. Road work needed to mitigate soil compaction or address undersized culverts for passage of storm flows or fish are identified as similar or connected actions to the proposed action.

NEED FOR ACTION

The purpose of the Curtis Timber Sale Project is to enhance development of species and structural diversity in managed plantations and fire-regenerated second growth and reduce the risk of large-scale disturbance in high risk landscapes in a cost-effective manner. Previous clearcutting in the watershed, along with the exclusion of fire over the last several decades, has created dense, second-growth forest stands now in the stem exclusion stage of development with fuel loads much greater than the historic range for the plant associations represented. Such second growth stands lack the structural and

species diversity they would otherwise have if exposed to natural successional pathways. Dense stocking leads to low growth rates, retards the timely development of desirable stand characteristics, such as large diameter trees with large crowns and limbs as well as resistance to windthrow and fire damage. An abundance of vertical fuels, characteristic of densely stocked plantations, allows fire to spread up and through tree crowns, affecting fire behavior at the landscape scale. The difference between the existing conditions and the desired conditions defines the need for action in terms of elements that can be measured. These 'elements' are:

Element 1: Stand Density

Currently, the majority of the 40-50 year old stands in the Curtis planning area (both in the uplands and in the Riparian Reserves) are densely-stocked and dominated by Douglas-fir and ponderosa pine trees of the same age class. 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 400 trees per acre. As such, many stands in the planning area are on a development path lacking natural canopy gaps and understory diversity, with suppressed growth, and receding tree crowns.

The desired condition for both Matrix and Riparian Reserve second-growth stands is to place these stands on an accelerated trajectory to more complex and diverse forest habitat conditions. Removing some of the existing trees would reduce stand density, allowing for the development of understory layers, increased species diversity, increased forage for big game, and improved fire resiliency.

Element 1 would be measured by:

- *Acres of second growth thinned to improve conditions for species and structural diversity;*
- *Acres of improved stand fire resiliency;*
- *Acres of Riparian Reserve thinned to accelerate the development of late-successional conditions; and*
- *Acres of winter range improvement by providing forage areas.*

Element 2: Risk of Large Scale Disturbance

The Curtis planning area is characterized as an area with a high amount of fire risk, and is recommended as a priority for treatment to reduce that risk. Also, portions of the planning area are mapped as having substantial amounts of Fire Regime Condition Class (FRCC) 3, representing a high degree of departure from the historic conditions that likely existed prior to the era of fire exclusion. Currently, the dense and uniform plantations that have high fuel loads would likely result in more severe fire effects should a fire occur.

The desired condition is reduced risk of large-scale fire where strategically placed treatments would help "break" the spread of stand-replacing fire into spotted owl core areas, old-growth stands, and onto private land holdings. To accomplish this, commercial thinning of merchantable and sub-merchantable trees and treating activity-created fuels would occur.

Element 2 would be measured by:

- *Acres of fuel reduction treatments;*
- *Miles of hazard reduction along roadways; and*
- *Acres of condition class improved..*

Element 3: Timber Production

The planning area is in the Matrix land allocation, identified in the Northwest Forest Plan as locations where the production of timber is an important objective. In this allocation, most of the timber harvest and silvicultural activity would take place. It is also in MA10 of the LRMP where cost-efficient, sustainable timber production is a major goal.

In order to produce a sustained yield of timber from the Matrix land allocation, harvest needs to occur on a regular basis. This is particularly true in stem exclusion stands where harvesting and removing 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 likely leading to diseased conditions, and lost economic opportunities.

Element 3 would be measured by:

- *Board feet of timber produced by commercial thinning.*

PROPOSED ACTION

The proposed action (Alternative 2) was designed to meet the purpose and need of reducing tree density and improving diversity in unnaturally dense, managed plantations and fire-regenerated second growth, while providing wood products to the local community. 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 description of alternatives in Chapter 2. Alternative 2 includes the following:

- Commercial thinning of about 1,508 acres of managed plantations and fire-regenerated second growth using ground-based or skyline logging systems in the Matrix land allocation generating approximately 12.5 million board feet of timber. Thinned acres will include about 825 acres of off-site ponderosa pine to remove non-localized conifers and to restore to native plant communities.
- About 165 acres of managed stands in Riparian Reserve land allocations outside of the no cut shade zone would be thinned to reduce stand density. This represents 51 percent of the total Riparian Reserve acres within the managed stands.
- Treating activity created fuels on about 878 acres by underburning, grapple or excavator piling (with machines remaining on pre-designated skid trails), lopping and scattering, chipping, jackpot burning, or handpiling and burning.

- Re-using 2.5 miles of existing temporary spur roads (unclassified roads) to access thinning areas, then subsoiling after use.
- Constructing 0.6 mile of new temporary spur roads to access thinning areas, then subsoiling after use.
- Re-opening and maintaining 1.2 miles of closed system roads to access thinning areas, then closing them after use.
- Reconstructing portions of 10 sections of existing system roads (work would occur along 0.7 mile of road) including the placement or replacement of surface rock, the replacement of undersized or deteriorated stream crossings, the addition or replacement of ditch relief culverts, armoring culvert outlets, stabilizing road fills and road shoulders, reshaping road beds, and the reconstruction of ditches as needed.
- Maintaining about 65 miles of existing roads (includes Level 1 and 2 roads and paved roads) including the grading and shaping of existing road surfaces, dust abatement, constructing water bars, ditch maintenance as needed, opening and re-closing existing closed roads; and the cutting of intruding vegetation along roadsides.
- Hauling timber during the wet season on about 34 miles of gravel roads and 18 miles of paved roads.
- Utilizing the following existing rock pits, along with several rock disposal sites as the rock source for the road work: Road 2929 MP 2 – Surveyor; Road 2929-500 – East Collins; Road 29 mp 8.5 – Big Stump; and Road 2980-100 – Grassy Ridge.

DECISION TO BE MADE

Based on the analysis documented in this environmental assessment, the District Ranger of the Tiller Ranger District 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 there is a significant effect on the human environment that would require preparation of an Environmental Impact Statement.

SCOPING

The Forest Service listened to all input and addressed as many concerns as possible during development of the proposed action. Formal scoping (a process used to surface issues) began after the proposed action was developed when the project was first listed in the October 2007 Umpqua National Forest Quarterly Schedule of Proposed Actions (SOPA). A scoping notice was sent to the public in October of 2007 with the intent of introducing the proposed action and soliciting issues. The Curtis project record contains a scoping summary that details the scoping comments received for the project.

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 0.6 miles of new temporary spur roads, combined with the re-use of unclassified roads (2.5 miles would be re-used), and the re-opening and closing of 1.2 miles of system roads may cause numerous environmental impacts including erosion, spreading noxious weeds, and impacting wildlife habitat. Oregon Wild also asked for a display of the trade-offs of accessing thinning stands by roads. To help quantify and track this issue through the analysis the following indicators were developed:

- Miles of temporary road built.
- Total acres of thinning accessed per mile of new temporary road construction.

Issue 2: Forage in Winter Range

The American Forest Resource Council (AFRC) requested that elk forage be given additional consideration. While the proposed action contains small gaps, AFRC supports enhancing forage on lands designated as Matrix To help quantify and track this issue through the analysis the following indicators were developed:

- Size of canopy gaps proposed.
- Total acres of canopy gaps.

Issue 3: Economic Viability

The American Forest Resource Council (AFRC) stated that they are concerned about the economic viability of the project. To help quantify and track this issue through the analysis the following indicators were developed:

- Volume removed (million board feet).
- Cost Benefit Ratio and Present Net Value.

ISSUES THAT DID NOT DRIVE ALTERNATIVES

Several other issues or concerns raised by the public were resolved by clarifying the proposed action or by taking simple actions such as refining maps used in documents;

these will not be discussed further. Other 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 the development of mitigation measures:

Impacts to Riparian Reserves:

Oregon Wild was concerned about the potential impacts associated with yarding corridors and other logging activities adjacent to streams. These comments are addressed by including mitigation measures in Chapter 2 of the EA. The disclosure of effects regarding this issue is under the Aquatic Environment portion of Chapter 3.

Impacts to Soils from Ground Based Logging:

Oregon Wild was concerned that the disturbance and impacts to soils would be greater than the benefit achieved by thinning. This issue was resolved through use of Best Management Practices and mitigation measures to subsoil following yarding. Effects are also disclosed in Chapter 3.

Issue resolved through clarifying the silviculture prescription:

Retention of Minor Species and Tree Size:

Umpqua Watersheds was concerned that minor tree species would not be retained and that an upper diameter limit is needed to protect large trees. The prescription currently identifies minor species for retention. In addition, the prescription is designed to retain the largest trees within the stand. This issue was resolved by re-stating and clarifying the thinning prescription to further address the concerns of Umpqua Watersheds.

Issues through which disclosure of effects was requested in Chapter 3 of the EA:

Snags and Down Wood:

During scoping, Oregon Wild stated that impacts to snags and down wood, which serve as habitat for the Northern spotted owl should be considered, and that all snags should be retained. This topic is discussed in Chapter 3.

Aquatic Conservation Strategy Objectives:

Oregon Wild requested that the project analysis should separately discuss each of the Aquatic Conservation Strategy objectives (under the Northwest Forest Plan). Any commercial harvest activities or road construction in key watersheds should be avoided in order to protect water quality. This comment is addressed by discussing the nine ACS objectives in Chapter 3 of the EA.

Non-significant issues

One concern raised during scoping was considered to be 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.

Unroaded and Roadless Areas

Umpqua Watersheds stated that Units 37 and 38 are within areas mapped by Oregon Wild as roadless. A review of Oregon Wild's map shows that these units are located along the edge of their mapped area (within about 100-200 feet). Given that these are old regeneration harvest units, the overlap is likely a refinement of the mapping process. Additionally, Units 1, 4, 24, and 34 are adjacent to, but not within, Oregon Wild's mapped area. This issue was determined to be a non-significant issue because these units do not fall within Oregon Wild's mapped 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 several separate timber sale contracts.

The Forest Service may also choose to use a new 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 or similar 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.

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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 Curtis 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. In addition, three other alternatives were considered, but eliminated from detailed study.

ALTERNATIVES CONSIDERED, BUT ELIMINATED FROM DETAILED STUDY

During scoping, an alternative that would thin primarily with helicopters to avoid ground disturbance was suggested. In order to accomplish a substantial amount of restorative thinning, without any road construction, a prohibitive amount of helicopter logging would have been necessary. This would have resulted in a non-viable alternative based on economics. The economic analysis done for this alternative showed that the benefit/cost ratio would be below 1.00. This means that the combination of logging costs and other expenses such as costly road reconstruction plus the connected restorative treatments associated with the project would collectively cost more than the value of the timber. Since the proponents of this alternative support restorative thinning, leaving substantial areas unthinned where helicopter logging is cost-prohibitive was not desired nor would it meet the need for action. This alternative that would build no new temporary roads was eliminated from detailed study.

During scoping, an alternative that would have dropped three low-volume skyline units to improve economic viability was suggested. This alternative was eliminated from detailed study because it would result in a negative economic analysis that would have little or no likelihood of being sold and would thus not meet the purpose and need.

During scoping, an alternative that would have girdled or inoculated trees to create snags, then followed up with a prescribed burn was suggested. This alternative would not have removed a commercial product, thus not meeting all elements of the purpose and need. In addition, the two other needs of reducing stand density and reducing the risk of stand replacement fire would not have been met; stand density would not have been reduced through removal of trees (trees would remain until they died and fell to the forest floor), and fuels would not have been reduced, as snags and the subsequent down woody debris would have remained and contributed to existing and future fuel loads. Since this alternative would not have met the purpose and need, it was eliminated from detailed study.

ALTERNATIVE 1 – NO ACTION

Under Alternative 1, no thinning, fuel treatment, road construction, reconstruction, or maintenance, or other similar or connected activities, including tree planting, pre-commercial thinning, or subsoiling 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 (TABLE 1, FIGURE 3)

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 1,508 acres of managed plantations and fire-regenerated second-growth using ground-based or skyline logging systems in the Matrix land allocation generating approximately 12.5 million board feet of timber. Thinned acres will include about 825 acres of off-site ponderosa pine to remove non-localized conifers and to restore to native plant communities.
- About 165 acres of managed stands in Riparian Reserve land allocations outside of the no cut shade zone would be thinned to reduce stand density. This represents 51 percent of the total Riparian Reserve acres within the managed stands.
- Treating activity created fuels on about 878 acres by underburning, grapple or excavator piling (with machines remaining on pre-designated skid trails), lopping and scattering, chipping, jackpot burning, or handpiling and burning.
- Re-using 2.5 miles of existing temporary spur roads (unclassified roads) to access thinning areas, then subsoiling after use.
- Constructing 0.6 mile of new temporary spur roads to access thinning areas, then subsoiling after use.
- Re-opening and maintaining 1.2 miles of closed system roads to access thinning areas, then closing them after use.
- Reconstructing portions of 10 sections of existing system roads (work would occur along 0.7 mile of road) including the placement or replacement of surface rock, the replacement of undersized or deteriorated stream crossings, the addition or replacement of ditch relief culverts, armoring culvert outlets, stabilizing road fills and road shoulders, reshaping road beds, and the reconstruction of ditches as needed.
- Maintaining about 65 miles of existing roads (includes Level 1 and 2 roads and paved roads) including the grading and shaping of existing road surfaces, dust abatement, constructing water bars, ditch maintenance as needed, opening and re-closing existing closed roads, and the cutting of intruding vegetation along roadsides.
- Hauling timber during the wet season on about 34 miles of gravel roads and 18 miles of paved roads.
- Utilizing the following existing rock pits, along with several rock disposal sites as the rock source for the road work: Surveyor – Road 2929-500 in NE ¼ S17, T30S, R1W; East Collins – Road 2929-500 in NE ¼ S17, T30S, R1W; Big Stump – Road 29 in NW ¼ S3, T30S, R1E; and Grassy Ridge – Road 2980-100 in NE ¼ S33, T29S, R1E.

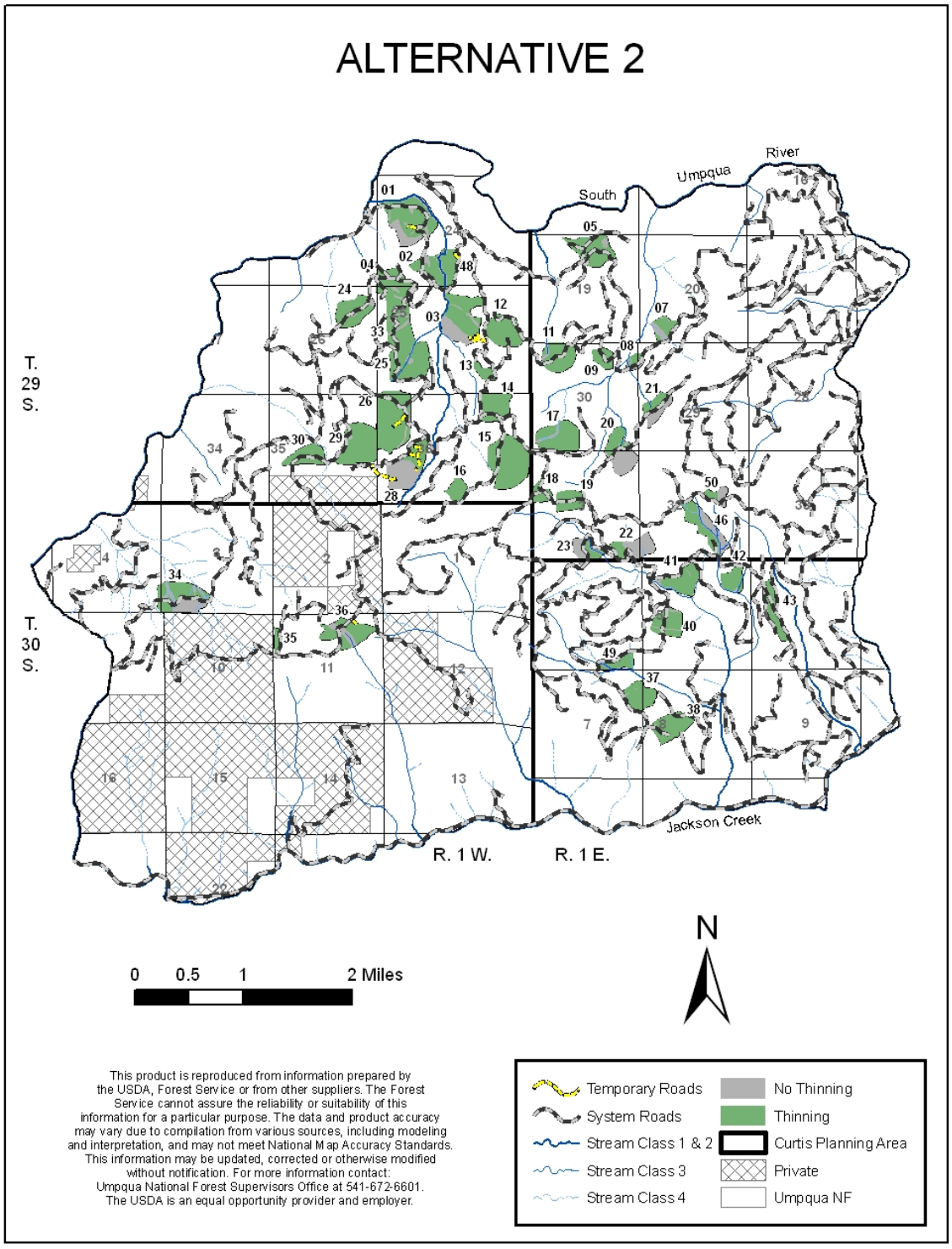

Figure 3. Alternative 2 – Proposed Action.

The various stand treatments on a unit-by-unit basis for Alternative 2 are as follows (Table 1).

Table 1. Alternative 2 unit summary.

Unit #	Total Acres in Unit	Thinned Acres in Unit	Unthinned Acres in Unit	Harvest Prescription Acres (trees per acre retained)		Volume Removed (thousand board feet)	Fuels Treatment Acres[2]		Logging Systems Acres[3]	
				40-70	70-100		Acres treated	Acres not Treated	Ground Based	Skyline
1	99	67	32	0	67	804.0	35	32	34	34
2	41	32	9	32	0	346.5	15	17	8	24
3	85	54	31	54	0	535.0	40	14	0	54
4	47	45	2	45	0	359.2	20	25	45	0
5	57	54	3	54	0	322.8	30	24	54	0
7	25	16	8	16	0	65.2	0	16	4	13
8	13	7	6	7	0	43.2	3	4	0	7
9	18	18	0	0	18	163.8	6	12	14	5
11	45	43	2	0	43	342.4	20	23	7	35
12	52	52	0	0	52	516.0	51	1	44	7
13	13	13	0	0	13	117.9	13	0	13	0
14	45	45	0	45	0	267.6	44	1	45	0
15	96	96	0	96	0	574.8	95	1	96	0
16	20	20	0	0	20	175.5	15	5	0	20
17	61	56	4	0	56	504.9	48	8	28	28
18	17	17	0	17	0	121.1	8	9	17	0
19	28	28	0	28	0	198.1	10	18	28	0
20	54	22	32	22	0	152.6	5	17	3	19
21	30	15	16	15	0	104.3	7	8	0	15
22	43	12	31	12	0	81.9	10	2	12	0
23	32	14	18	14	0	97.3	5	9	0	14
24	47	45	3	45	0	312.9	20	25	5	40

[2] Fuel treatments may include JPB – Jackpot Burn; UB – Underburn; HPB – Handpile Burn along Roadside for 66 feet; Prune and Chip; and NT – No Treatment.
[3] Logging Systems include ground based (loader, mechanized, and cut-to-length) and skyline (yoader skyline, multispan skyline, and downhill skyline).

Unit #	Total Acres in Unit	Thinned Acres in Unit	Unthinned Acres in Unit	Harvest Prescription Acres (trees per acre retained)		Volume Removed (thousand board feet)	Fuels Treatment Acres[2]		Logging Systems Acres[3]	
				40-70	70-100		Acres treated	Acres not Treated	Ground Based	Skyline
25	72	69	4	0	69	620.1	20	49	21	48
26	100	96	4	0	96	859.5	96	0	96	0
28	70	39	31	0	39	269.5	25	14	24	15
29	74	73	2	0	73	654.3	30	43	50	23
30	33	33	0	33	0	334.0	10	23	22	23
33	61	53	8	53	0	480.6	30	23	53	0
34	75	44	31	44	0	308.0	20	24	9	35
35	9	9	0	0	9	77.4	8	1	4	5
36	55	43	11	0	43	476.3	30	13	15	29
37	38	37	1	0	37	333.0	10	27	0	37
38	43	43	1	0	43	384.3	10	33	8	35
40	39	35	4	0	35	247.8	15	20	17	18
41	44	38	7	0	38	263	20	18	12	26
42	24	23	2	23	0	204.3	9	14	23	0
43	33	32	1	32	0	224.0	25	7	32	0
46	54	30	24	30	0	269.1	10	20	30	0
48	27	24	3	24	0	166.6	0	24	3	21
49	21	14	7	14	0	99.4	5	9	0	14
50	15	6	9	6	0	38.4	5	1	6	0
Tot.	**1,856**	**1,508**	**347**	**760**	**748**	**12,516**	**878**	**630**	**868**	**640**

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 System Road Construction

No new system road construction would occur under Alternative 2.

New Temporary Road Construction and Subsoiling

The 0.6 miles of new temporary road to be constructed under Alternative 2 would be native surface roads, with rock added at limited locations where soil moisture requires the use of rock to effectively pass log trucks (units 9, 11, 25, 28, 34, and 36). Temporary roads are typically constructed with an excavator or dozer. After logging they would be subsoiled 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.

Re-use of Existing Unclassified Roads

The 2.5 miles of unclassified roads[4] found in and adjacent to the Curtis units were built 40 to 50 years ago to provide logging access to the original clearcuts. None have been recognized as system roads, and as such, they have not been inventoried nor have they received any maintenance. Some of these old roads were rocked when they were originally built and are in good condition today. Others are native (dirt) surface and may present erosion problems except for those on flat ground.

Most of the unclassified roads found in the proposed units would be re-used[5] under the proposed action because they would provide cost-effective logging access and because the impacts to the site from road building have already occurred. All of these existing unclassified roads would be subsoiled following the thinning operation. An excavator would be used to modify the existing road beds to improve drainage and in some cases to decompact soil in the road beds.

System Road Reconstruction

Alternative 2 would include the reconstruction of 0.7 miles (or ten sections) of existing open system roads 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 reduce the risk of erosion (ROD C 32-33), while providing for safe, cost-effective timber haul. The reconstruction would be done using heavy equipment such as an excavator, backhoe, road grader, dump truck, and a water truck. Reconstruction could include culvert installations, replacements or upgrades, road slump repairs, reshaping roadbeds for improved drainage, or adding rock surfacing.

Rock for these reconstruction activities would be generated from the following existing rock quarries:

- Road 2929 MP 2 – Surveyor;
- Road 2929-500 – East Collins;
- Road 29 MP 8.5 – Big Stump; and
- Road 2980-100 – Grassy Ridge.

Rock is generally suitable and available within these quarries and no additional drilling, blasting, or crushing is anticipated to produce the needed rock. Other existing rock stockpiles in the watershed also would 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 65 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, and a street sweeper on paved sections. The road maintenance under Alternative 2 would include:

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

[5] Some unclassified roads would not be re-used because logging systems such as skyline would not require re-use.

• Opening and closing (upon completion of haul) currently closed roads (Level 1 system roads) totaling 1.2 miles;
• Removing downed trees, large rocks, slides, etc. from roads;
• Brushing roads and road sides;
• Blading road beds, including ditches where needed;
• Cleaning existing culverts as needed for proper drainage;
• Constructing water bars on some existing system roads (both closed and open) as needed for proper drainage;
• Applying dust abatement materials to portions of roads;
• Danger/hazard tree felling, and possible removal, to meet OSHA requirements on haul routes.

Wet Season Haul

Under Alternative 2, timber would be hauled outside the normal operating season when conditions allow such haul to occur as long as sediment delivery to streams associated with the haul remains at acceptable levels and road surfaces are not unduly impacted. Conditional wet season haul would occur on 34 miles of graveled and 18 miles of paved roads.

Connected and Similar 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. Similar actions are located in the general vicinity of the timber sale area and are included in order to evaluate their environmental consequences. Table 2 displays the connected and similar actions for all action alternatives.

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 in selected units.	25	22	25	Element 1 – Increase diversity by re-introducing native species.
Acres of Noxious weed treatment: • Post-treatment control of weeds within 5 years of thinning; • Post-treatment competitive planting with native grass seed.	150 15	150 15	150 15	Element 1 – Maintains diversity by reducing weed spread.
Erosion control by native grass seeding of landings and unclassified roads.	35	31	35	Element 1 – Increases diversity by planting forage.
Snag creation (# of snags).	1,000	1,000	1,000	Element 1 – Increase diversity.
Sump maintenance locations– Vegetation cleared and rock placed for driving surface.	6	6	6	Element 2 – Reduces risk of large-scale fire by providing water sources.
Acres of subsoiling: • Purchaser to subsoil utilized skid trails, unclassified roads used, and temp roads. • Post-harvest subsoil unused skid trails in Unit 2.	45 4	11 4	45 4	Required to meet Standards and Guidelines.
Culvert installation locations (18-24” diameter).	2	1	2	Required to meet Standards and Guidelines.

ALTERNATIVE 3 (TABLE 3, FIGURE 4)

Alternative 3 was developed to meet the purpose and need and to respond to the issues of the impacts of new temporary roads. Specifically, Alternative 3 differs from Alternative 2 by dropping six units that would have utilized temporary roads. When compared to Alternative 2, Alternative 3 reduces costs related to construction and subsequent obliteration of temporary roads, and reduces the acres of restorative thinning in Matrix and riparian reserves.

Alternative 3 would thin 255 acres less than Alternative 2 because of the changes described above. The timber output of Alternative 3 would be about 17% less than Alternative 2, harvesting an estimated 10.3 million board feet.

Alternative 3 includes the following:

- Commercial thinning of about 1,253 acres of timber stands using ground-based and skyline logging systems in both the Matrix and Riparian Reserve land allocations generating about 10.3 million board feet of timber. Thinned acres will include about 718 acres of off-site ponderosa pine harvesting or girdling to remove non-localized conifers and to restore to native plant communities.
- About 144 acres of managed stands in Riparian Reserve land allocations outside of the no cut shade zone would be thinned to reduce stand density. This represents 54 percent of the total Riparian Reserve acres within the managed stands.
- Treating activity created fuels on about 757 acres by underburning, grapple or excavator piling (with machines remaining on pre-designated skid trails), lopping and scattering, chipping, jackpot burning, or handpiling and burning.
- Re-using 2.2 miles of existing temporary spur roads (unclassified roads) to access thinning areas, then subsoiling after use.
- Re-opening and maintaining 1.2 miles of closed system roads to access thinning areas, then closing them after use.
- Reconstructing portions of 10 sections of existing system roads (work would occur along 0.6 mile of road) including the placement or replacement of surface rock, the replacement of undersized or deteriorated stream crossings, the addition or replacement of ditch relief culverts, armoring culvert outlets, stabilizing road fills and road shoulders, reshaping road beds, and the reconstruction of ditches as needed.
- Maintaining about 65 miles of existing roads (includes Level 1 and 2 roads and paved roads) including the grading and shaping of existing road surfaces, dust abatement, constructing water bars, ditch maintenance as needed, opening and re-closing existing closed roads; and the cutting of intruding vegetation along roadsides.
- Hauling timber during the wet season on about 29 miles of gravel roads and 18 miles of paved roads.
- Utilizing the following existing rock pits, along with several rock disposal sites as the rock source for the road work: Surveyor – Road 2929-500 in NE ¼ S17, T30S, R1W; East Collins – Road 2929-500 in NE ¼ S17, T30S, R1W; Big Stump – Road 29 in NW ¼ S3, T30S, R1E; and Grassy Ridge – Road 2980-100 in NE ¼ S33, T29S, R1E.

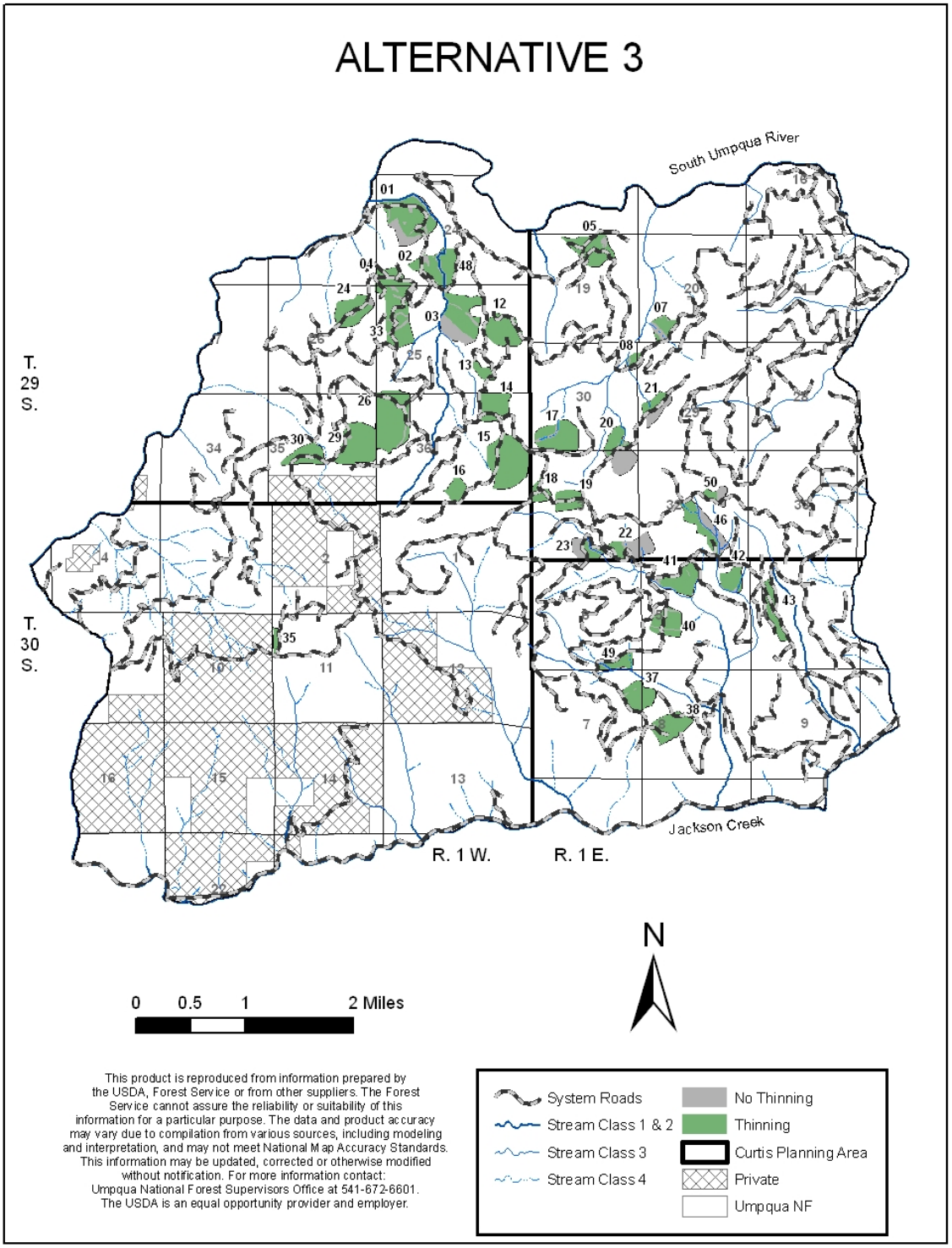

Figure 4. Alternative 3.

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 Acres (trees per acre retained)		Volume Removed (thousand board feet)	Fuels Treatment Acres[6]		Logging Systems Acres[7]	
				40-70	70-100		Acres treated	Acres not Treated	Ground Based	Skyline
1	99	67	32	0	67	804.0	35	32	34	34
2	41	32	9	32	0	346.5	15	17	8	24
3	85	54	31	54	0	535.0	40	14	0	54
4	47	45	2	45	0	359.2	20	25	45	0
5	57	54	3	54	0	322.8	30	24	54	0
7	25	16	8	16	0	65.2	0	16	4	13
8	13	7	6	7	0	43.2	3	4	0	7
12	52	52	0	0	52	516.0	51	1	44	7
13	13	13	0	0	13	117.9	13	0	13	0
14	45	45	0	45	0	331.5	44	1	45	0
15	96	96	0	96	0	616.8	95	1	96	0
16	20	20	0	0	20	175.5	15	5	0	20
17	61	56	4	0	56	532.0	48	8	28	28
18	17	17	0	17	0	121.1	8	9	17	0
19	28	28	0	28	0	198.1	10	18	28	0
20	54	22	32	22	0	152.6	5	17	3	19
21	30	15	16	15	0	104.3	7	8	0	15
22	43	12	31	12	0	89.0	10	2	12	0
23	32	14	18	14	0	97.3	5	9	0	14
24	47	45	3	45	0	312.9	20	25	5	40
26	100	96	4	0	96	931.5	96	0	96	0
29	74	73	2	0	73	654.3	30	43	50	23

[6] Fuel treatments may include JPB – Jackpot Burn; UB – Underburn; HPB – Handpile Burn along Roadside for 66 feet; Prune and Chip; and NT – No Treatment.
[7] Logging Systems include ground based (loader, mechanized, and cut-to-length) and skyline (yoader skyline, multispan skyline, and downhill skyline).

Unit #	Total Acres in Unit	Thinned Acres in Unit	Unthinned Acres in Unit	Harvest Prescription Acres (trees per acre retained)		Volume Removed (thousand board feet)	Fuels Treatment Acres[6]		Logging Systems Acres[7]	
				40-70	70-100		Acres treated	Acres not Treated	Ground Based	Skyline
30	33	33	0	33	0	334.0	10	23	11	23
33	61	53	8	53	0	480.6	30	23	53	0
35	9	9	0	0	9	77.4	8	1	4	5
37	38	37	1	0	37	333.0	10	27	0	37
38	43	43	1	0	43	384.3	10	33	8	35
40	39	35	4	0	35	247.8	15	20	17	18
41	44	38	7	0	38	262.5	20	18	12	26
42	24	23	2	23	0	204.3	9	14	23	0
43	33	32	1	32	0	224.0	25	7	32	0
46	54	30	24	30	0	269.1	10	20	30	0
48	27	24	3	24	0	166.6	0	24	3	21
49	21	14	7	14	0	99.4	5	9	0	14
50	15	6	9	6	0	38.4	5	1	6	0
Tot.	**1,520**	**1,253**	**267**	**716**	**537**	**10,336**	**762**	**491**	**778**	**475**

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

Proposed Road Work

New System Road Construction

No new system road construction would occur under Alternative 3.

New Temporary Road Construction/Obliteration

No new temporary road construction would occur under Alternative 3.

Re-use of Existing Unclassified Roads

The 2.2 miles of unclassified roads[8] found in and adjacent to the Curtis units were built 40 to 50 years ago to provide logging access to the original clearcuts. None have been recognized as system roads, and as such, they have not been inventoried nor have they received any maintenance. Some of these old roads were rocked when they were originally built and are in good condition today. Others are native (dirt) surface and may present erosion problems except for those on flat ground.

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

System Road Reconstruction

Alternative 3 would include the reconstruction of 0.6 miles (or ten sections) of existing open system roads 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 reduce the risk of erosion (ROD C 32-33), while providing for safe, cost-effective timber haul. The reconstruction would be done using heavy equipment such as an excavator, backhoe, road grader, dump truck, and a water truck. Reconstruction could include culvert installations, replacements or upgrades, road slump repairs, reshaping roadbeds for improved drainage, or adding rock surfacing.

Rock for these reconstruction activities would be generated from the following existing rock quarries:

- Road 2929 MP 2 – Surveyor;
- Road 2929-500 – East Collins;
- Road 29 MP 8.5 – Big Stump; and
- Road 2980-100 – Grassy Ridge.

Rock is generally suitable and available within these quarries and no additional drilling, blasting, or crushing is anticipated to produce the needed rock. 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 about 62 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, and a street sweeper. The road maintenance under Alternative 3 would include:

- Opening and closing (upon completion of haul) currently closed roads (Level 1 system roads) totaling 1.2 miles;
- Removing downed trees, large rocks, slides, etc. from roads;
- Brushing roads and road sides;
- Blading road beds, including ditches where needed;
- Cleaning existing culverts as needed for proper drainage;
- Constructing water bars on some existing system roads (both closed and open) as needed for proper drainage;
- Applying dust abatement materials to portions of roads;
- Danger/hazard tree felling, and possible removal, to meet OSHA requirements on haul routes.

Wet Season Haul

Under Alternative 3, timber would be hauled outside the normal operating season when conditions allow such haul to occur, as long as sediment delivery to streams associated with the haul remains at acceptable levels and road surfaces are not unduly impacted. Conditional wet season haul would occur on 29 miles of graveled and 18 miles of paved roads.

ALTERNATIVE 4 (TABLE 4, FIGURE 5)

Alternative 4 was developed to meet the purpose and need and to respond to the issues raised concerning wildlife in the planning area and economics. Specifically, Alternative 4 would create foraging habitat for Roosevelt elk and blacktail deer as well as enhance habitat for songbirds and landbirds by creating 1- and 2-acre wildlife gaps within units 14, 15, 17, 22, 26, 41, and 46 (total of 25 acres). Gaps would be located away from roads to avoid elk foraging habitat and outside riparian areas to eliminate sediment runoff to streams. Gap size would be restricted to 1 acre on slopes greater than 10%. Larger, 2-acre gaps would be created only on slopes less than or equal to 10%.

Alternative 4 would incorporate 25 acres of wildlife gaps in seven units. The timber output of Alternative 4 would be about 2% more than Alternative 2 as a result of these gap treatments. It would harvest an estimated 12.7 million board feet, increasing the economic viability of the project.

Alternative 4 includes the following:

- Commercial thinning of about 1,508 acres of managed stands (second growth) using ground-based or skyline logging systems in the Matrix land allocation generating approximately 12.7 million board feet of timber. Thinned acres will include about 825 acres of off-site ponderosa pine harvesting or girdling to remove non-localized conifers and to restore to native plant communities.
- Creation of wildlife gaps within units 14, 15, 17, 22, 26, 41, and 46. Specifically, gap creation would include two 2-acre gaps in unit 14, one 1-acre and three 2-acre gaps in unit 15, one 1-acre and one 2-acre gaps in unit 17, one 1-acre gap in unit 22, two 1-acre and three 2-acre gaps in unit 26, one 1-acre gap in unit 41, and one 1-acre gap in unit 46. Wildlife gaps would total 25 acres. Gaps would be located away from roads and riparian areas. Gap size would be restricted to 1-acre on slopes greater than 10%. Larger, 2-acre gaps would be created only on slopes less than or equal to 10%.
- About 165 acres of managed stands in Riparian Reserve land allocations outside of the no cut shade zone would be thinned to reduce stand density. This represents 51 percent of the total Riparian Reserve acres within the managed stands.
- Treating activity created fuels on about 878 acres by underburning, grapple or excavator piling (with machines remaining on pre-designated skid trails), lopping and scattering, chipping, jackpot burning, or handpiling and burning.
- Re-using 2.5 miles of existing temporary spur roads (unclassified roads) to access thinning areas, then subsoiling after use.
- Constructing 0.6 mile of new temporary spur roads to access thinning areas, then subsoiling after use.
- Re-opening and maintaining 1.2 miles of closed system roads to access thinning areas, then closing them after use.
- Reconstructing portions of 10 sections of existing system roads (work would occur along 0.7 mile of road) including the placement or replacement of surface rock, the replacement of undersized or deteriorated stream crossings, the addition or replacement of ditch relief culverts, armoring culvert outlets, stabilizing road fills and road shoulders, reshaping road beds, and the reconstruction of ditches as needed.

- Maintaining about 65 miles of existing roads (includes Level 1 and 2 roads and paved roads) including the grading and shaping of existing road surfaces, dust abatement, constructing water bars, ditch maintenance as needed, opening and re-closing existing closed roads; and the cutting of intruding vegetation along roadsides.
- Hauling timber during the wet season on about 29 miles of gravel roads and 18 miles of paved roads.
- Utilizing the following existing rock pits, along with several rock disposal sites as the rock source for the road work: Surveyor – Road 2929-500 in NE ¼ S17, T30S, R1W; East Collins – Road 2929-500 in NE ¼ S17, T30S, R1W; Big Stump – Road 29 in NW ¼ S3, T30S, R1E; and Grassy Ridge – Road 2980-100 in NE ¼ S33, T29S, R1E..

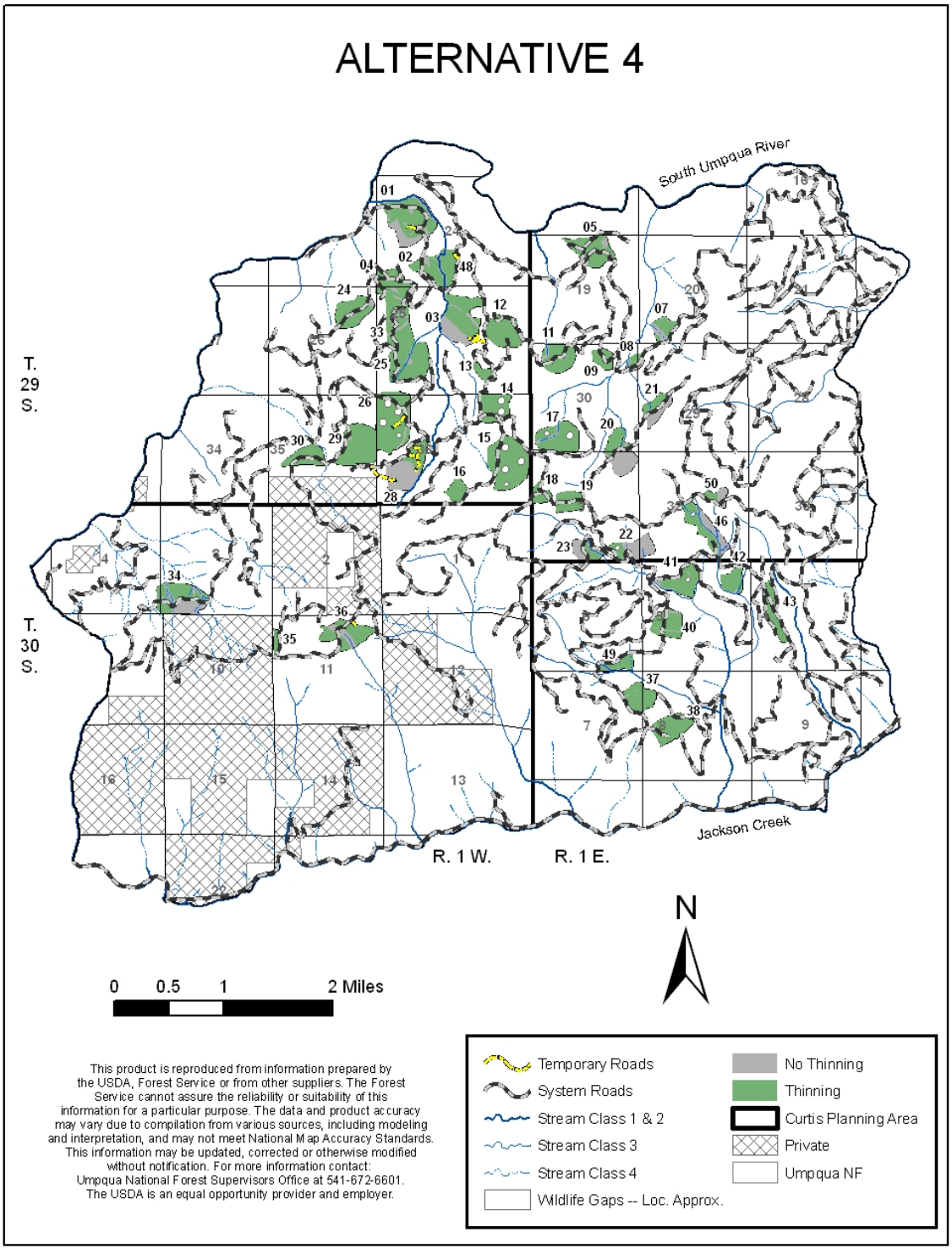

Figure 5. Alternative 4.

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 Acres (trees per acre retained)		Volume Removed (thousand board feet)	Fuels Treatment Acres[9]		Logging Systems Acres[10]	
				40-70	70-100		Acres treated	Acres not Treated	Ground Based	Skyline
1	99	67	32	0	67	804.0	35	32	34	34
2	41	32	9	32	0	346.5	15	17	8	24
3	85	54	31	54	0	535.0	40	14	0	54
4	47	45	2	45	0	359.2	20	25	45	0
5	57	54	3	54	0	322.8	30	24	54	0
7	25	16	8	16	0	65.2	0	16	4	13
8	13	7	6	7	0	43.2	3	4	0	7
9	18	18	0	0	18	163.8	6	12	14	5
11	45	43	2	0	43	342.4	20	23	7	35
12	52	52	0	0	52	516.0	51	1	44	7
13	13	13	0	0	13	117.9	13	0	13	0
14	45	45	0	45	0	331.5	45	0	45	0
15	96	96	0	96	0	616.8	96	0	96	0
16	20	20	0	0	20	175.5	15	5	0	20
17	61	56	4	0	56	532.0	48	8	28	28
18	17	17	0	17	0	121.1	8	9	17	0
19	28	28	0	28	0	198.1	10	18	28	0
20	54	22	32	22	0	152.6	5	17	3	19
21	30	15	16	15	0	104.3	7	8	0	15
22	43	12	31	12	0	89.0	10	2	12	0
23	32	14	18	14	0	97.3	5	9	0	14
24	47	45	3	45	0	312.9	20	25	5	40

[9] Fuel treatments may include JPB – Jackpot Burn; UB – Underburn; HPB – Handpile Burn along Roadside for 66 feet; Prune and Chip; and NT – No Treatment.
[10] Logging Systems include ground based (loader, mechanized, and cut-to-length) and skyline (yoader skyline, multispan skyline, and downhill skyline).

Unit #	Total Acres in Unit	Thinned Acres in Unit	Unthinned Acres in Unit	Harvest Prescription Acres (trees per acre retained)		Volume Removed (thousand board feet)	Fuels Treatment Acres[9]		Logging Systems Acres[10]	
				40-70	70-100		Acres treated	Acres not Treated	Ground Based	Skyline
25	72	69	4	0	69	620.1	20	49	21	48
26	100	96	4	0	96	931.5	96	0	96	0
28	70	39	31	0	39	269.5	25	14	24	15
29	74	73	2	0	73	654.3	30	43	50	23
30	33	33	0	33	0	334.0	10	23	11	23
33	61	53	8	53	0	480.6	30	23	53	0
34	75	44	31	44	0	308.0	20	24	9	35
35	9	9	0	0	9	77.4	8	1	4	5
36	55	43	11	0	43	476.3	30	13	15	29
37	38	37	1	0	37	333.0	10	27	0	37
38	43	43	1	0	43	384.3	10	33	8	35
40	39	35	4	0	35	247.8	15	20	17	18
41	44	38	7	0	38	262.5	20	18	12	26
42	24	23	2	23	0	204.3	9	14	23	0
43	33	32	1	32	0	224.0	25	7	32	0
46	54	30	24	30	0	269.1	10	20	30	0
48	27	24	3	24	0	166.6	0	24	3	21
49	21	14	7	14	0	99.4	5	9	0	14
50	15	6	9	6	0	38.4	5	1	6	0
Tot.	**1,856**	**1,508**	**347**	**760**	**748**	**12,728**	**878**	**630**	**868**	**641**

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

Proposed Road Work

The road work proposed for Alternative 4 is the same as has been described for Alternative 2. The slight increase in haul volume due to the wildlife gaps may increase the frequency of routine surface maintenance during the contract, but the type of maintenance is not changed.

Connected and similar actions for Alternative 4 are the same as those for Alternative 2.

Connected and similar actions for Alternative 4 are listed in Tables 2 and 3.

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.

	Alt.1	Alt. 2	Alt.3	Alt. 4
Element 1 – Stand Density				
• Acres of second-growth commercially thinned to accelerate late-successional habitat development in sale areas	0	1,508	1,253	1,508
• Acres of trees planted to increase species diversity.	0	25	22	25
Element 2 – Risk of Large Scale Disturbance				
• Acres of FRCC 3 converted to FRCC 1 through commercial thinning and fuel treatment (burning) to reduce the risk of fire spread and intensity:				
o FRCC 3	0	1,508	1,253	1,508
o FRCC 1	0	632	497	632
Element 3 – Timber Production				
• Million board feet of timber produced by commercial thinning	0	12.5	10.3	12.7
Issue 1 – New Temporary Road Building				
• Miles of temporary road built, then obliterated	0	0.6	0	0.6
• Miles of abandoned road rebuilt and added to the road system	0	2.5	2.2	2.5
• Total acres of thinning accessed per mile of new temporary road construction	0	471	569	471
Issue 2 – Forage in Winter Range				
• Size of canopy gaps proposed	0	¼-, ½-acre	¼-, ½-acre	¼-, ½-, 1-, 2-acre
• Total acres of canopy gaps	0	80	77	105
Issue 3 – Economic Viability				
• Volume removed (million board feet)	0	12.5	10.3	12.7
• Cost Benefit Ratio	0	0.98	0.96	0.99
• Present Net Value	0	-$86,814	-$150,443	-$43,353
Comparison of Activities/Effects				
Logging systems				
• Acres Skyline	0	641	475	641
• Acres Ground Based	0	868	778	868
Fuels Treatments (Activity Fuels)				
• Underburn or Jackpot Burn	0	334	334	334
• Chipping or Handpile and Burn	0	544	423	544
TOTAL FUELS TREATMENT	0	878	757	878

	Alt.1	Alt. 2	Alt.3	Alt. 4
• No fuel treatment on commercially thinned units	0	630	491	630
Commercially Thinned Acres Susceptible to Potential Future Fire Effects				
• Surface Fire Effects	N/A	735	711	661
• Passive Crown Fire Effects	N/A	470	431	395
• Active Crown Fire Effects	N/A	494	470	405
Pre-Commercially Thinned Acres Susceptible to Potential Future Fire Effects				
• Surface Fire Effects	N/A	297	286	314
• Passive Crown Fire Effects	N/A	217	199	237
• Active Crown Fire Effects	N/A	377	358	360
Riparian Reserves				
• Acres Riparian Reserve Thinned	0	165	144	165
• Acres New Permanent Road Const.	NA	0	0	0
• Acres Abandoned Roads Removed	0	0.3	0.3	0.3
Instream Activity (sites)				
• New Road/Stream Crossings	0	1	1	1
• Stream Crossings Repaired	0	1	1	1
• Replace Damaged Culvert	0	3	1	3
• Add culvert/French drain to reconnect stream/drainage	0	2	1	2
Operating Season Restrictions				
• Northern Spotted Owl (harvest and road construction)	N/A	3/1-7/15	3/1-7/15	3/1-7/15
• Bark Slippage (waivers are possible for some units)	N/A	4/15 – 7/1	4/15 – 7/1	4/15 – 7/1
• Pile burning	N/A	No spring/ summer	No spring/ summer	No spring/ summer

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; and
- 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 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-65-3, 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.

LOGGING PRACTICES

BMPs T-1, T-11, T-12, T-16, T-17; 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, skyline roads will be no closer than 150 feet at the outer unit boundary of all units, or as required in order to protect green trees prior to felling.

✓ Location of all tractor skid roads will be agreed to prior to felling, unless otherwise agreed to in writing (BT6.422) at an average of 100 feet apart.

✓ Locate landings so that timber can be yarded with minimal disturbance to riparian reserves and meadows.

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

✓ Identify suspended log yarding (e.g.; skyline) to protect soils from excessive disturbance where identified by Soil Scientist (completed during planning process).

✓ If skyline logging corridors are needed, Forest Service will designate logging corridor locations across streams that minimize riparian and meadow disturbance while using full log suspension.

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 (May 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 call 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 according to the need for controlling runoff and to ground and weather conditions.

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

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

✓ Pollutants from logging or road reconstruction equipment will be kept from entering waterways during servicing or refueling by selecting areas at least 100 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 construction and approval for the landings shall insure water quality protection (BT6.422).

✓ Road construction operations will occur during minimal runoff periods.

✓ Timely erosion control measures will be applied to incomplete road and stream crossing projects before the rainy season.

✓ Ground based logging operation equipment will be excluded from wetlands and meadows in units 12, 14, 15, 16, 18, 19, 24, 34, 36, 42, and 46.

RIPARIAN RESERVES 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-61-11, 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:

✓ Wetlands would be protected from ground disturbance by applying the following: a 150-foot no-cut buffer on unique habitats >1 ac; wetlands <1 ac would be thinned to the outer edge of riparian vegetation, using directional felling, and no equipment will be allowed within riparian reserves; no logging corridors or equipment through wetlands; and not igniting fire in the buffers or wetlands during fuel treatment.

✓ During ground-based logging, equipment will not be allowed in riparian reserves.

✓ Apply no-cut shade zone 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 site specific buffers have been mapped by unit.

✓ 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 vegetation.

WATERSHED PLANNING AND MONITORING

BMPs W-7.

OBJECTIVE: To monitor the long-term stream temperature trends in the Buckeye/Zinc and Jackson Watersheds and compare with State Water Quality Standards.

ACTIONS:

✓ Forest Plan long-term stream temperature monitoring program includes Jackson Creek at the mouth (approximately 1.5 miles downstream from the Curtis Planning Area). This is an on-going monitoring element under the 1990 Umpqua NF LRMP. Stream temperature will also be monitored at additional short-term sites in conjunction with the Curtis Actions. Thermographs will be placed at the mouths of Zinc Creek, Deep

Cut Creek, and Ralph Creek in 2008 and will be monitored for 2 years after Curtis treatments.

TEMPORARY ROAD CONSTRUCTION and OBLITERATION; EXISTING ROAD RECONSTRUCTION, AND MAINTENANCE

BMPs R-2, R-3, R4, R5, R-6, R-7, R-8, R-9, R-10, R-11, R-12, R-13, R-14, R-15, R-16, R-18, R-19, R-20, 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 the reconstruction of 0.7 miles of existing system road (Alternatives 2 and 4) and reconstruction of 0.6 miles of existing system road for Alternative 3; maintenance of approximately 65 miles of existing system roads (Alternatives 2 and 4) and 62 miles of existing system roads for Alternative 3. Temporary roads will be constructed to facilitate harvest operations and then obliterated after logging is completed (0.6 miles for Alternatives 2 and 4 and 0 miles for Alternative 3).

ACTIONS:

✓ Develop an erosion control plan to be included in the TSC (CT6.6#).

✓ Heavy vehicles will be restricted to all weather roads outside of the normal operating season (May 1 through October 31).

✓ Construction activities that may expose new soil (including cleaning, grubbing, excavating, and fill placement) will be limited to the normal operating season (May 1 to October 31). However, construction activities may be suspended anytime during wet weather to protect water quality of affected streams.

✓ Where appropriate, native-surfaced roads will have water bars installed and road barriers placed to prevent damage after commercial use is complete. Aggregate surfaced 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 functioning and effectively draining. Grading of roads will be done in accordance with maintenance specification T-811. Apply water during blading when sufficient moisture is not present (T-891).

✓ During construction and reconstruction activities, waste material and other end hauled materials shall be placed in areas agreed to by the Forest Service. These areas shall generally avoid riparian reserves and avoid affecting fish, wildlife, cultural, and botanical resources.

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

✓ 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, Hydrologist, or Wildlife Biologist.

✓ All temporary road construction will be done using outslope designs when needed, with drain dips and grade sags as needed, so that no new ditch lines will be built, and will not exceed 12 feet in width.

✓ Utilize stable natural benches and ridges wherever possible. Avoid slumps, slides, and wet spots.

✓ Relief culvert locations will be located, flagged, and approved by the Forest Service before installation. Minimum spacing will be 400 feet, but no closer than 150 feet to any natural defined channel to minimize cumulative road drainage into streamcourses.

✓ Waivers for surface rock placement outside the normal operating season may be granted upon approval by District Fisheries and/or Hydrology personnel based on weather and road conditions.

✓ Required erosion control work will be completed each season before Nov. 1.

✓ 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.

✓ All road cut slopes, fill slopes, and ditchlines will be stabilized with native grass/forbs.

✓ During construction, temporary roads will have the surface A-horizon (8 to 12 inches) removed and stored in a manner that will not cause surface water to flow to concentrate behind it. The A-horizon material will be returned to the surface when the temporary road is decommissioned.

✓ Waterbars sufficient to disperse water shall be installed where designated by the Forest Service to prevent future traffic and disperse subsurface water.

✓ Soil conditions associated with ridgetop roads are typically shallow depth soil (some occurrence of moderately deep soil). Subsoil to a depth of at least 20 inches, unless otherwise agreed to by the Forest Service. All subsoiling would be covered with available harvest slash or other suitable organic material. Stabilization of soil surface with organic material is done to prevent resulting subsurface from soil crusting.

✓ 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 monitoring.

• Hazard trees will be identified along the haul routes (in compliance with the Biological Opinion 1-15 2006-F-0035 dated December 23, 2005), and felled as needed to meet OSHA requirements.

ROCK SOURCE DEVELOPMENT

BMPs R-22

ACTIONS:

✓ Rock pit benches, access roads, and work areas within the rock pit will be outsloped at 5% to provide for adequate drainage at the following pits that would be used under all action alternatives:

Surveyor on Road 2929-500 in the NE ¼ S17, T30S, R1W;

East Collins on Road 2929-500 in the NE ¼ S17, T30S, R1W;

Big Stump on Road 29 in the NW ¼ S33, T30S, R1E; and

Grassy Ridge on Road 2980-100 in the NE ¼ S33, T29S, R1E.

FISHERIES/WATERSHED

BMPs T-1, T-2, T-3, T-4, T-5, T-6, T-7, T-8, T-9, T-10, T-11, T-12, T-13, T-14, T-15, T-18, T-19, T-21, T-22, R-1, R-2, R-3, R-6, R-7, R-11, R-14, R-17, R-18, R-19, R-20, R-21, R-23, F-2, W-3, W-4, W-5, VM-1, VM-2

ACTIONS:

✓ Trees must not be felled within the primary shade zone associated with any perennial stream, with the exception of trees within skyline yarding corridors.

✓ If an existing landing within 200 feet of a stream is used, erosion control measures must be installed prior to use to prevent soil movement downslope from the landing. The landing must be rehabilitated (compacted soils fractured, seeded) after use.

✓ Existing landings planned for use between Oct 16 and May 14 must be surfaced with aggregate material to reduce erosion and sediment transport during wet periods.

✓ All primary skid roads (defined as more than 5 passes by a machine) used for ground-based operations will be designated on the ground to limit extent of soil compaction.

✓ Do not allow sidecast road construction when the hill slope exceeds 30%.

✓ Require an aggregate or paved surface for all new roads or landings that will be used in the wet season (generally October 16 to May 14).

✓ Implement erosion control measures to prevent offsite movement of disturbed or exposed soil associated with new road construction, new landing construction, road renovation and road reconstruction (including cutbanks, fills, ditches, etc.) on road segments that have the potential to directly or indirectly deliver sediment to any stream channel. Erosion control measures include silt fences, straw bales, matting, mulch, slash, water bars, grass seed, or other products. This work will occur prior to the wet season.

✓ Existing vegetation in ditchlines that discharge to streams will not be removed.

✓ Do not grade material removed from ditchlines onto the road surface where the road surfaces are hydrologically connected to a stream. Remove and store this material and all other waste materials in a stable site which is not hydrologically connected to any stream.

✓ No haul allowed on native surfaced roads during the wet season. Close and waterbar native surfaced roads prior to the wet season (Oct 16 and May 14) and between operating seasons to prevent use and reduce erosion.

✓ If dust abatement is limited to the application of water only, do not draft water without using a NMFS approved screen on the drafting hose when drafting from fishbearing streams. Pumping of water for road maintenance use must allow for retention of at least 90% of the original stream flow below the pumping site.

✓ New aggregate surfacing must use durable rock (AASHTO T210), and have no more than 15% fines (#200 sieve).

✓ Require the complete excavation of overburden (road fill material) at each culvert replacement site prior to extracting the existing culvert.

✓ Quarries located in riparian reserves will only be operated during the dry season (generally May 15 to October 15). Use during the wet season will have prior approval from a Fisheries Biologist.

✓ Decommissioned roads must be effectively closed to all vehicle traffic, and closed roads must have waterbars or other water drainage features installed.

✓ Decompact the decommissioned road bed on natural and aggregate surfaced roads, and use seed or other materials to establish effective ground cover prior to the wet season.

✓ Timber transport operations will be stopped immediately if road use is causing rutting of the road surface, ponding of water on the road, failure of any drainage structure, or any other action occurs which increases the sediment delivery to a stream. Actively implement restorative work to reduce or eliminate the erosion. The road surface must be repaired before haul can resume.

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

✓ Hauling is not allowed when conditions exist (e.g., during intense or prolonged rainfall), that may cause generation of road related runoff to streams.

✓ Spot rocking and/or sediment traps will be employed to reduce potential sediment inputs to streams. Sediment traps will be inspected weekly during the wet season and entrained soil would be removed when the traps have filled to ¾ capacity. Dispose of these materials in a stable site which is not hydrologically connected to any stream.

✓ Hand piling of fuels intended for burning is prohibited closer than 100 feet from any stream channel.

✓ Prohibit the construction of hand-built fire lines where water could be channeled into areas of instability, headwalls or streams. Construct waterbars on fire line to reduce soil erosion.

✓ Danger trees felled within riparian reserves shall be left on site.

✓ Apply no-cut buffers to all perennial streams following guidance in the Northwest Forest Plan Temperature TMDL Implementation Strategies (USDA/USDI 2005) to protect the primary shade zone from harvest. The site specific buffers have been mapped by unit.

SOIL AND SITE PRODUCTIVITY

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

✓ Prior to the sale closing, approximately 97 total acres of temporary roads, skid trails, and landings used by the purchaser would be subsoiled in Units 1, 5 ,12, 14, 15, 23, 26, 28, 29, 33, 36, 40, 41, 42, 43, and 46 to mitigate for existing legacy disturbances to meet Standards and Guidelines for soil disturbance and long-term site productivity.

✓ Skid trails used by the purchaser would occur on preexisting disturbance in all units at the discretion of the sale administrator. 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 or to a rock limiting depth 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.

✓ The levels of effective ground cover will be monitored as the project progresses by the sale administrator and fuel treatment teams. 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). Units 1, 7, 8, 23, 30, 34, 43, and 48 shall be given high priority for soils monitoring.

• During the rainy season (November 1 - April 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 whenever possible. Locate skid trails away from areas identified as having sensitive soils (Project File – Soils).

• Restrict ground-based logging to areas less than 30% slope.

• Maintain at least 85% or more effective ground in categorically unsuited areas (CU); in all other areas maintain at least 65% effective ground cover in order to maintain soil productivity and prevent soil erosion.

• In order to mitigate effects to soils, slash piles will be placed on new, and existing skid trails, and landings, where practical. 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).

• Locate canopy gaps away from conditionally unsuitable (CU) areas as mapped in Figure S-4 (Project File – Soils).

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.

OBJECTIVES: 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. Reduce activity created fuels to tonnages within 18 to 21 tons per acre for fuels less than 6 inches in diameter.

ACTIONS:

✓ Burn plans would include water quality objectives.

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

✓ As needed, fire lines would require water bars at slopes greater than 30%. Fire line water bars would deflect surface run-off from the trail down slope onto stable material such as rock surface cover. Fire line construction would generally avoid sensitive areas like unique habitats. Fire lines would be constructed in portions of units: 12, 14, 15, 17 and 26.

• Handpiles would be located a minimum of 10 feet from the base of any live tree (greater than 8 inches in diameter), snag or large down wood. Handpiling will not occur within 100 feet of any stream channel.

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

• Handpiles would generally be constructed about 5x5 feet in size and not more than 4 feet high with slash material less than 4" on the large end and not more than 6 feet in length.

• Air quality would be emphasized during prescribed fire planning. Mitigating measures would be considered including extending the burning season to spread emissions throughout the year. All burning would be planned and conducted to comply with applicable air quality laws and regulations and coordinated with appropriate air quality regulatory agencies. Road signing would be used to alert all motorists of potential smoke impairments.

• All burning will be conducted when smoke management instructions allow permissible tonnages and only after the burning areas have been registered with the state.

Rx Sump improvement work would be accomplished on 6 existing pump chances in all action alternatives. The work required would include: felling of hazard trees affecting the pump chance; cleaning of the water catch basin to remove accumulated silt and deepen the sump to its original dimensions; gravel placement on sump spurs and landings; brushing of ingress/egress areas; and signing locations. The improvement work would be coordinated with the District Fisheries Biologist and District Wildlife Biologist.

Rx Mitigation with regard to fuels would consist of alternatives to burning such as chipping, crushing and/or no treatment of fuels in certain areas.

Rx Burning will only be conducted after burn plans have been approved by the appropriate line officer.

Rx Burns will only be conducted with a red card qualified burn boss on site.

MONITORING

↙ Smoke monitoring may be conducted by the Douglas Forest Protection Agency utilizing air craft. This reveals smoke column height and direction.

↙ Fuels monitoring will be conducted after fuel treatments to determine effectiveness of slash and fuel reduction methods. Underburning may result in an unacceptable amount of residual tree mortality or removal of too much coarse woody debris as an example. Handpiling may result in not enough fuels less than 3 inches in diameter removed from the stand.

WILDLIFE MANAGEMENT

• To protect nesting spotted owls, prohibit timber harvesting and road construction equipment operations from March 1 to July 15.

• Retain and protect (during harvest and burning) existing[11] large down wood (>6 inch diameter) and snags (>9 inch dbh) to the extent practical and safe. Avoid mechanical impacts and movement of existing large down wood where possible. OSHA requires that hazardous trees/snags be felled to protect workers on the ground during forest operations. Snags that must be felled for safety reasons should be retained to help attain down wood requirements.

• To mitigate for snag loss and a decreased rate of snag recruitment caused by thinning retain (>15 inch dbh or largest trees available) additional trees which could be inoculated or girdled to create snags:

1) Skyline units – between 8 and 10 trees per acre;

2) Ground based units – between 6 and 8 trees per acre;

3) Offsite pine units – between 8 and 10 trees per acre;

• In areas where snags are lacking, it may be beneficial to pile slash at the base of green trees and create a snag using fire. This should be coordinated with the Wildlife Biologist.

• Off-site pine in riparian buffers will be retained for later snag creation by girdling.

• 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. Jackpot/underburning should occur in the fall if at all possible.

• Abide by the terms and conditions in the programmatic Biological Opinion (FWS-1-15-03-F-0454) for all connected actions (e.g., road maintenance, brushing, prescribed burning, noxious weed control, etc.). When possible, schedule these activities to occur after July 15 and before March 1.

• Winter Range restrictions are from December 1 through April 30 on designated system roads to protect elk and blacktail deer.

• Retain trees with woodrat, raptor, or other nests when present. Retain live trees with defects such as broken or dead tops, heart rot pockets, loose bark, and mistletoe brooms. Leave large “wolf” trees as legacy trees.

• No suitable owl nest tree greater than 36” dbh should be removed. Trees selected for the project greater than 36” dbh may be felled if a Wildlife Biologist determines they are not suitable as nesting habitat.

• Consider topping or high-stumping trees to eliminate the hazard, rather than traditional felling. Even a stub (>4’) is more beneficial to wildlife than a stump.

• For wet swales, select retention trees around the edge to buffer existing hardwoods. Directionally fall trees away from hardwood inclusions and avoid yarding through these areas when possible.

• Retain trees and/or shrubs around rock outcrops for shading.

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[11] Retain snags that have features such as existing cavities, those that occur in clumps, and those that have a diversity of heights and diameters. Large snags are preferred. For down wood, leave existing down wood of all decay classes to the extent practical.

• Avoid yarding over rock outcrops.

• Avoid piling slash at the base of or near snags, down logs, or rock outcrops.

• Leave some piles unburned for use by wildlife, especially in riparian zones.

• If a suspected TES species is found during the operating period, activities will cease until Tiller RD wildlife personnel can be contacted and an identification and evaluation can be made.

• The District Wildlife Biologist will work with the contractors and fire crews to ensure that the mitigation measures are understood and implemented on the ground.

⸗ Meet with contractors to ensure that mitigation measures are applied during thinning activities.

⸗ Work with fire crews during activity fuels reduction.

⸗ Assess snag and down wood after project implementation to determine the need for snag creation.

⸗ Assess forage within winter range following treatment.

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:

• Under the action alternatives, gaps will be located based on the following criteria: Removal of off-site pine will create approximately five ¼- ½ acre gaps each in units 2, 3, 13, 16, 25, 26, 28, 29, 30, and 48 and twenty ¼- ½ acre gaps each in units 14, 15, 17, 22, 24, 41, 43, 46, and 50. Finally, in Alternative 4 only, 25 acres of 1- and 2-acre gaps will be created in units 14, 15, 17, 22, 26, 41, and 46 to enhance habitat for big game.

• KV funds will be collected for reforestation activities on 25 acres. Plug+1 sugar pine (100 TPA) will be planted in the large ½-acre gaps in units 2, 3, 13, 14, 15, 17, 24, 25, 26, 28, 29, 30, and 41.

• Animal damage protection, including netting or big game repellant[12], will be applied after planting, as needed.

• Tree handling will meet Regional standards.

• Restrict all logging operations during the bark slippage[13] season from April 15 to July 1.

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[12] Deer-Away® is a commonly used biodegradable and non-toxic repellent that is effective at reducing deer, elk, and rabbit browse on vegetation and is considered a mitigation measure that would be used as an alternative to tubing sugar pine seedlings. A hand sprayer is used for spot application to only the terminal bud of the seedling in spring (after budding) and again in the fall (before winter browsing). Application does not affect surrounding grass, forb, and shrub vegetation, which is the primary forage type. Therefore, the effect on big game forage is considered to be negligible and will not be analyzed further.

[13] A period of time during which the sap of a tree is flowing and the tree is susceptible to damage (bark removal/slippage from the connective cambium tissue) from logging operations.

✓ Two acre gaps will not be located in the riparian reserve land allocation or next to open system roads (maintenance level II or above) in Alternative 4.

Rx "Clumped" retentions will be achieved by retaining all conifers of equal size that are within 2 feet of each other when encountered as a reserve tree for the DXD.

Rx Where possible, hardwoods and Pacific yew will be left standing in harvest areas.

Rx Harvest trees 20 feet from the drip line of healthy sugar pine not exhibiting signs of white pine blister rust.

✓ The Silviculturist will review marking guides with the presale crew prior to marking and will monitor quality both during and after the unit is completely marked, on a sample of each type of prescription, as funding and staffing allows. If the number of leave trees per acre exceeds plus or minus 10 percent of the target, remarking or amending the silvicultural prescription will be necessary.

✓ Logging operations will be monitored by the sale administrator and may be monitored by a Soil Scientist and Silviculturist. If Standards and Guidelines, best management practices, mitigating measures or the silvicultural prescription are not being met, additional measures will be prescribed to insure compliance. If a leave tree must be harvested for safety reasons, the sale administrator may mark another tree for leave to replace it. The Sale Administrator will inform the appropriate staff member if logging feasibility issues may make it impossible to meet the desired conditions outlined in the environmental document.

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:

• 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).

• 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 revegetation projects.

• Revegetate disturbed sites as soon as practical using native species unless there is no immediate resource concern and the site is anticipated to revegetate naturally to native species to desired cover standards.

• Treat known sites of Scotch broom, meadow knapweed, and Forest Rated "A" noxious weeds 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 not treated, 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 are located. Contractor will avoid ground-disturbing activities in the flagged and/or staked areas unless otherwise directed by the COR/FSR.

• 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. 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) will be used.

• 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 at the Callahan rock pit, scrape off the top several inches of soil and rock to remove all 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 and contractors 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 a Timber Sale Administrator.

• Discourage public access to active road construction sites by establishing road closures. Allowing only vehicles involved with the project on the site will help limit introduction of weed seed.

• Wherever possible, use native revegetation techniques to reestablish native plants on sites where weeds are removed as well as in areas where fallow ground provides optimal habitat for weeds to colonize. Native plant materials are the first choice in revegetation 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 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). Whenever possible, roadside brushing will be accomplished prior to seed setting of noxious weed species (approximately late June). The intent of this is to stop and/or prevent noxious weed spread and establishment.

• After harvest, armor or mulch (3-8" deep) areas in need of cover if revegetation has failed or will likely fail.

• Firelines will be rehabilitated, as feasible, to restore the soil/duff layer and prevent introduction of noxious weeds.

• Revegetate firelines that are at high risk of noxious weed invasion (as determined by a District or Forest weed specialist).

• 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.

↗ After harvest, use KV funding to monitor and subsequently treat remaining or new infestations of noxious weeds for up to three years following sale closure.

RECREATION, MINING, 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. Units 14, 18, 20, 22, 26, 36, and 38 require mitigation during project implementation and consultation with the Forest Archaeologist is required prior to layout and implementation in these units.

• 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.

• Coordinate logging operations and use of road 2929-905 with the Collins Ridge mining claimant.

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 40-70 trees per

acre averaged over the area of a unit. Moderate thinning would leave an average of 70-100 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 cut-to-length 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. Cut-to-length logging uses 2 pieces of equipment: a processor which fells, limbs, and cuts trees into log lengths and a forwarder which transport the logs out of the unit. 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 generally utilized 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.

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 for 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 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 typically were built several decades ago during logging, and that have been left unattended. 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.

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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 Umpqua National Forest Final Environmental Impact Statement, as amended. In addition, many of the discussions in this chapter utilize the information found in the supporting documents, such as the 1995 Jackson Creek and 1996 Buckeye/Zinc Watershed Analyses (USDA 1995; USDA 1996). This chapter also incorporates by reference all reports and analyses prepared by resource specialists, which are summarized in this chapter.

ACTIVITIES THAT MAY CONTRIBUTE TO CUMULATIVE EFFECTS

Tables 6-8 document the relevant past, present, and reasonably foreseeable activities that may contribute to cumulative effects for the Curtis 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 Curtis project; the following tables are displayed to summarize information known about the Jackson and Buckeye/ Zinc Creek Watershed Analysis Areas. Discussion of these activities occurs throughout this chapter, where relevant.

Table 6. Past Activities that May Contribute to Cumulative Effects in the Buckeye/Zinc Creek and Jackson Creek Watersheds.

Activity	Decade	Buckeye/Zinc Creek Acres/Miles	Jackson Creek Acres/Miles	Comments
Regeneration Harvest/Final Overstory Removal Forest Service	1950's 1960's 1970's 1980's 1990's 2000's	904 2,915 2,513 2,528 1,191 0 **10,051**	1,114 4,307 15,367 4,117 1,592 0 **24,497**	Regeneration harvest primarily through ground based (highlead) methods and skyline logging. **TOTAL ACRES**
Commercial Thinning/Partial Harvest	1960's 1970's 1980's 1990's 2000's	58 1,721 890 1,136 0 **3,805**	1,528 5,920 2,250 1,625 320 **11,643**	Commercial thinning used both ground based and skyline logging methods. **TOTAL ACRES**
Pre-commercial Thinning (PCT)	1950's 1960's 1970's 1980's 1990's 2000's	110 781 968 1,650 1,056 352 **4,917**	390 2,769 3,432 5,850 3,744 1,249 **17,434**	PCT was accomplished using hand carried chain saws. **TOTAL ACRES**
Reforestation	1950's 1960's 1970's 1980's 1990's	850 2580 2450 2350 1100 **9,330**	980 3,870 14,500 10,500 4,500 **34,350**	Reforestation was accomplished using shovels, hoedads, and other planting implements. **TOTAL ACRES**
Release	1950's 1960's 1970's 1980's 1990's	150 425 430 980 250 **2,235**	1,200 4,500 4,800 8,500 2,500 **21,500**	Release included brushing or spot herbicide application around young trees to promote growth. Herbicide applications with helicopters common prior to 1980's. **TOTAL ACRES**
Fertilization	1950's 1960's 1970's 1980's 1990's	125 230 1130 1610 0 **3,095**	1,230 2,100 3,200 4,100 0 **10,630**	Fertilization included both hand and aerial application. **TOTAL ACRES**
Burning	1950's 1960's 1970's 1980's 1990's	380 1820 1920 2010 150 **6,280**	910 3,120 8,010 2,180 890 **15,110**	Broadcast/Slash Burning in clearcut harvest units. **TOTAL ACRES**

Activity	Decade	Buckeye/Zinc Creek Acres/Miles	Jackson Creek Acres/Miles	Comments
Salvage	1960's 1970's 1980's 1990's 2000's	34 75 200 60 112 **481**	64 105 290 80 0 **539**	Salvage harvest including salvage of burned stands. **TOTAL ACRES**
Road Building	1930's 1940's 1950's 1960's 1970's 1980's 1990's	1 10 43 25 54 35 8 **176**	0 0 11 17 81 24 2 **135**	Building of system roads for logging and transportation purposes. Includes ML 1, 2, 3, and 4 roads. **TOTAL MILES**
Road Decommissioning	1990's 2000's	0.3 miles	5 miles	Decommissioning through road closure, pulling culverts, recontouring roads, decompacting road beds, seeding, water barring, etc.
Instream Fish Habitat Enhancement	2000's	0 miles	8 miles	Placement of large wood in various streams throughout Jackson Creek, including Beaver Creek and Black Canyon Creek.
Noxious Weed Treatments	1990's 2000's	850 acres	1,275 acres	Throughout the watershed – manual pulling, competitive planting, etc.

Table 7. Present and On-going Activities that May Contribute to Cumulative Effects in the Buckeye/Zinc and Jackson Creek Watersheds.

Activity Type	Total Acres/Miles	Location
Instream Fish Habitat Enhancement	15 miles	Placement of large wood in various streams throughout the Jackson Creek and South Umpqua Watersheds.
Road Work	Road maintenance to continue as needed. 50 miles/year	Blading, ditch clean out, and maintenance as budgeted. Scattered throughout the Buckeye/Zinc and Jackson Creek Watersheds.
PCT	100 acres/year	PCT previously harvested units.
Noxious weed work	100-200 acres/year	Roadside for Scotch broom & Himalayan blackberry.

Table 8. Reasonably Foreseeable Activities in Buckeye/Zinc and Jackson Creek Watersheds.

Activity Type	Total Acres/Miles	Notes
Instream Fish Habitat Enhancement	15 miles	Placement of large wood in various streams throughout the Jackson Creek and South Umpqua Watersheds.
Pre-commercial Thinning (PCT)	100 acres/year	Ongoing PCT of plantations as determined by budgets.
Road Improvement	2 miles/year	Road improvements to multiple roads in Jackson Creek Watershed reduce erosion risk and improve aquatic connectivity.
Road Maintenance	About 50 miles/year	Ongoing maintenance of road system in the watershed.
Noxious Weed Treatment	About 100 acres/year	Ongoing treatment of noxious weeds in the watershed.
Timber salvage	250 acres	Tallow Salvage Sale will salvage windthrown trees in area east of Deep Cut Creek to Two Mile Creek on north side of Jackson Creek. No more than 0.5 miles of temporary roads would be constructed then obliterated.

Social Environment

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

During scoping, several conservation groups expressed concern over the construction of new temporary roads and the reuse of existing abandoned roads, stating that they cause numerous environmental impacts including erosion, channeling water, spreading noxious weeds, and reducing wildlife habitat. Oregon Wild also asked for a display of the trade-offs of accessing thinning stands by roads versus thinning by other methods. This significant issue was addressed in the development of Alternative 3. 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 trade-off analysis requested by Oregon Wild and the overall effects of the alternatives in terms of miles of roads, access, and economics.

Access for Management

To help quantify and track the issue of road use for thinning activities through the analysis the following indicators were developed:

- Miles of temporary road built.
- Total acres of thinning accessed per mile of new road construction.

Direct and Indirect Effects

Table 5 in Chapter 2 summarizes the road activities and effects to access in the planning area by alternative. In response to the issue, the first indicator focuses on mileage of temporary road built and old abandoned roads re-used. This includes building and obliterating temporary roads and re-using and obliterating old abandoned roads[14]. The abandoned roads that are not currently on the system are also proposed for re-use, followed by subsequent obliteration[15].

Access for management would remain the same as the existing current condition under all action alternatives, as all temporary roads would be obliterated after use and all abandoned roads re-used would be obliterated. These abandoned roads are not currently open or being used. Alternative 1 would not increase access, as no roads would be built. Therefore, under all alternatives, there would be no direct, indirect, or cumulative effect to access for land management.

The final indicator for the roads issue is focused on total acres of thinning accessed by temporary and new road construction[16]. A unit by unit analysis was conducted in response to Oregon Wild's concern (Project File). Alternative 2 utilizes about 3.2 miles of roads (temporary or abandoned roads), accessing 1,508 acres of commercial stands, resulting in the effect of thinning 471 acres per mile of temporary road built or reused. Under Alternative 3, about 2.2 miles of old abandoned road is reused, accessing 1,253 acres of commercial stands, resulting in the effect of thinning 569 acres per mile of road re-used. Under Alternative 4, about 3.2 miles of temporary or abandoned roads are used, accessing 1,508 acres of commercial stands, resulting in the effect of thinning 471 acres per mile of temporary road built or reused.

In comparing the action alternatives, Alternative 3 builds or uses about 1.0 miles less road, both temporary and reuse of old roads, while accessing slightly fewer thinning acres than under Alternatives 2 and 4. Alternative 3 forgoes the beneficial effect of thinning 255 acres, while disturbing about 2.4 acres less ground (through road work) than under Alternatives 2 and 4.

Transportation System

The transportation system in the Curtis planning area provides access for commercial users, including forest product harvesters. Recreation use focuses on hunting, fishing, and driving for pleasure, with the majority of the use in the fall.

The transportation system is thoroughly described in the Jackson Creek Watershed Analysis (USDA 1995), the Buckeye/Zinc Watershed Analysis (USDA 1996), and the Umpqua National Forest Roads Analysis (USDA 2003); these documents provide a complete description of the current road system, and the risks associated with it. These documents are included in the Project File and are incorporated by reference.

The transportation system is a network of existing roads, referred to as "system roads" because they are classified for long-term use. System roads are categorized and

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[14] Alternative 2 builds then obliterates 0.6 miles of temporary road, while Alternative 3 builds no temporary road. Alternative 4 builds then obliterates 0.6 miles of temporary road.

[15] Under Alternative 2, 2.5 miles of old abandoned roads would be used, then obliterated; under Alternative 3, 2.2 miles would be used, then obliterated; under Alternative 4, 2.5 miles would be used, then obliterated. There would be no net impacts to the road system from the use and obliteration of these roads.

[16] Trade-offs for building fewer roads also include economic impacts to the timber sale, which are displayed in the economics section.

managed for various levels of access from closed roads that are only intended for administrative use such as logging or fire fighting (maintenance level 1 roads), to open roads maintained for either high clearance vehicles (maintenance level 2 roads), or passenger cars (maintenance level 3 and 4 roads). This section discloses the effects of the alternatives on public access.

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 (system 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

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. Specific road reconstruction activities are identified for each alternative in Chapter 2. The reconstruction and maintenance work would provide for safe and economical timber haul, as well as improved drainage capacity and lower risk of road failure.

Road maintenance is important for user comfort and safety, and protection of resources and the road facility. The Umpqua National Forest Roads Analysis (USDA 2003) 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 would provide a substantial portion of the total needs for several years. Alternatives 2 and 4 would result in 64.7 miles of purchaser road maintenance over the period of the

associated timber sales. Alternative 3 would result in slightly less purchaser maintenance totaling 62.2 miles. Alternative 1 provides for no purchaser maintenance. Improved road maintenance results in higher degrees of user comfort and safety. In addition, well-maintained roads reduce the risk of road failures and the resulting ecological and economic effects. Alternative 1 would not result in any of these beneficial effects.

Cumulative Effects

The Buckeye/Zinc Creek and Jackson Creek Watersheds are the scale at which cumulative effects are analyzed for roads. The overall change in the number of total system road miles in the planning area is zero for all alternatives. Alternatives 2 and 4 use, then obliterate 2.5 miles of abandoned road, while Alternative 3 uses then obliterates 2.2 miles of abandoned road. Alternatives 2 and 4 reduce the footprint of roads on the landscape by removing 0.3 more miles of old abandoned road than Alternative 3. The reduction of these roads (0.3 miles) would result in no measurable decrease in road density for the watershed and thus no cumulative effect, especially given that there are no present or reasonably foreseeable road decommissioning projects in the watersheds (Tables 7 and 8).

Alternative 1 would have no cumulative effects since there are no direct or indirect effects under Alternative 1. None of the connected or similar actions affect access for management or the transportation system.

ECONOMICS – TRACKED AS A SIGNIFICANT ISSUE

During scoping, timber industry representatives expressed concern over the high costs of required road work, slash treatment, and expensive logging systems included in the proposed action. Depressed timber prices, low volume stands, and expensive mitigation might make purchasing these types of sales risky. This significant issue was addressed with the development of Alternative 4 and is tracked by benefit cost ratio and present net value, along with volume of timber harvested.

The disclosure of economic effects of each alternative is detailed in this section. This economic analysis focuses on the direct, indirect, and induced costs and benefits of the alternatives and the connected and similar 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, and were identified as a significant issue in Chapter 1. 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 Tiller Ranger District are purchased and operated by individuals and companies based in Douglas and Jackson Counties. This analysis will focus on Douglas County. Total mill capacity in Douglas County in 2003 stood at 760 mmbf/year (R. Ragon, pers. comm., 2003). There have been two permanent mill closings since then: one sawlog mill and one plywood mill. There have also been several mill shutdowns due to the poor housing and log markets. The estimated contribution of each alternative towards meeting market demand is approximately 12 mmbf. Final demand is considered 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 effects of the alternatives in the context of the benefit/cost analysis are displayed in Table 9. The standard criterion for deciding whether a government program can be justified on economic principles is net present value (NPV) – the discounted[17] monetized[18] value of expected net benefits (OMB A-94).

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 $144,000 to plan over the last two fiscal years. Based on the expected return to the Federal government shown in Table 9, all alternatives are below cost, including planning, sale preparation, and administration. 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 one or more individual timber sales. These sales would be offered in a public auction to achieve the highest return possible[19]. It is anticipated that all post-sale mitigation requirements and most sale area improvement work would be paid for by stumpage[20] from the timber sales. All action alternatives show a negative net present value and would not be considered advantageous to the U.S. government from an economic standpoint, due primarily to a current low log market. Current low timber prices, low volume stands, and expensive logging and mitigation could make the timber sale too risky for purchasers, and could result in no bids for the sale.

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

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

[19] 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.

[20] 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.

Table 9. Economic Efficiency Analysis.

	Alt. 2	Alt. 3	Alt. 4
Timber Volume (MBF)	12,557	10,377	12,796
Acres by Harvest Method[21]			
Skyline	644	478	644
Ground-based	869	780	869
Total Acres (numbers are rounded)	1,513	1,258	1,513
Volume (MBF)/Acre	8.30	8.25	8.46
Total Present Value Benefits			
Gross Benefits	$4,418,143	$3,619,382	$4,496,205
Value/MBF[22]	$352	$349	$351
Value/Acre	$2,920	$2,878	$2,972
Total Present Value Costs			
FS Prep & Admin	$276,964	$229,890	$282,163
Logging	$3,220,674	$2,629,250	$3,254,558
Slash Disposal	$581,449	$510,575	$581,468
Road Work	$321,756	$298,134	$317,255
Reforestation	$10,274	$10,274	$10,274
Sale Area Improvements	$93,839	$91,702	$93,839
Total Cost	$4,504,957	$3,769,825	$4,539,558
Cost/MBF	$359	$363	$355
Cost/Acre	$2,978	$2,997	$3,000
Net Present Value	-$86,814	-$150,443	-$43,353
NPV/MBF	-$6.91	-$14.50	-$3.39
NPV/Acre	-$57	-$120	-$29
Stumpage (2007 dollars)	$303,083	$179,102	$357,818
Predicted Stumpage Price/MBF	$24.14	$17.26	$27.96
Return to the Treasury	$176,393	$54,912	$231,128
B/C Ratio[23]	0.98	0.96	0.99

[21] Acres treated have been revised since completion of the economic analysis. However, the ratio of acres treated has not changed. Therefore, economic efficiency estimates reflect the best available information at this time.
[22] Westside delivered log prices have been adjusted to reflect equivalent east side values due to the differences in scaling rules.
[23] 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.

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 9 are not adjusted for inflation and are equated to west side long log Scribner scaling rules. The economic efficiency analysis displayed in Table 9 uses average local log prices from the most recent quarter (4th quarter, 2007).

ODF data for the 1st quarter of 2008 are not yet available, but the downward trend has continued. Current index values[24] as used in the timber sale contract to adjust rates indicate the market has declined by 7% since the 4th quarter of 2007. This 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 would reach a point where an individual sale may not be marketable. It is estimated that a decline of 3% or more from 4th quarter 2007 prices may result in no-bid sales, which appears to be the current situation. It would be highly speculative to predict the local markets at the time of sale offer or operation.

In terms of economic efficiency as described in Issue 1 in Chapter 1, Alternative 4 has the highest net present value and benefit/cost ratio, and returns the most money to the Federal Treasury. Alternative 4 has the highest predicted stumpage price, which would provide more of an economic cushion in this falling log market.

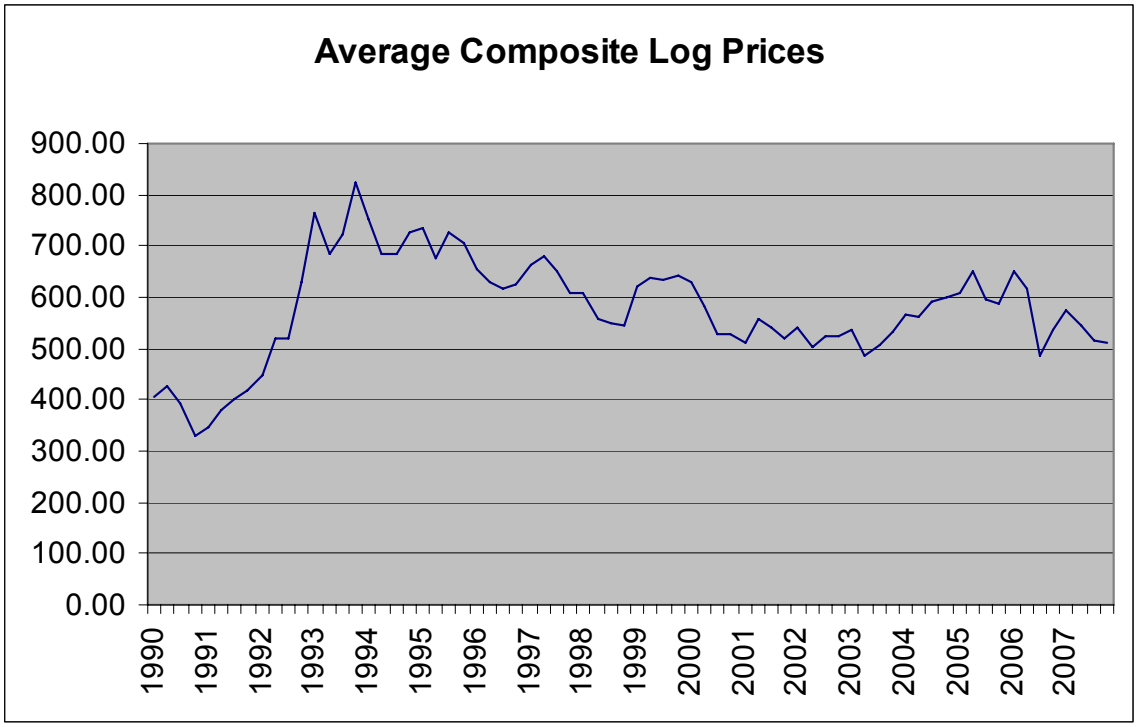


Figure 6. Average Composite Log Prices, Douglas County Market Area.

[24] The PNWC index for Douglas-fir in February 2008 was 243.14. The index for the 4th quarter of 2007 was 263.46.

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 10 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 9.

Other direct, indirect, and induced benefits are derived from road construction, reconstruction, and other connected or similar activities (Tables 2 and 3) 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 10. The IMPLAN output files that document the complete analysis by sector are part of the Economic analysis file.

Table 10. Economic Impact Analysis

	Alt. 2		Alt. 3		Alt. 4	
	Value*	%	Value*	%	Value*	%
Change in Total Industrial Output	+$7,821	0.14	+$6,500	0.12	+$7,907	0.14
Change in Employment	+57	0.11	+49	0.09	+58	0.11
Change in Labor Income	+$2,275	0.12	+$1,921	0.10	+$2,294	0.12

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

The numbers in Table 10 are not intended to be absolute. The analysis should be used to compare the relative differences among alternatives. 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 veneer and sawlog production is 25% and 75%, respectively, based on 1998 data.

Direct, Indirect, and Cumulative Effects

Alternative 1 is not shown in Table 10 since it would not change the conditions or level of economic activity in the County, by definition. However, this alternative may 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 the action alternatives would contribute to a beneficial cumulative effect to the local economy. This project, when combined with timber sales from the Drew Vegetation Management project and Boulder-Dumont Vegetation Management projects in the South Umpqua and Jackson creek watersheds, would contribute to a beneficial cumulative effect of sustaining the wood products infrastructure in Douglas County.

Terrestrial Environment

A detailed description of the terrestrial environment can be found in the Jackson Creek (USDA 1995) and Buckeye/Zinc Creek (USDA 1996) 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 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 – TRACKED AS A SIGNIFICANT ISSUE

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 25 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 25 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 1996) 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%. This includes the "shifting gap" stage as defined in the NWFP (USDA/USDI 1994).

For this analysis, mature and old growth vegetation were combined into a late successional class. Late-successional stands are generally 80 years or older.

Watershed Analysis Recommendations

Several recommendations help mold the Curtis proposal:

1995 Jackson Creek Watershed Analysis (USDA 1995):

- Restore species composition and structure more typical of native forests in off-site pine plantations, and in Douglas-fir/ponderosa pine plantations.
- Improve the health of sugar pine.

1996 Buckeye/Zinc Watershed analysis (USDA 1996):

- Focus vegetation treatments on stem exclusion stands to promote diversity and expedite the development of late-successional habitat.
- Concentrate activities in areas that have been heavily impacted by harvesting in order to restore the landscape level vegetation.

Existing and Desired Landscape Conditions

Today, late-successional habitat occupies approximately 36% of the 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. 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.

As described in Chapter 1, the Curtis Planning area was stratified into two broad landscape areas based on relationships between forest vegetation, climate, and physiography; gentle/ moist and inner gorge. Since the gentle slopes have greater moisture and lower slope location they are more likely to be a refuge from frequent fire. Steep landscape areas have fewer barriers to fire spread. There is historic evidence of larger patches of stand replacement fire in the steep terrain compared to the gentle slopes.

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).

In order to provide a context for the current vegetation patterns, a range of historic landscape patterns is useful. The use of reference ranges is based on the principal that when an ecosystem element moves outside its range, the element, and those elements depending on it, may not be sustainable naturally. Also, the concept of "improvement"

under the Aquatic Conservation Strategy, relates to restoring biological and physical processes within their ranges of natural variability (USDA/USDI 1994).

The Jackson Creek (1995) and Buckeye/Zinc (1996) Watershed Analyses provide a range of reference conditions. The broad range for late-successional forest shown in the Jackson Creek and Buckeye/Zinc Watershed Analysis is similar to the range of 45-75% published in an assessment of historic conditions for Western Oregon and Washington (USDA 1993).

At the broad landscape scale, the stem exclusion vegetation stage covers proportionately much more of the gentle and steep slopes than it did during the 1930s. The amount of late successional vegetation present today is closer to the lower end of the range of variability. Areas adjacent to roads in gentle and steep slope landscape areas are now dominated by plantations in the stem exclusion stage.

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. These desired larger patch sizes would approximate historic fire disturbance that covered thousands of acres and would align with a pattern produced by moderate severity fire effects. This pattern would be in keeping with the WA recommendations and with Objective 1 of the Aquatic Conservation Strategy, which calls for the restoration of the diversity and complexity landscape scale features such as vegetation patterns.

Existing and Desired Stand Conditions

History of off-site ponderosa pine

From 1950 to 1970, the Tiller Ranger District planted a series of plantations with ponderosa pine. Generally, these plantations were planted with seed or planting stock of unknown origin; or the use of known but unsuitable seed sources; or planting ponderosa pine as a nurse crop on severe sites where reforestation with native species had failed; or planting ponderosa pine as an introduced species. This practice created off-site pine plantations where the native trees are incapable of fully utilizing the site. Off-site plantations usually show poor vigor and are partially susceptible to snow breakage, frost injury, and attack by insects and disease. Some of these pines are infected with *Lophodermella morbida*, a needle-cast fungus. This disease appears in plantations above 2,500 feet, west of the crest of the Cascade Mountains, on sites where ponderosa pine does not occur naturally. Another serious problem of off-site pine plantations is the introduction of genetically undesirable material through pollination of native trees by off-site trees and establishment of natural reproduction from off-site parents.

From the 1950's until the 1980's, riparian forests within the watershed encompassing the Curtis Planning area were clearcut harvested without reserve trees. 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 even-aged stands of Douglas-fir and ponderosa pine. These stands are on trajectories for growth and yield and not for riparian diversity and function.

The current vegetative and geographic physical condition for the 39 managed stands and 2 unmanaged stands comprising the Curtis Density Management Project are summarized in Table 11. These plantations were clear-cut harvested between 1955 and 1963 and planted with Douglas-fir and ponderosa pine. In general, the stands are

dense, homogenous, even-aged stands of Douglas-fir and Ponderosa pine (some off-site pine species) with scattered white fir, and, to a lesser extent, incense-cedar and sugar pine in the overstory. Bigleaf maple and Pacific dogwood are present in many units. Tree species within riparian zones can include combinations of Douglas-fir, dogwood, white fir, western hemlock, red alder, willows, and Oregon ash. Golden chinquapin and madrone are common in drier habitats. The shrub layer is dominated by vine maple, Oregon grape, poison oak, salal, manzanita, and Pacific rhododendron. The understory commonly includes brackenfern, swordfern, beargrass, western star flower and whipplevine. Understory development of shade tolerant conifers, including white fir, western hemlock and Pacific yew, is primarily occurring within 20-60 feet of Class III streams. The presence of snags is very low, with diameters usually less than 12 inches dbh. White pine blister rust is causing widely scattered mortality of sugar pine and there is low incidence of dwarf mistletoe and root disease (*Phellinus weirii*).

Table 11. Stand summary for proposed Curtis harvest units.

Units	Landscape Area	Potential vegetation[25]	Tree Species	Elevation (feet)	Site class[26]
1, 2, 3, 4, 5, 9, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 28, 29, 33, 35, 36, 37, 38, 40, 41, 42, 43, 46, 48, 49, 50	Gentle/moist	White fir series	Douglas-fir / sugar pine / ponderosa pine / incense-cedar / white fir / golden chinquapin / Pacific madrone / dwarf Oregon grape / salal	2000 to 3200	DF 90 - 120
7, 8, 12, 24, 30, 34	Inner Gorge	Douglas-fir series	Douglas-fir / sugar pine / ponderosa pine / incense-cedar / white fir / golden chinquapin / Pacific madrone / dwarf Oregon grape / salal	2000 to 3200	DF 90 - 120

Recent studies of old growth forest development in western Oregon suggest that today's young managed stands are much denser than most historic early seral stands. The dominant old-growth trees originally developed in stands of low tree densities, allowing them to develop old-growth structural characteristics sooner than if they had developed under more crowded conditions. The fast-growing young trees that eventually became the dominant trees in the old-growth study stands developed at stand densities of about 40 to 50 trees per acre and sustained high growth rates during their first 50 to 100 years (Poage and Tappeiner 2002). This allowed the early development of late-successional

[25] Potential vegetation is named for the most shade tolerant tree species on the site that would dominate the stand in the absence of disturbance over a long period of time. Groups of the most commonly occurring Plant Associations in proposed harvest units are listed in order of abundance.
[26] Site class = 100-year tree height growth potential for Douglas-fir and western redcedar; 50-year tree height growth potential for western hemlock.

characteristics such as large diameter trees with deep crowns and resistance to wind and fire damage. The old-growth study stands also developed by a gradual establishment of trees over time, probably in conjunction with intermittent disturbance. Thus, under historic conditions, evidence indicates that the regeneration of old-growth in western Oregon occurred over a prolonged period, at lower tree densities and with less self-thinning than managed stands today (Tappeiner et al. 1997).

Desired stand conditions would include more open canopies and larger, more fire-resilient trees. The added light would accelerate tree growth and understory development. Different thinning intensities and fuel treatments would restore the variability of stand structure characteristic of a moderate severity fire regime. In about fifty years, two-layer stands and multi-age stand structure would result from the proposed treatments (Figure 7).

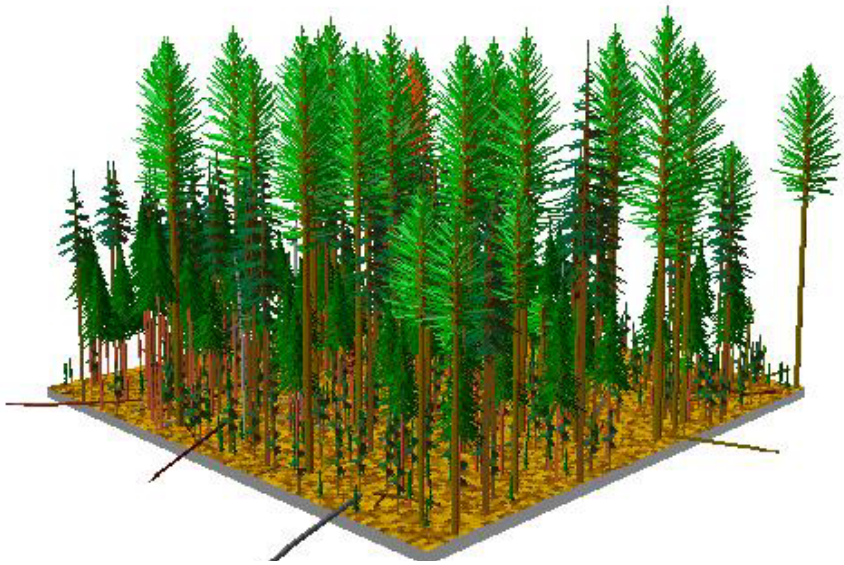


Figure 7. Desired stand conditions. Example of a multi-age stand 50 years after thinning showing large overstory trees released by thinning and a layered understory that developed under an open canopy.

The desired condition for Riparian Reserves within managed stands is that they continue to serve their existing aquatic ecosystem protection functions (effective stream shade, bank stabilization, provisions of wood and leaf litter to the stream channel, etc.) and are on a trajectory to provide high quality, sustainable, future late-successional riparian habitat in the shortest 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, band erosion, and channel mitigation than currently exist. Large size overstory trees with dominants over 36” diameter at breast height (dbh) would be common; amount and distribution of coarse woody debris and snags would be sufficient to sustain the physical complexity and

stability of the stream; and early seral vegetation along stream reaches would be limited to less than 15% on any given tributary length (USDA 1995).

Proposed Thinning Treatments

Thinning, gap creation by removing off-site ponderosa pine, gap creation for wildlife habitat enhancement, and the culture of understory trees and shrubs are proposed to set a course for stand development that leads to a multi-age structure characteristic of the historic old growth in the Curtis Planning area. In the absence of fire, these characteristics would be postponed for many decades without such treatments (Franklin et al. 2002).

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 (as summarized above). Emphasis is placed upon initiating uneven-age and 2-age mature stand structure while using planting and canopy gaps to diversify homogeneous plantations.

Six types of treatments are proposed to advance plantation stands toward maturity while reducing tree density and increasing stand diversity (Table 12):

1. Heavy thinning (40 to 70 TPA) followed by underburning or handpiling;
2. Heavy thinning (40 to 70 TPA) with off-site Ponderosa pine removal, followed by underburning or handpiling;
3. Moderate thinning (70 to 100 TPA) followed by underburning or handpiling;
4. Moderate thinning (70 to100 TPA) with off site ponderosa pine removal followed by underburning or handpiling; and
5. Light thinning in riparian areas (100-140 TPA) followed by underburning or handpiling.
6. Light thinning in riparian areas (100-140 TPA) with off-site Ponderosa pine removal and/or girdling followed by underburning or handpiling.

A “no thin” prescription would apply to portions or all of some units to mitigate concerns for merchantability, riparian shade, unique habitats and slope instability[27]. 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.

[27] Except for units 9, 12, 18, 19, 35, and 50, portions of all Alternative 2 units include no thin areas that buffer streams, unstable areas and unique habitats. All of units 27, 32, 39, 44, and 45 are no thin because the standing tree volume is too low for commercial thinning.

Table 12. Five treatment types proposed to decrease stand density and increase diversity.

Treatment Type	Alt. 1	Alt. 2	Alt. 3	Alt. 4
	(Acres)			
Heavy thin	0	293	259	293
Heavy thin & off-site pine removal with gaps	0	374	374	374
Heavy thin Sub-total	**0**	**667**	**633**	**667**
Moderate thin	0	308	207	308
Moderate thin & off-site pine removal with gaps	0	368	269	360
Moderate thin Sub-total	**0**	**676**	**476**	**676**
Riparian Areas Light thin	0	83	69	83
Riparian Areas Light Thin & off-site pine removal and/or girdling	0	82	75	82
Light thin Sub-total	**0**	**165**	**144**	**165**
Total Treatments	**0**	**1,508**	**1,253**	**1,508**
No thin	0	348	267	348
Grand Total	**0**	**1,856**	**1,520**	**1,856**

Moderate to heavy thinning is proposed as the first step in accelerating the development of a late-successional forest. The most rapid development of large tree boles, vertical diversity and tree-species diversity is accomplished in simulations via heavy thinning early in stand development (Garman et al. 2003, Andrews et al. 2005).

Canopy gaps are prescribed in 18 stands where off-site Ponderosa pine is removed, and in Alternative 4 larger canopy gaps are prescribed for wildlife habitat enhancement. Gaps are important structural components in older, natural stands (Coates et al. 1997). Gaps help to produce variable density and initiate an understory. In mature and old growth stands of natural origin, the average area occupied by gaps is typically 18% and 13%, respectively (Spies et al. 1990).

Three types of canopy gaps are prescribed for the action alternatives (Table 13):

1) ¼-acre gaps to introduce diversity into the off-site ponderosa pine stands;

2) ½-acre gaps to regenerate rust resistant sugar pine into the off-site ponderosa pine stands where it is presently lacking;

3) 1-2-acre gaps to regenerate sugar pine, create snag patches, and enhance big game habitat (Alternative 4 only).

Table 13. Summary of canopy gaps proposed under all Action Alternatives. Alternative 1 is not displayed as no harvest is proposed.

	Alternative 2					Alternative 3					Alternative 4			
Unit[28]	**¼-ac.**	**½-ac.**	**1-ac.**	**2-ac.**		**¼-ac.**	**½-ac.**	**1-ac.**	**2-ac.**		**¼-ac.**	**½-ac.**	**1-ac.**	**2-ac.**
2	5	0	0	0		5	0	0	0		5	0	0	0
3	5	0	0	0		5	0	0	0		5	0	0	0
13	4	1	0	0		4	1	0	0		4	1	0	0
14	5	15	0	0		5	15	0	0		5	15	0	2
15	5	15	0	0		5	15	0	0		5	15	1	3
16	1	4	0	0		1	4	0	0		1	4	0	0
17	10	10	0	0		10	10	0	0		10	10	1	1
22	10	10	0	0		10	10	0	0		10	10	1	0
24	5	15	0	0		5	15	0	0		5	15	0	0
25	3	2	0	0		0	0	0	0		3	2	0	0
26	3	2	0	0		3	2	0	0		3	2	2	3
28	5	0	0	0		0	0	0	0		5	0	0	0
29	3	2	0	0		3	2	0	0		3	2	0	0
30	4	1	0	0		4	1	0	0		4	1	0	0
41	10	10	0	0		10	10	0	0		10	10	1	0
43	15	5	0	0		15	5	0	0		15	5	0	0
46	5	15	0	0		5	15	0	0		5	15	1	0
48	4	1	0	0		4	1	0	0		4	1	0	0
Totals	**102**	**108**	**0**	**0**		**94**	**106**	**0**	**0**		**102**	**108**	**7**	**9**

The different gap sizes and thinning prescriptions are based on disturbance processes of the landscape areas and by the necessary removal of off-site ponderosa pine to restore native forests.

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 14).

[28] Units 25 and 28 are not included in Alternative 3. Only Alternative 4 includes 1- and 2-acre gaps.

Table 14. Summary of Direct and Indirect Effects to vegetation.

Treatment	Vegetation Change	Primary Effect (Beneficial/ Adverse)	Duration (years)	Treatment Acres by Alternative			
				1	2	3	4
Commercial Thinning[29]	Lower stand densities & canopy closure / variable density in stands and landscape areas	Beneficial--improved species and structural diversity	30-50	0	1,508	1,253	1,508
	Lower amounts of snags and down wood / larger diameter trees and snags	Adverse - loss of suppression-related mortality in smaller-sized trees Beneficial - large snags created / accelerated growth of larger leave trees	30-50	0	1,508	1,253	1,508
¼ acre canopy gaps	Removal of off-site ponderosa pine Individual tree release and added growth	Beneficial - accelerated growth of dominate tree in gap center and improved structural diversity within stands	30-50	0	26	24	26
½ acre canopy gaps	Removal of off-site ponderosa pine Trees Planted	Beneficial--accelerated age-class and species diversification within stands and across landscape. Rust resistant sugar pine planted.	30-50	0	54	53	54
1-and 2-acre canopy gaps	Removal of off-site ponderosa pine Trees Planted	Beneficial--improved species and structural diversity Big game habitat improved	30-50	0	0	0	25

Canopy closures and large tree sizes were developed using a stand growth-and-yield model (Donnelly and Johnson 1997). Average stand canopy closure and tree diameter statistics are grouped by the types of treatments. In the long-term, heavy thinning with burning treatments would have the greatest effect on canopy closure. The jackpot and underburning treatments would kill some of the residual trees adding to the amount of canopy openings. Because of the more open canopy, a stronger understory growth response would occur. The understory layer would respond very rapidly to surpass the

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

overall canopy closure of the other thinning groups within about 15 years. The heavy thinning with burning treatment is predicted to surpass the overall canopy closure of no thinning in approximately 25 years (Figure 8)[30].

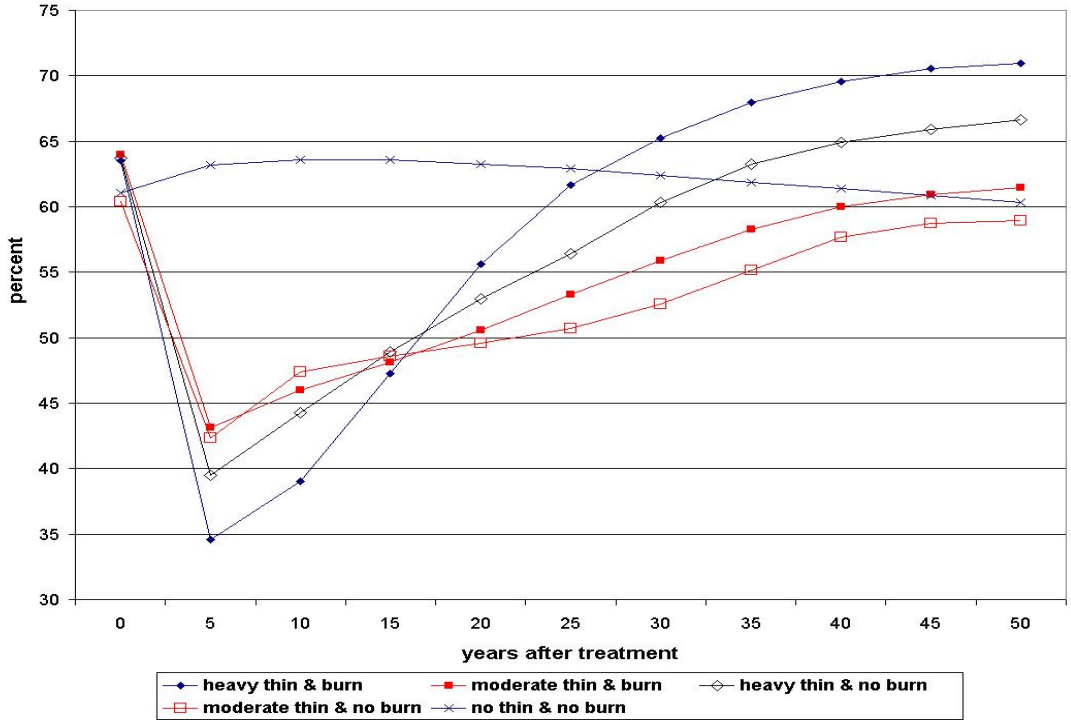


Figure 8. Average canopy closure for four treatment groups and no thinning before and after harvest and fuel treatments. Canopy closure is restored 30 to 50 years following treatment.

Tree size would also be affected by the various thinning treatments. The prescribed thinning would accelerate diameter growth compared to no thinning.

The action alternatives would increase variation in stand densities within and between stands meeting Element 1 of the purpose and need (Table 5) while establishing stand trajectories to meet desired conditions. Immediately following thinning, stand canopy closures would vary from 25% to 55% depending on the thinning intensity, gap area, and the amount of unthinned area within stands. The direct effects of thinning (change in canopy closure) would be greatest for Alternatives 2, 3, and 4 because of the total thinning acreages and similar amounts of heavy thinning.

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 and stand structure would be diversified. At the individual tree scale, thinning would develop large diameter branches, large deep crowns, and wind-firm stems. At the stand scale, understory growth would initiate the

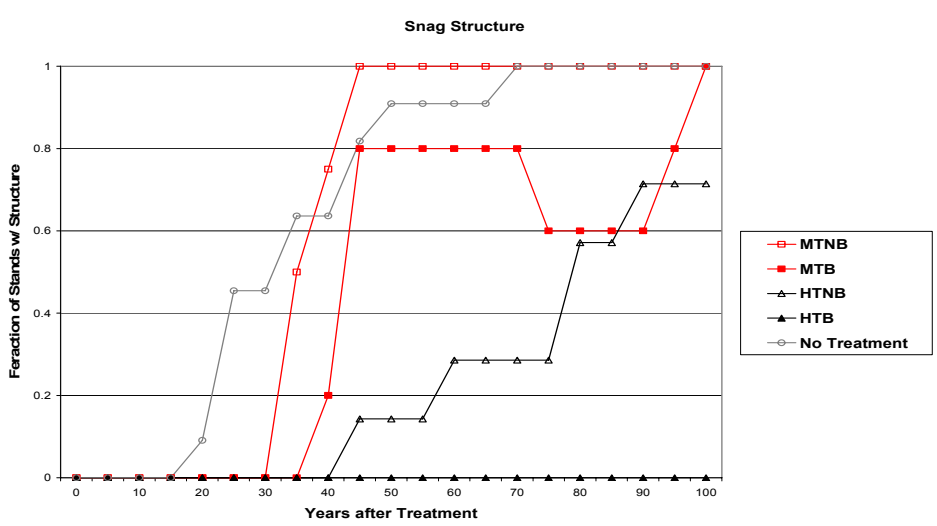
[30] The model estimated average canopy closures of 60 to 65 percent. In reality, most Curtis stands have 75 to 90 percent canopy closure. Post-harvest canopy closures of 30 to 45% are both realistic and desired to allow retained trees room to grow and to have sufficient light penetration to stimulate the growth of understory vegetation.

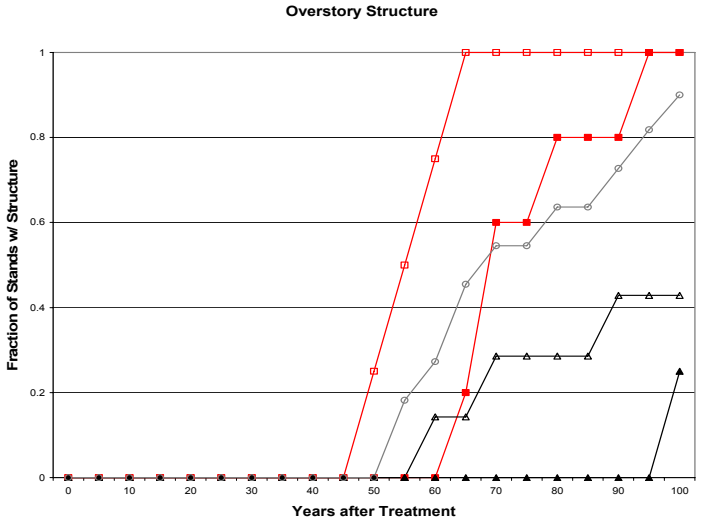
layering that is characteristic of late-successional structure. In the long-term, these beneficial effects would be greatest for heavy thinning and burning treatments, less for heavy thin/no burn and moderate thin/burn, and least for light thinning without burning. Indirect effects would be comparable for Alternatives 2, 3 and 4. Alternatives 2 and 4 have more thinning and burning acres than Alternative 3, resulting in similar indirect effects (Table 14).

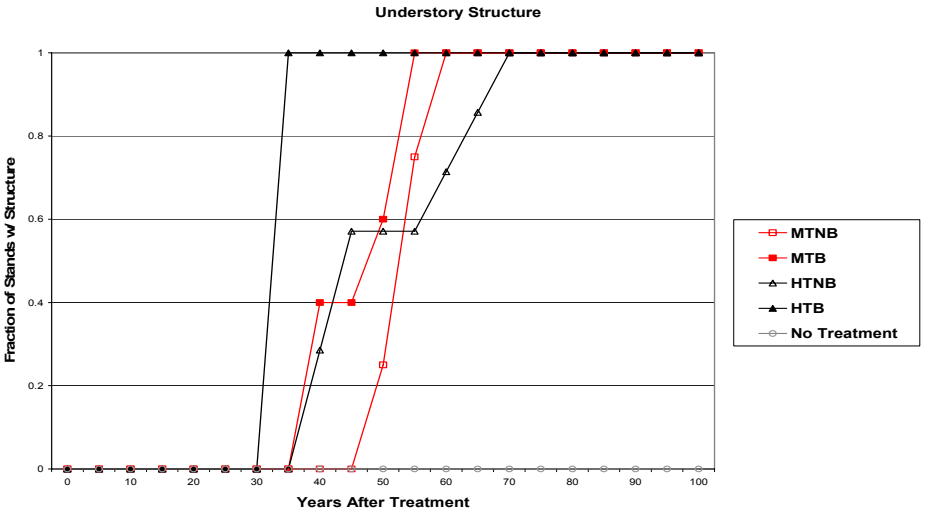
At the landscape scale, treatments would accelerate the development of late-successional structures in areas where they would more likely persist. The proposed treatments would also shift the vegetation pattern toward larger, late-successional patches, as recommended in the 1995 Jackson Creek WA and the 1996 Buckeye/Zinc WA. Western Oregon studies support the practice of thinning young stands to mimic natural disturbance processes or to accelerate the development of old forest structures (Tappeiner et al. 1997; Muir et al. 2002; Garman et al. 2003; Lindh and Muir 2004; Andrews et al. 2005).

Stand growth modeling and the use of late-successional structure indices[31] show that the proposed treatments would accelerate the development of some structures and delay others compared to no treatment (Figure 9). The treatment differences reflect the fundamental tradeoffs between overstory (large trees and snags) and understory structure development (understory plants and coarse woody debris). Heavy thinning and underburning treatments have the greatest effect on overstory development and fuel reduction. In contrast, moderate thinning and no burning treatments would have the greatest effect on the growth of large trees and snag development while retarding understory development and increasing fuel loads (compare moderate and heavy thinning treatments and overstory versus understory development with and without burning (Figure 9).

[31] The four components of the late successional index include 1) large diameter living trees; 2) larger dead trees; 3) multiple canopy layers and; 4) larger woody material on the forest floor. The definition of each, including supporting literature citations are as follows: A) At least 8 trees per acre (TPA) over 31" in diameter (DBH) (USDA 1986); B) at least 20 TPA of western hemlock or western redcedar greater than 7" DBH (Andrews et al. 2005); C) at least 5 snags (>5m in height) greater than 10" DBH and at least 5 snags (>5m in height) greater than 20" DBH (Mellen et al. 2006); and, D) greater than 20 tons/acre of large wood that is >6 in. diameter (Mellen et al. 2006).







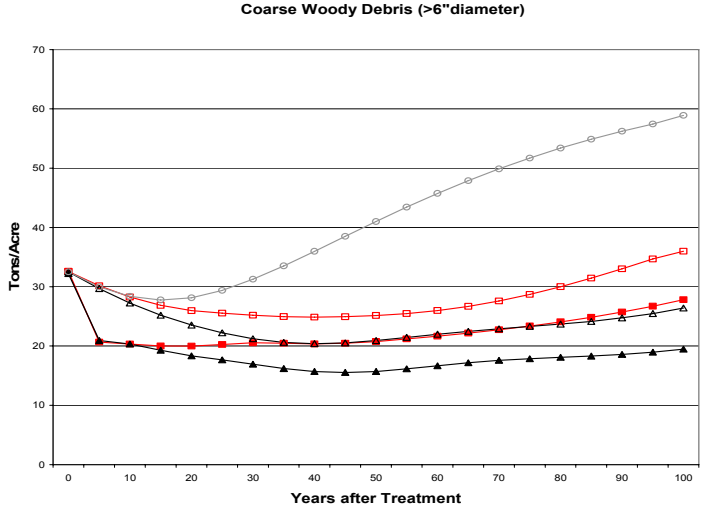


Figure 9. Long-term effects of treatments on the development of four late-successional structures. Four treatments modeled are MTNB=moderate thinning and no burning; MTB=moderate thinning and burning; HTNB= heavy thinning and no burning; and HTB=heavy thinning and burning. Coarse woody debris is displayed in tons/acre to show treatment group differences since all treatments meet or exceed the coarse woody debris criterion for late successional structure in all cycles.

The action alternatives would implement various combinations of thinning treatments and no thinning across the landscape (Table 5). The resulting mosaic would approximate the natural pattern of forest structure compared to Alternative 1. Each of the action alternative's treatment combinations would also accelerate the development of late-successional structure compared to Alternative 1.

Alternative 1 would not accelerate successional development to attain desired stand or landscape conditions, nor would it meet element 1 of the purpose and need (Table 5). Under Alternative 1, stands would remain densely stocked and 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 short-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 Curtis stands remain stalled in this stage. Finally, under Alternative 1, only two of the four structural attributes of late-successional forests would be attained during the analysis period because no treatment would retard either understory or overstory development, or both, compared to the action alternatives.

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 (Table 5) with Alternatives 2 and 4 accomplishing more toward meeting the Purpose and Need of lowering tree density and fire hazard.

Planting would diversify the species composition in gap areas. The beneficial effects of planting sugar pine seedlings would be proportional to alternative treatment acreage (Table 5) with the action alternatives achieving the Purpose and Need of increasing diversity, which would not occur under Alternative 1.

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 Buckeye/Zinc and Jackson Creek watersheds. This scale is appropriate because of the size of historic fires and because of the extensive management activities in the watershed. 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.

The current distribution of age classes in the Curtis planning area is reported in the 1995 Jackson Creek WA and 1996 Buckeye/Zinc Watershed Analyses. Based on the premise that ecological processes function more naturally when they are within the historic range of variability, the ecosystem would become stressed when conditions exceed the range of variation for vegetation. As such, levels of ecosystem stress were established to help assess cumulative effects for two important vegetation conditions related to forest succession and fuel accumulation (Table 15).

Table 15. Measures and analysis framework for vegetation conditions.

Vegetation Condition	Measure	Level of Ecosystem Stress	Analysis Timeframe
Distribution of vegetation stages	Percent of area in stand initiation & stem exclusion stage	>40% of analysis area	30-50 years
Fire hazard	Area of Fuel Reduction Activities per Decade	<8,000 acres per decade*	50 years

* The natural fire rotation for the Buckeye/Zinc and Jackson Creek landscape within the Curtis Planning area ranges from about 20-100 years (USDA 1995; USDA 1996).

Based on the information presented in Tables 6 showing past, present and reasonably foreseeable activities, approximately 36% of the Buckeye/Zinc and Jackson Creek watersheds has been harvested. This includes over 37,000 acres of regeneration harvest and overstory removals since about 1950.

The current sum of stand initiation and stem exclusion vegetation exceeds 40% of the landscape area. Under Alternative 1, the area in the stem exclusion stage in the landscape would approach the upper end of the range of variability within several decades because the young stands would enter and add to the stem exclusion stage while existing stem exclusion stands would linger in this stage during this period.

The action alternatives would beneficially reduce the existing stem exclusion vegetation by approximately 6% in the landscape. As such, thinning would help move stands toward maturity and out of the stem exclusion stage, helping to correct the landscape deviations from reference conditions.

The current and foreseeable fuel reduction activities exceed the level of ecosystem stress for fire hazard; less than 5,000 acres/decade of fuel treatments and wildfire combined have occurred over the last five decades. This suggests that there has not been enough fuels reduction in the watershed to keep fuel loads within the natural range of variability that was maintained in the past by wildfires. No fuel treatments (Alternative 1) and continued exclusion of fire from the landscape would only aggravate fuel loads.

Thinning and fuel treatments in the action alternatives would reduce fuel loads over 3% to 4% of the gentle and steep landscape areas, thereby increasing the resiliency of these landscape areas to wildfire effects. When combined with the indirect effects of recent wildfires and other thinning and fuel treatments in the Buckeye/Zinc and Jackson Creek watersheds, the action alternatives would result in beneficial cumulative effects to the distribution of both vegetation and fuels in the landscape over the next 30 to 50 years. These beneficial cumulative effects would be proportional to the thinning and burning acres in each alternative (Table 5). Alternative 2 and 4 would have the most thinning and burning acres, followed by Alternative 3.

Aquatic Conservation Strategy

As disclosed above in the Forest Vegetation section, the action alternatives would move landscape patterns toward the natural range of variability by helping to advance an over-abundance of stem exclusion vegetation toward mature vegetation. 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

Forest plans provide Standards and Guidelines to direct management. Standards and Guidelines and management area prescriptions were considered "mitigation measures" as discussed in the FEIS (USDA 1990, II-23). The FEIS (USDA 1990, 11-23, IV-2) states that mitigation measures are an integral part of implementation and are taken to cause an action to be less harsh or severe. They may take the form of avoiding, minimizing, correcting, or compensating for adverse effects. This definition is similar to that described in the Habitat Conservation Planning Handbook (USFWS/NOAA 1996), which defines mitigation as measures taken to avoid, minimize, rectify, reduce, eliminate or compensate for the expected impacts of a management action. The mitigation measures in the FEIS 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) and LSR assessments (LSRA). 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). These CWD components account for two of the five structural elements of late-successional forest stands, described as:

1. Live, old-growth trees;
2. Standing dead trees (snags);
3. Fallen trees or logs; and
4. Multiple canopy layers;

5. Canopy gaps.

The Northwest Forest Plan requires site-specific analysis and the 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 species mixes and densities to achieve the objectives stated above. The Fire and Fuels Extension to the Forest Vegetation Simulator model (Reinhardt and Crookston 2003) was used to analyze existing and future levels of snags and down wood.

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 thinning units. For this project, the Southwest Oregon Mixed Conifer-Hardwood Forest, 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 and Desired Conditions

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. 2006), 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 (Ohmann and Waddell 2002; White et al. 2002).

The desired condition is to maintain CWD levels at moderate to high levels advised for in DecAID which would be between 50-80% tolerance levels.

Direct and Indirect Effects

Figures 10 and 11 show predicted snag levels for the no action, and all action alternatives. Commercial thinning slows the time period when the stands achieve the same number of snags per acre as the no action alternative does. For example, Alternative 1 reaches 20 snags per acre ($\geq$10”) due to suppression mortality from a high stocking level after approximately 7 years (Figure 10). Thinning delays this until year 32 for Alternatives 2 & 4 and until year 42 for Alternative 3 (Figure 10). However, these alternatives fall into the natural range of variation for snags in this vegetation type (Southern Oregon Mixed Conifer/Hardwood) as shown by the gray shaded area. The range for the 50% tolerance level is about 7 to 34 snags/acre $\geq$10”dbh.

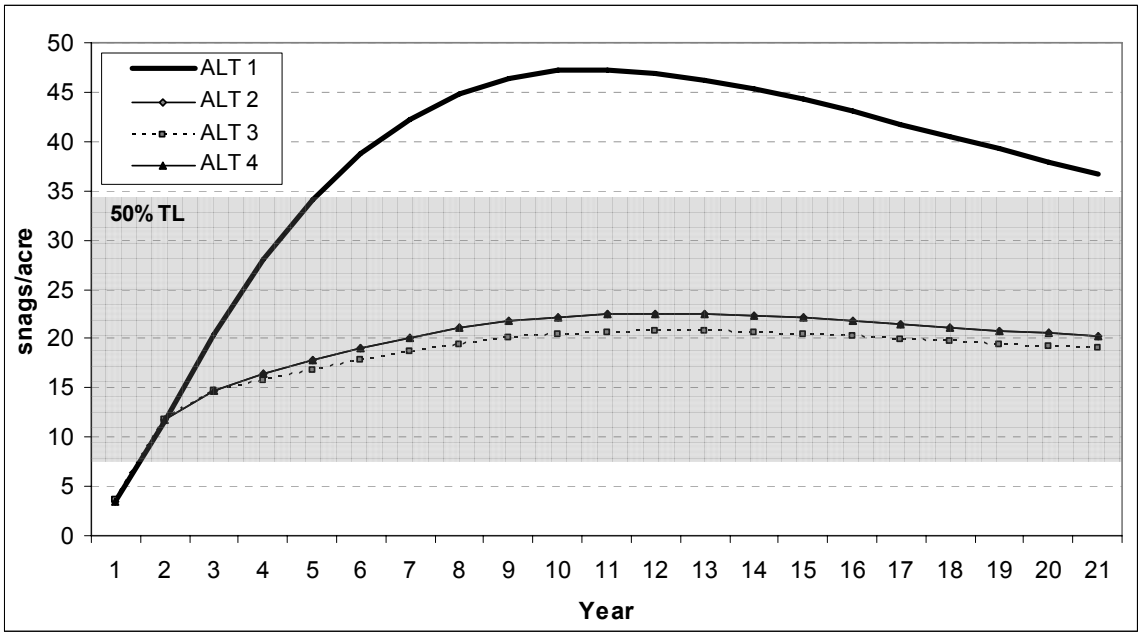


Figure 10. Short- and long-term changes to ≥10" dbh snags.

Figure 11 depicts the same trends for snags ≥20". Alternative 1 achieves 5 snags per acre around year 25 and the action alternatives achieve the same levels at around year 37. All treatments would continue to produce some larger snags over time.

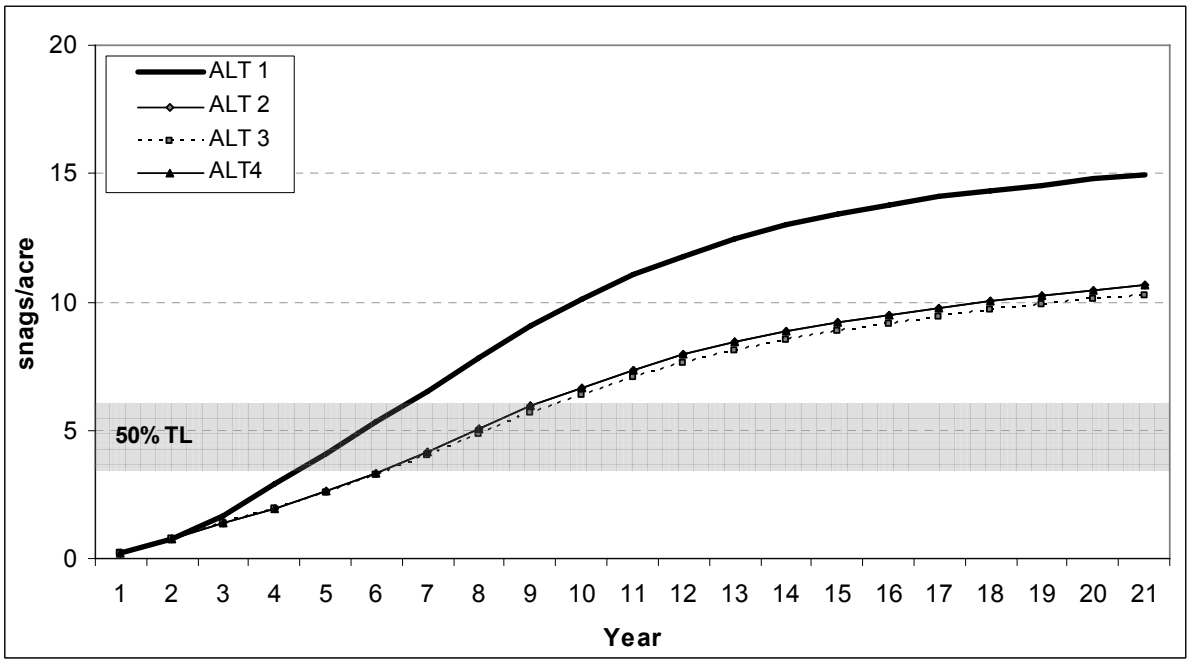


Figure 11. Short- and long-term changes to ≥ 20" dbh snags.

Mitigation measures, such as snag creation, would be required if the action alternatives had fallen below the natural range of conditions. Snag creation through burning or girdling treatments associated with the Curtis project would be considered enhancement of this habitat structure. Mitigation measures to retain snags and wildlife trees further enhance this habitat across the planning area.

Figure 12 reflects changes in down wood as percent cover over time. The action alternatives provide smaller amounts of down wood than the no action alternative, but still fall into the 50% tolerance level from DecAid.

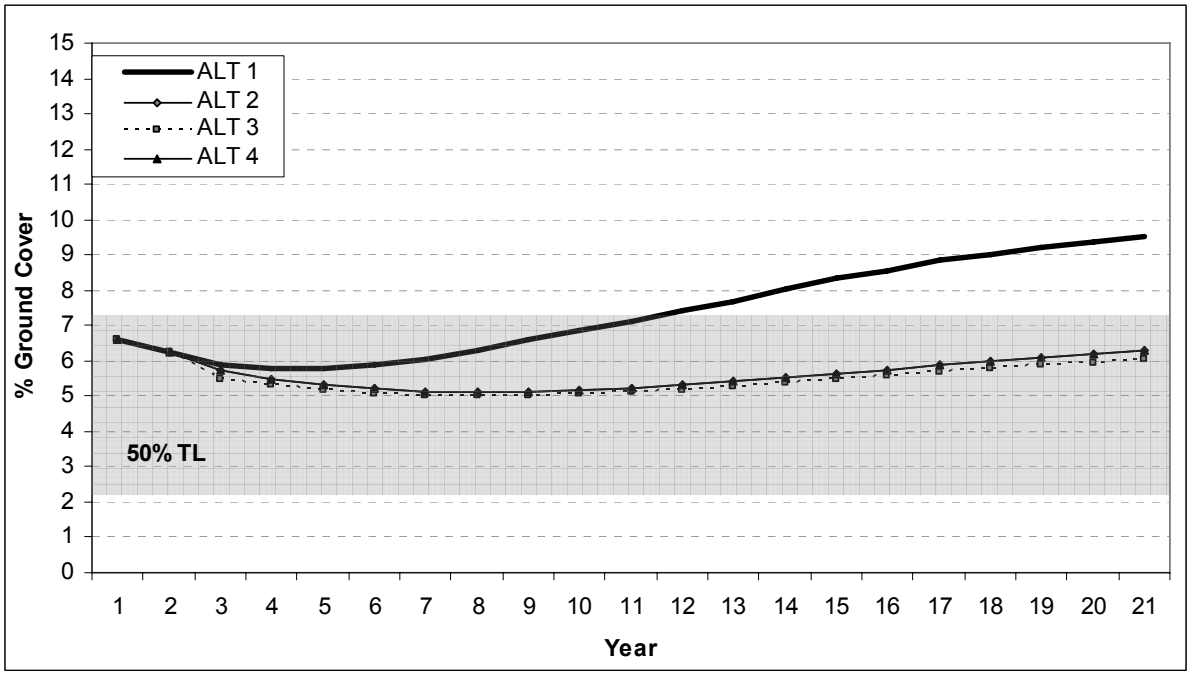


Figure 12. Down Wood Cover (%).

Cumulative Effects

Substantial adverse impacts to levels of CWD at both the stand and landscape-scale have resulted from past clearcut timber harvesting, road building, roadside salvage, and fire exclusion. There is an overabundance of land area inside the planning area with no snags and a shortage of land area with high snag densities (caused by fire exclusion). About 1% of the planning area (mainly northern portion) has high-density snag patches ranging in size from (0.25 to 45 acres) created by the wildfires in 2002. It would take several decades to restore CWD conditions to within the ranges advised in DecAID at these two extreme ends of the range. The action alternatives would not add to this existing condition at the stand level, because they maintain snag and down wood levels within natural ranges as identified in DecAID. The action alternatives do not add to the cumulative loss of snags at the landscape-scale.

FUELS

Fuel Conditions

Fuel conditions within the Curtis Density Management Project are composed of managed stands in various stages of age development, up to 60 years old and unmanaged stands that exhibit old growth characteristics. Natural disturbances within the planning area consist of previous wildfires, previous timber harvest (clearcutting, salvage, and shelterwood harvest), very minor land failures, minor insect infestations, and tree mortality due to age. The 2002 Tiller Complex Fire is the most recent natural disturbance within the planning area, including the Tallow Fire. The Tallow Fire burned a minimal amount of acres in the southeastern portion of the planning area. The most recent management activity in the planning area consists of recent clearcutting on private lands within the west and southwestern portions of the planning area. There are 3,896 acres of private land within the planning area and most of those acres have been clearcut or salvage harvested. Slash disposal has been minimal and has involved primarily machine and grapple piling with piles left unburned.

The Tallow Fire has the most potential to continually add to the fuel conditions when the burned trees fall and accumulate on the forest floor. Young managed tree stands within the planning area have the potential to add to fuel loading and fire spread.

FIRE HAZARD

A number of factors important to a fire's ability to spread determine the "fire hazard" of an area and also affect the difficulty or ease in suppressing a fire. Various schemes for rating fire hazard have been developed; the scheme used in this analysis is based on six elements: 1) vegetation and the moisture within the foliage; 2) canopy cover; 3) slope; 4) aspect; 5) elevation; and 6) structures (developments including infrastructure).

Vegetation directly influences rate of spread, flame length, fire line intensity, heat per unit area, and other elements of concern in the suppression of wildfire. Canopy cover and ladder fuels are also closely related when it comes to hazard rating. A greater percentage of ladder fuel means a greater likelihood of a surface fire moving into the crown canopy, increasing the difficulty of suppressing the fire due to torching heat and spotting. If there are no ladder fuels present, a closed canopy would not, by itself, cause a crown fire.

Slope is also a factor in the rate of fire spread. As the slope becomes steeper, fire increases in speed as warm air rises and preheats fuels. On flat terrain, the spread of fire relies more on wind. Aspect affects fire spread in that southern aspects are drier and warmer, promoting a more active fire, whereas the typically cooler and damper northern aspects have a lower level of fire behavior.

Elevation has an effect on fire behavior due to heating and cooling patterns (diurnal flow) and the percent of moisture maintained within all types of foliage present. Lower elevations get a slightly higher rating than higher elevations because they receive less precipitation.

Finally, structure includes individual as well as clustered homes and associated out-buildings. Infrastructure can include campgrounds, roads, powerlines, bridges or other man made improvements. These have an effect on human as well as firefighter life and safety when it comes to natural or wildfire. The decision may be to defend structure or infrastructure rather than trying to suppress fire outside these boundaries. Once all five

elements have been determined for an area, it can be given a hazard rating: the higher the rating, the worse the hazard.

Existing and Desired Conditions

The Buckeye/Zinc, Jackson Creek, and Middle South Umpqua Watershed Analysis (WA) areas that encompass the Curtis planning area provide a meaningful landscape-scale context for discussing fire and fuel conditions that includes a detailed discussion of the reference, existing, and desired future landscape conditions.

Prior to fire suppression and intensive timber harvesting, wildfire was the major disturbance pattern shaping the forests of the western Oregon Cascades (Teensma 1987; Morrison and Swanson 1990; Agee 1993). 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 1990). Moderate severity fire regimes have infrequent fires (25-100 years) that are often partial stand-replacement fires and include areas of high and low intensity.

Historical fire patterns seen in the 1946 photos were similar to those described in other Western Cascades studies (Morrison and Swanson 1990; Van Norman 1998). Areas within the moderate severity regime (steeper, more dissected, lower elevation landscapes) experienced more frequent wildfires (17 to 30 year return intervals) that were normally low to moderate in severity and occasionally crowned out to create patches of even-aged stands. These patches usually occurred in the mid to upper slopes, ridge tops and tops of steep draws. Forest canopies along larger-order streams were more intact and experienced mostly low to moderate severity fires.

Currently, the Zinc Creek watershed and portions of the Jackson Creek watershed are considered to be a moderate severity fire regime showing signs of transitioning to a high severity regime. This transition is primarily due to fire exclusion and a lack of prescribed fire. Increasing surface and crown fuel loads are creating conditions that make stands more susceptible to stand replacement fire. Fire has not been allowed to burn as a natural ignition (prescribed natural fire), nor has it been reintroduced to the project planning area purposefully (prescribed management ignited fire), except for burning slash after logging. Fires that occur today would either be ineffective at reducing fuels, because of fire suppression, or increasingly destructive due to high severity burning conditions if initial suppression efforts were not effective.

The Buckeye/Zinc Creek Watershed Analysis states that modern management has disrupted historic disturbance processes. Thus, many fundamental ecosystem processes have been disrupted: plant succession, nutrient cycling and other processes that rely on the ecosystem patterns historically created by fire. Timber harvest has occurred on 49 percent of the Buckeye/Zinc watershed, 36 and 13 percent by regeneration and selection methods, respectively. Fire suppression has nearly eliminated disturbance from the rest of the landscape. The result of this changed disturbance regime is a fragmented landscape, low in both early and late-successional vegetation, with unusually high conifer density. Pines are being killed directly as a result of high tree density and indirectly by insect attack. The habitat formerly provided by frequent, low-severity fires is completely absent from the landscape. Wildfire hazard has increased with the accumulation of live and dead fuel and landscape homogenization.

Pines are dying because of tree density and associated insect attack, suggesting that sustainability has declined, as defined by diversity and health (USDA 1996).

The Buckeye/Zinc WA also states that "activities should be concentrated in WAA's that have already been heavily impacted by roads and harvesting in order to restore the landscape level vegetation and aquatic conditions. Proposed management activities should focus on reducing sediment production and inputs into streams, minimizing erosional processes, reducing road densities and channel extension. The risks associated with canopy removal should be considered when landscapes are evaluated for vegetation treatment.

Harvesting projects can provide an opportunity to reduce channel extension and sediment input to streams through KV opportunities and road reconstruction.

Vegetation manipulation should be guided by the following priorities (1 is highest priority for restoration):

1. frequent fire regime – any previous entry
2. infrequent fire regime – previous regeneration entry
3. frequent fire regime – no previous entry
4. infrequent fire regime – no previous entry

The risks associated with high tree density should be considered when landscapes are evaluated for vegetation treatment."

The Curtis Density Management Project proposes to reduce tree densities throughout a portion of the landscape which may reduce mortality to pines. The project is designed within areas already impacted by roads and harvesting that occurred over forty years ago. The project would then reduce road densities afterward. The project works within the highest priority for vegetation treatments, frequent fire regimes within previously harvested stands. The desired future condition is to move the watershed back towards a more natural fire regime.

Fire Regime Condition Class

Fire regime condition classes[32] (FRCC) are coarse-scale measures of the degree of departure from the natural fire regime (USDA et al. 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.

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

Fire regime condition class delineations for the Curtis Planning Area fall under three watersheds. The Middle South Umpqua watershed was used for this analysis following the process outlined in the Interagency Guidebook (USDA et al. 2005). The landscape areas shown in Figure 13 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 Middle South Umpqua; all biophysical settings chosen were considered to be the best available fit for each landscape area (Table 16).

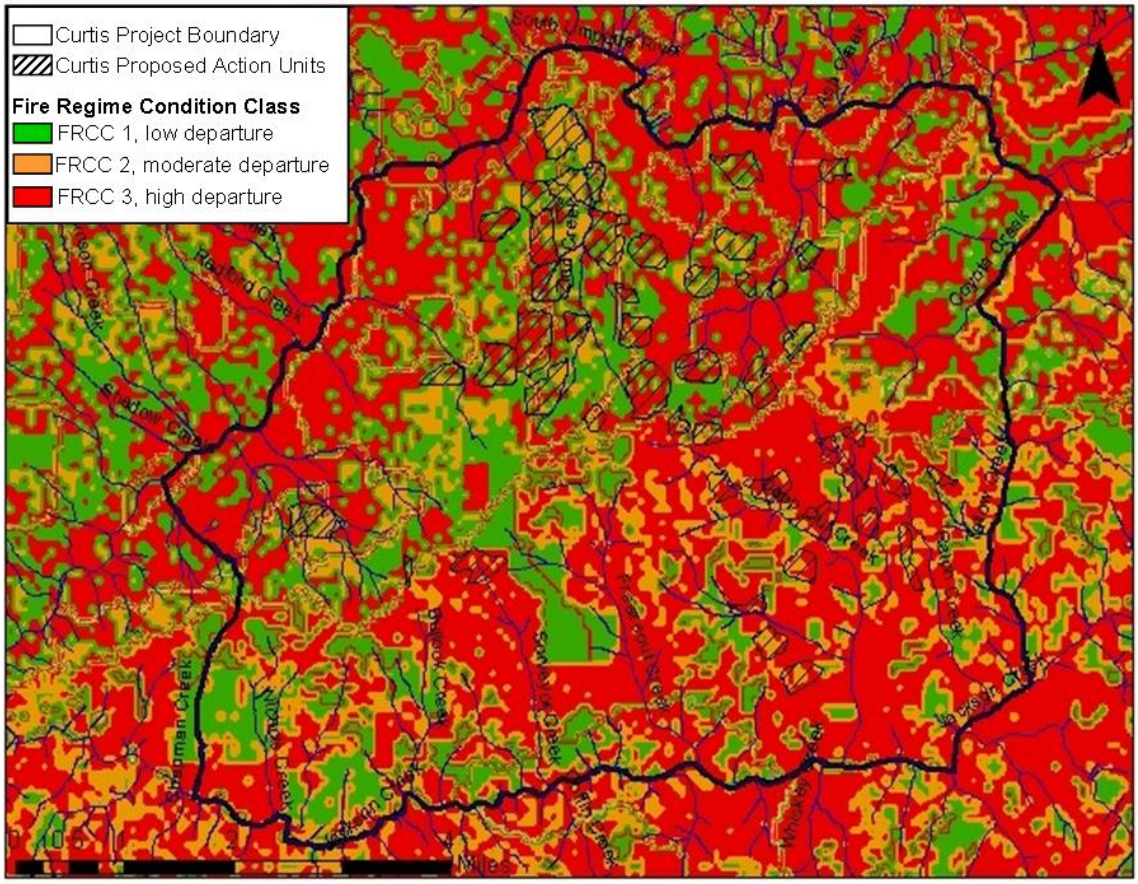


Figure 13. Fire Regime Condition Class (FRCC) delineations for the Curtis Planning Area.

Table 16. Summary of fuel treatment effects by Alternative.

Treatment type	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Effects
Underburn acres (including jackpot burning)	0	334	334	334	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 costs to implement and impacts from building handline[33] surrounding treatment areas.
Handpiling burning or chipping acres	0	544	423	544	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.
Thinning & No Fuel Treatment acres	0	630	496	630	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 – Short-term increase in the 0-3" surface fuels with an increased risk for higher intensity fires effects during future wildfires.

Based on the assumptions underlying the biophysical settings applied to the landscape areas, there are high departure areas in the Middle South Umpqua watershed (Table 17). Since fire has been essentially excluded from Middle South Umpqua for several decades, most of the landscape areas have a moderate to high level of departure for all FRCC aspects considered (Vegetation/Fuels or Fire Frequency/Severity)[34]. The Curtis planning area does not fall within the High Elevation landscape area; as such, the FRCC ratings for that area will not be discussed further.

[33] Handline construction involves exposing mineral soil (two foot width) along the perimeter of the area to be underburned. Wet lines can be used in riparian reserves to extinguish backing fires as opposed to digging handline.

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

Table 17. FRCC ratings for the Middle South Umpqua based on Landscape Areas.

Middle South Umpqua FRCC Setting; Acres and % watershed	Curtis Units within the Landscape Area	Current FRCC Rating	Treatment Acres Needed to Lower Condition Class in Middle South Umpqua Fifth Level Watershed
California Mixed Evergreen 23,149 acres (29%)	2, 3, 5, 7, 8, 9, 22, 23, 25, 28, 33, 34, 36, 37, 38, 40, 41, 42, 43, 46, 48, 49	FRCC 3	14,322 acres to move from FRCC 3 to FRCC1
Mixed Conifer 29,887 acres (37%)	1, 4, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 26, 29, 30, 35, 50	FRCC 3	17,900 acres to move from FRCC 3 to FRCC 1
California Mixed Evergreen Mixed Conifer 27510 acres (34%)	No units in this landscape	FRCC 3	15,800 acres to move from FRCC 3 to FRCC 1

The majority of the areas proposed for thinning currently have an FRCC 3 rating (Table 17). While thousands of acres would have to be treated to move the entire watershed back to an FRCC 1 rating, the areas proposed for thinning are important for stand maintenance or are some of the highest risk areas (highest risk of stand replacement fire) in the watershed, thus moving the watershed towards the desired condition.

Many of the areas shown as having the highest departure from natural ranges are located within riparian zones. This is due in part to slope and aspect as well as land management activities that have resulted in high vertical fuel loading and fire exclusion. High vertical fuel loading can be attributed to dense tree planting in clearcuts logged in the mid 1940's, even though many of the plantations have received at least one pre-commercial thinning entry.

FlamMap Modeling

Since the FRCC process uses non-spatial reference parameters derived from data over large areas, a more site specific tool was used to further assess the risk of stand replacement fire and help validate the results of the FRCC analysis of the Curtis Planning Area. The FlamMap model (Finney et al. 2004) is a spatial fire behavior mapping and analysis program that uses local terrain, fuel, and weather data to make fire behavior calculations such as flame length and crown fire for specific locations. The model was populated with local data then calibrated with actual site-specific fire effects from the 2002 Boulder Fire which burned about 3 air-miles northeast of the Curtis Planning Area. Model inputs were adjusted (calibrated) so that the output closely resembled the actual map of stand replacement fire that occurred in the 48,000 acre Boulder fire where 32% burned with a moderate to high fire severity killing most of the

overstory trees. Once calibrated to the local area[35], the model was applied to the Curtis Planning Area.

Overall, the FlamMap model validates the moderate to high levels of departure from the historic range of variability in the planning area (Project File – Fuels). Areas of passive crown fires (where individual trees torch out) are expected to kill individual trees or small groups of trees on about 36% of the planning area. Active crown fire[36] areas are currently predicted to occur on 14% of the planning area, and are expected to kill from 70-100% of the trees whose crowns are affected during the crown fire run. Surface fires (expected to kill <20% of the overstory trees) are predicted on 49% of the rest of the watershed. Spotting is expected to be minimal in surface fires and moderate to extreme for both passive and active crown fires.

Overlaying the FlamMap results with the FRCC results shows that the steep landscape areas display the highest risk of active crown fire (Project File – Fuels). Thinning in both the steep and the gentle mountain slope landscape areas would lower crown fire hazard levels by separating crowns between the retained trees.

Fuel Models

Fuels are classified by vegetation type, fuel size and loading, and potential fire behavior. 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[37] (FM) and of the six fuel models relevant to the Curtis planning area, four are found in the stands proposed for thinning (FM 5, 8, 9, 10 and 11), while FM 5 is relevant for young tree stands less than 15 years old. All fuel models are depicted in the Project File.

Logging slash fuel models include slash loading from thinning and are represented by either a FM 10 or 11. Curtis stands that are proposed for moderate thinning (70-100 trees per acre left) are represented by a FM 11 after harvest. Stands that are heavily thinned (40-70 trees per acre left) are represented by a FM 11 after harvest. Where treated, FM 11 stand areas would immediately convert back to a residual FM 8. Without slash treatment, FM 11 stands would retain higher fuel levels for about 10 years, before converting back to either a FM 8 or a FM 10.

Fire behavior models indicate 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 FM 8 could be expected to produce 1 - 2' flame lengths and rates of spread from 1 to 7 chains per hour.

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[35] The model was populated with local data and then calibrated with actual site-specific fire effects from the Boulder Fire that burned in 2002 on the Tiller Ranger District. Model inputs were adjusted (calibrated) so that the output closely resembled the actual map of stand replacement fire that occurred in the 48,000 acre Boulder fire that burned with 32% moderate to high severity fire.

[36] Active crown fires are defined as a rapidly moving fire that travels between tree crowns, killing substantial areas of forest by burning the trees and their canopies.

[37] 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.

Initial attack suppression forces (two engines staffed with three person crews and a one hour time delay) would also be inadequate to contain the fire in a Fuel Model 10, as fire behavior can be expected to be 8 to 15 chains per hour with flame lengths of 3 to 6 feet. When flame lengths exceed 4 feet, the fire becomes too intense for direct attack with hand tools, and handline alone cannot be relied on to hold the fire.

Effective techniques for increasing stand resilience to wildfire include reducing crown-fire occurrence and fire severity. To accomplish this, management activities can (1) reduce surface fuels, (2) increase canopy base height, (3) reduce canopy bulk densities, and (4) reduce forest canopy continuity (Peterson et al. 2005). These four factors interact together allowing ground fires to reach the crown, spread to other crowns and become stand-replacing fires[38].

Of the four factors mentioned above, the most effective method for lowering fire hazard is to maintain 0-3" surface fuels (tons/acre) within the desired range[39], which represents the approximate ranges found in reference conditions.

At the landscape scale, the desired condition is that vegetation in the Curtis Density Management Project approximates conditions typically found in a moderate severity fire regime (as described in the vegetation section). At the stand scale, the desired condition is an increase in stand resiliency to fire (conditions typical of a FM 8).

Direct Effects

For fire and fuels, direct effects are those that would occur at the stand scale. All action alternatives would thin and remove trees from the stands, thus reducing canopy continuity and the potential for crown fire spread. All action alternatives would treat acreage as detailed in Table 5 in Chapter 2. Alternatives 2 and 4 treat the most acreage among the action alternatives.

The direct effects of the various fuel treatments that include burning in the action alternatives would be to immediately separate (break up) and lower 0-3" surface fuels to levels that would reduce future potential fire behavior, thereby increasing stand resiliency to fire over time, as the trees grow larger and increase in bark thickness. Both alternatives would have a direct effect of consuming surface fuels that include portions of the litter, duff, 0-3" material, >3" material, and also the stand herb and shrub components. The majority of the Douglas-fir trees that remain 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, like heat per unit area and fire duration. The resulting stand would have fuel conditions similar to a FM 8. Future fires would be less intense because of lower fuel loads; fires would likely burn in the understory, with pockets of torching, and would resemble fires that would normally burn in a moderate severity fire regime.

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[38] Treatment graphs for the main factors affecting fire behavior are located in the fire specialist report section for the Curtis planning area. Graphs included show stand trends for canopy bulk density (CBD), canopy base height (CBH), fuels >3", total surface fuels, mortality % expected with severe fire conditions, crowning index and the torching index.

[39] Brown et al. (2003) provide a general rule-of-thumb for "optimal" fuel loadings. For the forests within the Curtis planning area, desired fuel loadings would range from 2-5 tons/acre for fuels <3" and between 15-30 tons/acre for the 3+ inch surface fuels. Generally fire hazards, including resistance-to-control, fire behavior and excessive soil heating, increase when 3+ inch surface fuel levels reach over 30 tons per acre.

The direct effect of not burning activity-generated fuels (e.g., crushing and no treatment) 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 hazard for a period for 5-10 years after harvest (fuel conditions would be similar to FM 11 or FM 12). The result of this change in fuel models would be a potential increase in fire behavior at the stand scale and an overall reduction in stand resiliency to fire until the slash decomposes within about a decade.

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 underburning or jackpot burning would effectively lower the risk of stand replacement to less than 40% of the retention trees. This finding was noted in a 2005 study (Crystal and Peterson 2005) conducted after the Biscuit fire burned over a thinned stand. Mortality was most severe in thinned stands without fuel treatments (80%–100%), 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 were treated. Both the Curtis planning area and the area within the Biscuit fire study area have moderate-severity fire regimes.

Crushing fuels via cut-to-length logging has the beneficial effect of crushing and separating the fuels, speeding slash decomposition, and breaking up fuel continuity, although overall fuel loads are increased after thinning. In contrast, not treating fuels from thinning (activity slash) does not have this same beneficial effect. Regardless of fuel treatment, the thinning and removal of trees in the canopy would reduce the potential for crown fire spread by breaking up canopy continuity.

All of the action alternatives would create 35 to 40 acres of gaps that are ¼, ½, or 2-acres in size (Table 14). Slash in those gaps would be hand-piled (if no other fuel treatment is scheduled for the stand) and burned. The hand piles created along the main system roads also would be burned. The direct effects of burning these piles would be to reduce the 0-3” surface fuels, thus reducing the potential fire behavior of future fires, particularly along the main travel routes (where human-caused fires are most likely to occur).

Additionally, under all action alternatives, two commercial thinning stands that are adjacent to Northern Spotted Owl cores would be treated by cutting and leaving handpiles of small understory trees and shrubs (less than 5 inches in diameter) that function as ladder fuels. The effects of this treatment would be to rearrange the fuel continuity, thereby reducing the severity and intensity of future fires as well as creating habitat for NSO prey. Handpiles within the shade zone of riparian areas also would be left as habitat.

The action alternatives would also maintain six existing sumps used during fire suppression. Gravel would be placed on existing sump access roads and vegetation would be brushed to allow fire engine access. Signs also would be maintained and hazard trees may be identified and felled, if needed. The beneficial effect would be to provide firefighters with ready access to water, resulting in more efficient and effective fire suppression.

With all action alternatives, the connected action of wildlife snag creation would occur through the use of fire in the areas selected for sugar pine restoration and through other

methods, such as girdling. These snags would be retained on the landscape as wildlife habitat and would not be expected to present a hazard for torching or fire spread due to low crown ratio and small snag size (15-40 ft.).

Alternative 4 involves creating 1- and 2-acre wildlife openings in stands 14, 15, 17, 22, 25, 41, and 46. These openings may cause an increase in fuel loading but would not significantly alter the fuel treatment prescription for the stands. Only stand 14 is prescribed for underburning and this treatment would reduce excess fuels less than 3" in diameter. The remaining stands would be handpiled with handpiling acres concentrated in wildlife openings if fuel loading warrants it.

Indirect Effects

Indirect effects are those that would occur at the landscape scale and/or later in time. For this analysis, the watershed is used as a basis for comparing landscape scale effects from fire disturbances. A timeframe of 10 or more years following implementation defines long-term effects for this analysis.

Thinning under the action alternatives would have the landscape effect of lowering the fire regime condition class, which results in lowering the risk of both passive and active crown fire, meeting the purpose and need of the project. This is because thinning separates the crowns and increases the distance between shrub and understory trees and the base of the retained trees live crowns (canopy base height). Over the long term, even stands not receiving fuel treatment would be more resilient to being replaced by a crown fire because of the changes in canopy base height and crown bulk density associated with the thinning.

The purpose and need of lowering landscape-scale fire hazard is measured in three ways. The first measure is acres of commercial thinning and fuel treatment in areas currently mapped as either FRCC 2 or FRCC 3, which represents areas with a moderate or high departure from reference watershed conditions. The measure was chosen because it represents how risk is lowered because of the combination of thinning and fuel treatments. Overall, Alternatives 2 and 4 treat the most moderate and high risk acres of any action alternative followed closely by Alternative 3. Alternative 1 does not treat any high risk acres and retains the current FRCC ratings for the watershed.

Among the action alternatives, Alternatives 2 and 4 would be more effective at immediately reducing fuel loads than Alternative 3, as they would reduce fuels on more acres after thinning. Alternative 1 would not be effective at reducing fuel loads, vertical or horizontal loading, as no thinning would occur.

Alternative 1 would continue to gradually increase the current fuel loading in the 0-3" fuel category that already exists across the Curtis project area. Total surface fuels would average about 15% over the next twenty years.

Cumulative Effects

The analysis area for fuels is the 25,630 acre Zinc, Buckeye, Jackson Creek and Middle South Umpqua watersheds. This area is of sufficient size to characterize landscape-level fire behavior and events.

Commercially thinning the stands would reduce the vertical loading, open up the stands for more growth, and improve the condition class from a 3 to a condition class of 1. Condition class 1 has the lowest risk of destructive wildfires and is closest to the natural

conditions. Condition class 3 is defined as having missed many fire cycles and has the highest risk of intense and damaging wildfire.

SOIL PRODUCTIVITY

Management History

Past timber harvest (prior to 1975) primarily utilized ground skidding using cables or tractors without suspending logs. During highlead operations, logs were yarded both down and uphill without suspension, often resulting in severe soil displacement and surface erosion. Tractor yarding on moderate slopes (35-55%) typically created an average disturbance of about 21-24% of the ground, and required cutting skid trails into the slope. These skid trails often crossed swales where ground water could be intercepted and redistributed as surface flow, which down-cut new channels.

Skid trails and smaller haul roads were placed across swales containing buried streams in Curtis units 1, 7, 8, 26, 28, and 34. These streams later opened up and are now stream channels. Harvest and fuel treatments during this period would be considered extreme disturbance by current standards. Areas of active concern include old undesignated roads in unit 8 and intercepted and rerouted ditch water from the 2929 Road onto unstable ground in unit 34.

Past disturbance and the current condition in each of the proposed units was assessed by the project Soil Scientist. Tools used in this investigation included GIS, ShalStab slope stability modeling results, and aerial photo interpretation of the 1956-57, 1965, 1972, and most recent photo series. Units 1, 7, 8, and 34 received further field stability assessments. Past failures have revegetated and stabilized with the exception of 49 acres identified and mapped unstable and unsuitable for harvest. Concentrated areas of compaction were found to persist, but have revegetated and adjusted to any increases in concentrated, intercepted, or diverted surface flows. These areas are no longer chronic sources of sediment delivery to streams.

The maintenance of soil productivity during forest management activities is critical to maintaining healthy forest. Consequently, soil productivity is addressed with several Standards and Guidelines in the Umpqua Land and Resource Management Plan (USDA 1990). The primary focus of this analysis centers on past and predicted soil disturbances as well as the maintenance of ground cover.

Relevant Standards and Guidelines

The Standards 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.

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.

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.

Soil Productivity S&Gs 5, 10, 11, and 12 and other NWFP requirements are addressed here or as mitigation measures or monitoring requirements in the soils section at the end of Chapter 2.

Existing and Desired Conditions

Soil interpretations for the planning area were made using the Umpqua Soil Resource Inventory (USDA 1976) and field review. This inventory provides landscape-scale soils information on broadly mapped areas (average size = 250 acres) that have distinctly unique geology, landforms, and soils, which affect the growth and development of forest vegetation. This information is summarized for each landform and provides useful information for sale planning. The proposed timber harvest units occur on the following landforms as mapped in the analysis file:

Gentle to Moderately Steep Lower Sideslopes and Benches – About 38% of the proposed units occur on gentle to moderately steep lower sideslopes and benches. The minimum effective ground cover to meet standards and guidelines for erosion and site productivity in this area is 65%. These moderately deep to deep, moderately well-drained soils are resilient to soil disturbance. Mass wasting and soil erosion hazard is relatively low. Riparian reserves were found to represent 10% to 14% of this area. No treatment prescriptions occurred on 10% of this landform. The potential for competition from grass, and brush may be moderate where ground disturbances such as yarding or fire expose bare mineral soil. Windthrow hazards are generally high.

Gentle to Moderately Steep Earth flow – About 23% of the proposed units occur on the gentle to moderately steep dormant earth flow terrain. The minimum effective ground cover to meet standards and guidelines for this area is 65%. This landform represents various earth flow complexes that were most likely active following the last ice age, but have since stabilized. These very deep, poorly to moderately well-drained soils are very resilient to soil disturbance. Mass wasting hazards are low and the soil erosion hazard is moderate. Approximately <1% of the earth flow was delineated as unsuitable for stability concerns; these are inclusions of active soil creep and slumping primarily found in unit 1, in an otherwise dormant landform. Wetland soils represent approximately 1% of the units, and are typically found in hydrologic features such as hummocky slopes with saturated soils, swales with shallow soil piping, and buried stream channels. Riparian reserves were found to represent 15% to 26% of this area. Many streams in this landform are discontinuous. No treatment prescriptions occurred on 10% of this landform. The potential for competition from grass, and brush may be high where ground disturbances such as yarding or fire expose bare mineral soil. Windthrow hazards are generally high.

Upper Dissected Sideslopes, Headwalls, and Ridgetops - About 38% of the units occur on the stable portion of these landforms. The minimum effective ground cover to meet standards and guidelines for this area would be 65% on sideslopes and 85% in the steep headwalls. These sites generally have moderately deep, well to excessively well drained soils that have a low to moderate resiliency to soil disturbance (Sanchez et al. 2006). Mass wasting hazards are low to moderate, but can range from moderate to high in steep headwall areas. Soil erosion hazard is moderate to high. Riparian reserves were found to represent 13% to 19% of this area. Many streams in this landform are discontinuous. No

treatment prescriptions occurred on 28% of this landform. The potential for competition from grass is low and brush may be high where ground disturbances such as yarding or fire expose bare mineral soil. Windthrow hazards are generally low.

Approximately 60% of the harvest units are located on soils that have a moderately high to high resiliency to soil disturbance. The desired condition for soils is to keep compaction and displacement to less than 20% of the landscape and maintain >65% effective ground cover of surface organic material for soil productivity. About 15 acres of the harvest would occur on soils located in steep headwalls have a low to moderate resiliency to soil disturbance. These areas were mapped as categorically unsuitable (CU) on the Umpqua Forest Soil Suitability map. The desired condition for these soils is to increase root strength, avoid soil displacement, and maintain >85% effective ground cover of surface organic material for soil productivity.

Direct and Indirect Effects

Unacceptable soil disturbance

The direct and indirect effects are discussed at the landscape scale for soil compaction and displacement associated with S&G #1, and at the stand scale for effective ground cover (S&G #2) and surface organic material (S&G #3). Displacement, compaction, and severe heating of the soil are considered unacceptable soil disturbance when they cumulatively (legacy and proposed) affect more than 20% of a given treatment area. Timber harvest activities have the direct effect of such disturbance during harvest, fuel treatment, and road reconstruction.

Under Alternative 1, legacy soil displacement and compaction would remain at around 8% of the area analyzed. Under the action alternatives, access and logging systems would follow along the existing foot print of legacy soil disturbance from past harvest so that potentially only about 20 to 23 acres would be considered new disturbance. Cumulatively considering past and the potential for soil disturbance in the reasonable foreseeable future over the prescription areas there would be approximately 244 to 247 acres or about 13% in an unacceptable soil condition following harvest. However, at the unit level, areas previously tractor harvested currently exceed standards and guidelines with approximately 21% to 24% unacceptable soil compaction and displacement.

Approximately 80 acres of the legacy roads, landings, and skid trails would be mitigated. The mitigation measure of subsoiling would have the direct effect of reducing soil compaction, increasing the soil's tilth, rain infiltration, permeability, and aeration. This in turn improves the soil environment for the biologic processes required to bring the soil back into production mode. Combined with past and proposed activities, Units 1, 5, 12, 14, 15, 23, 26, 28, 29, 33, 36, 40, 41, 42, 43, and 46 would exceed standards and guidelines for unacceptable soil disturbance in areas scheduled for ground-based harvest. Purchaser subsoiling of landings and skid trails would meet standards and guidelines in all units except unit 15[40]. The amount of ground disturbance this entry is not expected to overlap the majority of legacy compaction from past entries. Therefore,

[40] Meeting unit and subsoil recommendations of 20% minimum for unacceptable soil disturbance in unit 15 would involve supplemental restoration on 12 acres following purchaser treatment of 4 acres.

it is expected that 12 additional acres would require subsoiling using additional funding. Following subsoiling, all units would meet soil standards and guidelines for unacceptable soil disturbance both for compaction and for effective ground cover, thus complying with soils S&G #1 and erosion risk S&G #2. Unacceptable soil disturbances this entry would range from 11% to 12% of the harvested area and landings and would vary little between all action alternatives (Table 18).

Ten years following fuel treatments, the potential for severely burned soil from wildfire would be reduced over 13% of the total prescription acres (Table 18). This estimate assumes that treating harvest slash with underburning, machine piles, or jackpot burning treatments would be effective in reducing burn severity from 15% down to 13% of the area in a mixed severity wildfire[41]. Treatments such as fuel compaction, hand piling, and thinning can be effective in reducing the spread of wildfire but would not adequately reduce the fuel loading to prevent wildfire effects to soil associated with a ground fire.

Table 18: Unacceptable soil disturbance estimates from compacted and severely burned soil for the Curtis Planning area.

	Alt. 1	**Alt. 2**	**Alt. 3**	**Alt. 4**
Total Curtis Planning Area Acres[42]	1,856	1,856	1,856	1,856
Soil Disturbances (acres):				
Legacy compaction – landings and skid trails	214	214	214	214
Legacy compaction – unclassified roads	10	10	10	10
New compaction – permanent roads	0	0	0	0
New compaction – temporary roads	0	1	0	1
New compaction – harvest trails	0	16	15	16
Severely burned soil – fuels	0	6	5	6
Net Soil Disturbance (acres)	224	247	244	247
Soil Mitigations (acres):				
Subsoil mitigation – roads	0	7	5	7
Subsoil mitigation – harvest trails and landings	0	43	10	43
Net Soil Mitigated (acres)	(0)	(50)	(15)	(50)
Net Soil Unmitigated (acres)	224	197	229	197
Cumulative Wildfire Risk and Mitigation (% area)	12%	11%	12%	11%
NET Severely Burned Soil Potential - Wildfire (% area)	15%	13%	13%	13%
NET Soil Disturbance + Wildfire Risk (% area)	**27%**	**24%**	**25%**	**24%**

[41] Refer to Chapter 3 Fire and Fuels, Indirect Effects (Landscape Scale) discussion.
[42] Includes total acres (thinned and unthinned).

Given the recent and foreseeable activities in the Curtis planning area, there would be a cumulative net beneficial effect to long-term soil productivity. Other sales implemented in the planning area in the past 10 years have included projects that treat existing levels of legacy compaction, including decommissioning and subsoiling 4 to 6 miles of unclassified roads. In addition, fuel treatments have resulted in lower impact, low-intensity, short-duration burns resulting in acceptable levels of soil disturbance (USDA 1997a) while reducing the future potential risks associated with wildfire on 13% of the analyzed units. Long-term (10-30-year) benefits would be expected from the combined thinning that improve root stability, fuel treatments that reduce fuels, and soil mitigation that obliterate some of the existing unclassified roads, landings, and skid trails over 3% of the area for Alternatives 2 and 4, and less than 1% for Alternative 3.

Effective Ground Cover and Soil Organic Matter

Effective ground cover (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 surface erosion (LRMP IV-68). Minimum ground cover recommendations have been prescribed 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 (refer to existing and desired conditions above for effective ground cover prescriptions). Carbon (standing and down woody material, litter, soil organic matter) is a critical element to site productivity and soil development. Most available plant nutrients are retained by the organic fraction in the upper ten inches of forest soils. Fine roots and mycorrhizal fungi activity occurs at the litter-soil interface and 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. Increased carbon storage in forest soils can be achieved through forest management including site preparation, fire management, species management/selection, and use of soil amendments (Lal 2005).

Under the action alternatives, the direct effects of fuel treatments would be to reduce fine fuel (0-<3") over 58% to 66% of the activity area. The combined effect of harvest, landings, and fuel treatments would potentially expose soil on average 13% of the units, with some units not receiving any fuel treatments. This amount of disturbance would be considered acceptable for maintaining long-term soil productivity (LMRP IV-68). Disruption of natural processes would not occur under any of the Curtis alternatives, because little or no effect on soil carbon would occur under any of the action alternatives (Lal 2005). The risk of wildfire would be a potential indirect effect of maintaining fine fuels and litter. Under Alternative 1, a future wildfire would potentially reduce the effective ground cover by 72% of the area (Table 19), thereby increasing the potential for erosion and potentially reducing long-term site productivity on less resilient sites, such as steep sideslopes with shallow soils. This risk would be approximately 10% less under the action alternatives, thereby reducing the potential to indirectly impact to the effective ground cover.

Historically, these areas experienced higher fire frequencies with relatively shorter fire return intervals (until fire was excluded). Higher fire frequencies resulted in low to moderate mixed severity fires with higher amounts of carbon retained in the soil than under the current condition. Under the current condition, a century of fire suppression has allowed these sites to carry a higher proportion of the ecosystems carbon in the form of vegetation and down wood. When this occurs, a larger proportion of the site's carbon pool is exposed to wildfire effects than when it is protected within the soil as soil

organic matter. Therefore, an indirect effect of no action in these areas would be to maintain a higher future level of risk to the ecosystem's potential productivity from wildfires (Hatten et al. 2005).

Table 19: Potential acres of exposed soil resulting from (a) harvest and fuels treatments and (b) wildfire for each alternative.

	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Total Curtis Planning Area Acres	1,856	1,856	1,856	1,856
(a) Harvest and Fuels Treatments:				
Exposed acres of harvest and landings	0	167	143	167
Exposed acres of fuels treatments	0	66	65	66
% Exposed soil (% of total acres)	0	13	11	13
% Effective ground cover (average)	100	87	89	87
(b) Wildfire:				
Wildfire (acres of exposed soil)	1,336	1,114	1,151	1,169
% Exposed soil (% of total acres)	72%	60%	62%	63%
% Effective ground cover (average)	28%[43]	40%	38%	37%

Under Alternative 1, a future wildfire would be larger and possibly more severe than under the action alternatives (Table 19). Instead of storing carbon and maintaining soil organic matter, a wildfire would release carbon into the atmosphere. A wildfire could potentially consume greater than 80% of the litter and duff layer over 28% to 40% of the burn area and may expose 60% to 72%[43] of the soils litter. Depth-of-mortality[44] (60°C) would be expected to reach a depth 2 to 3 inches of the soil surface with mixed severity. This type of fire occurring in the steeper landscapes with shallower soils would have a detrimental effect on soil organic matter due to increased soil loss through erosion (Hatten et al. 2005). Given that the long-term potential effects of no action may increase stand replacement fire potential, the long-term effects to soil productivity would be approximately 11% to 13% greater than under Alternatives 2 through 4 (Table 19).

Cumulative Effects

The Curtis Planning Area is in a mixed severity fire regime dominated by soils that are relatively resilient to disturbance. Alternatives 2, 3, and 4 include 80 acres of subsoiling to mitigate soils on legacy skid trails, landings, and undesignated roads. These soils would be within the parameters of acceptable disturbance and therefore would not add to any past soil impacts that result in any adverse cumulative effects to soil.

[43] First Order Fire Effects results using 6% soil moisture and 20% duff on SAF-Douglas-fir – western hemlock.

[44] Depth of mortality can be defined as the depth of soil heating where the soil reaches 60°C, the generalized temperature used to estimate tissue death and provide an indicator of potential soil effect.

FOREST WILDLIFE

This section includes the effects analysis for Landbirds, Threatened and Sensitive Wildlife Species, Survey and Manage wildlife species, and Management Indicator Species.

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 MOU continues to provide guidance for the two federal agencies until more detailed direction is developed 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 in the next section), raptors (protected from human disturbance until nesting and fledging is complete), and TES species (e.g., northern spotted owl).

Watershed Analysis Recommendations

There are no specific recommendations for landbirds in the Buckeye/Zinc Creek or Jackson Creek Watershed Analyses. However, the recommendations to manage landscape patterns to approximate the natural disturbance regime and maintain connectivity are relevant to landbird populations.

Existing and Desired Conditions

The planning area is located on the west-slopes of the Cascade Mountains in Oregon. 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 understory shrubs. Monitoring data from local BBS routes shows a decreasing trend for the warbler in Oregon but an increasing trend in the Cascades and an increasing trend for the vireo in both Oregon and the Cascades.

Direct and Indirect Effects

The direct and indirect 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. The action alternatives would cause changes to landbird habitats that would occur over the next 10-20 years. The main effect would be the opening up of the existing dense conifer stands and creation of scattered small canopy gaps. 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).

The impacts from the action alternatives would be less favorable for the focal species (Table 20). 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, Hutton's vireo, and hermit warbler detections over 5 years, but did not cause extirpations. Given the locally stable to increasing trends for these species, the impacts of the action alternatives are not expected to cause significant declining trends for these species in this area. In the Cascade Mountains, hermit warblers have territories that range from 2-6 acres (Pearson and Manuwal 2000). No-thin buffers (or units dropped from thinning) cover about 33-42% of planning area and would maintain suitable stands of nesting habitat for this species in the planning area. Focal species that showed an increase or no change in populations after thinning were Hammond's flycatcher and Wilson's warbler (Hayes et al. 2003).

Table 20. Breeding Bird Survey results for Oregon and the Cascades Region (OR, WA) from 1966-2006. Data includes landbirds identified by the Oregon and Washington Partners in Flight Conservation Plan for coniferous forests (Sauer et al. 2006).

Common Name	Habitat Association	Species or Habitat Present in Planning Area?	Trend Estimate OR 1966-2006	Trend Estimate Cascades (OR&WA) 1966-2006
Vaux's Swift	Old-growth Forest, Large Snags	Y	+	+
Brown Creeper	Old-growth Forest, Large Trees	Y	+	-
Red-Crossbill	Old-growth Forest, Conifer Cones	Y	-	-
Pileated Woodpecker	Mature Forest, Multi Layered, Large Snags	Y	+	+
Varied Thrush	Mature Forest, Multi Layered, Mid-story tree layers	Y	-	-
Pacific-slope Flycatcher	Mature Forest, Multi Layered, Deciduous Canopy/sub-canopy trees	Y	---	---
Hermit Warbler	Mature Forest, Multi Layered, Closed Canopy	Y	+	+
Hammond's Flycatcher	Mature Forest, Multi Layered, Open Midstory	Y	+	+
Wilson's Warbler	Mature Forest, Multi Layered, Deciduous Understory	Y	-	-
Winter Wren	Mature Forest, Multi Layered, Forest Floor Complexity	Y	+	+
Black-throated Gray Warbler	Pole Forest, Stem Exclusion, Deciduous Canopy Trees	Y	-	+
Hutton's Vireo	Pole Forest, Stem Exclusion, Deciduous Subcanopy/understory	Y	+	+
Olive-sided Flycatcher	Early-Seral Forest, Stand Initiation, Residual Canopy Trees	Y	-	-
Western Bluebird	Early-Seral Forest, Stand Initiation, Snags	Y	+	-
Orange-crowned Warbler	Early-Seral Forest, Stand Initiation, Deciduous Vegetation	Y	-	-
Rufous Hummingbird	Early-Seral Forest, Stand Initiation, Nectar-producing Plants	Y	-	-
Band-tailed Pigeon	Unique Habitats, Mineral Springs	Y	-	-
Lincoln's Sparrow	Unique Habitats, Montane Wet Meadows	Y	+	-
American Pipit	Unique Habitats, Alpine	N	---	---
Black Swift	Unique Habitats, Waterfall	N	---	+

--- = no data available, + = Rising population trend, - = Downward population trend

Direct impacts from the actual logging activity would be avoided by implementing seasonal restrictions on timber harvest operations (for northern spotted owl). Harvesting would not occur until after July 15 and would end before spring (outside of the primary 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 (includes jackpot burning) would occur in late spring and may cause disruption of nesting on 339 acres in the action alternatives. The impact is of short-duration (1-2 days) at any one location and burning is likely to be scattered across the year(s). To help further mitigate the short-term impacts, deciduous hardwoods would be retained in the silvicultural marking guide as feasible. There are no meaningful differences between the action alternatives relative to their potential impacts on landbirds, except the creation of 1-2 acre gaps in Alternative 4, with snag retention, would provide breeding habitat for western bluebirds.

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 watershed scale, past timber harvesting in the Jackson Creek and South Umpqua watersheds has resulted in high existing levels of habitat in the stem exclusion stage. Ongoing and foreseeable future activities in the watershed that would impact landbird habitat in this structural category are similar to Curtis in scale and impact. There are thousands of acres of 15-20 year-old stands in the watershed that would 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.

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 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 21 provides a list of Region 6 sensitive wildlife species for the Umpqua National Forest, Tiller Ranger District[45] and Table 22 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. Effects to Threatened, Endangered, and Sensitive species are summarized for each alternative in Table 23. If a substantial, measurable impact or effect is anticipated, further analysis and discussion of the direct, indirect and cumulative effects is included following Table 23.

Table 21. Sensitive and threatened wildlife species on the Tiller Ranger District relevant to the Curtis Planning Area (Updated December 2007).

Common Name	Scientific Name	Habitat Description and Existing Condition Information
Johnson's hairstreak	*Callophrys johnsoni*	Conifer forests; larvae feeds on mistletoe growing on pine and other conifers; this small butterfly flits in circles or side to side; range is local and scarce; this species is suspected to occur on the Umpqua.
Coronis fritillary	*Speyeria coronis coronis*	Wide-ranging butterfly found in many habitats; larvae feed on violet; populations rare, but 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; likely found within 100 feet of wet areas; suspected on the Umpqua; specimen found in Cow Creek drainage 20 miles to southwest.
Salamander slug	*Gliabates oregonius*	Leaf litter in conifer stands; some specimens found in Lane county; suspected on the Umpqua
Oregon shoulderband	*Helminthoglypta hertleini*	Rocky areas associated with deciduous leaf litter, generally adjacent to areas with grass or herbaceous vegetation. Woody debris used as refugia in moist situations; documented on Tiller RD and in planning area.
Chace sideband	*Monadenia chaceana*	Klamath province and southwestern Oregon Cascades; prefers rocky forested habitats, but can be associated with large woody debris; documented on Tiller RD and in planning area.
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; activities that compact soil may be detrimental to species; there is habitat in planning area, but nearest documented site is on Diamond Lake RD.
Pristine springsnail	*Pristinicola hemphilli*	Aquatic snail; small, undisturbed cold springs or seeps; suspected on the Umpqua, but limited habitat is available in the planning area for this species.

[46] The following species have little or no likelihood of occurring on the Tiller Ranger District and/or in the Planning Area – they are documented in the BE, but are not discussed further here: Mardon skipper; Foothill yellow-legged frog; Oregon spotted frog; Bufflehead; Yellow Rail; Black Swift; American Peregrine Falcon; Bald Eagle; Harlequin Duck; Horned Grebe; Red-Necked Grebe; Lewis' woodpecker; White-Headed Woodpecker; Purple Martin; Pacific Pallid Bat; Townsend's Big-Eared Bat; Wolverine; Siskiyou short-horned grasshopper.

Common Name	Scientific Name	Habitat Description and Existing Condition Information
Northern Pacific pond turtle	*Actinemys marmorata marmorata*	Inhabits marshes, ponds, lakes or slow-moving portions of rivers and streams; requires terrestrial habitats for nesting; long-lived species; large amounts of emergent logs, vegetation, or rock are needed for basking and cover; documented on Tiller RD and in planning area.
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 8 historic owl cores within the Curtis planning area; see discussion.
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 in forested habitats; one documented record on Tiller 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 Diamond Lake Ranger District; see discussion.

Table 22. 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?
Johnson's hairstreak	Yes, conifers with mistletoe are present in planning area.	May impact individuals or habitat.	No
Coronis fritillary	Yes, a variety of habitats are present within the planning area.	May impact individuals or habitat.	No
Oregon shoulderband	Yes, specimens have been found within planning area.	May impact individuals or habitat.	No, consistent with conservation assessment and NWFP.
Chace's sideband	Yes, specimens have been found within planning area.	May impact individuals or habitat.	No, consistent with conservation assessment, low probability of occurrence.
Crater Lake tightcoil	Low probability, species may occur adjacent to harvest units. Not found during local surveys.	Low potential – see discussion.	No, consistent with conservation assessment and NWFP.
Evening fieldslug	Low probability, habitat is present; no specimens have been detected in mollusk surveys	May impact individuals or habitat.	No, consistent with NWFP.
Salamander slug	Low probability, habitat is present; no specimens have been detected in mollusk surveys.	May impact individuals or habitat.	No, consistent with NWFP.
Pristine springsnail	Low probability, habitat is extremely limited.	Low potential – see discussion.	No, consistent with NWFP.
Northern Pacific pond turtle	Low probability of species occurrence in proposed units, but stream habitat is adjacent.	Low potential – see discussion.	No, due to the small scale and low potential of impacting the species in potential wintering habitat.

Sensitive Species	Is species or habitat in or adjacent?	Is impact or effect expected?	Loss of viability or trend?
Northern spotted owl	Yes, there are 8 historic nest sites within the planning area.	Yes – see discussion.	No, consistent with the NWFP.
Pacific fringed myotis	Probable, habitat occurs adjacent to proposed thinning units.	Indirect – thinning would accelerate development of habitat.	No, action alternatives do not impact current habitat; may benefit species through indirect effects.
Pacific fisher	Very low probability of species occurrence, but habitat occurs adjacent to proposed units.	Indirect – thinning would accelerate development of habitat.	No, action alternatives do not impact current habitat, may benefit species through indirect effects.

Table 23. Determination of effects to Threatened, Endangered, and Sensitive[46] Wildlife Species.

Sensitive Wildlife Species	No Action	Alt 2	Alt 3	Alt 4
Johnson's hairstreak	NI	MIIH	MIIH	MIIH
Coronis fritillary	NI	MIIH	MIIH	MIIH
Oregon shoulderband snail	NI	MIIH	MIIH	MIIH
Chace sideband snail	NI	MIIH	MIIH	MIIH
Crater Lake tightcoil snail	NI	MIIH	MIIH	MIIH
Evening fieldslug	NI	MIIH	MIIH	MIIH
Salamander slug	NI	MIIH	MIIH	MIIH
Pristine springsnail	NI	MIIH	MIIH	MIIH
Northern Pacific pond turtle	NI	MIIH	MIIH	MIIH
Northern spotted owl	NE	NLAA	NLAA	NLAA
Pacific fringed myotis	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.*

[46] Species formally known as Survey and Manage species have been reclassified as Sensitive species and include the mollusk species discussed above. No further discussion of these species will occur.

Johnson's hairstreak – see summary table for existing condition.

Direct and Indirect Effects: Alternative 1 would not impact this species because no trees would be removed. The action alternatives would enhance habitat in younger age stands and would help move these stands toward a condition more favorable for this species. There are some trees infected with mistletoe in the stands selected for thinning. Harvest prescriptions dictate that some of these trees would be retained for wildlife needs. There is some potential for direct impacts to eggs or larvae in the mistletoe brooms during tree felling. Indirect effects include reduction of canopy and subsequent increase in grass, forbs and shrubs in the understory. Alternative #4 with the creation of 1-2 acres gaps would improve habitat for adult butterflies by providing more food sources. Increasing structural and vegetative diversity would enhance habitat for this species in the long run.

Cumulative Effects: This project should not contribute to a cumulative negative impact to this species as the action alternatives move the stands toward a condition favorable to Johnson's hairstreak. As no projects are planned in late successional stands within the watershed there would be no cumulative effects from this project.

Determination of Impact: For all action alternatives, because habitat is present there is potential that the project 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 not impact this species.

Coronis fritillary – see summary table for existing condition.

Direct and Indirect Effects: The action alternatives would provide a diversity of habitats and vegetation which should benefit this species. There may be direct impacts to individuals or nectar plants (violets) from the action alternatives during felling, yarding and fuels treatments. Indirect effects include reduction of canopy and subsequent increase in grass, forbs and shrubs in the understory. Alternative 4 with the creation of 1-2 acre gaps would improve habitat for adult butterflies by providing more food sources. Increasing structural and vegetative diversity would enhance habitat for this species in the long run.

Cumulative Effects: This project should not contribute to a cumulative negative impact to this species because the action alternatives move the stands toward a condition favorable to Coronis fritillary.

Determination of Impact: The "No action" alternative would not impact this species or its habitat. For all action alternatives, because habitat is present there is potential that the project 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 not impact this species.

Mollusks: Formerly categorized as Survey and Manage species, three mollusk species listed below are now treated as Sensitive Species on the Region 6 Regional Forester's Sensitive Species List. In order to determine the need for pre-disturbance surveys Line Officers must consider the probability of the species being present on the project site, as well as the probability that the project would cause a significant negative effect on the

species habitat pr the persistence of the species at the site. There are three criteria for determining the need for pre-disturbance surveys (USDA/USDI 2001):

1. The proposed activity (project) is within the known or suspected geographic range of the species;
2. Suitable habitat that may potentially contribute to a reasonable assurance of persistence occurs within the proposed project area and;
3. The proposed activity has the potential to "cause a significant negative effect on the species habitat or the persistence of the species at the site".

If all 3 of these criteria are met, then pre-disturbance surveys should be conducted following the guidelines established in survey protocols

For the three mollusk species listed below two of the three criteria (#1, 2) are met. For the third criteria, the action alternatives do not have the potential to "cause a significant negative effect on the species habitat or the persistence of the species at the site". This is based on the harvest prescriptions, which retain hardwoods and riparian buffers, and maintain at least 40% canopy closure, and mitigation measures that retain coarse woody debris, avoid disturbance to rock outcrops, and protect down wood, ash swales, hardwood trees, shrubs and rock outcrops during fuels treatment. Based on this assessment, surveys are not recommended for this project.

Oregon Shoulderband – see summary table for existing condition.

Direct and Indirect Effects: Direct and indirect effects are analyzed at the stand scale. Direct impacts to this species include injury or crushing from ground skidding equipment or falling trees from the thinning operation. Activities fuels reduction through piling and burning or underburning could also impact individuals. Indirect effects include environmental changes to the stand from thinning and fuels treatments. Indirect effects include environmental changes to the stand from thinning. Thinning opens up the overstory of the stand thereby reducing canopy cover. This allows more sunlight to reach the forest floor which can increase drying and reduce humidity on the forest floor, changing the microclimate of the understory. The result is a short term negative impact to mollusks in general, although probably not a large impact to this species. Increased sunlight should initiate a long term benefit to grass/forb and shrub layers, providing a more stable microclimate and increase in available hiding cover. Mitigation measures that retain coarse woody debris, leaf and needle litter and rock outcrops assure long-term viability within the project area and follow management considerations outlined in the Conservation Assessment for this species (Duncan 2004).

Cumulative Effects: Cumulative effects are analyzed at the Lower Jackson, and Buckeye/Zinc sub-watershed scale. Alternative 1 has no cumulative impacts. For the action alternatives, this project could add cumulatively to the impacts which have occurred in the past. This includes regeneration harvest and commercial thinning. The effects are short term and are not of a scale that would cause a loss of viability to the population or species. Long term effects of thinning would diversify the vegetative layers within the stands and reduce the effects of wildfire that could occur in the future.

Determination of Impact: For all action alternatives, because habitat is present there is potential that the project 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 not impact this species.

Siskiyou or Chace Sideband – see summary table for existing condition.

Direct and Indirect Effects: Direct and indirect effects are analyzed at the stand scale. Direct impacts to this species include injury or crushing from ground skidding equipment or falling trees from the thinning operation. Activities fuels reduction through piling and burning or underburning could also impact individuals. Indirect effects include environmental changes to the stand from thinning and fuels treatments. Thinning opens up the overstory of the stand thereby reducing canopy cover. This allows more sunlight to reach the forest floor which can increase drying and reduce humidity on the forest floor, changing the microclimate of the understory. This results in a short term negative impact to mollusks in general, including this species. Increased sunlight should initiate regeneration of the grass/forb and shrub layers, providing a more stable microclimate and an increase in available hiding cover. Mitigation measures that retain and protect down wood and rock outcrops assure long-term viability within the project area. Known locations within harvest units have been buffered following guidelines in the Conservation Assessment for this species. Mitigation measures that retain and protect coarse woody debris, leaf and needle litter and rock outcrops assure long-term viability within the project area.

Cumulative Effects: Cumulative effects are analyzed at the Lower Jackson and Buckeye/Zinc sub-watershed scale. Alternative 1 has no cumulative impacts. For the action alternatives, this project could add cumulatively to the impacts which have occurred in the past. This includes regeneration harvest and commercial thinning. The effects are short term and are not of a scale that would cause a loss of viability to the population or species. Long term effects of thinning would diversify the vegetative layers within the stands and reduce the effects of wildfire that could occur in the future.

Determination of Impact: For all action alternatives, because habitat and individuals are present there is potential that the project 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 not impact this species.

Crater Lake Tightcoil – see summary table for existing condition.

Direct and Indirect Effects: Direct and indirect effects are analyzed at the stand scale. Direct impacts to this species include injury or crushing during harvest activities. Activities fuels reduction through piling and burning or underburning could also impact individuals. Indirect effects include environmental changes to the stand from thinning and fuels treatments. There is a low probability of this as this species is restricted to wet areas which are buffered. Indirect effects include environmental changes to the stand from thinning. Thinning opens up the overstory of the stand thereby reducing canopy cover. This allows more sunlight to reach the forest floor which can increase drying and reduce humidity on the forest floor, changing the microclimate of the understory. Stream buffers and shade zones maintain habitat along streams. The thinning prescription for riparian areas is low (140 leave trees per acre), and retains hardwoods. The impacts to

microclimate would be minimal under this prescription. This design exceeds the Conservation Assessment recommendation for 33 foot buffers on perennial waters and would prevent impacts to the species from microclimate changes. Mitigation measures that retain and protect coarse woody debris, uncompacted leaf litter, and maintain riparian shading follow Conservation Assessment management considerations and assure long-term viability within the project area.

Several narrow (<100 feet wide) yarding corridors would cross some streams and could potentially result in some direct impacts, but given the small-scale of this impact and the low probability that this species occurs in this area, this impact is considered to be unlikely and minor. The corridors are too narrow and dispersed to cause major changes in riparian stand structure and alterations to microclimates.

Cumulative Effects: Cumulative effects are analyzed at the Lower Jackson, and Buckeye/Zinc sub-watershed scale. Alternative 1 has no cumulative impacts. For the action alternatives, given the low probability of this species occurring within the watershed (based on thousands of acres of surveys resulting in no known sites) and the small-scale of impacts to its potential habitat, this project is not expected to add cumulatively to the impacts which have occurred in the past.

Determination of Impact: For all action alternatives, because habitat is present there is potential that the project 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 not impact this species.

The next group of mollusks was recently added to the Region 6 Sensitive Species List.

Evening fieldslug – see summary table for existing condition.

Direct and Indirect Effects: Direct and indirect effects are analyzed at the stand scale. Direct impacts to this species include injury or crushing during harvest activities. Activities fuels reduction through piling and burning or underburning could also impact individuals. Indirect effects include environmental changes to the stand from thinning and fuels treatments. There is a low probability of this as this species is restricted to wet areas which are buffered. Indirect effects include environmental changes to the stand from thinning. Thinning opens up the overstory of the stand thereby reducing canopy cover. This allows more sunlight to reach the forest floor which can increase drying and reduce humidity on the forest floor, changing the microclimate of the understory. Stream buffers and shade zones maintain habitat along streams. The thinning prescription for riparian areas is low (140 leave trees per acre), and retains hardwoods. The impacts to microclimate would be minimal under this prescription. This design exceeds the Conservation Assessment recommendation for 33 foot buffers on perennial waters and would prevent impacts to the species from microclimate changes. Mitigation measures that retain and protect coarse woody debris, uncompacted leaf litter, and maintain riparian shading follow Conservation Assessment management considerations and assure long-term viability within the project area.

Several narrow (<100 feet wide) yarding corridors would cross some streams and could potentially result in some direct impacts, but given the small-scale of this impact and the low probability that this species occurs in this area, this impact is considered to be

unlikely and minor. The corridors are too narrow and dispersed to cause major changes in riparian stand structure and alterations to microclimates.

Cumulative Effects: Cumulative effects are analyzed at the Lower Jackson, and Buckeye/Zinc sub-watershed scale. Alternative 1 has no cumulative impacts. For the action alternatives, given the small-scale of impacts to its potential habitat, this project is not expected to add cumulatively to the impacts which have occurred in the past.

Determination of Impact: For all action alternatives, because habitat is present there is potential that the project 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 not impact this species.

Salamander slug – see summary table for existing condition.

Direct and Indirect Effects: The stands selected for thinning in Curtis are younger than the stands in which voucher specimens were found. However, given the fact that very few specimens of this species have been found it is possible that the Curtis Planning area could be suitable habitat. If present, some individuals could sustain impacts from tree harvest, log yarding or fuel treatments. Thinning would promote vegetative and structural diversity within stands which would be a long term benefit to this species.

Cumulative Effects: Cumulative effects are analyzed at the Lower Jackson, and Buckeye/Zinc sub-watershed scale. Alternative 1 has no cumulative impacts. For the action alternatives, given the low probability of this species occurring within the watershed (based on thousands of acres of surveys resulting in no known sites) and the small-scale of impacts to its potential habitat, this project is not expected to add cumulatively to the impacts which have occurred in the past.

Determination of Impact: For all action alternatives, because habitat is present there is potential that the project 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 not impact this species.

Pristine springsnail – see summary table for existing condition.

Direct and Indirect Effects: Because this species is totally aquatic, and habitat is extremely limited, there is little potential for direct effects from the project. Riparian buffers further protect this snail's habitat. Indirect effects could include sediment delivery to appropriate habitat due to tree harvest, log skidding and yarding. With riparian buffers and Best Management Practices in place this is unlikely.

Cumulative Effects: Cumulative effects are analyzed at the Lower Jackson, and Buckeye/Zinc sub-watershed scale. Alternative 1 has no cumulative impacts. For the action alternatives, given the low probability of this species occurring within the watershed and the unlikely potential for impacts to habitat, this project is not expected to add cumulatively to the impacts which have occurred in the past.

Determination of Impact: For all action alternatives, because habitat is present there is potential that the project 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 not impact this species.

Northern Pacific Pond Turtle

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. It overwinters in mud bottoms of lakes or ponds or in upland habitats adjacent to water bodies. Pond turtles are long-lived, with an estimated life-span of 50 to 70 years. 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). Telemetry studies (Holland 1994) have shown the South Umpqua watershed to be high quality turtle habitat and locations documented along the Curtis planning area boundary include 69 nest sites along or within close proximity of the South Umpqua River and Jackson Creek.

Unit 1 of the Curtis Project is 192 meters from the South Umpqua River and 700 meters from a known pond turtle nest site. Unit 5 is 585 meters from a known nest site along the river. Both of these units are up steep slopes (50% slope and >400 feet elevation gain) from the river. There is low potential for turtles to climb to Units 1 and 5 for nesting or overwintering.

Direct and Indirect Effects: The direct and indirect effects are analyzed at the scale of Units I and 5. Riparian buffers would maintain shade and stream temperatures. Thinning in Unit 1 is at a moderate level and Unit 5 is at a high level. Both units would still function as terrestrial habitat if utilized by turtles.

Cumulative Effects: Cumulative effects are analyzed at the Lower Jackson and Buckeye/Zinc sub-watershed scale. The biggest impacts to the turtle within these sub-watersheds are from timber harvest and associated road construction and subsequent traffic. Other anthropogenic factors are disturbance to nests, either accidentally or intentionally, and shooting of turtles. This is uncommon, but has been documented on the ranger district. The action alternatives produce a small-scale impact, which is not expected to add cumulatively to the impacts which have caused concern for this species as no new roads are being constructed.

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 are not likely to contribute to a trend toward federal listing or loss of viability of the species". The "no action" alternative would not impact this species.

Northern Spotted Owl

Existing Condition: The Northern spotted owl is listed as a threatened species under the authority of the Endangered Species Act. 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. For this analysis, NRF habitat is defined as mature understory reinitiation and transitional old growth forests from the current vegetation map. Large contiguous blocks of NRF habitat were believed to be necessary for nesting success and survival. In the western Cascades, a 1.2-mile radius circle around an owl activity center is often used to represent the owl's home range and 40% NRF within this circle (1,182 acres) was once considered the minimum acceptable amount of habitat for long-term owl survival. However, recent studies have shown that some amount of landscape diversity may actually be beneficial to the owl (Franklin et al. 2000).

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[47] of proposed harvest units and all known or potential owl home ranges that could be directly, indirectly or cumulatively impacted through the proposed actions.

The Curtis Timber Sale Planning Area covers about 29,821 acres, of which 12,589 acres (42%) are currently suitable nesting, roosting, and foraging habitat (NRF) for the NSO (Figure 14). There are 12 potential NSO home ranges within this planning area, with approximately 24,282 acres (81%) considered to be dispersal habitat. Although the action area slightly overlaps 155 acres of CHU OR-29, no project units are within critical habitat. Land ownership is primarily USFS (91%), with the remaining 9% managed by privately-owned industrial timber companies. These private lands are mainly covered with dispersal habitat, younger tree plantations and recent clearcuts.

[47] Median northern spotted owl home range radius for the western Cascades of Oregon.

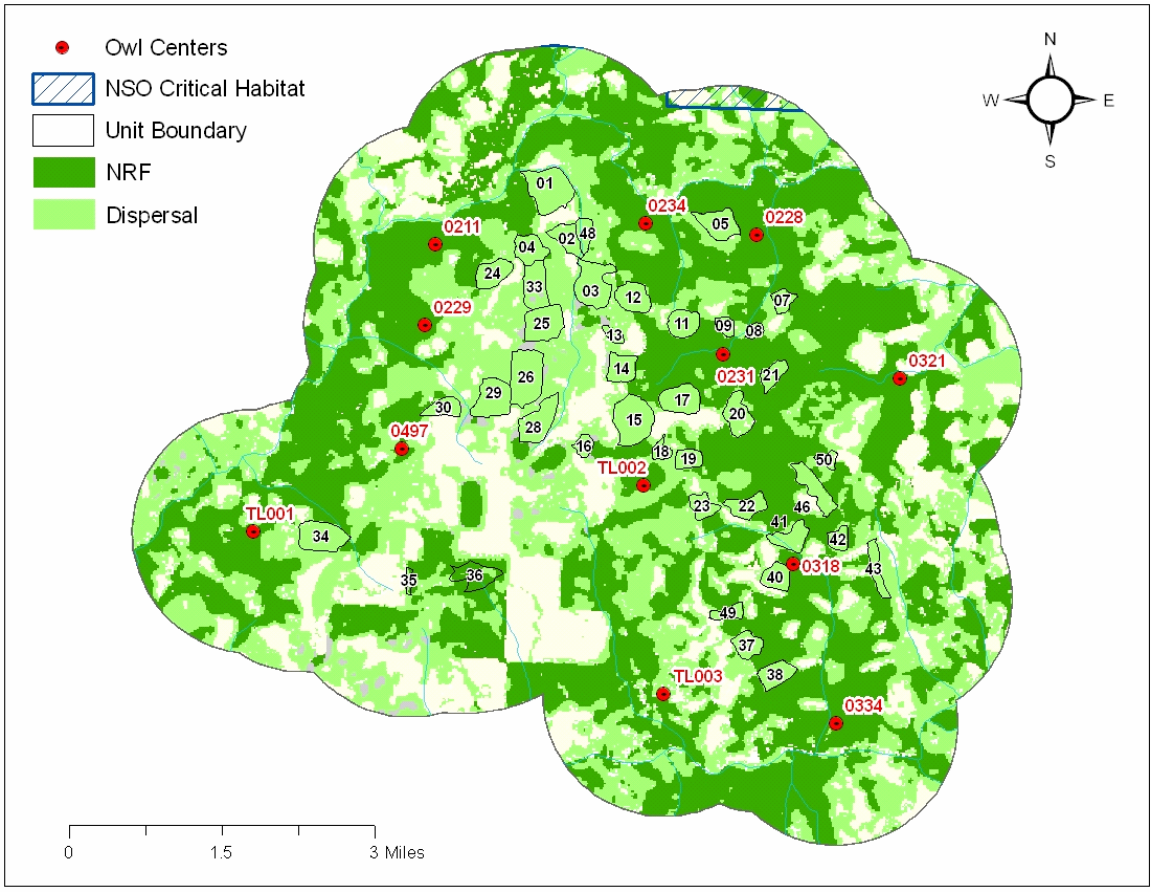

Figure 14. Northern Spotted Owl (NSO) habitat within the Curtis Planning Area.

Critical Habitat

Critical habitat units (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 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." This includes, "…areas not currently containing all of the essential features, but with the capability to do so in the future."

They are areas considered "critical" to the conservation and recovery of the northern spotted owl and were designated under the Endangered Species Act by the US Fish and Wildlife Service on January 15, 1992 (FWS 1992a). A total of 190 CHUs, covering 6.9 million acres were designated across the range of the owl. The Service's intent in designating critical habitat was to provide protection for habitat that contains constituent habitat elements (NRF and dispersal habitat) in sufficient quantities and quality to maintain (and recover) stable populations of owls throughout its range. During the mapping of CHUs, the following base factors were considered:

1. Large contiguous blocks of forested stands >80 years old
2. Quality of habitat (e.g., fragmentation, elevation…etc)
3. Spacing to allow for dispersal
4. Occupancy by owl pairs or resident singles

The action area slightly overlaps 155 acres of CHU OR-29 however there are no Curtis units within critical habitat.

Direct and Indirect Effects

Northern Spotted Owl - To minimize the potential for adverse effects on the owl, all units directly adjacent to owl cores would not be heavily thinned, nor have gaps larger than 0.25 acres created in them.

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 40-60/70 trees per acre would reduce canopy closure to about 40-50 percent. Thinning to 70-90/100 trees per acre is expected to lower canopy closure to 50-60 percent. These change 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. And following thinning, there would be an expected gain in canopy closure of 2% per year (Chan et al. 2006). Small gaps from 1-2 acres would total 25 acres of dispersal habitat loss, however these gaps are 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"[48], adopted as the strategy for enhancing successful NSO dispersal through a forested landscape. Commercial thinning would modify the structure of dispersal habitat, 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 of NSOs is considered to be minor.

Thinning in Curtis Units 35 and 36 would lower existing tree densities to 70-100 trees per acre and canopy closure would fall below 60% for a period of a decade or so before it recovers. This would result in a modification of NRF to a dispersal condition. Unit 35 would modify 8 acres and Unit 36 would modify 44 acres. Unit 35 is the only one of these two units that overlaps a potential NSO home range (NSO# 0497). This unit barely overlaps into this home range by about 1 acre. Thinning in these two units would have a barely measurable direct impact on NRF and NSO territories.

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,

[48] The 50-11-40 threshold refers to recommendation in the ISC Report to maintain at least 50% of the Federal forest land outside of habitat conservation areas for the NSO with conifer stands of average stand diameters ≥11 inch dbh and with canopy closure ≥40%

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 these projects 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*, 2 genera of fungi that highly selected for by flying squirrels, in moderately or heavily thinned stands 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 sporocarps is positively associated with proximity to large trees and down wood, the thinning should have an indirect beneficial effect.

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, the proposed silvicultural treatments are expected to accelerate development of NRF habitat, improve habitat connectivity in the action areas and reduce the risk of loss of habitat due to stand-replacing wildfires. Consequently, the project would indirectly benefit the NSO over the long-term.

The proposed project 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 NSOs, 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[49] of known or predicted owl sites. Activities outside of these 260-meter buffers may occur anytime during the year, but if activities occur between March 1 and September 31 they may affect, but not likely adversely affect NSOs. Activities that occur outside of this time period would have no effect on NSOs.

Critical Habitat - There are no units within CHU therefore there are no direct effects to critical habitat.

[49] A 260-meter buffer around of a known (historic) or computer-generated owl site as described in USDI/USDA (2007).

Cumulative effects

Cumulative effects are those effects of future state or private actions, not involving Federal actions, that are reasonably certain to occur within the action area of a Federal action subject to consultation (50 CFR 402.02). Cumulative effects analysis of foreseeable state and private actions provide greater insight to understanding the current environmental factors and likely trends that might affect a species.

Northern Spotted Owl - There are no anticipated actions on non-federal lands within the project action areas that would contribute to cumulative effects for this project. There is an estimated future clearcut harvesting on private land of about 200 acres per year that would not impact NRF habitat, because this harvest in occurring in second-growth plantations, but would potentially impact dispersal habitat. Given this estimated rate of harvest, the amount of dispersal habitat is not predicted to fall below the 50% threshold for any of the action areas.

Critical Habitat - At the scale of the CHU, the anticipated cumulative effects are the same, just at a larger scale in surrounding private lands. The harvesting of current habitat on these lands would affect dispersal habitat. Given this estimated rate of harvest, the amount of dispersal habitat is not predicted to fall below the 50% within this CHU.

Determination of Effects

Northern Spotted Owl - Given the information above, the direct, indirect and cumulative impacts "may effect, but are not likely to adversely affect" the NSO. Habitat impacts are considered minor because the scale of the direct impacts from the proposed thinning and silvicultural actions would modify, but maintain dispersal habitat above the thresholds considered important for dispersal of NSOs. The effects to NRF amount to a degradation of less than 1% of the NRF (about 50 acres of 75 year old natural fire regenerated stands) within the Curtis Action area, and only 1 acre within a potential NSO territory. This impact would produce a negligible and hardly detectable change to the amount and quality of habitat within that action area. Prescribed fire from underburning would generate smoke during the critical egg laying season, because it is not practical to place 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 mitigate the impacts, handpiles would be burned during the fall.

Road construction and maintenance operations, as well as other connected actions (e.g., precommercial thinning) would abide by the terms and conditions in the Forest

programmatic biological opinion (FWS-1-15-03-F-0454). This 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".

Following consideration of the above information, it is determined that the Curtis Timber Sale "May affect, but is not likely to adversely affect" northern spotted owl because of effects on NRF and dispersal habitat and also from noise/smoke disturbance.

Critical Habitat - Given the information above, the direct, indirect and cumulative impacts "may affect, but are not likely to adversely affect" critical habitat for the NSO, because the scale of the direct impacts from modifying dispersal habitat within this CHU would produce a negligible and hardly detectable change to the amount and quality the primary constituent elements of dispersal habitat within this CHU. Considering there are no units within CHU in the proposed action, and including cumulative effects of habitat loss on private lands, this CHU would still contain sufficient quantities and quality of habitat to maintain a stable population of NSO territories in this portion of the owl's range.

Disturbance effects

Disturbance effects are based on time of year and nesting chronologies. Activities that occur between March 1 and July 15 within 0.25 miles of occupied habitat are considered May Affect- Likely to Adversely Affect (MA-LAA); activities between July 16 and September 30 are May Affect- Not Likely to Adversely Affect (MA-NLAA), and activities between October 1 and February 28 is No Effect (NE).

Pacific Fringed Myotis – see summary table for existing condition.

Direct and Indirect Effects: The direct and indirect effects are analyzed at the stand scale. Alternative 1 would have no direct impacts to fringed myotis or their habitat. However, this alternative forgoes the opportunity to enhance future habitat through thinning and forgoes the opportunity to reduce fire risk which could degrade myotis habitat. Under the action alternatives potential direct impacts are associated with thinning, temporary road building, and prescribed fire. Tree felling could directly impact individuals that are roosting in or near a felled tree or snag. Preferred trees/snags for roosting are generally larger in diameter and height than are found in commercial thin units. Long term positive effects include future stand differentiation and diversity which would lead to the development of nest/roost snags and reduction of risk of stand replacing wildfire.

Cumulative Effects: Cumulative effects are analyzed at the Lower Jackson and Buckeye/Zinc sub-watershed scale. Alternative 1 has no cumulative impacts. For the action alternatives, this project could add cumulatively to the impacts which have occurred in the past. The effects are short term and are not of a scale that would cause a loss of viability to the population or species. Long term effects would benefit this species.

Determination of Impact: The action alternatives "may impact individuals or habitat but are not likely to contribute to a trend toward federal listing or loss of viability of the

species" because of the minor potential of disturbing this species during project activities. The "no action" alternative would not impact this species.

Pacific fisher

Existing Condition: A medium-sized member of the weasel family, the fisher is associated with low to mid-elevation (<4,100 ft.) late-successional and old growth forests in western Oregon (Aubrey and Lewis 2003), but is known to use younger forests that have remnant large trees, snags or logs (USDA/USDI 1994, Appendix J2-52). Fishers generally avoid non-forested openings (Ruggiero et al. 1994), clearcuts and forested stands with <40% overstory canopy cover and occur at low densities in landscapes that have been extensively fragmented by timber harvesting (Aubry and Lewis 2003).

Fishers may benefit from a combination of older forest with large trees and snags for denning and resting, and some younger forest because a mixture of different-aged forests increases the density and diversity of prey (Yaeger 2005).

Fisher primarily use live trees for denning and resting (Aubrey and Lewis 2003). Other structures used included large snags and logs. Fishers are closely associated with forested riparian areas, which they use for foraging, resting and as travel corridors (Ruggiero et al. 1994). Reasons for their association with riparian areas may be due to the fact that those areas are conducive to developing larger trees and denser canopies and higher abundance of prey species.

Fishers are thought to have occupied most conifer forests in Washington, Oregon and California prior to European settlement in the 1800s (Aubrey and Lewis 2003). Over trapping in the early 1900s (the season was closed in 1930s), combined with widespread habitat loss from clearcut logging, have resulted in the extirpation of this animal from much of its former range in the Pacific states (Aubrey and Lewis 2003, Thompson 2005). Currently in Oregon, there are two separate and genetically isolated populations. One population occurs in the southern Cascade Range and the other in the northern Siskiyou Mountains. The population in the southern Cascade Range was reintroduced between 1961 and 1981 and is descended from fishers from British Columbia and Minnesota (Aubrey and Lewis 2003), while the Siskiyou population is indigenous. Currently, this species appears to be on the brink of extinction in the Cascade Range and populations are considered extremely low in Oregon (USDA/USDI 1994). Fishers were released on the Tiller Ranger District in the 1970's as part of a porcupine control program. Mustelid surveys conducted in the mid to late 1990's did not detect fisher on the Tiller District. A population exists on the Prospect Ranger District, Rogue River National Forest, approximately 20 miles to the east. This is well within the range that individual fishers can travel.

Where fisher populations are a management concern, timber harvest strategies should attempt to maintain scattered groups of the largest diameter trees, dense canopy cover, in close proximity to drainage-bottoms. Homogeneous stand management should be minimized because local structural and growth characteristics of different trees species may affect fisher resting and denning habitat availability (Yaeger 2005). Landscape timber harvest strategies emphasizing a juxtaposition of young-, mid-, and older-successional forests, with a retention of large diameter conifers and hardwoods in all successional stages, could promote prey diversity as well as supply required resting and denning habitat.

Direct and Indirect Effects: There are no direct effects to fisher from the No action alternative. Action alternatives would create more diversified habitat for this species and maintain riparian buffers for travel corridors. Direct effects include disturbance to individuals from harvest activities, falling of natal den trees/snags due to safety requirements, and impacts to down logs from harvest activities. Indirect effects include impacts to prey species from tree felling, skidding and yarding. Opening up of the forest canopy would promote vegetative and structural diversity which would benefit this species over time.

Cumulative Effects: The network of 100-acre owl cores (of which 8 occur in the planning area) is expected to provide for well-distributed habitat and reduce the chances of local extirpations. Maintenance of riparian reserves also benefits this species. Riparian reserve buffers are being implemented on all perennial and intermittent streams. Future commercial thinning and fuels treatments in the Jackson Creek and Buckeye/Zinc watersheds would maintain this mix of habitat over time.

Determination of Impacts: The "no action" alternative would not impact this species in the short term, but maintains a higher risk of high intensity fire, with loss or set-back of future habitat (than the action alternatives). All action alternatives may impact individuals or habitat, but would not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or the species, because of adherence to coarse woody debris standards and guidelines, and 100 acre spotted owl cores and riparian reserves within the planning area. The diversification of stands from thinning treatments is likely a benefit to this species as the project provides a combination of older forest with large trees and snags for denning and resting, and some younger forest because a mixture of different-aged forests increases the density and diversity of prey.

MANAGEMENT INDICATOR SPECIES

The Umpqua National Forest LRMP (USDA 1990) identified 7 species, and one group of species (cavity nesters) as Management Indicator Species. They 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 the black-tailed deer. The bald eagle and peregrine falcon are sensitive species that require special management; however, this project does not impact their nesting, foraging or wintering habitat, therefore they are not discussed further. Effects to northern spotted owls were discussed under the sensitive species section and are not repeated here. The planning area is located in the lower elevations of the forest, and pine marten occur in the higher elevations and true-fir, mountain hemlock and lodgepole pine forest types. Therefore, pine marten are not discussed further.

Umpqua National Forest Wildlife Standards and Guidelines pertaining to MIS:

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 (FLRMP 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 (FLRMP IV-37). Twelve of 13 described pine marten habitat areas are currently encompassed within Late Successional Reserves created by the Northwest Forest Plan.

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 (FLRMP IV-38).

Pileated Woodpecker & Primary Cavity Excavators

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. 2006).

The planning area is located on the west-slopes of the Cascade Mountains in Oregon. There are two Cascade Mountain breeding bird surveys (BBS) routes to the northeast of the planning area. They are the Warner Mountain route (69219) and the Cinderella Route (69244). These routes are part of a large-scale survey of North American breeding birds and have been used to monitor landbirds on an annual basis for many years (Sauer et al. 2006). The primary cavity excavators found in the planning area and surrounding forest are listed in Table 24 along with monitoring trends from local breeding bird surveys (Sauer et al. 2006).

Table 24. List of the cavity nesters present on the Umpqua National Forest and their population trends for Oregon from 1966-2006 (Sauer et al. 2006).

Species	Local status	Trend
Red-breasted sapsucker	Common	Stable
Hairy woodpecker	Common	Stable
Northern flicker	Common	Decreasing
Pileated woodpecker	Common	Increasing
Downy woodpecker	Uncommon	Decreasing

Species	Local status	Trend
Black-backed woodpecker	Uncommon	Decreasing
White-headed woodpecker	Uncommon	Stable
Lewis' woodpecker	Uncommon	Decreasing

Red-breasted sapsucker, downy, hairy, and pileated woodpeckers, and northern flicker are resident nesters. Lewis' and black-backed woodpeckers are transient or migrant, and white-headed woodpecker would be accidental on Tiller RD.

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 the thinning and snag patch creation in gaps. The indirect effects are caused by changes in future snag recruitment caused by both thinning and inoculations. 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 more slowly, and would not reach desired levels for another 20 years. The action alternatives would decrease small diameter snags densities through timber harvesting impacts. Timber harvesting and fuels treatments would also damage and create some new snags. Large snags would develop slower than the no action alternative and not reach levels recommended by DecAID for another 30 years. These changes in snag levels would have very little negative effects on primary cavity excavators because they maintain 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 2-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 clumps would have high snag densities (up to 34 snags/acre). These direct changes would provide beneficial effects for primary cavity excavators such as the hairy woodpecker, red-breasted sapsucker and northern flicker. The creation of gaps (Alternative 4) 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. The thinning prescriptions in the action alternatives were designed to achieve desired late-successional forest structure quicker than the no action alternative.

Cumulative Effects: Cumulative effects are analyzed at the Lower Jackson and Buckeye/Zinc sub-watershed scale. Past timber harvesting is the management action that has had the greatest influence on habitat condition and availability for primary cavity excavators in the watersheds. However, the trend in clearcut harvesting on federal forest lands that caused the concerns for decreasing populations of primary cavity excavators has largely been halted (or at least dramatically decreased) by the NWFP. Currently, all of the federal forests in the Curtis planning area are in the Matrix land allocation, and the primary type of timber harvesting, is commercial thinning with mitigations for snag recruitment. Late-successional and old growth stands are not being managed for timber production at this time. Adjacent private timber lands are harvested using the clearcutting method.

The action alternatives would help to offset the past effects of timber harvesting and fire exclusion in this area by accelerating forest succession. Ongoing and foreseeable future thinning in the watershed would result in similar impacts (minor adverse impacts with over-riding long-term benefits). 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 magnitude of potential adverse impacts and the expected beneficial impacts, when considered in the context of past, present, and foreseeable actions, it is determined that there are no consequential negative cumulative impacts to primary cavity excavators associated with the action alternatives. Alternative 1 would cause no direct or indirect impacts to this species group; thus, there would be no associated cumulative impacts.

Roosevelt Elk and Black-tailed Deer – Big Game Winter Range

Existing Condition: Certain areas of the forest were identified as big game winter range under the Umpqua LRMP (USDA 1990). 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; Brown 1991), but more recent studies suggest smaller ratios may be suitable as long as the interspersion of forage and cover is good (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 (e.g., Wisdom et al. 1986) 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 (HEs) 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 the main index used in this analysis to compare the habitat effectiveness of each alternative. For the Curtis Planning Area the HEs = 0.877. This number represents a highly viable condition for the habitat variable sizing and spacing of cover to forage areas.

The 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% 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 Curtis planning area is 25,630 acres in size with 13,380 acres of designated winter range. About 3,000 acres of winter range is on private land. The forage/cover ratio within the planning area is currently 17/82. 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. The majority of the natural openings are found on the south slopes of the Jackson Creek side of the planning area, on private and federal lands. This area is presently a highly used forage area for elk and deer. Year round use of the planning area by deer and elk is well-documented (ODFW telemetry data and field reconnaissance). The thinning prescribed by the proposed action would enhance the forage base while still providing thermal cover. Hardwood clumps and ash swale riparian buffers would continue to provide hiding cover. Forage quality would be improved through direct seeding of natural grasses and forbs on soils disturbed by harvest activities. Hardwood shrubs would experience a flush of new growth after thinning as canopy cover is reduced and more sunlight reaches the shrub layer. In flatter units where there is offsite pine and where fuels are to be underburned or jackpot burned, Wildlife Biologists propose to create 1 to 2 acre gaps (Alternative 4) where the offsite pine is reduced to $\leq$ 34 trees per acre and clumped, then treated with fire. This would kill the pine, creating snags, and opening up these areas for seeding, enhancing the available forage for elk and deer. The units suggested for this treatment are: 14, 15, 17, 22, 26, 41, and 46. The gaps would be placed as far from open roads as feasible.

Direct and Indirect Effects: The direct and indirect effects to big game winter range were analyzed at the planning area scale. Alternative 1 (no action) would maintain the current forage/cover ratio and declining trend in forage habitat on federal lands resulting in poorer future forage habitat and winter range conditions. This would have a negative effect on elk and deer. The action alternatives alter the condition of big game winter range habitat by creating additional forage in proximity to cover within the harvest units. Thinning would increase the amount of sunlight to reach the shrub/forb/grass component of the harvested units and creates forage habitat. The effect 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. The proposed larger gaps (Alternative 4) would increase forage quality and quantity.

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). Spur roads are closed to traffic from December 1 through April 30 to protect elk and deer during winter months.

The action alternatives would have a negligible effect on open road density in the planning area as no new roads would be constructed that would be left in place.

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 within this allocation is not expected to occur 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 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

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 1990). They are important due to their scarcity in the forest environment and high wildlife and plant values (USDA 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 25,000-acre Curtis Planning Area, account for roughly 3% (approximately 685 acres) of the area (USDA 1995; USDA 1996). The majority of unique habitats in the watershed are meadows and mosaic areas of large trees and meadows (USDA 1999).

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). In the Curtis Planning Area, fire played a minor role in maintaining unique habitat size in wetlands (including wet meadows) (USDA 1999). Fire may have played a bigger role in maintaining unique habitats in the Jackson Creek area of the Planning Area. This area has the highest density of unique habitats and may have been heavily used by various tribes (USDA 1999). There is a high probability that these people utilized fire to maintain and enhance their gathering and foraging grounds (USDA 1999).

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, no action would 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 montane 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 there would be no direct effects to unique habitats associated with Alternatives 2 or 3 and the connected actions. Over the long-term, thinning under Alternatives 2 and 3 would 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 2, 16, 24, 35, and 42 would not be 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. 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.

The proposed burning associated with the action alternatives would also make the stands more resilient to stand replacement fire. Thinning may not help with the tree encroachment issue in meadows. Buffers would implement standards and guidelines for openings between 1 and 75 acres and protect all the unique habitats from direct impacts from timber harvest activities.

Cumulative Effects

The scope of analysis for cumulative effects to unique habitats is Units 2, 16, 24, 35, and 42, because these are the only locations where the effects of the action alternatives could possibly overlap with and add to past effects (Table 6), potentially resulting in cumulative effects. There are no other on-going or planned future activities in these units (Tables 7 & 8).

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 subwatershed.

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 and 3 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 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 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 do or are likely to cause economic or environmental harm, or harm to human health (USDA 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 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, adaptations for growing on nutrient-poor soils, and allelopathic (plants with natural pesticides) abilities. 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 Umpqua National Forest are presented, by category, in Table 25.

Table 25. Noxious Weed List for the Tiller Ranger District[50].

Common Name	Scientific Name	Curtis Planning Area?
High-Priority Species (Forest Rating A)		
Scotch Broom	*Cystisus scoparius*	Yes
Sulfur Cinquefoil	*Potentilla recta*	Yes
Lower-Priority Species (Forest Rating B)		
Meadow Knapweed	*Centaurea debeauxii* spp. *thuillieri*	Yes
Bull Thistle	*Cirsium vulgare*	Yes
Canada Thistle	*Cirsium arvense*	Yes
St. Johnswort	*Hypericum perforatum*	Yes
Himalayan Blackberry	*Rubus discolor*	Yes
Tansy Ragwort	*Senecio jacobaea*	Yes
Medusahead Rye	*Taeniatherum caput-medusea*	Yes
Other Weeds of Interest (Forest Rating O)		
Oxeye Daisy	*Chrysanthemum leucanthemum*	Yes
Chicory	*Cichorium intybus*	Yes
Wild Carrot	*Daucus carrota*	Yes
Common Teasel	*Dipsacus fullonum*	Yes
Reed canarygrass	*Phalaris arundinacea*	Yes

[50] Noxious weeds found on the Tiller Ranger District and/or on other Ranger Districts, but not within the Curtis Planning Area include: False Brome; Italian Thistle, Spotted Knapweed, Diffuse Knapweed, Yellow Starthistle, Tocalote, Rush Skeletonweed, Portugese Broom, French Broom, English Ivy, Yellow Toadflax, Japanese Knotweed, Giant Knotweed, Puncture Vine, and Gorse. 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.

Noxious weed surveys for the proposed Curtis timber sale were conducted during the summer of 2007. Scotch broom and Himalayan blackberry are fairly common in the planning area. There are numerous small sites of Scotch broom along the 2980-800 road with a large infestation by unit 10 on the 854 spur. The 2980 road also has scattered small infestations with a larger infestation of about 200 plants on the 2980 spur, much of which is within unit 18. Scotch broom is abundant in the Grassy Ridge quarry, which is one of the identified rock sources for the project. Scotch broom is widely distributed but rarely abundant on the Tiller Ranger District, therefore infestations have been aggressively managed as the budget allows. Himalayan blackberry is common and occasionally quite abundant, particularly at lower elevations on the District. Site management for this species is typically confined to areas with a broader restoration objective. St. Johnswort is common within the planning area and across the Umpqua National Forest is general. Tansy ragwort, bull thistle and Canada thistle are scattered throughout the area but are not abundant except for a large patch of Canada thistle within unit 15 along the 2980-600 road. These species are also lower priorities for treatment on the Forest.

Meadow knapweed within the planning area is largely confined to the Collins Ridge Road (2929) which crosses private timberlands. It is abundant in the Surveyor Rock Quarry and continues up the road into unit 34. The only other site in the planning area is a single plant that was found along the 2980-630 road at the top of unit 29. At this time, there are only a few areas of the Tiller Ranger District with substantial infestations of meadow knapweed so isolated sites are targeted for eradication. There are two potential means of minimizing the risk of spreading meadow knapweed further through the planning area. Material from this quarry could be only used on the 2929 road as far as unit 29 where the weed is already present. Otherwise, meadow knapweed is currently confined to the part of the quarry east of the 200 road. This area could either be quarantined from vehicle and machinery or the soil from the infested area scraped off and piled to the side.

The highest priority weeds that were found in the planning area are sulfur cinquefoil and yellow starthistle. A small patch of sulfur cinquefoil was found along the road between units 35 and 36. There are other small infestations of this weed in the general vicinity of the sale area. Yellow starthistle occurs along the edge of the Big Stump Rock Quarry. This site has been handpulled in recent years and was down to 12 plants in 2007. Because yellow starthistle seed is known to persist in the soil for many years, the infested areas would need to be avoided or the areas treated prior to use. Also known in the lower South Umpqua drainage are spotted knapweed, diffuse knapweed, tocolate, and rush skeletonweed.

The desired condition for the watershed and planning area is to be free of priority noxious weed infestations and maintain plant communities that are resilient to the introduction and spread of all invasive plants. Disturbed areas, such as rock quarries and waste disposal areas, are maintained free of invasive weeds to the degree practicable.

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 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 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 revegetation projects.
- Revegetate disturbed sites as soon as practical using native species unless there is no immediate resource concern and the site is anticipated to revegetate 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. 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. Application of the Standards and Guidelines and mitigation measures would nearly eliminate direct effects by restricting the potential for introduction of weed seeds and avoiding areas already infested with priority noxious weeds. These measures, along with competitive revegetation, post-harvest inventory and weed treatments would minimize the indirect effect of soil disturbance and canopy opening. Mitigation includes post-harvest early detection and rapid response treatments on approximately 150 acres. Competitive seeding and planting of native plants would occur under all action alternatives. Revegetation would target landings, skid trails, temporary roads and disturbed understory adjacent to existing sites of invasive weeds. Alternative 4 would be slightly more susceptible to weed invasion over time since this alternative proposes to leave 1-2 acre forage openings in seven of the units. None of the openings are immediately adjacent to weed infestations so successful revegetation should minimize invisibility of these areas.

Roads create habitat for invasive weeds and provide corridors for movement of weeds. Alternatives 2 and 4 propose to construct 0.55 miles of temporary road and 2.7 miles of unclassified roads. Alternative 3 proposes to construct no temporary road and 2.4 miles of unclassified roads. These roads would be subsoiled and revegetated after the sale under all alternatives. Because less road construction is involved in Alternative 3, this alternative would contribute less to invasive weed introduction than Alternatives 2 or 4 although timely revegetation should largely obviate this difference. The absence of any roadwork under Alternative 1 would result in no direct, indirect or cumulative effect upon invasive plants. There have been a total of 176 miles of road construction in the

Buckeye/Zinc Creek watershed and 135 miles in the Jackson Creek watershed. Five miles of road were subsequently decommissioned in the Jackson Creek watershed. The priority weed infestations are largely confined to the roadsides, with heavily traveled roads tending to have more diverse and abundant roadside weeds. Because all new roads would be decommissioned and revegetated, there would be no cumulative impact due to retention of additional roads in the watersheds.

THREATENED, ENDANGERED, AND SENSITIVE BOTANY SPECIES

Biological Evaluation

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 on the Umpqua National Forest. This species occurs in low-elevation upland prairies and is primarily known from Willamette Valley grasslands although there are isolated occurrences documented throughout the Umpqua basin as well. *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. There is no potential habitat for either of the federally listed species within the Curtis planning area therefore there would be no effect to either species.

It is USDA 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. Most rare plant species are associated with rare habitats including dry meadows, wetlands and rock outcrops. Many of the non-vascular plants appear to be associated with old-growth stands. The closed-canopy plantations proposed for commercial thinning under both of the action alternatives are generally not suitable habitat for sensitive species. However, scattered openings, riparian zones, and plantation margins adjacent to mature forest provide potential habitat for a number of sensitive species. Species with identified potential habitat are displayed in Table 26.

Field surveys for plant species, other than fungi, were conducted throughout 2007. No sensitive species were discovered in any of the proposed units or in any adjacent areas that might be indirectly affected by proposed activities therefore there are no direct, indirect or cumulative impacts anticipated from any of the proposed activities under any of the alternatives. Pre-project surveys are not considered to be a reliable conservation tool for fungi because of their unreliable and often cryptic fruiting characteristics. Conservation of fungi on Forest Service lands entails management of known sites, targeted surveys based on Regional priorities, and consideration of habitat elements for fungi during project planning.

Fungi

There are no known sites of any sensitive fungi in the Curtis Planning Area. The proposed timber harvest would target overstocked, second-growth stands that appear to represent poor habitat for most sensitive species of fungi, which are generally thought to favor older stands. However, suitable habitat for a few sensitive fungi appears to be present within the proposed project area. None of the sensitive fungi appear to have particular fidelity to habitats within any of the proposed units. However, published habitat requirements for rare fungi are only broadly described (Aurora 1986; Castellano

et al. 1999; Castellano et al. 2003; Exeter et al. 2006) so it is often difficult to confidently predict presence or absence.

Habitat modeling for *Ramaria amyloidea, R. aurantiisiccescens, R. largentii*, and *Turbinellus kauffmanii* (*Gomphus k*.) indicates that the Curtis planning area is too low in elevation for these species (York and Helliwell 2007). Local experience on the Forest also suggests that *Cudonia monticola* would also only be found at higher elevations. The locations of *Pseudorhizina californica* (*Gyromitra c*.) on the Forest occur along wetland and riparian ecotones so its habitat should already be managed within the riparian reserve buffers.

Boletus pulcherrimus, Cortinarius barlowensis and *Leucogaster citrinus* 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 land. The described habitat for each of these species is quite general but is consistent with stands within the planning area except that these species are thought to be associated with late-successional or old-growth stands.

Among species on the sensitive list that are suspected to occur on the Umpqua National Forest, *Chroogomphus loculatus* is known from only a single site in the Northwest Forest Plan area. This site is in a *Tsuga mertensiana* stand at 4590 ft. on the Willamette National Forest unlike anything in the Curtis planning area. *Dermocybe humboldtensis* is known from two sites on Roseburg BLM land in the Myrtle Creek and Riddle area

Table 26. A Project Effects Assessment for Threatened, Endangered, and Sensitive Plants[51].

Taxa Group and Species	Potential Habitat	Species Present	Project Effects			
Threatened or Endangered Plants			**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Lupinus sulphureus ssp. kincaidii	No	No	NE	NE	NE	NE
Plagiobothrys hirtus	No	No	NE	NE	NE	NE
Bryophytes						
Chiloscyphus gemmiparus	Yes	No	NI	NI	NI	NI

[51] The following Sensitive species have no potential habitat in the Curtis Planning Area and are not listed in the table, but can be found in the Botany BE, which is incorporated by reference: *Barbilophozia lycopodioides*, *Bryum calobryoides*, *Calypogeia sphagnicola*, *Calypogeia sphagnicola*, *Jamesoniella autumnalis* var. *heterostipa*, *Jamesoniella autumnalis* var. *heterostipa*, *Marsupella emarginata* var. *aquatica*, *Meesia uliginosa*, *Polytrichum sphaerothecium*, *Pseudoleskeela serpentinensis*, *Rhizomnium nudum*, *Scouleria marginata*, *Splachnum ampullaceum*, *Tayloria serrata*, *Tomenthypnum nitens*, *Tritomaria exsectiformis*, *Chaenotheca subroscida*, *Dermatocarpon meiophyllizum*, *Lobaria linita*, *Pseudocyphellaria rainierensis*, *Chroogomphus loculatus*, *Cudonia monticola*, *Dermocybe humboldtensis*, *Gastroboletus imbellus*, *Gastroboletus vividus*, *Gomphus bonarii*, *Martellia fragrans*, *Pseudorhizina californica*, *Ramaria amyloidea*, *Ramaria aurantiisiccescens*, *Ramaria largentii*, *Stagnicola perplexa*, *Adiantum jordanii*, *Arabis suffrutescens* var. *horizontalis*, *Arnica viscose*, *Asplenium septentrionale*, *Botrychium pumicola*, *Calamagrostis breweri*, *Calochortus umpquaensis*, *Carex nardina*, *Collomia mazama*, *Elatine brachysperma*, *Fritillaria glauca*, *Gentiana newberryi*, *Kalmiopsis fragrans*, *Lewisia columbiana* var. *columbiana*, *Lewisia leana*, *Pellaea andromedifolia*, *Perideridia erythrorhiza*, *Poa rhizomata*, *Rotala ramosior*, *Scheuchzeria palustris* var. *americana*, *Schoenoplectus subterminalis*, *Utricularia minor*, *Utricularia ochroleuca*, *Viola primulifolia* ssp. *occidentalis*, *Wolffia borealis*, *Wolffia columbiana*, and *Platismatia lacunosa*. The District will continue to monitor all weed species, including those found in the list above.

Taxa Group and Species	Potential Habitat	Species Present	Project Effects			
Threatened or Endangered Plants			**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Encalypta brevicolla var. crumiana	Yes	No	NI	NI	NI	NI
Encalypta brevipes	Yes	No	NI	NI	NI	NI
Entosthodon fascicularis	Yes	No	NI	NI	NI	NI
Funaria muhlenbergii	Yes	No	NI	NI	NI	NI
Porella bolanderi	Yes	No	NI	NI	NI	NI
Codriophorus depressum	Yes	No	NI	NI	NI	NI
Schistostega pennata	Yes	No	NI	NI	NI	NI
Tetraphis geniculata	Yes	No	NI	NI	NI	NI
Trematodon boasii	Yes	No	NI	NI	NI	NI
Lichens						
Leptogium burnetiae	Yes	No	NI	NI	NI	NI
Leptogium cyanescens	Yes	No	NI	NI	NI	NI
Nephroma occultum	Yes	No	NI	NI	NI	NI
Pannaria rubiginosa	Yes	No	NI	NI	NI	NI
Peltigera neckeri	Yes	No	NI	NI	NI	NI
Peltigera pacifica	Yes	No	NI	NI	NI	NI
Pseudocyphellaria mallota	Yes	No	NI	NI	NI	NI
Ramalina pollinaria	Yes	No	NI	NI	NI	NI
Usnea longissima	Yes	No	NI	NI	NI	NI
Fungi						
Boletus pulcherrimus	Yes	N/A	NI	MIIH	MIIH	MIIH
Cortinarius barlowensis	Yes	N/A	NI	MIIH	MIIH	MIIH
Destuntzia rubra	Yes	N/A	NI	MIIH	MIIH	MIIH
Leucogaster citrinus	Yes	N/A	NI	MIIH	MIIH	MIIH
Ramaria spinulosa var. diminutiva	Yes	N/A	NI	MIIH	MIIH	MIIH
Rhizopogon exiguous	Yes	N/A	NI	MIIH	MIIH	MIIH
Rhizopogon inquinatus	Yes	N/A	NI	MIIH	MIIH	MIIH
Vascular Plants						
Botrychium minganense	Yes	No	NI	NI	NI	NI
Carex abrupta	Yes	No	NI	NI	NI	NI
Carex crawfordii	Yes	No	NI	NI	NI	NI
Carex diandra	Yes	No	NI	NI	NI	NI
Carex lasiocarpa var. americana	Yes	No	NI	NI	NI	NI
Carex serratodens	Yes	No	NI	NI	NI	NI
Carex vernacula	Yes	No	NI	NI	NI	NI
Cimicifuga elata	Yes	No	NI	NI	NI	NI
Cypripedium fasciculatum	Yes	No	NI	NI	NI	NI
Eucephalus vialis	Yes	No	NI	NI	NI	NI
Iliamna latibracteata	Yes	No	NI	NI	NI	NI
Ophioglossum pusillum	Yes	No	NI	NI	NI	NI
Polystichum californicum	Yes	No	NI	NI	NI	NI
Romanzoffia thompsonii	Yes	No	NI	NI	NI	NI
Other Rare or Uncommon Species						
Cypripedium montanum	Yes	No	NI	NI	NI	NI

but is otherwise known from the Northern California coast. *Gastroboletus vividus* is only known from above 5,400 ft. while *Martellia fragrans* is only known from above 4,900 ft.

Gastroboletus imbellus is likewise reported from high-elevation *T. mertensiana* and *Abies amabilis* forest.

Ramaria spinulosa var. *diminutiva* has only one known site in Oregon. That site is in a *Pseudotsuga menziesii* stand at 1470 ft. in the Myrtle Creek area on Roseburg BLM land. *Rhizopogon exiguous* and *R. inquinatus* are false truffles that are known from a handful of sites at low to moderate elevations in *P. menziesii* and *Tsuga heterophylla* forest. *Destuntzia rubra* is another false truffle that is reported from *P. menziesii* forest. There is a site of *Stagnicola perplexa* known from the Rogue River National Forest in the vicinity of Crater Lake National Park, not far from the Diamond Lake Ranger District. There is no useful habitat information for this species other than the fact that it is a wood saprobe so it would depend upon rotten wood. Of these species, there is a reasonable chance that the *Rhizopogon* spp., *D. rubra*, and *Ramaria spinulosa* var. *diminutive* could occur in the planning area. Occurrence of any of the other species would represent an expansion of their currently recognized habitat niche.

Direct Indirect and Cumulative Effects

Under Alternative 1, there would be no direct adverse effects to sensitive fungi due to the absence of ground disturbing activities. There is the potential for direct adverse impacts to the above noted species of fungi, were they to be present in the proposed units, by removal of host trees in the two action alternatives. However, all prescriptions leave between 40-140 dominant trees per acre (tpa) in both action alternatives. Retention trees have the potential to act as refugia which can contribute, if needed, to recolonization (Luoma et al. 2006). There is also a potential for indirect impacts to rare fungi due to diminished habitat quality resulting from opening the canopy, soil disturbance, and short-term disruption of down wood recruitment. This would be expected to have the most impact to fungi in the units where only 40-70 tpa are left. Many of these units are partially comprised of off-site ponderosa pine, which would presumably further diminish the existing habitat potential for these overstocked plantations. Alternative 3 proposes to thin slightly fewer acres than Alternative 2 so the potential adverse effects would be marginally less. Alternative 4 maintains 25 acres of 1-2 acre forage clearings in seven units so this alternative would have marginally greater impact to suitable fungi habitat than either Alternative 2 or 3. There have been approximately 36,000 acres of regeneration harvest between the two watersheds with practically all of the harvest occurring prior to the 1990s. It is unclear how many of these plantations are in a similar stand condition as the proposed units in the Curtis planning area but only 320 acres within the two watersheds have been commercially thinned since 2000 so there would be little cumulative affect of the proposed Curtis acres added to past thinning effects within the Buckeye/Zinc Creek and Jackson Creek watersheds. Because the chances of rare species occupying the site are low and the habitat impacts are anticipated to be of moderate intensity and of short duration, all action alternatives may impact individuals or habitat but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

EFFECTS TO OTHER RARE OR UNCOMMON SPECIES

Two additional species that have previously been considered to be of conservation concern although they do not currently meet the criteria for Forest Service sensitive are here evaluated should their status be reconsidered. *Cypripedium montanum* and *Platismatia lacunosa* were surveyed for but not found in the project area. Therefore, no direct, indirect or cumulative effects would be anticipated to impact either species from actions associated with this timber sale.

Aquatic Environment

The proposed action and its relationship to the aquatic environment were assessed during the scoping process. Concerns that were raised over impacts of new road construction were addressed in the development of Alternative 3. Effects related to this issue are disclosed in this section and under the Terrestrial and Social Environments.

Concerns were also raised during scoping over impacts to riparian areas and streams from ground based logging. These concerns were addressed by the application of mitigation measures and standards and guidelines that lessen impacts from logging and remove unstable areas from management. The effects related to these concerns are also disclosed in this aquatic section.

This aquatic analysis focuses on how the Curtis alternatives affect riparian and aquatic physical and biological processes at various scales. This includes site specific disclosure at the scale of individual streams or thinning units and at various larger scales including the 6th field subwatersheds that fall within the Curtis Planning Area and the Middle South Umpqua and Jackson Watersheds[52] (Figure 15).

The compatibility with the objectives of the ACS is discussed in this section of Chapter 3. 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.

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[52] A “watershed” is a subdivision of land that is based on hydrologic drainage and defined by a national hierarchical system, which delineates hydrologic drainage in nested multi-level subdivisions (FGDC 2004). The watershed level subdivides the “sub-basin” level (4th level). The 5th level watersheds in the planning area are Jackson Creek, made up of 5 smaller subwatersheds (6th level) and Middle South Umpqua which is subdivided by six smaller subwatersheds. The subwatersheds are subdivided by drainages (7th level), which is the smallest hydrologic subdivision.

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.

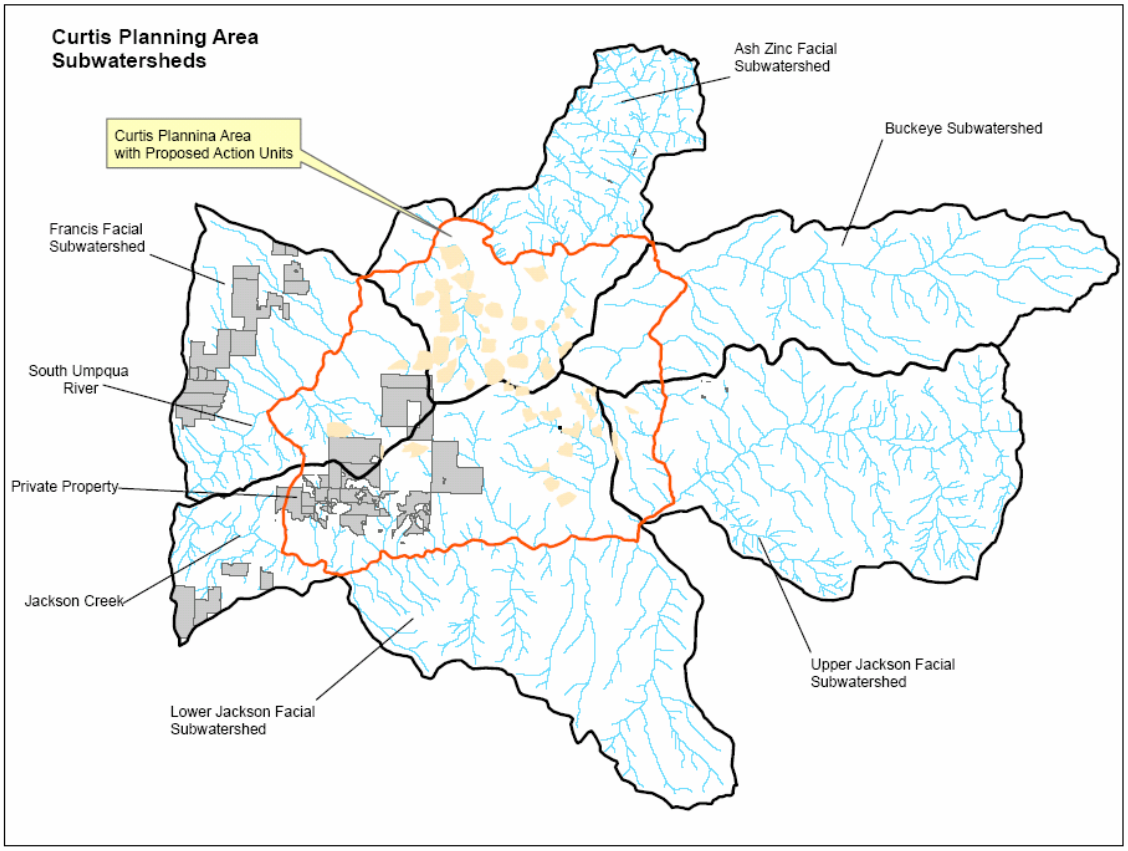

Figure 15. Five subwatersheds subdividing the Curtis Planning Area.

The Curtis planning area is located in five subwatersheds (Table 27) which encompass about 25,630 acres, mostly within the Middle South Umpqua (23,329 acres) and Jackson Creek (14,447 acres) Watersheds. A small piece of the planning area is within the Upper South Umpqua Watershed (11,826 acres), but no units are located within that watershed. The planning area is bordered by the South Umpqua River on the north and Jackson Creek on the south. The main streams within the planning area are Zinc Creek (tributary of the South Umpqua River) and Deep Cut and Ralph Creeks (tributaries of

Jackson Creek). Jackson Creek is a major tributary of the South Umpqua River. All proposed project units are on Forest Service Administered land, but there are approximately 3,896 acres of private land within the Curtis Planning Area.

Table 27. Summary of 6th Level Subwatersheds that include the Curtis Planning Area. Stream Density is estimated from GIS layers, computer modeling, and limited field checking. Actual stream densities may be different.

Subwatershed Name 6th Level	Area (acres)	Stream Density (miles/square mile)	Fish Bearing Stream Miles (Class I & II)
Ash/Zinc Facial	17,192	4.3	17.8
Buckeye	16,078	4.9	7.9
Francis Facial	12,725	4.2	10.0
Lower Jackson Facial	28,427	3.5	21.1
Upper Jackson Facial	18,845	4.4	21.9
Subwatershed Totals:	93,267	--	78.7

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 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. The relevant beneficial uses of the South Umpqua River and its tributaries, including Jackson Creek, 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) fish and aquatic life; 6) wildlife and hunting; 7) fishing; 8) boating; 9) water contact recreation; 10) aesthetic quality; and 11) hydro power (ODEQ 2003a).

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 Jackson Creek and 1996 Buckeye-Zinc Creek Watershed Analyses (WAs) recommend restorative thinning to avoid mortality in second growth stands, and to restore species composition and structure more typical of native forests prior to fire suppression (USDA 1995; USDA 1996)

Northwest Forest Plan Temperature Direction

Specific treatment and buffer recommendations are based on the Northwest Forest Plan Temperature TMDL Implementation Strategies (USDA/USDI 2005) which balance thinning and retention of primary shade to minimize effects to stream temperature. According to this strategy, the primary shade zone is the strip of trees along a stream that provides shade to the water between 1000 and 1400 hours during a summer day. This is the most effective shade for protecting water from temperature increases. Guidelines to protect stream temperature specify primary shade zone widths determined by tree height and slope (Table 28). When these guidelines are followed, sufficient stream temperature protection is assured. All perennial stream buffers in the Curtis units are 50 to 60 feet wide, except in areas of instability, where they are wider.

Table 28. Primary shade zone width guidelines.

Tree Height	Hill Slope		
	< 30%	30-60%	>60%
<20 feet	12	14	15
20-60 feet	28	33	55
>60 feet	50	55	60

WATER QUALITY

Existing and Desired Conditions

Removal or reduction of stream shade during timber harvesting was a common practice throughout the Jackson and Middle South Umpqua Watersheds from initial entry into the watershed in the 1950's through the early 1990's. In the 1980's riparian buffers were utilized, although these buffers were not always adequate for maintaining stream shade. Flooding and debris torrents also contributed to the loss of stream shade and wider channels. During this time, an average of 29% (ranging from 19% in the Lower Jackson subwatersheds to 37% in the Ash/Zinc Facial) of the Northwest Forest Plan riparian reserve land allocation on U.S. Forest Service land was harvested along streams in the five Curtis subwatersheds. Substantial riparian vegetation removal along perennial streams has contributed to increased stream temperatures. Only after the 1994 Northwest Forest Plan was shade and other riparian dependent functions consistently addressed through riparian reserves along all streams.

Water pH has also been affected by the loss of riparian shade. Recent modeling for stream temperature and pH Total Maximum Daily Load (TMDL) in the Jackson Creek

Watershed indicated that pH has naturally exceeded the criteria, but the past loss of riparian shade has worsened the condition (ODEQ 2006).

The Oregon Department of Environmental Quality (DEQ) has identified water quality limited streams throughout the State of Oregon as required by the Clean Water Act, Section 303(d). Jackson Creek was first included on DEQ's 303(d) List in 1998 (ODEQ 1998) and remains on the latest approved list (2004) by the Environmental Protection Agency for exceeding limits for biological criteria, pH (summer), and temperature (spawning and core cold water; ODEQ 2003b). The temperature exceedance occurs during the summer months, for salmonid fish spawning and/or rearing. The upper reaches of the South Umpqua River are listed for pH (summer) and Temperature (core cold water). Jackson Creek near the mouth has been monitored for stream temperature as part of the Forest Plan long-term stream temperature monitoring program. This site has been monitored for 20 years since 1977; the highest average 7-day maximum temperature was 76.0°F in 2006. Zinc Creek temperature was monitored by Umpqua National Forest in 1997 and 1998. Mean 7-day maximum temperatures for those years were 62.0 and 64.2° F. Curtis Area 303(d) Listings and extent by river mile are displayed in Table 29.

Table 29. Water Quality Listings in the Curtis Project Area.

Waterbody Name	River Mile	Parameter	Season	List Date	Data Source
Jackson Creek	0 to 25	Biological Criteria	Undefined	1998	DEQ
Jackson Creek	0 to 25	pH	Summer	1998	DEQ
Jackson Creek	0 to 25	Temperature	Summer –spawning (55.4°F)	1998	DEQ
South Umpqua River	57.7 to 102.2	pH	Summer	1998	DEQ
South Umpqua River	68.8 to 102.1	Temperature	Summer – core cold water (60.8° F)	1998	DEQ

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 Curtis 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, pH, or dissolved oxygen. No ground disturbing activities would occur that would accelerate sediment delivery and reduce water clarity (measured by turbidity). However, over the long-term, stream temperatures could increase as a

result of Alternative 1 if a stand replacing wildfire affected large portions of the planning area. In this case, canopy closure would be lost, allowing increased solar radiation to affect stream temperatures, pH, and dissolved oxygen. Over the long-term, there is a higher likelihood of such a fire under Alternative 1 than under the action alternatives due to higher fuel levels resulting from the no action alternative.

Alternatives 2, 3 and 4 would not have a direct or indirect effect on stream temperature. The action alternatives would thin within riparian reserves, while retaining the effective shade in the primary stream shade zone along perennial streams. Therefore, the action alternatives would meet the water quality/riparian area Standard and Guideline 1. Streams within and adjacent to thinning units would be identified with applicable protection, which meets water quality Standard and Guideline 5.

The pH listings would not be affected by the action alternatives. According to Umpqua Basin TMDL (ODEQ 2006), high pH levels, even above the numeric water quality criteria, likely occurred under natural conditions. However, the historical harvest of shade trees along fish and non-fish bearing streams of similar size worsened the condition through warmer stream temperatures and increased light to the stream, which encouraged algae growth.

Although nutrient input to the stream system can also encourage algae growth, DEQ did not identify elevated nutrients, only natural sources. Thinning treatments typically do not result in nitrogen delivery to streams, although clear-cut harvesting can release nitrogen that can leach to adjacent surface waters during runoff periods (Brown 1972; Brown et al 1973; Sollins et al. 1980; Harr and Fredriksen 1988; Beschta et al. 1995). Nitrogen leaching to surface water is directly proportional to the size (clear-cut versus thinning and small gaps) of created openings (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 action alternatives.

The underburning, jackpot burning, or handpiling of activity fuels within riparian reserves would not impact the overall effective shade. All action alternatives include underburning, jackpot burning, or handpiling on 42% or 39% of the total thinned riparian reserve acreage. Handpiles would be ignited on only 27 or 29 acres within riparian reserves. The mitigation measures of not igniting piles within 100 feet of channels, 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 or jackpot burning would potentially release nitrogen to the soil, the mobile nitrogen would remain local and would be 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 and Weil 1996).

Wet season haul on gravel roads requires the administrative attention in order to protect water quality. Wet season timber hauling would occur on 18 miles of paved roads and 34 miles of gravel roads. 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. Implementation of the road rules would prevent direct and indirect impacts to water quality.

Road reconstruction under Alternatives 2, 3, and 4 would address minor on-going turbidity sources and associated nutrient input at existing stream crossings as displayed in Table 30. No new crossings would be constructed under any of the action alternatives, since no new roads would be built. However, the repair of existing crossings would occur under each action alternative (Table 30).

Table 30. Instream Road Work at Stream Crossings.

	Alternative			
	1	**2**	**3**	**4**
Construct drive-through stream crossings	0	1	1	1
Improve drive-through draw crossings	0	1	1	1
Add culverts or French drains to reconnect stream/drainage	0	2	1	2
Replace damaged culverts	0	3	1	3
Total instream road work sites	**0**	**7**	**4**	**7**

Reconstruction and connected actions common to all action Alternatives potentially having an influence on water quality may include the maintenance of six sumps, the addition of two culverts on roads 2929 and 2980, improvements to two drive-through cross drains on road 2980-200, and construction of one armored crossing to replace a humboldt crossing on the 2980-700 road. 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. Each action alternative would cause in-stream work-induced turbid water with potential sediment bearing nutrient release. This direct effect would be short-term, only occur during in-stream work, and mitigated from carrying downstream through specific design features and BMPs. Direct and indirect effects in response to rain and runoff (turbid water and nutrient release) would be short-term (one season) during the wet season and difficult to discern from background runoff turbidity. These effects would not be expected since 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), Alternatives 2 and 4 would correct chronic road drainage problems providing a beneficial water quality trend while Alternative 1 would not. Alternative 3 would correct fewer drainage problems than Alternatives 2 and 4 (Table 30).

The sump maintenance would involve brushing, rocking the driving approach, and possibly spot placement of in-stream rocks to improve pooling of water. These actions would not create changes in stream temperature or related effects on pH or dissolved

oxygen. Rock placement on a drive approach to a sump would be a benefit by reducing potential surface erosion and sediment delivery to the stream. Therefore, no direct or indirect effects are expected.

Cumulative Effects

Past harvesting of perennial stream shade occurred up until about the early 1990's in the watershed. Loss of stream shade has contributed to past elevated stream temperatures and pH and depressed DO levels 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 6). However, areas harvested prior to 1970 would today be nearly recovered (Holaday 1992).

Alternative 1 would result in no direct or indirect effects to water temperature, pH, DO, or turbidity to incrementally add to possible downstream heating, algae responses, or stream turbidity due to past, present or reasonably foreseeable future disturbance. Therefore, Alternative 1 would not have a cumulative temperature, pH, DO, 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 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, DO, 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, DO, or turbidity effects would result from these action alternatives.

Stream temperature would be monitored beginning in 2008, and continuing for 2 years post-treatment in Zinc, Deep Cut and Ralph Creeks. Jackson Creek would continue to be monitored indefinitely.

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 would not be set back; water quality in Zinc Creek and 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 Curtis 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. In general, the streamflow record from the gaging station on the South Umpqua near Tiller (about 10 stream miles away), and a discontinued gage on Jackson Creek (near the southwest corner of the planning area), reveal that winter flow for the Middle South Umpqua and Jackson Creek Watersheds respond quickly to storm precipitation during the winter causing rapid runoff, which is in sharp contrast to summer flows that are very low.

Relevant Standards and Guidelines

The relevant Standard and Guidelines from the Umpqua National Forest 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.

Watershed Analysis Recommendations

Basin-wide recommendations in the Jackson Creek Watershed Analysis include "suspend use of ground-lead harvesting systems throughout the watershed to prevent additional compaction and increase in peak stream flows due to compaction". In 1995 this document was written to address the clear-cut logging practices common prior to that, to prevent additional large scale compaction and canopy removal. Because the Curtis Project is a thinning project, much of the canopy would remain. This, and the canopy closure of earlier logged units that has resulted with time, would keep the hydrologic recovery level above the threshold of concern for increased peak flow due to canopy removal. Peak flow studies that have evaluated the effect of compaction have found that the influence was evident when about 12% or greater of the area was compacted (Beschta et al. 1995). A review of 1956 and 1966 aerial photography identified 10 Curtis units where over 20% of the area originally tractor harvested is in an unacceptable soil condition due to soil compaction (Project File – Soils). Using skyline yarding on slopes greater than 30% and using existing skid roads on slopes less than 30% would minimize increases in peak flow due to soil compaction. New temporary roads, utilized unclassified roads, and landings would be subsoiled after project completion. Subsoiling existing landings and utilized unclassified would reduce compaction from current levels. Additional subsoiling of unutilized existing skidroads is planned, which would further reduce compaction from current levels produce a small positive effect on soil compaction, and may decrease the effect of soil compaction on peak flows within the project area.

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). The hydrologic recovery procedure (HRP) was used to estimate the hydrologic recovery of the forest canopy at the drainage, subwatershed, and watershed scales. 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 Jackson Creek and Middle South Umpqua Watersheds (5th level), the five subwatersheds which make up the Curtis Planning Area (6th level), and the eight watershed analysis areas (approximately 7th level) are currently greater than the 75% level of concern. The current hydrologic levels are displayed in Table 31. Hydrologic recovery was determined using GIS activity layers. All private land within the analysis area was assumed to be 0% recovered and a site class of IV was used to predict recovery on Forest Service land.

Table 31. Current Hydrologic Recovery for the Five Curtis Subwatersheds.

Subwatershed	Area (acres)	Current Hydrologic Recovery
Ash/Zinc Facial	14,192	95%
Buckeye Creek	16,078	78%
Francis Facial	12,725	77%
Lower Jackson Facial	28,427	87%
Upper Jackson Facial	18,845	91%

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 the subsurface flow interception effect of roads produced moderate (13-36%) increases of large (>1 return period) peak discharge events in seven of eight small catchments studied (25-625 acres), with increases persisting for decades (Jones 2000). The Curtis watersheds are composed of many smaller catchments in this size range that contribute to larger drainages.

Interception of ground water at road-cuts and the extension of the channel network through the road ditches with an insufficient number of 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

Peak flows represent an indirect effect rather than a direct small-scale effect. The Forest Plan (USDA Forest Service, Umpqua NF 1990) identified an analysis area of at least 1,000 acres to evaluate potential peak flow response. As such, only downstream indirect effects and cumulative effects are discussed for the peak flow analysis.

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 at the site scale (Storck et al. 1999). The analysis for the action alternatives assumed a 30% canopy recovery condition for proposed thinning units with 40-70 trees per acre and off-site pine and 40% canopy recovery condition for proposed thinning units with 40-70 trees per acre with no off-site pine. For the moderate thinning prescription of 70-100 trees per acre, the analysis assumed a 40% to 60% recovery level, and a 55% to 70% recovery level in the lightly thinned riparian areas. Gaps created with Alternative 4 were not considered to be recovered for canopy closure calculations. These conservative assumptions allowed for a margin of safety in the analysis to address scale differences from the original study (site response versus larger area) and treatment differences (shelterwood versus thinning).

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 would be less than 70%. However, the remaining leave trees in the thinned areas would buffer the snowpack from rapid snowmelt during rain-on-snow events by breaking up the flow of warm wind across the snow pack, thereby substantially moderating the rapid melt process. Within riparian reserves, off-site pine would be harvested to prescription and any additional off-site pine present would be girdled and left standing to provide some dissipation of warm wind in these otherwise open areas as other trees grow in. Snag clumps would be retained in the 1 to 2 acre gaps created in Alternative 4, buffering the snowpack from warm winds in these larger openings. Because canopy removal in the Curtis project is only partial in most of the treatment areas, and because areas of past harvesting have had time to recover, the resulting reduced hydrologic recovery level in the planning area would remain above the level of concern at the drainage, subwatershed and watershed scales.

The combined loss of canopy from the proposed thinning and the current recovery of past harvesting would reduce the hydrologic condition from 1% to 10% at the watershed analysis area (approximately 7th field) scale and <1% to 4% at the subwatershed scale. Reduction at the watershed scale is minimal. Hydrologic recovery would not drop below 75% at any of these scales.

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&G 2 and S&G 4, listed above). No cumulative peak flow effect is expected under the action alternatives when considering past, present, or reasonably foreseeable future activities.

The action alternatives would result in less risk of stand replacement fire in the steep and gentle mountain slope landscape areas, which is a long-term beneficial effect. If a wildfire occurred in the planning area, the thinning and fuel treatments under the action alternatives would have alleviated dense stand conditions that would cause a surface fire to torch into the crowns and carry across multiple acres. As such, a future wildfire under the action alternatives is more likely to create smaller pockets of stand replacement fire compared to Alternative 1. Thus, the action alternatives exert less risk of future peak flow increases and the potential impacts to the beneficial uses of water.

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 activities 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. All action alternatives are in keeping with the overarching intent of the Aquatic Conservation Strategy (USDA/USDI 1994) since they apply all relevant Standards and Guidelines and since they were developed to restore riparian ecosystem health at the stream reach and landscape scale.

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 (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 Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems. This strategy is based, in part, 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 Curtis Project Area, about 29% of the riparian reserves have been previously clearcut. These previously clearcut riparian reserves are 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. Many of these stands are on a developmental trajectory to develop as closed, homogeneous stands that are not representative of 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. There are approximately 121 miles of permanent system road in the riparian reserves within the five subwatersheds in the Curtis planning area; this equates to about 367 acres occupying riparian reserves. Thus, about 0.5% of the riparian reserves are experiencing long-term impacts from the presence of roads

The planning area also has 0.8 miles of abandoned roads (or 1.5 acres) within the riparian reserves within the 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 Curtis units would have qualified as temporary roads that would have been obliterated following logging use. Several abandoned roads located on slopes and lacking 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 the 1994 Northwest Forest Plan) specifically related to the Curtis 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

1996 Buckeye-Zinc Creek Watershed Analysis:

- Concentrate activities in areas that have already been heavily impacted by roads and harvesting in order to restore landscape level vegetation and aquatic conditions
- Silvicultural prescriptions should meet management objectives within the context of site conditions and historic fire processes. Stands should be restored to species composition and structure that is more sustainable and typical of native forests prior to fire suppression.
- Riparian vegetation along Zinc Creek and its tributaries is primarily small trees. Site-specific riparian prescriptions should be developed to thin the vegetation and encourage stand differentiation and diversity.

1995 Jackson Creek Watershed Analysis:

- The Jackson Creek WA (USDA 1995) did not recommend thinning in the riparian reserves in the Curtis Project Area except along intermittent streams. The document was written to address the clear-cut logging that was common prior to the early

1990's, when little buffer was left along perennial streams. Recent research information indicates that thinning stem exclusion stands within riparian reserves prevents undesired mortality due to overstocking, reduces risk of stand replacement fire, accelerates growth of leave trees, providing shade and large wood recruitment sooner, and promotes species and age diversity (Tappeiner et al. 1997; Brown et al. 2004; Chan et al. 2006).

Proposed Riparian Reserve Treatments

The action alternatives would apply restorative thinning to riparian reserves using various logging methods and activity fuel reduction techniques (Table 32).

Table 32. Thinning, fuel treatment, and logging activity proposed in riparian reserves.

Actions	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Thinning in Riparian Reserves				
Total Riparian Reserve in commercial harvest units	N/A	325 acres	268 acres	325 acres
Commercial Thinning in Riparian Reserves	0	165 acres (51%)	146 acres (54%)	165 acres (51%)
Precommercial Thinning in Riparian Reserve	0	130 acres	100 acres	130 acres
Treatments in Riparian Reserves				
Jackpot and/or Underburn	0	16 acres	16 acres	16 acres
Handpiling/ burning	0	63 acres	57 acres	63 acres
No fuel treatment	N/A	107 acres	91 acres	107 acres
Total RR fuel treatments	0	79 acres (24%)	73 acres (27%)	79 acres (24%)
Logging Systems in Riparian Reserves				
Skyline	0	110 acres	95 acres	110 acres
Ground-based	0	59 acres	53 acres	59 acres

The riparian reserve thinning prescriptions would be the moderate and light prescriptions. In riparian reserves, dominant trees would be left and 70 to 100 square feet basal area of trees would be retained, or about 90 to 140 trees per acre. This would leave a spacing of 14 to 21 feet. Gap creation in the riparian reserve would be limited to ¼ to ½ acre openings of off-site pine treatment. In these areas, any off-site pines present after the prescribed removal would be girdled and left standing, slowly creating gaps as the snags fall and are replaced by growing replacement trees. All but two perennial streams (located in units 7 and 34) would receive 50-60 foot stream protection buffers. In these two exceptions, the buffer would be widened to 300 and 100 feet respectively, due to instability. Stream protection buffers would also be widened to beyond the slope break where inner gorges are present. The riparian reserve thinning would retain 25 foot no-harvest buffers along intermittent stream channels and forested

wet areas larger than 1 acre. Unique habitats larger than 1 acre would retain a no-cut buffer of 150 feet. Wetlands smaller than 1 acre would be thinned to the outer edge of the riparian vegetation but no equipment would be allowed within 25 feet. Three units (13, 14, and 49) have ephemeral draws which would be protected with 25 foot stream protection buffers, but no riparian reserve. Precommercial thinning outside the primary shade zone would remove smaller trees in riparian reserves; canopy would not be reduced below 70%. Skyline corridors through riparian reserves would be 12 feet wide, less than spacing width of riparian leave trees. No trees would be skidded across any channel under any of the action alternatives. No equipment would be allowed in riparian reserves.

Road work in the riparian reserve would be necessary in order to access the plantations for thinning and log haul (Table 33).

Table 33. Road actions within riparian reserves to provide access for thinning.

	Alt. 1	Alt. 2	Alt. 3	Alt. 4
New permanent roads	0	0	0	0
New temporary roads (subsoiled following use)	0	0	0	0
Reuse unclassified road, subsoil after use*	0	0.3 ac	0.3 ac	0.3 ac
Change from existing condition	0	0	0	0

*A 15 foot road width was used to calculate the road acreage figures displayed in this table. This is a liberal estimate of the combined area of the actual road surface (typically about 12 feet wide) and additional width where trees on either side would be cut to allow truck passage.

Finally, four landings located in riparian reserves are limited to existing landings and pullouts along existing roads. Little modification would be necessary for their use.

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.

No new temporary roads would be constructed within riparian reserves under either Alternative 2 or 4. Nine hundred ninety-two feet (0.3 acres) of existing unclassified road would be reconstructed within riparian reserves (units 1, 14, 41, and 42) to access timber. This acreage figure includes the cutting of trees parallel to the temporary road prisms to allow room for truck passage. This temporary reconstruction would result in short-term impacts to riparian forest conditions by disturbing soil, vegetation, and changing localized habitat conditions at the site scale. No such impacts would occur under Alternative 1 where no unclassified roads would be re-built. The action alternatives would result in losses of small organisms and their habitat at the immediate site of the road prisms. The duration of these impacts are expected to last up to a decade. The roads would be subsoiled following use and some of the displaced wood and duff would be pulled back across the roads to hasten recovery from the impacts.

Since the linear openings created with temporary road building can be expected to be at most 14 feet in width, the change in riparian forest crown closure associated with the

temporary road building would be essentially no different than the crown closure changes from the thinning treatments.

The thinning and fuel treatments within riparian reserves under the action alternatives (Table 32) would lower the existing canopy closure down to 55 to 70% (depending on the thinning intensity) allowing more light penetration, resulting in warmer and dryer riparian forest conditions compared to Alternative 1. The gaps created in the riparian reserve, limited to ¼ and ½ acres, represent the most impact in terms of localized, small-scale loss of crown closure and associated site warming. However, small organisms that live on the surface of the soil or that burrow in the soil may not be adversely affected since soil moistures remain high following thinning and gap creation due to the decreased use of water by fewer trees on the site. Since the off-site pine clumps would be girdled and left standing, these gaps would open slowly, allowing other vegetation to fill in as the overstory opens. The thinning under the action alternatives would also lower the rate of litter input to the riparian forest floor which represents important nutrient cycling and food bases of small organisms. This thinning effect may lower local populations of these dependant terrestrial organisms. Stream protection buffers (at least 50 feet wide) along perennial streams would eliminate this impact on aquatic organisms while 25 foot buffers along intermittent streams would greatly reduce it in those streams. Such effects would gradually subside as canopy closure returns over time. 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). Alternative 1 also carries the highest risk for catastrophic wildfire, which could cause large scale canopy removal.

The prescribed underburning and jackpot burning 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. Disturbance of riparian ground cover, vegetation, and small organisms associated with the fuel treatments are somewhat minimized because the concentrated slash piles would not be burned within 100 feet of stream channels, and would be burned during wet weather when site impacts are minimized to the extent possible. Some handpiles may be constructed within 100 feet of channels and left unburned for wildlife habitat. A mitigation measure incorporated into the action alternatives requires that underburning and jackpot 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.

Underburning and jackpot burning are expected to create exposed soil in about 18% of the treatment area. Such 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. The action alternatives are very similar in their amount of such burning (Table 32), so no real differences in effects can be expected among them.

The fuel treatments that apply fire to concentrated slash piles (grapple 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 hand piles cover only 3% of the treatment area at most, and none within 100 feet of stream channels would be ignited.

Standard and guideline FM-4 would be met with the action alternatives since the prescribed burning in riparian reserves would lower activity fuels to reasonable levels and create gaps over time as girdled off-site pine dies. These activities are necessary in order to contribute to meeting the desired riparian forest conditions of improved species and structural diversity.

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. Of the estimated 5,750 acres of riparian reserve in the planning area, only 3% of the network would be thinned under the action alternatives and only 0.3% of the reserve network would be underburned or jackpot burned under the various action alternatives. Moreover, the 50+ foot stream protection buffer on all perennial streams and 25 foot buffers on the intermittent streams, would help moderate these effects providing a cooler, dense forest paralleling all the channels.

Equipment would not be allowed within riparian reserves. Thinning of riparian reserves would be done either by skyline harvest or by yarding logs from equipment placed outside the reserve. No ground-based yarding would be done across stream channels. Using these low-impact methods, would minimize the logging impact to short-term, localized soil and vegetation disturbance from the yarded logs. Overall, Alternative 3 would result in slightly less impact in riparian reserves than Alternatives 2 and 4 because it would implement five fewer acres of ground-based logging.

Mitigation measures to minimize impacts from ground based logging throughout the entire treatment areas include limiting the density of skid trails, excluding equipment from riparian reserves, 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.

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.

Finally, the activity fuels that would not be treated at all (Table 32) would result in a short-term risk of partial stand replacement fire in the riparian reserves under the action alternatives. Since the thinning prescription within the riparian reserves leaves 100 to 140 trees per acre, untreated fuels would probably be light in most cases. The added activity fuel under the action alternatives would increase the fire hazard in portions of the planning area for a period of about 5 to 10 years, with hazard levels eventually returning to pre-treatment levels as the smaller-sized fuel (less than 3 inches in diameter) decays and loses its tendency to spread fire. If a fire were to get started during the 5 to 10-year period following completion of the action alternatives, then more risk of fire impacts to riparian reserves can be expected. Fuels treatments within the activity units are

generally planned to create short fuelbreaks along roads, increasing the chance of controlling a fire before it spreads over the landscape. As such, the risk of stand-replacement fire in thinned riparian reserves lacking fuel treatments is expected to be short-term and relatively low.

If areas of riparian tree mortality were to occur as a result of a wildfire during the increased period of risk from untreated activity fuel, then stream temperature increases, increased surface erosion, and increased wood recruitment to the riparian forest floor and to streams may occur. The extent of these potential direct effects are expected to be low since untreated fuel in riparian reserves ranges from only 107 to 91acres in the action alternatives (Table 32). Alternative 1 would not affect short-term hazard levels since no activity fuel would be generated.

In summary, some direct adverse effects to riparian forest conditions can be expected to occur under each action alternative. The magnitude of these effects at the site-scale in relation to the planning area and the broader 5th and 6th field watersheds 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 Curtis harvest units over the long-term (continue for more than two decades), or that would occur beyond the immediate Curtis treatment areas.

No new temporary or permanent roads would be built within riparian reserves and there would be no net increase or decrease of roads within the riparian reserves under any Curtis alternatives.

Thinning under the action alternatives would lower snag and down wood recruitment rates in the short term 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 because suppression mortality typically kills smaller, suppressed trees rather than the larger dominate trees. The girdling of off-site pine in riparian reserves in seven units (3, 15, 25, 28, 38, 41, and 43) may create small snags that would offset this reduction in the short term, and decrease snag recruitment for a time after these snags fall, but before new growth produces useful snags. 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 girdled patch creation is not expected to result in riparian species population declines. The large wood recruitment loss to perennial stream channels would be largely mitigated by the 50-60 foot stream protection 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). This amount is inconsequential in the context of the riparian reserve network of the Curtis Project Area.

The action alternatives would result in long-term beneficial effects to riparian forest structure and composition with the development of more late-successional 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 girdled pine patches and slowly resulting canopy gaps would approximate a moderate severity fire, the process that historically created gaps and triggered the initiation of understory layers (Zenner 2005). 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 dependent species that rely on late-successional forest conditions. The magnitude of these beneficial effects from the action alternatives are slight since only 3% 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.

Perhaps the most profound indirect effect to riparian reserve forest conditions under the Curtis alternatives, are the effects to fire behavior that operate over several decades at both the stand and broader landscape scale. Dense homogenous forests have dramatically altered how wildfires burn today compared to how they burned historically under more open and heterogeneous forest structures. The homogenous forest structures that proliferate today exert increased potential for crown fires (Powell et al. 2001; Peterson et al. 2004). The Jackson Creek WA determined that the average fire return interval for the north side of Jackson Creek, prior to the era of fire exclusion, ranged between 11 and 41 years for upslope forests and slightly longer for riparian areas. The Buckeye-Zinc WA suggests a more variable fire interval based on aspect and slope, but frequent, low-severity fires seemed to be common, with high-severity stand replacing fires occurring infrequently. The exclusion of fire over the last several decades in the Curtis area has exacerbated the dense, homogenous conditions in forest stands, and has allowed the buildup of fuels that could result in unprecedented fire intensities and higher fire severity compared to historical conditions.

The combined effects of the thinning with treatment of activity fuels under the action alternatives would help modify fire behavior to reduce the likelihood that future wildfires might result in severe fire effects within the treatment areas and beyond. In particular, such beneficial effects can carry over to larger areas, especially where treatment areas are clumped, such as in the Zinc Creek and Deep Cut Creek drainages. This is because treatments applied on a substantial scale, as proposed under the action alternatives, can modify the spatial pattern of fuels over a landscape area that can modify wildfire behavior (Peterson et al. 2004). This means that nearby untreated forests and their riparian areas can potentially benefit from adjacent treatments where fuels have been reduced and canopy base heights increased. As a result, wildfire in the area would burn at a lower intensity, spreading slower, which locally delays the forward progress of a fire and creates variability in the intensity of a wildfire as it moves across the landscape (Peterson et al. 2004). Thus, the action alternatives would likely result in reduced fire intensities (in terms of heat generated and rate of spread), increased ability to fight future fires, and reduced fire severity (in terms of the fire effects on killing trees).

At the scale of the Middle South Umpqua and Jackson Creek Watersheds riparian reserve network which covers about 48,235 acres, all the above indirect effects to riparian reserves would be very limited in extent and magnitude such that they would be substantially diluted at the larger scale of these 5th Field Watersheds. The possible exception to this conclusion might be the beneficial effect of lower chances of stand replacement fire. Such an effect may be realized at the watershed scale if fire behavior is modified by the treatment of fuels along roads and the clumped thinning treatments in the vicinity of Zinc and Deep Cut Creeks and Collins Ridge.

STREAM CHANNELS

During scoping, two conservation groups were concerned that building new temporary spur roads and using existing unclassified roads could cause numerous environmental impacts including impacts to streams. The impacts to streams from the various forms of road construction and road work are disclosed in this section.

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.

Existing Condition and Desired Condition

Most streams in the Middle South Umpqua and Jackson Creek watersheds and in the Curtis 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 and impacts from roads (USDA 1995; USDA1996).

Some of the proposed Curtis thinning units are adjacent to fish bearing streams where instream wood was previously removed, including Zinc Creek and Deep Cut Creek. The proposed thinning units adjacent to both these Creeks were clearcut down to the creek's edge or very near it.

Stream surveys in 1992 reported only 19 pieces of large wood per mile of Zinc Creek. Similarly, instream wood was scarce in Deep Cut Creek with 16 pieces per mile reported. Scoured bedrock riffles were common and pools were shallow and widely spaced. These general conditions persist today.

Large wood is an important feature of a healthy aquatic ecosystem; an indicator of aquatic habitat complexity and resilience. The mean density of large wood in reference streams on the Umpqua National Forest is 55 pieces per mile. Because winter flows are so high in these watersheds, three of the most severely compromised wood-related functions are over-wintering habitat for aquatic fauna, organic matter and nutrient retention for aquatic insect communities, and gravel retention for pool formation and fish spawning.

Desired conditions for stream channels in the planning area include: 1) decreased risk of road-related stream diversion and stream crossing failure, in keeping with ACS Objective 5 that addresses the sediment regime; 2) improved habitat connectivity for upstream movement of aquatic organisms in keeping with ACS Objective 3 that addresses connectivity within watersheds; and 3) improved levels of large instream wood in keeping with ACS Objective 2 that addresses stream bed and bank conditions.

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.

Transportation Plan

A transportation report was prepared for the Curtis Density Management Project to determine the most efficient and environmentally sound methods to address and remove timber from proposed harvest units while maintaining water quality and soil productivity. The report followed requirements of the Umpqua National Forest Plan (USDA 1990), the Northwest Forest Plan (1994), the Jackson Creek and Buckeye-Zinc Watershed Analyses (USDA 1995; USDA 1996), and the Umpqua Forest-level Roads Analysis (USDA 2003). Approximately 66 miles of system roads would be maintained for haul for the Curtis Project (Project File – Transportation). Road improvements to these haul routes would occur to varying degrees. This includes unclassified roads that would be opened and reconstructed for sale use, then subsoiled afterwards (2.5 miles for Alternatives 2 and 4 and 2.2 miles for Alternative 3). Another 0.6 miles of new temporary road would be constructed for the project, then subsoiled afterwards, and 0.6 miles of system road would be reconstructed to improve drainage and safety along haul routes. Another 1.2 miles of currently closed system road would be opened for use during project operations, then closed upon completion.

Proposed Road Treatments in Stream Channels

Under the action alternatives, all system roads proposed for haul would be maintained to achieve safe haul conditions. This includes dust abatement, clearing encroaching vegetation, grading and shaping road surface, constructing and improving waterbars and armored dips, and ditch maintenance. Two humboldt crossings would be replaced by armored draw crossings. Three damaged existing culverts would be replaced under Alternatives 2 and 4; only one would be replaced under Alternative 3.

None of the new temporary roads under the actions alternatives would cross any streams. One existing unclassified road (unit 42) crosses a small interrupted, intermittent channel. This road would be cleared of brush, but no excavation is needed for use. The use of Best Management Practices and project design for the reconstruction, use, and subsoiling of roads, including timing of log haul and erosion control measures, would minimize effects at the immediate work site and downstream through the first winter season. Each action alternative would cause instream work-induced turbid water with potential sediment bearing nutrient release. This direct effect would be short-term, only occur during winter flow, and would be 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. However, these effects would not be expected as mitigation measures (e.g., erosion control) become effective over time (by the second season).

In addition to the above reconstruction done with the timber sale contract, the action alternatives may implement several connected actions at stream crossings (Table 30 and Table 33). This work is beyond routine timber sale reconstruction, and is intended to improve hydrologic connectivity of one small intermittent stream, and drainage

connectivity of another, both of which were disconnected during roadbuilding in the 1950's. Six sumps also would be improved.

Several mitigation measures are included as part of this instream road work in perennial channels to lower or minimize the risk of water contamination and turbidity when equipment and workers are working in and near these streams (see Road Construction and Reconstruction mitigation measures, Chapter 2).

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 in-channel and bank disturbances associated with road reconstruction, obliteration, and various instream restoration projects.

The direct effects to stream channels from instream road work would be increased sediment input associated with implementing the work and with bare soil exposure throughout the area of the stream crossing work. Channel banks and beds also would be 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. No armored crossings or culvert work sites are on fish-bearing streams so there is no potential to harm fish related to that work.

The amount of sedimentation potentially delivered with each instream construction site is low, with all sites together estimated to deliver 3 cubic yards per year for 2 years. This amount 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, erosion control measures and restrictions on the timing of work would effectively lower both the extent and duration of the work-site sedimentation (see Road Construction and Reconstruction mitigation measures, Chapter 2).

The work at armored crossings plus the subsequent haul across these small channels and the channel crossed in unit 42 would result in new disruption of this previously impacted, but healed sites. These rocked crossings would occur on a small, intermittent, interrupted stream, where rock may be added to allow trucks to cross the small channel without bogging down. The placement of rock to prepare them for truck traffic would result in sedimentation once winter rains begin in the intermittent channels.

Short-term impacts to aquatic species and habitat are expected where fire sumps are located within stream channels. Only one of the sumps is located in a fish-bearing stream. This sump is in Zinc Creek, an anadromous fish bearing stream, near units 2, 3, and 48. No instream work would be done at this sump; only gravelling of the approach. At the other sump sites, other aquatic organisms could be adversely affected by the activity in the channels. This direct impact would be small in extent and scattered in nature.

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 small long-term beneficial effects to stream channel connectivity and long-term sediment reduction as a result of work done to improved stream crossings compared to Alternative 1, where no such work would occur.

Alternatives 2, 3, and 4 would result in improved stream connectivity at one site where a small intermittent stream would be reconnected, thereby improving movement of organisms up and downstream and/or improving flow of water and sediment compared to Alternative 1, where no work would occur. At another site, under Alternatives 2 and 4, the addition of a culvert would keep water in its proper drainage; a ditch currently carries the water to a different drainage where it is badly downcutting the receiving gully. The culvert replacements would decrease the risk of culvert failure due to damaged and/or deteriorated culverts.

In sum, adverse effects associated with the action alternatives are generally out-weighed by the longer-term beneficial effects (Table 34). That is, the accelerated attainment of desired riparian forest conditions through thinning and the improvement of stream connectivity 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 34. Summary of riparian reserve actions and effects.

Riparian Actions	Riparian/ Stream Change	Primary Effect	Duration	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Commercial thinning	Lower tree density and less crown closure	Beneficial—improved species and structural diversity/late successional characteristics, lower risk of severe fire effects	30 years	0	135 ac	122 ac	135 ac
		Adverse—dryer microclimate, less litter to forest floor	10-20 years				
	Change in snag and down wood recruitment process	Adverse—loss of suppression mortality in smaller-sized trees	30 years				
		Beneficial—accelerated growth of leave trees for future recruitment of larger snags	Up to 60 years				
Commercial thinning with canopy gaps (girdled off-site pine)	Lower tree density and less crown closure	Beneficial—improved species and structural diversity/late successional characteristics, lower risk of severe fire effects	30 years	0	34 ac	26 ac	34 ac
		Adverse—dryer microclimate, less litter to forest floor	10-20 years				

Riparian Actions	Riparian/ Stream Change	Primary Effect	Duration	Alt. 1	Alt. 2	Alt. 3	Alt. 4
	Change in snag and down wood recruitment process	Adverse—loss of suppression mortality in smaller-sized trees Beneficial — creation of small diameter snag patches; accelerated growth of leave trees for future recruitment of larger snags	30 years Up to 60 years				
Pre-commercial Thinning	Lower tree density	Beneficial — moves stands to more fire resilient conditions; speeds large wood recruitment	15 years	0	130 ac	100 ac	130 ac
Timber sale road actions	Subsoiling of existing non-system roads/landings, new temp roads.	Beneficial — decreased soil compaction	In perpetuity	0	66 ac	63 ac	66 ac
	Add or Reconstruct existing stream fords	Adverse — small scale modifications to stream channels Beneficial – small long term sediment reduction; improved flow	20+ years	0	4 fords	4 fords	4 fords
	Replace culverts on system roads	Adverse — increased short-term sedimentation Beneficial — reduced risk of culvert failure	1-2 years 30-40 years	0 0	3 CY 3 crossings/ ditch relief	2 CY 1 crossings/ ditch relief	3 CY 3 crossings/ ditch relief
Creation and treatment of activity fuel	Activity fuel created, not treated	Adverse — increased hazard and stand replacement fire	5-10 years	0	107 ac	91 ac	107 ac
	Jackpot and underburning	Beneficial— reintroduction of excluded process	20 years	0	16 ac	16ac	16ac
	Equipment or handpiling of slash	Adverse— soil disturbance, loss of site productivity, risk of weed infestations	5-20 years	0	63 ac	57 ac	63 ac

Riparian Actions	Riparian/ Stream Change	Primary Effect	Duration	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Connected Actions	Culvert additions	Adverse — small scale modifications to stream channels; small short term sediment increase Beneficial – small long term sediment reduction; hydrologic reconnection	5 years 20+ years	0	2 crossings/ ditch relief	1 crossings	2 crossings/ ditch relief
	Sump improvement	Adverse— small scale modifications to stream channels; small short term sediment increase Beneficial – small long term sediment reduction	5 years 20+ years	0	6 sumps	6 sumps	6 sumps

Cumulative Effects to Streams Channels and Riparian Forest Condition

The potential of the Curtis 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 (as detailed above), 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 direct and indirect effects of the action alternatives to riparian forest conditions discussed above (such as microclimate changes, lower litter input to forest floor, lower snag and down wood recruitment levels) could overlap with commercial thinning treatments in approximately 1,500 acres in the area covered by the Buckeye/Zinc and Jackson Creek Watershed Analysis Areas within the next five years. Most thinning would occur in the transient snow zone. As such, when the direct effects of the Curtis action alternatives are added to the riparian impacts from the overlapping future riparian treatments, both short and long-term cumulative effects can be expected

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 (1,679 acres) because these acres are not yet producing a full complement of snag and down wood habitats. The added impacts from the Curtis 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.

In contrast to the short-term cumulative effects detailed above, the long term beneficial effects of thinning under the Curtis action alternatives could combine with the beneficial effects of riparian thinning within the vicinity of Coyote Creek. Together these thinning

projects would lower the risk of stand replacement fire in this area and incrementally improve riparian conditions in the Curtis planning area.

Substantial impacts to streams and riparian forests have resulted from past road building and timber harvest in the Curtis planning area. The existing 30 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.

The direct stream channel effects disclosed above from the instream work at stream crossings would incrementally add to other recent and foreseeable instream activities in the planning area.

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, and subsoiling of abandoned roads would all incrementally add to the present and pending restorative work described above to result in beneficial cumulative effects to both riparian forest conditions and stream channels.

In general, since the beneficial cumulative effects of the Curtis 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.

Alternative 1 has the potential for a future wildfire to result in more intense fire behavior with more severe fire effects. The numerous stem exclusion stands that have developed following clearcutting are susceptible to rapidly spreading fire and for proliferation of crown fires. Under Alternative 1 no cumulative effects are expected since no activities would occur to result in any potential additive 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 proposed thinning and fuels treatments in the reserves under the action alternatives 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, 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 stream/drainage reconnection are 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 (improvement of existing stream fords and construction of armored crossdrain to replace Humboldt crossing) 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.

Chemical Contamination

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 (Mg2+, 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 1997b). 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 (Bolander and Yamada 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 roads along the haul route as needed. 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 occur generally 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 (Bolander and Yamada 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.

Magnesium 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 Curtis planning area, effects from these compounds on 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 and would be required to develop spill prevention plans if substantial amounts of fuel or other pollutants are stored in sale areas. Traffic control measures also 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), serve 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 en-route 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 also has 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), city and town development, and use by people (sewage, in addition to the aforementioned 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 local human population. Therefore, the cumulative effects of all the additive forms and sources of water contamination would be most likely realized in the lower areas of the Umpqua River basin.

The chances of any of the Curtis action alternatives resulting in any cumulative effects to water contamination hinges on whether a substantial spill of petroleum or dust abatement products occurs. A cumulative effect could be realized if a spill should occur and clean-up measures fail. This is particularly true the further downstream an accidental spill occurs.

None of the Curtis 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 unless an accidental spill were to occur within a waterway. 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 for all 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 and Desired Conditions

The Middle South Umpqua and Jackson Creek was designated as a Tier 1 key watershed in the Northwest Forest Plan because it is an area critical for maintaining and recovering habitat for “at-risk” stocks of anadromous and resident fish species and aquatic invertebrates. The Watershed Analyses provide background information on these areas and are incorporated by reference. Within the project area there are approximately 30 miles of Oregon Coastal coho salmon habitat, 27 miles of spring chinook habitat and 34 miles of steelhead habitat (Figure 16). A summary of fish habitat within each stream is shown in Table 35.

Table 35. Miles of anadromous fish habitat within the project area.

Stream	OC coho salmon (mi.)	OC spring Chinook (mi.)	OC steelhead (mi.)	OC chum (mi.)
Mainstem South Umpqua	15.2	15.2	15.2	0
Mainstem Jackson Creek	11.9	11.9	11.9	0
Ralph Creek	1	0	2	0
Deep Cut Creek	0.2	0	0.2	0
Tallow Creek	1	0	1.6	0
Zinc Creek	0	0	3.1	0
Total	29.4	27.1	34	0

In addition to anadromous fish, the Umpqua Oregon Chub, a non-game fish species of concern, is found within the project area. Two aquatic invertebrate species of concern, the western ridged mussel and rotund lanx, also may be located within the project area. Potential habitat for the Umpqua chub and the aquatic invertebrates within the project area is shown in Table 36.

Table 36. Potential Umpqua chub and aquatic invertebrate habitat within the project area.

Stream	Umpqua Oregon chub	Western ridged mussel	Rotund lanx
	(miles)		
Mainstem South Umpqua	10	15.2	0
Mainstem Jackson Creek	0.5	11.9	0
Ralph Creek	0	0	2
Deep Cut Creek	0	0	1
Tallow Creek	0	0	1.6
Zinc Creek	0	0	3.1
Total	**10.5**	**27.1**	**7.7**

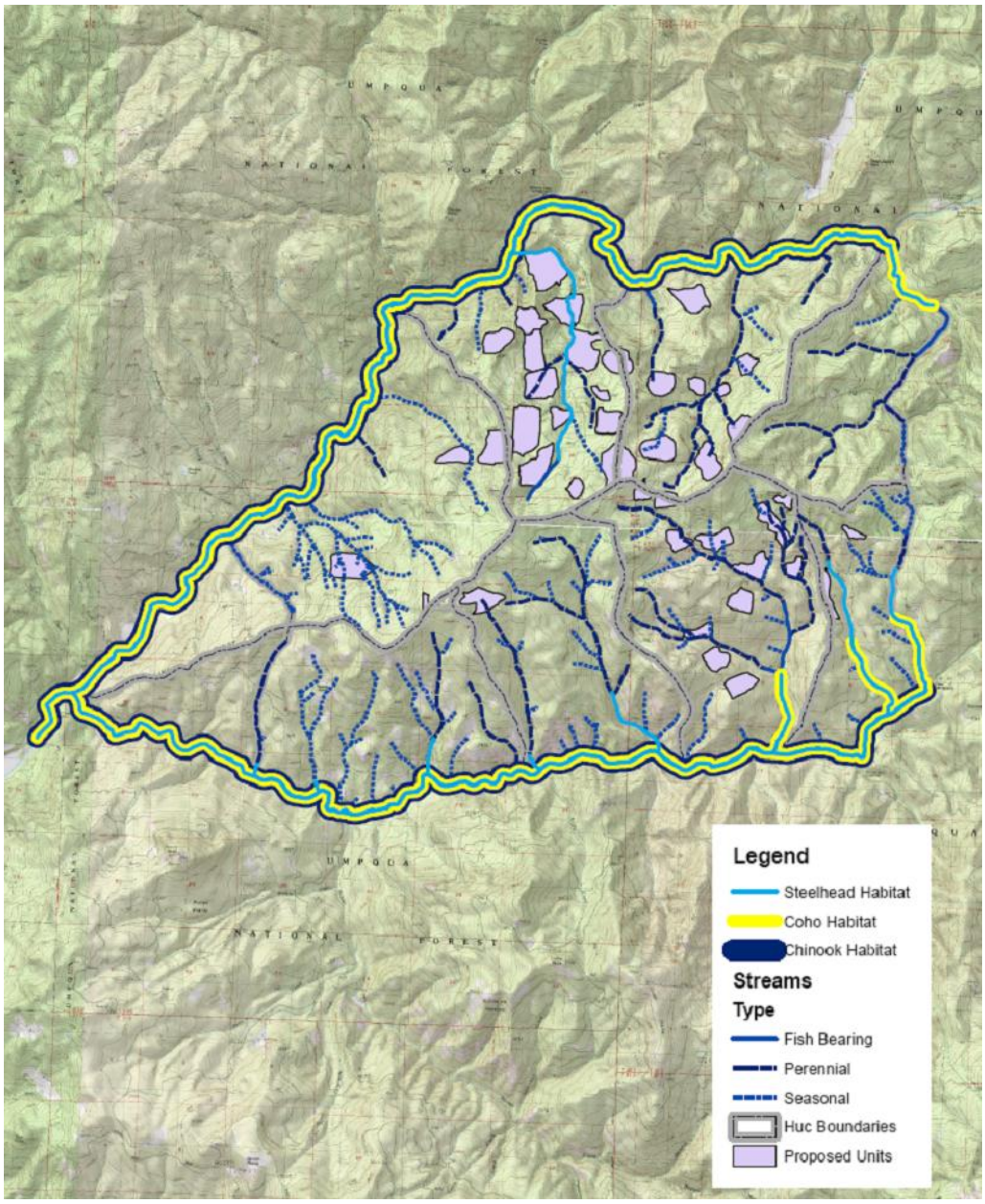

Figure 16. Salmon distribution within the Curtis Planning Area.

Aquatic Habitat

Middle South Umpqua

The Middle South Umpqua (MSU) 5th field is approximately 99,330 acres with the BLM administering 17%, USFS 71% and private lands accounting for 12%. Within the Forest Service Boundary, administrative land allocations include 31,368 acres of matrix and 44,461 aces of Late Successional Reserves (LSR). The entire South Umpqua basin on the Tiller Ranger District is classified as a Tier I Key Watershed under the Northwest Forest Plan. The MSU is included in this designation and is intended to provide high quality habitat to serve as refugia for the possible recovery of depressed fish stocks.

Tributaries to the MSU support a diverse assemblage of fish species including Coastal cutthroat trout, Oregon Coast coho salmon, spring chinook salmon, and winter steelhead.

Currently the most important subwatersheds in the MSU 5th field for anadromous salmonids are Dumont and Boulder Creeks. Roper (1995) identified Dumont Creek as a tributary with high species diversity and productivity. All anadromous salmonid species within the South Umpqua River basin inhabit Dumont Creek at some time during their life cycle and Dumont is considered a refuge for coho. A substantial proportion (near 100%) of the total smolt production in the Upper South Umpqua basin may come from Dumont. Boulder Creek contained the highest density of young chinook in the MSU, but the variability was very high.

Aquatic habitat has changed from historic conditions within the river and tributaries of the MSU. Aquatic conditions reflect the influences of private forest lands and National Forest Management. Stream habitat has been degraded as a result of timber harvest and road building within the basin. Land ownership patterns, road building, timber harvest, stream cleanout, and landslide/debris torrents have negatively affected aquatic ecosystems in this 5th field.

Zinc Creek

Aquatic habitat indicators considered to be “at risk” in Zinc Creek include water temperature (MWAT 63°F), sediment/turbidity, water chemistry, pools and refugia, while those indicators considered “not properly functioning” are substrate, large wood, off-channel habitat, width/depth ratio, streambank condition, floodplain, peak flows, drainage network, roads, disturbance, and riparian reserves. Zinc Creek is slowly recovering from intense timber harvest (clear cuts) which occurred within this watershed in the 1950s. Almost the entire Zinc Creek watershed is located within the transient snow zone (2000’ to 5000’). Drainage density increases of 213% occurred during this era of harvest, through 16 miles of road construction. The combination of intense harvest activities and increased drainage densities, coupled with rain on snow events, has resulted in increased peakflows, and led to substantial down-cutting of the stream channel. This process has created numerous unstable streambanks along the channel and has resulted in poor substrate conditions. The riparian reserves are devoid of large trees and are composed mainly of alder immediately adjacent to the stream channel and a monoculture of Douglas-fir ranging in size from 6” to 18” dbh within the riparian reserves. The drainage is comprised of 28% earthflow terrain and 11% steep sideslope, yet during a peakflow event in November of 2007, a field check of the stream channel revealed very low turbidity values, indicating that the watershed is recovering.

Jackson Creek

Jackson Creek watershed is approximately 102,307 acres in drainage size. The Umpqua National Forest owns 94% of the watershed and private land comprises 6%. Jackson Creek and many of its tributaries exhibit large changes from historic conditions with respect to levels of large woody debris (LWD), flow regime, riparian vegetation, fine sediment levels, streambank stability, low flow channel widths, water temperatures, velocity refuge, habitat connectivity and substrate particle size distribution (Dose and Roper 1994; USDA 1995; Roper 1995). These habitat parameters have been degraded as a result of land management activities and are likely responsible for the poor egg-smolt survival rates documented for chinook salmon in Jackson Creek (USDA 1995).

Some of these same parameters are likely to have had negative effects on the survival of juvenile coho, steelhead and other native fishes in Jackson Creek and its tributaries. The primary causes of coho salmon declines appear to be low spawning escapement, lack of juvenile rearing habitat complexity, and high summer water temperature (USDA 1995). Most of the aquatic components described as not properly functioning or at risk affect the recruitment of salmonids by influencing spawning habitat, juvenile rearing habitat, or adult holding habitat (pool filling in the low gradient earthflow tributaries).

The most important subwatersheds in the Jackson 5th field for anadromous salmonids are Beaver, Lower and Upper Jackson Facials, Squaw and Falcon Creeks. These areas are important because they provide unique aquatic attributes to Jackson Creek, including high aquatic diversity, important refuge for one or more anadromous species, good water quality, and/or largely intact riparian reserves and habitat.

The Jackson Creek watershed was first entered for commercial timber harvest in the late 1940's. Harvest in the 1950's to 1960's were first focused on the most accessible areas along riparian and in earthflow terrain. However, it was not until the 1960's that extensive road construction began to access most of the watershed. As a result timber harvest increased substantially for twenty years and heavily impacted portions of the watershed.

Private lands in the Jackson Creek 5th field occur in the Beaver (lower Beaver), Upper Jackson Facial (Luck Creek) and Lower Jackson Facial (Chapman, Nichols, Mule, and Bullock Creeks) subwatersheds. Private lands in these areas have higher road densities, higher amounts of regeneration and riparian harvest, less hydrologic recovery and greater impacts in the stream channel compared to Forest Service managed lands in the Jackson Creek fifth field. Private lands and roads in the Beaver and Lower Jackson Facial subwatersheds are likely to remain chronic sediment sources over time due to continued management practices. This degraded baseline condition and continued private land management activities would pose challenges to improving watershed health and recovering fish stocks in the lower portion of this 5th field watershed.

Deep Cut Creek

Deep Cut Creek is one of three streams within the project area with known coho habitat and usage. This stream can be characterized as spawning and rearing habitat approximately 1.6 miles in length. A single coho salmon was observed approximately 1 mile upstream of the confluence with Jackson Creek in the winter of 2005 while juvenile coho were observed the summer of 2006. In 2005 and 2006, approximately 75 pieces of large wood were placed within the stream channel as part of an instream restoration project within the Jackson Creek watershed. A portion of Deep Cut Creek above the 2980-010 spur resembles Zinc Creek, with large areas of intense timber harvest in the 1950's and monocultures of Douglas-fir. One old regeneration harvest occurs adjacent to the channel immediately downstream of the road. The remaining stream channel between the 010 spur and Forest Road 29 is flanked by old growth and an intact riparian community. This section contains the lower 1.6 miles of known coho salmon usage.

The aquatic habitat indicators in Deep Cut Creek considered "at risk" are temperature (due primarily to conditions above the -010 spur road), water chemistry, turbidity, large wood, pools, off-channel habitat, refugia, streambank condition, connectivity, and riparian reserves. Habitat indicators considered to be "not properly functioning" include

physical barriers (culvert on 2980-010 spur), substrate, width/depth ratio, peakflow, drainage network, and disturbance history. Road densities are 4.6 miles per square mile within the watershed and 3.5 miles per square mile within riparian reserves. Width/depth ratio, pools, substrate, floodplain connectivity, water temperature, and off-channel habitat are expected to improve as Deep Cut Creek responds to the placement of large wood in the stream channel. The large wood indicator is presently considered "at risk" because flows sufficient to engage the large wood placed in the channel and allow the trapping and storage of sediment have not occurred.

Ralph Creek

Ralph Creek is another stream within the project area with known coho habitat and usage, including spawning and rearing habitat approximately one mile in length. The overall watershed condition is considered to be "not properly functioning". Extensive timber harvest and road building have occurred, with 56% of the watershed having been regeneration harvested and 21% partially cut. Regeneration harvests have occurred on 77% of the riparian reserves, with 0% remaining in a late seral stage. Road densities are 5.3 miles per square mile within that portion of the Tallow 6th field subwatershed in the project area and the riparian reserves contain 4.4 miles of road per square mile.

The aquatic habitat indicators in Ralph Creek considered "at risk" include temperature, turbidity, water chemistry, and width/depth ratio, while all other indicators are considered to be "not properly functioning".

Tallow Creek

Tallow Creek is the final stream within the project area with known coho habitat and usage, with approximately one mile of spawning and rearing habitat. The overall watershed condition is considered to be "not properly functioning". Approximately 41% of the watershed has been regeneration harvested and 23% has been partial cut. Regeneration harvests have occurred in 32% of the riparian reserves and 38% are in a late seral stage. Road density is 5.3 miles per square mile within that portion of the Tallow 6th field subwatershed and the riparian reserves contain 4.4 miles of road per square mile.

The aquatic habitat indicators for Tallow Creek considered "at risk" include temperature, turbidity, water chemistry, pools and refugia, while the remaining indicators are considered to be "not properly functioning".

AQUATIC BIOLOGICAL EVALUATION AND ESSENTIAL FISH HABITAT

Currently, one fish species is listed as threatened under the Endangered Species Act, and four fish species[53], one bivalve and one aquatic gastropod are listed as sensitive by the USDA Forest Service Region 6 Regional Forester in December of 2007 for the Umpqua National Forest:

1) Oregon Coast (OC) coho salmon (*Oncorhynchus kisutch*) — Proposed Threatened
ODFW estimates that there are 340 miles of coho habitat in the South Umpqua basin. Most South Umpqua coho spawn and rear in the Cow Creek subbasin or in lower South Umpqua tributaries, which are downstream from the Forest. Important coho streams on the district include Dumont, Deadman, Elk, Jackson, and Beaver Creeks. Of these locations, Beaver and Dumont Creeks have had the highest numbers of coho spawners observed (15-30 spawners per mile) since the mid 1980s, followed by Joe Hall and Francis Creeks. Along the South Umpqua and Jackson Creek mainstems within the project area, the predominant use of stream habitat for adults and outmigrating smolts is as migration corridors. Limited coho spawning has been observed in the lower Jackson Creek. Spawning habitat for coho salmon is primarily found in lower Deep Cut Creek, Tallow Creek, and Ralph Creek (Figure 16).

2) Oregon Coast (OC) Steelhead (*O. mykiss*) — Sensitive
Steelhead habitat is fairly ubiquitous throughout the project area and totals 34 miles (Figure 16). Most of the streams within the project area are utilized for spawning and rearing, including Deep Cut, Ralph, Tallow and Zinc Creeks, while mainstem of South Umpqua and Jackson Creek are primarily for migration and rearing.

3) Southern Oregon/Northern California Coasts (SONCC) spring chinook — Sensitive
Spring chinook adults return in late spring and spend the summer in the deep pools of the mainstem of the South Umpqua River and Jackson Creek (Figure 16). They spawn in the low to moderate gradient reaches and utilize larger spawning substrate than the other salmonids. Spring chinook habitat found within the project area is primarily for migration, holding and rearing. Sporadic spring chinook spawning has been observed in the vicinity of Deep Cut Creek in past years.

4) Umpqua Oregon chub (*Oregonichthys kalawatseti*) — Sensitive
The Umpqua Oregon chub is endemic to the Umpqua basin (mainstem Umpqua, South Umpqua, and to a lesser extent North Umpqua river systems). The chub primarily utilizes habitat with moderate to slow flowing water (runs and channel margins). Spawning occurs in May to June on rocky substrate. Observations in aquaria reveal they are a bottom-oriented fish, which surface to grab prey items, then return to the bottom (Markle et al. 1991). Simon and Markle (1999) found that Umpqua Oregon chub were being replaced by smallmouth bass in the Umpqua basin. The precise cause was unknown, but the authors surmised that direct predation or competition on chub by smallmouth bass was a factor (Loomis n.d.). Displacement by smallmouth bass was thought to restrict chub certain sections of mainstem river habitat to lower order tributaries resulting in a fragmented population. A 2007 Umpqua chub survey revealed that approximately 90% of the population above Tiller was located within the reach between the South Umpqua/Jackson Creek confluence and 3C Rock. This reach is located approximately 1 mile downstream from the project area.

[53] The Pacific Coast Chum salmon is a sensitive species that is found about 180 miles downstream from the project area and will not be discussed further. No impact to this species would occur.

5) Western ridged mussel (*Gonidea angulata*) — Sensitive
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. Freshwater mussels are confined to permanent water bodies, including creeks, rivers, ponds, and lakes. They are often absent or sparse in high-gradient, rocky rivers where the erosive forces of rocks and water may be too strong for juveniles to become established. Creeks and rivers usually support the greatest diversity of mussels, perhaps because they provide a variety of habitat conditions, reliable flow, good water quality, and diverse fish communities. Although considered fairly sedentary, adult mussels may move in response to abnormal or transient ecological events. A 2006 mussel survey of the South Umpqua found a single specimen 5 miles upriver from Tiller, well below the project area (Duncan 2006).

6) Rotund Lanx (*Lanx subrotunda*) — Sensitive
The rotund lanx is a small freshwater limpet (length 10-20 mm). 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. The lanx is not found in pools or slow water locations with sediment or silt deposition, or in sites that are exposed during low water conditions. A 2006 aquatic mollusk survey found this species in the mainstem North Umpqua, but not in the South Umpqua (Duncan 2006). This species would most likely be found in Zinc Creek, Deep Cut Creek, Ralph Creek, and Tallow Creek within the project area.

Direct and Indirect Effects to Aquatic Species
Direct effects to aquatic species are those that would occur in the short-term and in the immediate vicinity of treatment activities. Indirect effects would occur downstream from activities or over longer periods of time.

Direct effects to aquatic species are not anticipated as nearly all of the proposed treatment activities are a minimum of 25’ from ephemeral streams and 50’ from perennial and fish-bearing streams. The only exception is the wet weather haul over the Zinc Creek Bridge which crosses the mainstem of the South Umpqua River. The potential for sediment delivery from surface erosion and wet season haul to directly affect any of the aquatic species in the South Umpqua River in the immediate vicinity of the Zinc Creek Bridge site, has been analyzed and determined to be negligible at the site scale. Instream road work under the action alternatives includes the maintenance of sumps, culvert replacements, culvert installations, and the improvement of drive-through rocked cross drains. An estimated three cubic yards of sediment may be delivered to the stream channel from all of the instream road work. The proposed sump maintenance consists of graveling a currently existing native surface road that accesses Zinc Creek. This action is anticipated to reduce sediment delivery to the stream channel. The proposed instream road work would occur during summer low or no-flow conditions, typically July 1 through September 15. All of the instream road work would occur on ephemeral streams and the resulting short-term pulse of turbidity would occur during the first major rainfall event resulting in water flowing through the stream channel. This would most likely occur prior to coho spawning when juvenile steelhead and coho would

able to move away from areas of localized turbidity. This minor amount of sediment is expected to be quickly transported and would not exert any long-term stress on individuals or populations of any aquatic species.

The amount of log haul under the action alternatives would differ slightly among the three action alternatives. Alternative 2 would have 40 additional loads of logs compared to Alternative 3 while Alternative 4 would have an additional 100 loads of logs compared to Alternative 3. Log haul could occur any time after July 15 and until March 1 under "dry conditions", as described under Control of Purchaser Operations in Chapter 2. Road maintenance prior to log haul would improve road drainage and limit stream extensions due to ditch lines, cleaning culverts, and adding ditch relief culverts where necessary. In addition, blading and reshaping roads, where necessary, would help disperse surface water runoff and would decrease water channeling and ponding on the road surface. Haul during fall or winter wet weather would occur only on gravel or paved roads and would not occur when precipitation events are imminent or excessive road deformity would occur during haul due to road moisture conditions. Haul would be suspended if surface run-off carrying sediment were reaching stream channels.

Haul during suitably dry conditions is predicted to deliver minor amounts of sediment to streams under all action alternatives. Since this would be widely dispersed, it would have little potential to result in any impacts to aquatic species or habitat. Mitigating effects of road maintenance and reconstruction prior to haul and enforcement of the BMPs (Chapter 2) would minimize the adverse effects to fish and essential fish habitat if wet weather haul occurs.

The connected and similar actions (Table 2) including tree planting, subsoiling, erosion control, snag and down wood creation, precommercial thinning and associated fuels treatment, fire sump maintenance, noxious weed treatments, girdling of off-site pine within riparian area, and felling of danger trees, are all very minor activities of limited extent and duration that would result in no impacts to fish or other aquatic life. As such, these connected actions would have no chance of resulting in immediate, direct, on-site effects to fish or fish habitats.

DIRECT AND INDIRECT EFFECTS

Alternative 1 would result in no direct effects to aquatic species since no activities would occur to impart any short-term direct effects. In contrast, over the long term, Alternative 1 has the potential to deliver substantially more sediment from surface erosion as a result of a wildfire compared to the action alternatives. Riparian Reserves under Alternative 1 would continue to progress towards the desired future conditions, but at a slower rate than under the action alternatives.

Although Alternative 1 would not have the in-stream work effects, there may be long-term indirect effects to aquatic species from erosion and nutrient releases at these crossings from chronic road drainage problems that would not be fixed. Over the long-term (by the second season), the action alternatives would correct chronic road drainage problems, thereby improving water quality.

Alternatives 2, 3, and 4 would not have a direct or indirect effect on stream temperature. The action alternatives would thin within riparian reserves, while retaining the effective shade in the primary stream shade zone along perennial streams. Road reconstruction under Alternatives 2, 3, and 4 would address on-going turbidity sources and associated nutrient input at existing stream crossings. The connected and similar actions common to Alternatives 2, 3, and 4 that would potentially have an influence on water quality

include the maintenance of six sumps, improvements to four rocked, drive-through cross drains, culvert replacements, placement of new culverts, and the construction of one armored crossing to replace a humboldt crossing. All action alternatives would result in the release of limited amounts of turbid water with potential sediment bearing nutrient release. This direct effect would be short-term 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). Beneficial uses of water and aquatic habitats would not be degraded by pH, DO, turbidity, or scoured stream channels caused by timber harvest, road construction, and related activities. Current hydrologic recovery would be maintained under the action alternatives, as well as current peak flows which should avoid adverse change to physical channel conditions and associated factors such as water quality and fish habitat.

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. 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.

In summary, there are no direct effects to aquatic species from all action alternatives. Indirect effects from the action alternatives are limited to a negligible increase in turbidity from culvert replacements, road-stream channel crossing improvements, and wet season haul. The enforcement of the BMPs and mitigation measures as described in Chapter 2 would minimize the effects to aquatic species and fish habitat to the point where there is no discernable difference between the three action alternatives. The magnitude of these effects at the site-scale and at the broader 5th and 6th field watersheds is inconsequential as both the extent and the duration of these impacts (as described above) are predicted to be negligible.

Cumulative Effects

The potential for the action alternatives to result in adverse cumulative effects to aquatic species and habitat is anticipated to be negligible. Currently, timber harvest on an unknown number of acres of privately owned lands within the Middle South Umpqua and Jackson Creek watersheds are in the planning and implementation stages. The effects to aquatic species and habitat from the action alternatives, added to those on private lands would be negligible because the project has been designed to minimize impacts aquatic habitat components such as stream temperature, peakflow and sedimentation.

Determination of Effects

Oregon Coast coho salmon: The project may affect, but is not likely to adversely affect (NLAA) Oregon Coast (OC) coho salmon (threatened), or will not adversely modify or destroy OC coho salmon critical habitat. This determination is based upon evaluating effects of the nine constituent project elements (tree falling; yarding; new temporary road and landing construction; road renovation, reconstruction, and maintenance; rock quarry operation; road decommissioning and closure; timber transport; fuels treatment and sump maintenance) connected actions on fifteen non-watershed habitat indicators

(Table 2) and four watershed habitat condition indicators following the Analytical Process[54]. The result of this analysis concluded that the nine project elements will have 1) neutral; 2) discountable positive and negative effects; and 3) insignificant positive and negative effects on OC coho salmon and their critical habitat.

The determination that action alternatives may affect individuals or habitat but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population for OC Steelhead, SONCC spring chinook, Umpqua Oregon Chub, Western ridged mussel, and Rotund Lanx is based in large part on the effects analysis conducted for OC coho salmon. Oregon Coast steelhead, OC spring chinook and Umpqua Chub use similar or the same habitats as OC coho salmon and in the case of steelhead and chinook have similar life histories. Typically steelhead have a larger range within a given watershed than coho salmon, and because the project has been designed to minimize potential sediment impacts and water temperature increases throughout the watershed, effects to this species are not anticipated but cannot be ruled out with 100% certainty. Oregon Coast spring chinook known spawning and rearing habitat occurs primarily above the project area and the negligible effects of the project to OC coho salmon would be similar for OC spring chinook. While little is known about the life history of the Umpqua Chub, it seems reasonable to assume that a species which has co-evolved with salmonids would have similar water quality and substrate requirements and that the effects of the project would be similar.

Western ridged mussel: May affect individuals or habitat but would likely not contribute to a trend towards federal listing of cause a loss of viability to the population. Given an insignificant increase in turbidity and no anticipated increases in stream temperature or peakflow, negative effects to the more sessile Western ridged mussel are not anticipated.

Rotund Lanx: May affect individuals or habitat but would likely not contribute to a trend towards federal listing or cause a loss of viability to the population. Given an insignificant increase in turbidity and no anticipated increases in stream temperature or peakflow, negative effects to the more sessile Rotund Lanx are not anticipated.

Essential Fish Habitat:
As discussed above throughout this aquatic section, the proposed project is unlikely to have downstream effects that would adversely affect any Essential Fish Habitat as defined under the Magnuson-Steven Fishery Conservation and Management Act (MSA) for salmon commercial fisheries.

Specifically Required and Other Disclosures

RECREATION

Recreation within the planning area can best be described as dispersed, with no developed recreational opportunities. The majority of the planning area where the thinning units are located is managed as Roaded Modified under the Recreation

[54] USFS Memorandum Dated November 5, 2004. Procedures for Endangered Species Act Consultation for Timber Sales Affecting Listed Salmonid Species within the Northwest Forest Plan Area.

Opportunity Spectrum. Dispersed sites along Jackson Creek corridor and the Cover Camp Old Growth Grove are managed as Roaded Natural. Primary activities in the planning area are driving for pleasure, hunting, and dispersed camping. No system trails are located in the planning area. All streams in the upper South Umpqua and Jackson Creek drainages are closed to angling.

Relevant Standards and Guidelines

The Forest Plan lists the following Standards and Guidelines:

- Developed Recreation Areas – There are no developed recreation sites in the planning area.
- Dispersed Roaded Recreation Areas – Two dispersed roaded recreation sites displayed in Chapter IV-15 of the Forest Plan occur in the riparian area along Jackson Creek: Arroyo and Black Canyon. There are no units near the dispersed sites and they would not be affected. The area would be managed to Forest Plan standards as no visual alterations to the sites would occur.

No other specific Standards and Guidelines apply to the planning area. All standards and guidelines for this area would continue to be met with this project.

Watershed Analysis Recommendations

The Jackson Creek Watershed Analysis (1995) made several recommendations related to future recreation planning needs. The Buckeye-Zinc Creek Watershed Analysis (1996) does not have any recommendations specific to recreation except to discourage recreation use in winter range areas from 12/1 to 4/30. None of the recommendations in either watershed analysis are pertinent to action alternatives in the Curtis planning area.

Direct and Indirect Effects

There would be no direct, indirect or cumulative effects under Alternative 1 as no actions would occur that would impact recreationists or recreational opportunities.

Direct effects to recreationists and recreational opportunities in these areas under both 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. For all other parts of the planning area, impacts to hunters, campers, and people driving for pleasure would include noise, traffic, access limitations during logging, and smoke from burning operations.

None of the connected or similar 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.

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.

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. Improvement in deer and elk forage may also be appealing to those who view wildlife and those who may hunt in the area. No effects would occur to any system trails, as there are no trails located in the planning area.

Cumulative Effects

The scale at which cumulative effects are analyzed is the planning area. The limited extent and duration of direct and indirect effects to recreationists under the action alternatives are not expected to contribute to any cumulative effect to people recreating in the area. There are no recent past or reasonably foreseeable similar activities in the planning area that would contribute to any cumulative effects.

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[55]) 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 Curtis, they include partial retention (moderate scenic integrity), modification (low scenic integrity) or maximum modification (very low scenic integrity). 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 37 describes the visual quality objectives found in the planning area.

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[55] 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.

Table 37. 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	0	0	0	0	0
Partial Retention	5,001	108	81	81	81
Modification	7,988	922	581	537	581
Maximum Modification	8,748	1,530	1,061	1,021	1,061
Totals	21,737	2,560	1,723	1,639	1,723

South Umpqua 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; only Unit 1 is close to this road. All other roads and routes seen from or adjacent to all other units 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 openings. 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. In all areas of partial retention (81 acres for Alternatives 2 and 4, 57 acres for Alternative 3), thinning prescriptions would retain enough trees such that the harvest activity would remain visually subordinate, as required by the above Forest Plan Standards and Guidelines. The small ¼ and ½ acre openings created where offsite pine is removed, along with the associated residual slash would not be substantially visible in the harvest units and would not degrade the visual quality in any of the 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. No other direct or indirect effects from any other actions or connected actions would occur with these alternatives.

None of the connected or similar 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 (11,170 acres in the planning area). Of those acres, about 2,756 acres were regeneration harvested after 1983; those harvest units would potentially still have a visual impact in the area as the trees may be less than 20 feet tall. Under the existing condition, there are 506 acres harvested after 1983 that are in partial retention; this is about 10 percent of the 5,001 acres of partial retention in the planning area and at the low end of the 10%-25% of the area allowed to be in openings. Most of these acres are likely to be visually covered.

For the modification VQO, there are currently 1,351 acres that were harvested after 1983 or 16.9% of the 7,988 acres; again, this is at the lower end of the 15%-30% allowed for openings. Finally, for maximum modification, there are 816 acres that were harvested after 1983, or 11% of the 8,748 acres of maximum modification ground, or well below the 33% allowed for 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 are commercial thinnings 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 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[56] 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[57]. Three primary pollutants produced by fire are

[56] Ambient air quality is defined under the Clean Air Act of 1963 as the air quality outside of industrial site boundaries.

[57] 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

particulate matter, carbon monoxide (CO) and carbon dioxide (CO_2). The closest population center or designated area is Medford is about 45 air miles to the south/southwest of the activity area and Roseburg, which is 30 air miles to the west/northwest. The closest Class I Airsheds (where there is an emphasis on the reduction of regional haze) are Rogue-Umpqua Divide Wilderness (15 air miles to the due west), and Crater Lake National Park (23 air miles due west).

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 burns in duff consumption and emission levels. An example would be to burn after a rain and a few days of drying. 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 (Ward and Hardy 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).

Direct and Indirect Effects

Particulate matter emissions were estimated for the Curtis Project using the Fire and Fuels Extension to the Forest Vegetation Simulator model (Reinhardt and Crookston 2003). Only the treatments that use fire would produce emissions, while none of the other treatments would directly impact air quality.

Three main emissions (PM 2.5, CO, CO_2) are compared in Tables 38 and 39, which display the differences between emissions from fuels treatments and emissions from wildfire. Table 38 shows that there are acres listed for Alternative 1 in order to analyze emissions produced as a result of a future wildfire.

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.

September 15 under the Oregon Visibility Protection Plan), fuel and duff moisture, diurnal wind shifts, ignition techniques and rapid mop-up.

Table 38. Total PM 2.5 Emissions in Tons by Alternative.

Fuels Treatment	Thinning and Burning Acres	Total PM2.5 Emissions (tons/acre)[58]	Total PM2.5 Emissions with Burned Activity Fuels[59]
Alternative 1	1,896[60]	1.16	2,199
Alternative 2	1,896	0.94	1,782
Alternative 3	1,561	0.94	1,467
Alternative 4	1,896	0.94	1,782

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 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. The impacts to recreationists 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. This source of particulate matter is not expected to create measurable or lasting emissions.

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[61] to firefighters. It is a chemical asphyxiate that interferes with oxygen transport in blood.

The production of carbon dioxide (CO_2) 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

[58] PM 2.5 emissions from a moist burning scenario were used for Alternatives 2-4 and emissions from a dry fuel condition were used for Alternative 1 (no action).
[59] Curtis activity fuels burned include those with the following fuel treatments: underburning, jackpot burning, machine pile and burning, burning of skyline and helicopter landings, and includes all handpiling and burning associated with all Curtis stands and the fire and fuel breaks, the tactical fire clearings and the Grandad Butte RAWS station maintenance.
[60] 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.
[61] 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).

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 CO_2 emissions is provided.

Direct and Indirect Effects

Under Alternative 1, no direct emissions of CO or CO_2 would occur, as no fuels treatment would take place. Table 39 shows that with no action, a wildfire burning under moderate to high severity conditions would generate more CO and CO_2 emissions, compared to fire that would burn under prescribed conditions under either of the action alternatives.

Table 39. CO and CO_2 Emissions in Tons by Alternative.

Alternative	Thinning and Burning Acres	Total CO Emissions (tons)	Total CO_2 Emissions (tons)
Alternative 1	1,896	28,629	152,059
Alternative 2	1,896	23,131	121,912
Alternative 3	1,561	19,512	101,777
Alternative 4	1,896	23,131	121,912

Considering the remoteness of the project area to any definable population centers, and the ability of firefighters to find 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 would occur from the Curtis fuel treatments.

Cumulative Effects

The analysis area encompasses the designated airsheds of Medford and Roseburg to the south and west respectively, and Crater Lake National Park to the southeast.

There are no past projects that when combined with any of the alternatives associated the Curtis 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.

The Drew Stewardship Project would treat activity fuel on 88 acres, which may overlap in time with the burning of Curtis activity fuel under the action alternatives. It is reasonable to expect fewer emissions from the Drew Stewardship Project. Burning conducted by other user groups or the public (i.e., firewood burning for heat at campsites or homes) may also occur at the same time that burning for the Curtis 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 Curtis Project would combine with other projects or other burning. Therefore, there would be no cumulative effects to air quality. Alternative 1 would have no 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.). These projects have the potential to affect archaeological and historic properties.

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 (as amended). The Curtis Timber Sale Project reconnaissance report has been completed and submitted to the State Historic Preservation Office (SHPO) as required. The Curtis cultural resources inventory and monitoring meets the criteria for Case-by Case Review required by the Programmatic Agreement 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 Curtis 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 has 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 Curtis 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 Curtis Timber Sale Project action alternatives. The no action alternative would have no direct, indirect or cumulative effect on any heritage resources.

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 34). The action alternatives would also reconstruct stream crossings and other road improvements (Table 30). 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.

Small wetlands are located within several of the harvest units in the action alternatives. The existing water table elevations in these wetlands would not be 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. Therefore, the action alternatives would be 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 Curtis 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.

RANGE

The Curtis Timber Sale overlaps the Collins Ridge Pasture of the Acker Divide Cattle and Horse Allotment. The decision to graze this pasture is addressed in the Record of Decision for the Drew Creek, Diamond Rock and Divide Cattle Allotments (2006). This decision established the 7,060-acre pasture on NFS lands and authorized grazing of 50 cow/calf pairs. The environmental analysis supporting the decision concluded that grazing could be accomplished in a manner that was consistent with the Umpqua National Forest LRMP Standards and Guidelines. Annual monitoring of grazing use has validated this.

Existing Conditions

The Acker Divide Allotment has been grazed since the 1960's, but the exclusive use of the Collins Ridge Pasture began in 2003. The pasture boundary encompasses a total of 10,760 acres, of which 3,700 acres are comprised of privately-owned timberlands and other small end-holdings. Approximately 6,100 acres of the pasture are contained within the proposed Curtis Timber Sale Planning Area.

The District range program relies on transitory range, where growth of early successional vegetation associated with openings, or units, created by timber harvest becomes available as forage for grazing. There are approximately 3,350 acres of transitory range in the Collins Ridge Pasture. In units harvested by clearcutting, transitory range generally provides palatable forage for the first 15 years following harvest, after which time desirable vegetation are shaded out by the growth of young trees and brush. In some areas, forage production extends for as long as 30 years because units do not become well-stocked with competing vegetation. The older Ponderosa pine plantations, especially in the vicinity of Forest Road 2929 MP 8.0, are examples of this kind of sustained grass production.

Livestock grazing for this pasture is permitted under a Term Grazing Permit (2007) and managed according to terms and conditions set forth in the Collins Ridge Pasture Allotment Management Plan (2007). The permittee is allowed to graze a maximum of 50 cow/calf pairs from May 1 to October 31, subject to range readiness. This plan also contains number of utilization standards for allowable livestock use that prescribe management practices; and through which Forest Plan compliance is assessed. There are five key areas in the pasture that are monitored for impacts to, or utilization of, meadow mosaics, wetlands and streams. Monitoring results are used to adaptively manage, or adjust, use by livestock throughout the pasture in order to comply with the Forest Plan, as amended.

Effects to Livestock Use

All action alternatives are expected to have short and long-term effects on livestock grazing. These effects involve increased forage production, or availability; and consequent opportunities to better distribute livestock use within the pasture. There also is potential for short-term disruptions to livestock use patterns due to disturbances from logging-related activities.

Under Alternative 2, 41 units, totaling 1,508 acres, would be commercially thinned. Eighteen of these units, totaling 885 acres, are completely or partially located within the pasture. Approximately 44 percent of the harvest acreage within the pasture, or 385 acres, is situated on gentle landforms (0-30 percent gradients) that livestock have historically used for grazing because of their accessibility. Some of these stands still produce usable forage; and livestock still graze within them.

Alternative 3 contains 409 acres of transitory range situated on gentle landforms, or 24 acres more than Alternative 2. Alternative 4 is similar to Alternative 2, except it would include a total of 25 acres of temporary openings within selected units. This acreage difference, or creation of openings, is not substantial enough to favor one alternative over the other in terms of effects to grazing. Since the allotment is not currently being grazed at or near capacity, nor is it anticipated that grazing would approach that level in the future, the acreage gain or small openings would not affect livestock management for this pasture.

Commercial thinning does not produce the amount of forage growth that normally results from clearcutting. This is so because residual trees and brush compete for growing space and the canopy cover hinders the full light conditions favored by grasses. Despite these limitations, the ground disturbance created by ground-skidding provides excellent seedbeds for grasses, particularly on south-facing exposures. Based on previous commercial thinning entries on the 1985 Bark-School Timber Sale in the Joe Hall area of the Elk Creek, new forage response can be substantial and long-lasting. Therefore, a similar direct effect, or response, would be expected on the aforementioned 385 acres proposed for the Curtis Timber Sale.

The expected increase in forage production would indirectly increase grazing capacity and afford opportunities to better distribute livestock within the pasture. Most of the aforementioned 18 units are situated on the northeast side of the pasture, particularly in areas along Forest Road 2980-700, where increased grazing use is desirable. Proper distribution of livestock use is a key management practice to avoid concentrated use, which frequently leads to overgrazing, resource damage or conflicts with other resource uses, including trespass onto private holdings.

There is potential for a short-term disruption to livestock use patterns. Recent logging activities on adjacent private timberlands on Collins Ridge have affected the way livestock use the range, which in turn required additional permittee efforts to manage livestock. Similar direct and indirect effects are anticipated from the proposed logging activities and increased vehicular traffic associated with the Curtis Timber Sale. In addition, there is potential for vehicle/livestock collisions. Based on previous experience, however, these effects are not considered to be substantial; or highly probable in the case of collisions. This is because timber sale activities in this locality are part of the normal range management environment. This pasture has sufficient capacity to absorb the displacement of livestock, which in turn affords the flexibility to adjust use patterns.

In terms of cumulative effects, the action alternatives would increase the forage base for the pasture. Presently, the forage baseline consists of 3,350 acres of transitory range. Since the commercial thinning entries would take place in units already comprising this acreage, no net gain in transitory range would occur. However, there would be a substantial increase in production of new and more palatable forage over that being produced at this time for 385 acres. Based on previous entries, this production is expected to continue for at least 15 years. The net increase in production, coupled with the locality of the contributing units, is expected to afford additional flexibility in managing livestock use in the Collins Ridge Pasture.

Alternative 1 would have no direct effects to forage; however, because no forage would be created with no action, this alternative has the potential to indirectly reduce the amount of forage produced over time, since no new openings would be created.

POTENTIAL OR UNUSUAL EXPENDITURES OF ENERGY

The action alternatives would require expenditures of fuel for workers to access the Curtis project. In addition, fuel would be used for power equipment (chainsaws) and all machinery used during logging systems. None of the action alternatives use helicopter logging, so no jet fuel would be used. 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. There are no inventoried roadless areas in the planning area; as such, there are no direct or indirect effects to these areas. According to Oregon Wild's uninventoried roadless area map, there are 0.019 acres of uninventoried roadless in the planning area, specifically in Units 24 and 34; these are edges of units and would not substantially impact these areas described by Oregon Wild.

The Curtis planning area also encompasses a valid and active mining claim. Mitigation measures listed in Chapter 2 would help reduce conflicts between the claimant and any actions that occur as a result of this project. No other direct, indirect, or cumulative effects to mining claims or mineral resources are expected to occur.

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 proposed alternatives on the economic conditions of the State and county are disclosed in the Economics section of this chapter.

According to statistical data for Douglas County, 6.1% of the population is made up of minorities. Unemployment and poverty in the county is higher than the State average (8.4% versus 5.6% for the State). The project occurs well away from any definable population centers that would be directly affected by the project. The community of Tiller lies about 8 air-miles to the southwest of the closest thinning unit; there is a small store that may see an increase in business during logging operations. The community of Drew, which lies about 8.5 air-miles to the southwest, may also see an increase in traffic. The largest community lies 23 miles to the west; the city of Canyonville may see an increase in traffic and business if log trucks heading to mills use the 1-5 corridor. No other adverse direct, indirect, or cumulative effects would occur.

The stands that would be thinned have limited 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.

CHAPTER 4

CONSULTATION WITH OTHERS

PUBLIC INVOLVEMENT

The Forest Service listened to all input and addressed as many concerns as possible during development of the proposed action. Formal scoping (a process used to surface issues) began after the proposed action was developed when the project was first listed in the October 2007 Umpqua National Forest Quarterly Schedule of Proposed Actions (SOPA). A scoping notice was sent to the public in October of 2007 with the intent of introducing the proposed action and soliciting issues. The Curtis project record contains a scoping summary that details the scoping comments received for the project. Concerns from the public ranged from leaving adequate snags, heavy thinning, building too many roads, and making sure the project could be economically implemented.

AGENCY CONSULTATION

The regulatory agency (US Fish and Wildlife Service) charged with overseeing the Endangered Species Act, was consulted throughout the planning process. Consultation was finalized prior to the issuance of the Decision Notice. Tribal consultation also occurred; no response has been received from the tribes to date.

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:

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In addition, the following people assisted in developing the proposal or in the editing and review of this document:

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